



# 2017 Air Quality Progress Report

## The City of Cardiff Council

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

September 2017

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# Executive Summary

The report fulfils the requirements of 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.

This document is part of Cardiff Council's sixth round of Review and Assessment. Results from air quality data captured in 2016 by the Council are presented and sources of air pollution identified. The Progress Report determines those changes since the last assessment, which could lead to the risk of an air quality objective being exceeded.

Since the 2016 Annual Progress Report the Council has continued its monitoring of local air quality. In line with the prescribed guidance document, Shared Regulatory Services (SRS) on behalf of Cardiff Council undertakes regular monitoring at specifically allocated locations across Cardiff using automated and non-automated principles for ambient air Nitrogen Dioxide (NO<sub>2</sub>), Particulate Matter (PM<sub>10</sub> & PM<sub>2.5</sub>), Sulphur Dioxide (SO<sub>2</sub>), Carbon Monoxide (CO) & Ozone (O<sub>3</sub>). With regards to prioritising ambient air quality sampling locations, the Council adopts a risk based approach to any allocation of monitoring sites, considering the requirements of Local Air Quality Management Technical Guidance 16, April 2016. The designated monitoring locations have been assigned based on relevant exposure and where the certain objective for a particular pollutant applies. The monitoring has been able to provide results that assist with quantifying the potential impacts of planning applications and significant industrial developments on local air quality.

The 2016 datasets collected for this report have been examined and treated in line with best practise guidance outlined in Local Air Quality Management (LAQM) Technical Guidance (TG16), April 2016.

The 2016 nitrogen dioxide monitoring data collected via the network of diffusion tubes deployed around the Cardiff Borough are presented in this report. There are a number of sites representative of relevant exposure with exceedences of the NO<sub>2</sub> annual mean objective (40µgm<sup>3</sup>). These sites are predominantly contained within the declared AQMAs. However, there are four monitoring locations (Site IDs 172, 180, 181, 185) which are not located within AQMAs.

Sites 180 & 181 were implemented due to new developments with the potential for adverse air quality impacting the amenity of future occupants (Windsor House, Windsor Lane & Fitzalan Court, Newport Road). Both developments were under construction in 2016, therefore influencing any

datasets recorded. Only recently has the student accommodation at Windsor House been completed and construction still continues at the Fitzalan Court site.

2015's site 175 was renamed as site 185 and relocated to the façade of Northgate House, Kingsway. Due to the fact there is no residential accommodation located at ground floor level where monitoring is undertaken, Site 185 is not representative of relevant exposure and does not apply to the annual mean objective set for NO<sub>2</sub>. Therefore, datasets collected at this monitoring location would apply to the 1-hour objective set for NO<sub>2</sub> (**200µg/m<sup>3</sup>, not to be exceeded more than 18 times per year**). Detailed in the Local Air Quality Management (LAQM) TG(16), Paragraphs 7.90 & 7.91 focus on predicting exceedences of the NO<sub>2</sub> 1-hour objective (**200µg/m<sup>3</sup>, not to be exceeded more than 18 times per year**) with the use of NO<sub>2</sub> diffusion tubes. It is stated that *"exceedances of the NO<sub>2</sub> 1-hour mean are unlikely to occur where the annual mean is below 60µg/m<sup>3</sup>."* Therefore, based on the 2016 datasets it can be concluded that the NO<sub>2</sub> 1 hour objective was not breached at this location.

Site 172 (Ocean Way) is a kerbside location situated up to 650m from any relevant exposure, used to examine potential impacts of traffic resulting from industrial development in the area.

Due to technical issues, Cardiff City Centre's AURN site recorded low data capture for PM<sub>10</sub> measured by a TEOM- FDMS sampler. The total data capture for the year was 47.1%. As outlined in LAQM (TG16) the data from the sampler has been annualised in accordance with box 7.9 and the 90.4<sup>th</sup> Percentile value has been given to examine the 24 hour objective.

### **Monitoring for other pollutants did not result in other exceedences of National Air Quality Standards.**

It was previously detailed that the City Centre AQMA needed to be extended on its northern boundary to encompass Kingsway/ Duke Street/ Castle Street Link area. Further studies were undertaken on Cardiff Council collected NO<sub>2</sub> datasets since 2014. It was determined that the City Centre AQMA does not need to be extended at this moment in time. As can be seen in Figure 1.1 the boundary of the City Centre AQMA does already extend to the façade of the buildings along Castle Street. The current use of buildings within this proposed extension link area is for commercial use at ground floor level. Residential properties are located at elevated levels >3m. The datasets collected since 2014 have therefore been compared to the 1-hour NO<sub>2</sub> objective (**200µg/m<sup>3</sup>, not to be exceeded more than 18 times per year**). Levels recorded by the monitoring locations representative

of this area (Site 185, 186 & 187) can be seen in Tables 2.5 & 2.6, whereby compliance is met with the 1-hour NO<sub>2</sub> objective.

At the time of writing this report, following the recently revised UK published document issued by the Department for Environment, Food and Rural Affairs (Defra) to mitigate against road transport emissions “UK Plan for tackling roadside nitrogen dioxide, detailed plan, July 2017” SRS on behalf of Cardiff Council are coordinating and developing a Clean Air Strategy & Action Plan with its main purpose to improve air quality to protect public health. The document will identify and implement strategic actions to deliver significant improvements to air quality in Cardiff, whilst supporting the sustainable economic growth of the city and wider region. This will involve a review of existing AQMA areas, strategies, policies and plans which either have a direct or indirect impact on air quality in Cardiff. **Please refer to Section 9 for more information.**

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# **1 Introduction**

## **1.1 Description of Local Authority Area**

The capital city of Wales, Cardiff has a population of 346,100 people, and is a base for many of the country's political, cultural, sporting and commercial institutions. Principal destinations include the Millennium Stadium in the city centre, the St David's I and II shopping centres, and the historic Cardiff Castle. To the south of the city, Cardiff Bay (in the Butetown and Grangetown Wards) houses the Senedd, Wales Millennium Centre, BBC studios. Cardiff City Football Club and rugby union side Cardiff Blues are also both based in the capital.

Cardiff is a relatively flat city bounded by hills on the outskirts to the north and west. The Western, Northern and Eastern areas of the City are mainly residential, with the main commercial areas being in the City Centre and to the south. The industrial areas are centered on the docks in coastal areas to the south.

## 1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management (LAQM) 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 compliance with air quality objectives.

The latest Policy Guidance from Welsh Government<sup>(11)</sup> details a new streamlined approach in terms of the reporting requirements for Local Authorities in Wales. Previous guidance required the submission of Progress Reports, in the intervening years between a three-yearly Updating and Screening Assessment report. The new Policy Guidance removes the need for these separate reports and local authorities are now only required to submit an Annual Progress Report. These reports incorporate monitoring results for the previous calendar year, a progress report on action plan implementation, and an update on any new policies or developments likely to affect local air quality.

Where an Annual Progress report indicates an area exceeds or likely exceeds an air quality standard the new Policy Guidance removes the requirement for a local authority to undertake a Detailed or Further Assessment before declaring an Air Quality Management Area (AQMA). Where the local authority does declare an AQMA the Policy Guidance requires that a local authority produce an action plan with 18 months of the declaration of the AQMA.

## 1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in Wales** are set out in the Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138), Air Quality (Amendment) (Wales) Regulations 2002, No 3182 (Wales 298), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre  $\mu\text{g}/\text{m}^3$  (milligrammes per cubic metre,  $\text{mg}/\text{m}^3$  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 LAQM in Wales**

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m <sup>3</sup>	Running annual mean	31.12.2003
	5.00 µg/m <sup>3</sup>	Annual mean	31.12.2011
1,3-butadiene	2.25 µg/m <sup>3</sup>	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m <sup>3</sup>	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m <sup>3</sup>	Annual mean	31.12.2004
	0.25 µg/m <sup>3</sup>	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m <sup>3</sup> not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m <sup>3</sup>	Annual mean	31.12.2005
Particulate matter (PM <sub>10</sub> ) (gravimetric)	50 µg/m <sup>3</sup> , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m <sup>3</sup>	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m <sup>3</sup> , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m <sup>3</sup> , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m <sup>3</sup> , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

## 1.4 Summary of Previous Review and Assessments

This Report is the second of Phase 6 of the Local Air Quality Management regime. The outcomes of the previous phases are discussed below.

### Phase 1

The Local Air Quality Management regime commenced with the Air Quality Regulations 1997, which came into force in December of that year. These Regulations were revoked and superseded by the current Air Quality (Wales) Regulations 2000 (as subsequently amended in 2002).

The first phase of the review and assessment process concluded that for six of the seven pollutants included in the regulations there was little or no risk of the objectives being breached and that Air Quality Management Areas (AQMAs) for these pollutants were not necessary. Measures taken at the national level would be sufficient to ensure that there would be no local “hot-spots” of these pollutants and therefore local controls in addition to the national measures would not be required.

However, for the seventh of these pollutants, nitrogen dioxide (NO<sub>2</sub>), it was concluded that national control measures such as vehicle emission and fuel standards, controls on industrial emissions, etc., would not, of themselves, be sufficient to ensure that the air quality objectives for this pollutant would not be met in all areas of Cardiff.

Whilst the vast majority of the area would meet the objectives, there were predicted to be local “hot-spots” close to heavily-trafficked road junctions where there were buildings close to the road and significant amounts of queuing traffic where the objectives would not be met.

As a result, four AQMAs were declared, each having been declared on the basis of measurements and modelling showing predicted breaches of the annual average objective for NO<sub>2</sub>. These AQMAs were known as:

- The Cardiff West AQMA
- The Newport Road AQMA
- The Philog AQMA
- The St Mary Street AQMA

The first three of these came into force on 1<sup>st</sup> December 2000 and the latter on 1<sup>st</sup> September 2002. AQAPs the first three were published in November 2002 and for St Mary Street in February 2010.

## **Phase 2**

The Council's 2003 USA concluded that for five of the seven pollutants regulated under the LAQM regime there was no evidence to suggest that local "hot-spots" for these pollutants had been missed in the first phase of the review and assessment process and that there was no need to consider these pollutants further at this time.

The 2003 USA also concluded that no local hot-spots of nitrogen dioxide had been overlooked during the first phase of review and assessment and that further detailed assessment of this pollutant was not necessary.

However, whilst the USA concluded that there was no evidence to suggest a likely breach of the 2004 objective for particulate matter (PM<sub>10</sub>), there was considerable doubt that the provisional 2010 objectives for PM<sub>10</sub> would be achieved.

As a result of the conclusions of the 2003 USA the Council issued Progress Reports in 2004 and 2005.

## **Phase 3**

Following the 2006 USA, the Council published and consulted upon an Air Quality Management Area (AQMA) Review during the autumn of 2006. This concluded that two of the four AQMAs could be revoked and that the then Cardiff West AQMA should be reduced in size and renamed as the Ely Bridge AQMA. Orders making the changes came into force on 1<sup>st</sup> February 2007.

The 2007 Progress Report highlighted a potential problem with regard to nitrogen dioxide concentrations on Newport Road in the immediate vicinity of Stephenson Court, where concentrations had been marginally, but consistently, above the Air Quality objective for a few years. It was concluded that the possibility of declaring a new AQMA would be assessed in the 2008 Progress Report.

The monitoring data for the Stephenson Court area presented in the 2008 Progress Report led to the conclusion that a further “watching brief” would be kept with a view to reaching a firm conclusion once ratified monitoring data for the 2008 calendar year became available.

The monitoring data for 2007 presented in the 2008 Progress Report provided reassurance that the Council’s decisions in respect of the 2006 AQMA Review were soundly based.

#### **Phase 4**

The 2009 USA concluded that a Detailed Assessment for the Stephenson Court area of Newport Road was required as the annual mean concentration of nitrogen dioxide at three sites representative of relevant exposure in the area were above the air quality Objective.

A Detailed Assessment for this area was consulted upon during the summer of 2010 and the AQMA came into force on 1<sup>st</sup> December 2010.

The Council’s 2010 Progress Report was submitted in December 2010 and the 2011 Progress Report in June 2011.

The 2011 Progress Report highlighted abnormally high NO<sub>2</sub> 2010 annual mean concentrations across the Council’s monitoring network which could not be attributed to a particular source and evidence was presented to show that this was a regional issue probably associated with a prolonged period of unusually cold weather during November and December 2010. After dialogue with Welsh Assembly Government with regard to the conclusions reached about this data it was concluded that the Council would proceed to Detailed Assessments for the Llandaff and Westgate Street areas of the city and review the situation with regard to other exceedences when 2011 data is available and reported in 2012.

A Further Assessment for the Stephenson Court AQMA was submitted to WAG for review in December 2011, i.e. one year after the AQMA was declared, in compliance with Section 84(2)(a) of the Environment Act 1995.

#### **Phase 5**

The 2012 USA was the first report in Phase 5 of the review and assessment process.

Monitoring data for 2011 largely confirmed that the annual mean concentrations of nitrogen dioxide previously reported for 2010 were unusually elevated, both locally and regionally, and local concentrations had returned to more typical values in 2011.

Detailed Assessments in respect of nitrogen dioxide in Westgate Street and for the Llandaff area were consulted upon during the summer of 2012 and as a result a new AQMA for Llandaff was declared on 1<sup>st</sup> April 2013 and Westgate Street was incorporated into the St Mary Street AQMA; this latter AQMA is now named Cardiff City Centre AQMA.

The Council's 2013 Progress Report recommended proceeding to a Detailed Assessment for the Fair Oak Road Roundabout in the Plasnewydd Ward of the city as monitoring data over previous years indicated the need. This was submitted for review during 2014. The Assessment concluded that, as monitoring data for 2013 had returned to Objective compliance, there was no need to declare an AQMA at that time. It was proposed to continue monitoring in the area and review the results year-on-year.

The Further Assessment for the City Centre AQMA was submitted in April 2014 and the conclusion that the declaration of the AQMA was justified was accepted.

A Further Assessment for the Llandaff AQMA was also submitted for review in 2014. This concluded that the declaration of the AQMA was justified based upon monitoring data available at the time. However, as monitoring data for 2013 showed compliance with the Objective, it was concluded that there was no need to develop an Action Plan at that time. Monitoring would continue and the situation would be reviewed year-on-year.

In summary, there are currently four AQMAs in Cardiff; all have been declared in respect of NO<sub>2</sub> resulting from road-traffic emissions:

- Cardiff City Centre AQMA
- Ely Bridge AQMA
- Stephenson Court AQMA
- Llandaff AQMA



## Phase 6

The 2015 USA was the first report in Phase 6 of the review and assessment process.

Monitoring data for 2014 largely confirmed that the annual mean concentrations of nitrogen dioxide previously reported for 2010 were unusually elevated, both locally and regionally, and local concentrations had returned to more typical values in 2011.

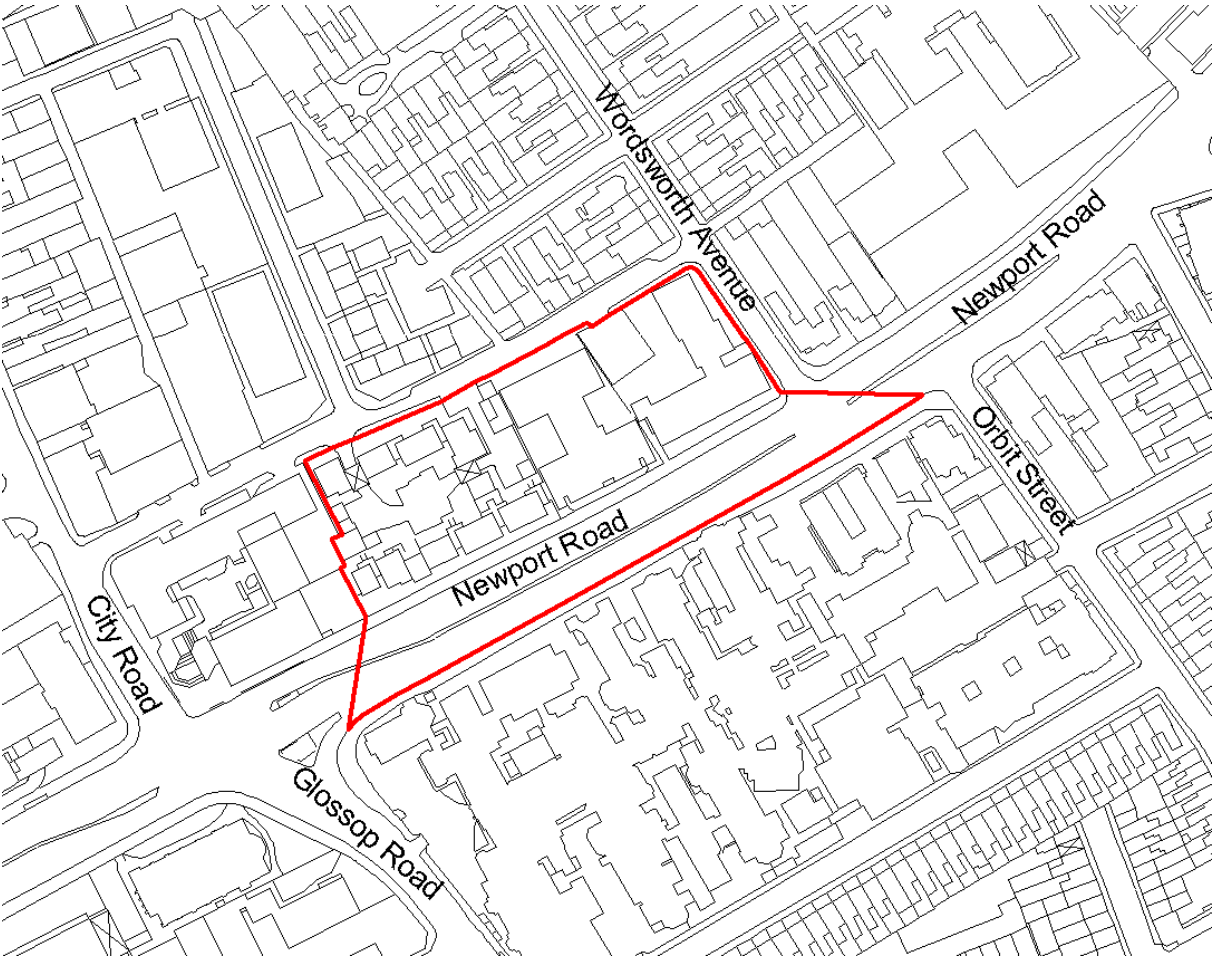
Monitoring data for 2015 indicated that annual mean concentrations of nitrogen dioxide were not unduly elevated during the year and that in some locations concentrations may have been lower than expected. The 2016 Progress Report showed a number of sites representative of relevant exposure with exceedences of the  $40\mu\text{g}\text{m}^{-3}$  annual mean objective, however these sites and recorded exceedences were not out of character as were predominantly contained within the declared AQMAs.

**Figure 1.1 Boundary of Cardiff City Centre AQMA**





**Figure 1.3 Boundary of Stephenson Court AQMA**



**Figure 1.4 Boundary of Llandaff AQMA**



## **2 New Monitoring Data**

### **2.1 Summary of Monitoring Undertaken**

#### **2.1.1 Automatic Monitoring Sites**

During 2016 monitoring took place at one automatic monitoring site in Cardiff, i.e. DEFRA's Cardiff Centre AURN site in Frederick Street (adjacent to the pedestrianized Queen Street shopping centre).

The Cardiff Centre AURN has been operating since May 1992. The station is part of DEFRA's AURN network and there are similar stations located in towns and cities across the UK.

This site is subject to six-monthly QA/QC audits by AEA, DEFRA's appointed contractor, and calibration gases are all traceable to National Standards. Calibrations have been carried out fortnightly by the appointed contractor. The repair and replacement of equipment has been contracted to suppliers of national repute throughout the station's working life. In February 2007 the PM<sub>10</sub> analyser was replaced with a PM<sub>10</sub> FDMS analyser and the site was augmented with a PM<sub>2.5</sub> FDMS analyser in August 2008.

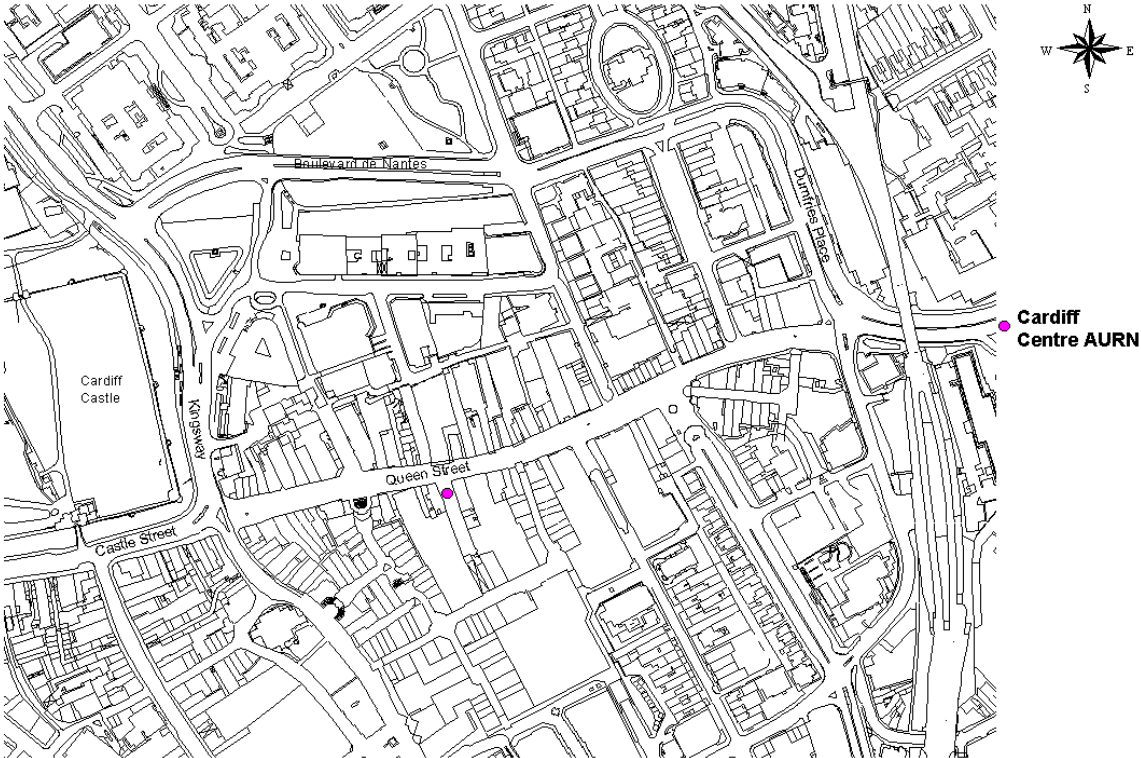
Data from the Cardiff Centre AURN site has been validated and ratified by Ricardo-AEA and was downloaded from the Welsh Air Quality Forum database. The site can be accessed here:

*<http://www.welshairquality.co.uk/>*

For 2016, data capture for NO<sub>2</sub> was recorded at 98% and 47% for PM<sub>10</sub>.

There are three diffusion tubes co-located at the station, whereby at the end of year, depending on data capture and precision, a locally derived bias adjustment factor is calculated. The bias adjustment factor derived from the co-location study was 0.76. This adjustment has not been applied to the network of diffusion tubes due to the fact that the National Bias Adjustment Factor supplied by the LAQM DEFRA website, based on 38 studies, which appointed ESG Didcot laboratory, was slightly higher at 0.78. In order to provide a conservative approach it was therefore decided to adopt the nationally derived bias adjustment factor as this would give slightly higher concentrations and fundamentally represent a worst case scenario.

Figure 2.1 Location of Cardiff Centre AURN Monitoring Site



**Table 2.1 Details of Automatic Monitoring Sites**

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Cardiff Centre AURN	Urban Background	318416	176525	NO <sub>2</sub>	N	Chemiluminescence	Y (5m)	200m	N
Cardiff Centre AURN	Urban Background	318416	176525	PM <sub>10</sub> , PM <sub>2.5</sub>	N	TEOM- FDMS	Y (5m)	200m	N
Cardiff Centre AURN	Urban Background	318416	176525	SO <sub>2</sub>	N	UV Fluorescence	Y (5m)	200m	N
Cardiff Centre AURN	Urban Background	318416	176525	CO	N	Infra-Red GFC	Y (5m)	200m	N
Cardiff Centre AURN	Urban Background	318416	176525	O <sub>3</sub>	N	UV Absorption	Y (5m)	200m	N



### **2.1.2 Non-Automatic Monitoring Sites**

Shared Regulatory Services (SRS) on behalf of Cardiff Council carries out monitoring of ambient air quality for Nitrogen Dioxide (NO<sub>2</sub>). During the period since the Progress Report in 2016, monitoring of NO<sub>2</sub> using passive diffusion tubes has been carried out at 77 locations throughout the district. The locations of the diffusion tubes are described in Table 2.2 and shown in Figures 2.2- 2.25.

The Council's monitoring network has evolved over time and, as sites have been closed and replaced by new ones, the tube locations have become increasingly focussed on residential premises close to busy roads and junctions.

Following a review of the 2016 NO<sub>2</sub> diffusion tube network, it was agreed to assign or relocate new monitoring locations. The new locations have been allocated based on known areas of particularly elevated traffic flows and foreseeable developments, all with nearby relevant exposure. Four new monitoring locations were established in February 2016 which are located in and around Cardiff City Centre (Sites 179, 180, 181 & 182). Site 74, now renamed at Site 183 has been relocated to an improved kerbside location to monitor traffic flows at a major road junction. Site 175 was renamed as Site 185 and relocated at the façade of Northgate House, Kingsway. Sites 176 & 177, renamed to Sites 186 & 187 have been repositioned to improved locations on Castle Street.

As mentioned previously; since 2002, three diffusion tubes have been located on the inlet duct of the Cardiff Centre AURN monitoring site for bias-adjustment purposes.

A map showing the location and distribution of the diffusion tubes is shown below and Table 2.2 details the monitoring sites and their locations.

**Table 2.2 Details of Non-Automatic Monitoring Sites**

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
16	Ninian Park Road	Roadside	317040	176060	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5m	Y
33	Mitre Place	Kerbside	315248	178165	3.0	NO <sub>2</sub>	Y	N	N (20m)	1m	Y
44	City Road	Kerbside	319086	177097	3.0	NO <sub>2</sub>	N	N	Y (2m)	1m	Y
45	Mackintosh Place	Kerbside	318722	177788	3.5	NO <sub>2</sub>	N	N	N (3m)	1m	N
47	Ely Bridge	Kerbside	314457	176738	2.5	NO <sub>2</sub>	Y	N	N (2m)	0.25m	Y
49	Penarth Road	Roadside	317760	175310	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	7m	Y
56	Birchgrove Village	Roadside	316816	180005	2.5	NO <sub>2</sub>	N	N	N (10m)	1.5m	Y
58	Westgate Street	Kerbside	317937	176400	2.5	NO <sub>2</sub>	Y	N	N (5m)	0.5m	Y
73	Green Street	Kerbside	317607	176434	2.5	NO <sub>2</sub>	N	N	N (2m)	0.5m	Y
81	Stephenson Court	Roadside	319387	176980	2.0	NO <sub>2</sub>	Y	N	Y (0.05m)	5m	Y
82	104 Birchgrove Road	Roadside	316518	179683	2.0	NO <sub>2</sub>	N	N	Y (0.05m)	5m	Y
85	497 Cowbridge Road West	Roadside	312129	175084	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5m	Y
86	19 Fairoak Road	Roadside	318452	178805	1.5	NO <sub>2</sub>	N	N	Y 0.10m)	10m	Y
96	Manor Way Junction	Roadside	316601	179653	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5m	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
97	Newport Road (premises)	Roadside	319955	177546	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	10m	Y
98	Western Avenue (premises)	Roadside	314805	177345	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	10m	Y
99	Cardiff Road Llandaff	Roadside	315275	178117	1.5	NO <sub>2</sub>	Y	N	Y (0.05m)	3m	Y
100	188 Cardiff Road	Roadside	316226	177305	1.5	NO <sub>2</sub>	N	N	Y (0.10m)	20m	Y
101	Cardiff Centre AURN	Urban Centre	318416	176525	3.0	NO <sub>2</sub>	N	Y, Triplicate with Tubes 102 & 103	Y (0.10m)	200m	Y
102	Cardiff Centre AURN	Urban Centre	318416	176525	3.0	NO <sub>2</sub>	N	Y, Triplicate with Tubes 101 & 103	Y (0.10m)	200m	Y
103	Cardiff Centre AURN	Urban Centre	318416	176525	3.0	NO <sub>2</sub>	N	Y, Triplicate with Tubes 101 & 102	Y (0.10m)	200m	Y
106	30 Caerphilly Road	Roadside	316851	179520	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5m	Y
107	Lynx Hotel	Roadside	320356	177618	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	4m	Y
111	98 Leckwith Road	Roadside	316444	175866	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	6m	Y
112	17 Sloper Road	Roadside	316613	175910	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5m	Y
115	21 Llandaff Road	Roadside	316604	176641	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	3m	Y
117	25 Cowbridge Road West	Roadside	314458	176735	2.0	NO <sub>2</sub>	Y	N	Y (0.05m)	2m	Y
119	Havelock Street	Kerbside	318184	176086	2.0	NO <sub>2</sub>	N	N	N	1m	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
124	287 Cowbridge Road East	Roadside	316586	17535	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	10m	Y
126	Westgate Street Flats	Roadside	317946	176387	1.5	NO <sub>2</sub>	Y	N	Y (0.10m)	5m	Y
128	117 Tudor Street	Roadside	317540	175979	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5m	Y
129	Stephenson Court 2	Roadside	319349	176963	1.2	NO <sub>2</sub>	Y	N	Y (3m)	4m	Y
130	Burgess Court	Roadside	319326	176949	2.0	NO <sub>2</sub>	Y	N	Y (0.05m)	5m	Y
131	Dragon Court	Roadside	319292	176932	1.75	NO <sub>2</sub>	Y	N	Y (0.05m)	5m	Y
133	St Mark's Avenue	Roadside	317019	179078	2.0	NO <sub>2</sub>	N	N	Y (21m)	2m	N
134	Sandringham Hotel	Roadside	318261	176229	2.0	NO <sub>2</sub>	Y	N	N (3m)	5m	Y
139	Lower Cathedral Road	Kerbside	317540	176410	2.0	NO <sub>2</sub>	N	N	Y (3m)	1m	Y
140	Clare Street	Kerbside	317600	176047	2.0	NO <sub>2</sub>	N	N	Y (6m)	0.5m	Y
141	Fairoak Road 2	Roadside	318438	178742	2.0	NO <sub>2</sub>	N	N	N (5m)	1.5m	Y
142	Pure Rugby	Kerbside	318326	176086	2.0	NO <sub>2</sub>	Y	N	N (>25m)	0.25m	Y
143	Windsor House	Roadside	318009	176337	1.5	NO <sub>2</sub>	Y	N	Y (0.10m)	6.5m	Y
144	Marlborough House	Roadside	318046	176307	1.5	NO <sub>2</sub>	Y	N	Y (0.10m)	6.5m	Y
145	Tudor Street Flats	Roadside	317904	175921	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	4.5m	Y
146	Neville Street	Roadside	317508	176275	2.0	NO <sub>2</sub>	N	N	Y (0.05m)	3.5m	Y
147	211 Penarth Road	Roadside	317636	175161	1.5	NO <sub>2</sub>	N	N	Y (0.10m)	7.0m	Y
148	161 Clare Road	Roadside	317695	175389	1.5	NO <sub>2</sub>	N	N	Y (0.05)	5.0m	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
149	10 Corporation Road	Roadside	317764	175174	1.5	NO <sub>2</sub>	N	N	Y (0.05)	4.6m	Y
152	James Street	Roadside	319003	174596	1.5	NO <sub>2</sub>	N	N	Y (0.10m)	6.0m	Y
153	Magic Roundabout	Roadside	319491	176183	1.5	NO <sub>2</sub>	N	N	Y (0.10m)	12.5m	Y
156	2a/4 Colum Road	Roadside	317997	177412	1.5	NO <sub>2</sub>	N	N	Y (0.10m)	5.0m	Y
157	47 Birchgrove Road	Roadside	316605	179703	1.5	NO <sub>2</sub>	N	N	Y (0.10m)	8.0m	Y
158	64/66 Cathays Terrace	Roadside	318093	177716	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	3.0m	Y
159	IMO façade replacement	Roadside	320709	177918	1.5	NO <sub>2</sub>	N	N	Y (0.10m)	4.0m	Y
160	High Street Zizzi	Urban Centre	318131	176407	2.0	NO <sub>2</sub>	Y	N	Y (0.10m)	65m	Y
161	52 Bridge Road	Roadside	315230	178205	1.5	NO <sub>2</sub>	Y	N	Y (0.05m)	7.9m	Y
162	58 Cardiff Road	Roadside	315533	177809	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	8.8m	Y
163	118 Cardiff Road	Roadside	315738	177723	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	14.8m	Y
164	725 Newport Road	Roadside	321405	179345	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	6.5m	Y
165	6 Heol Tyrrell	Roadside	315918	176221	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5.5m	Y
166	163 Lansdowne Road	Roadside	315950	176424	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	5.4m	Y
167	359 Lansdowne Road	Roadside	315326	176714	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	6.1m	Y
168	570 Cowbridge Road East	Roadside	314856	176929	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	4.8m	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
169	43 Clos Hector	Urban Background	321586	177414	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	43m	Y
170	11 Pengam Green	Roadside	320973	177721	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	9.3m	Y
171	23 Tweedsmuir Road	Roadside	320750	177053	1.5	NO <sub>2</sub>	N	N	Y (0.05m)	10.2m	Y
172	Ocean Way 1	Roadside	320544	175613	2.0	NO <sub>2</sub>	N	N	N (>650m)	1.5m	Y
173	Ocean Way 2	Roadside	320395	175623	2.0	NO <sub>2</sub>	N	N	N (>650m)	1.5m	Y
174	76 North Road	Kerbside	317508	177868	1.5	NO <sub>2</sub>	N	N	Y (0.1m)	1m	Y
179	Altolusso, Bute Terrace	Roadside	318627	176039	2.0	NO <sub>2</sub>	N	N	N (5.1m)	2.1m	N
180	Fitzalan Court, Newport Road	Kerbside	318929	176681	1.8	NO <sub>2</sub>	N	N	N (2.2m)	0.4m	N
181	Windsor House, Windsor Lane	Kerbside	318712	176749	2.0	NO <sub>2</sub>	N	N	N (5.2m)	0.5m	N
182	Admiral House, Newport Road	Roadside	319162	176827	1.5	NO <sub>2</sub>	N	N	N (9.2m)	3.2m	N
183	Station Terrace	Kerbside	318765	176623	2.0	NO <sub>2</sub>	N	N	N (5.5m)	0.5m	Y
184	Hopouse, St Mary Street	Roadside	318335	176074	2.0	NO <sub>2</sub>	Y	N	Y (0.05m)	3.0m	Y
185	Northgate House, Duke Street	Roadside	318224	176554	2.0	NO <sub>2</sub>	N	N	Y (0.05m)	9.65m	Y
186	Dempsey's Public House, Castle Street	Roadside	318044	176449	2.0	NO <sub>2</sub>	Y	N	Y (0.05m)	2.90m	Y
187	Angel Hotel	Roadside	317229	176154	2.0	NO <sub>2</sub>	Y	N	Y (0.05m)	2.85m	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
188	Westgate Street (45 Apartments)	Roadside	318229	176154	1.8	NO <sub>2</sub>	Y	N	Y (0.05m)	3.30m	Y



**Figure 2.2 Map Showing Location and Distribution of Diffusion Tubes in 2016**

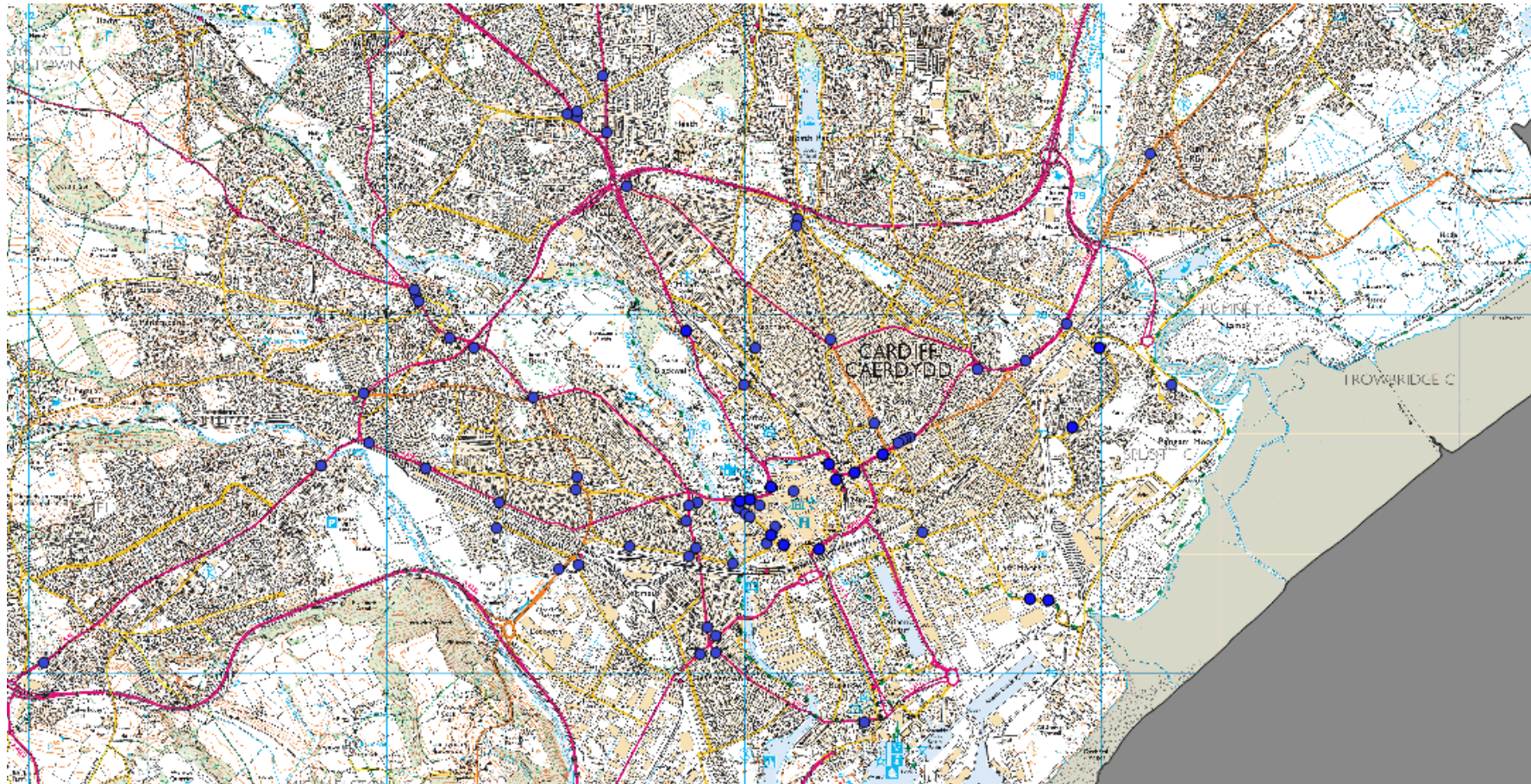




Figure 2.3 Map Showing Location of Diffusion Tubes in and around the Cardiff City Centre AQMA





Figure 2.4 Map Showing Location of Diffusion Tubes in and around the Ely Bridge AQMA



Figure 2.5 Map Showing Location of Diffusion Tubes in and around the Stephenson Court AQMA & City Road





Figure 2.6 Map Showing Location of Diffusion Tubes in and around the Llandaff AQMA & Western Avenue





Figure 2.7 Map Showing Location of Diffusion Tubes in Cathays area & Mackintosh Place

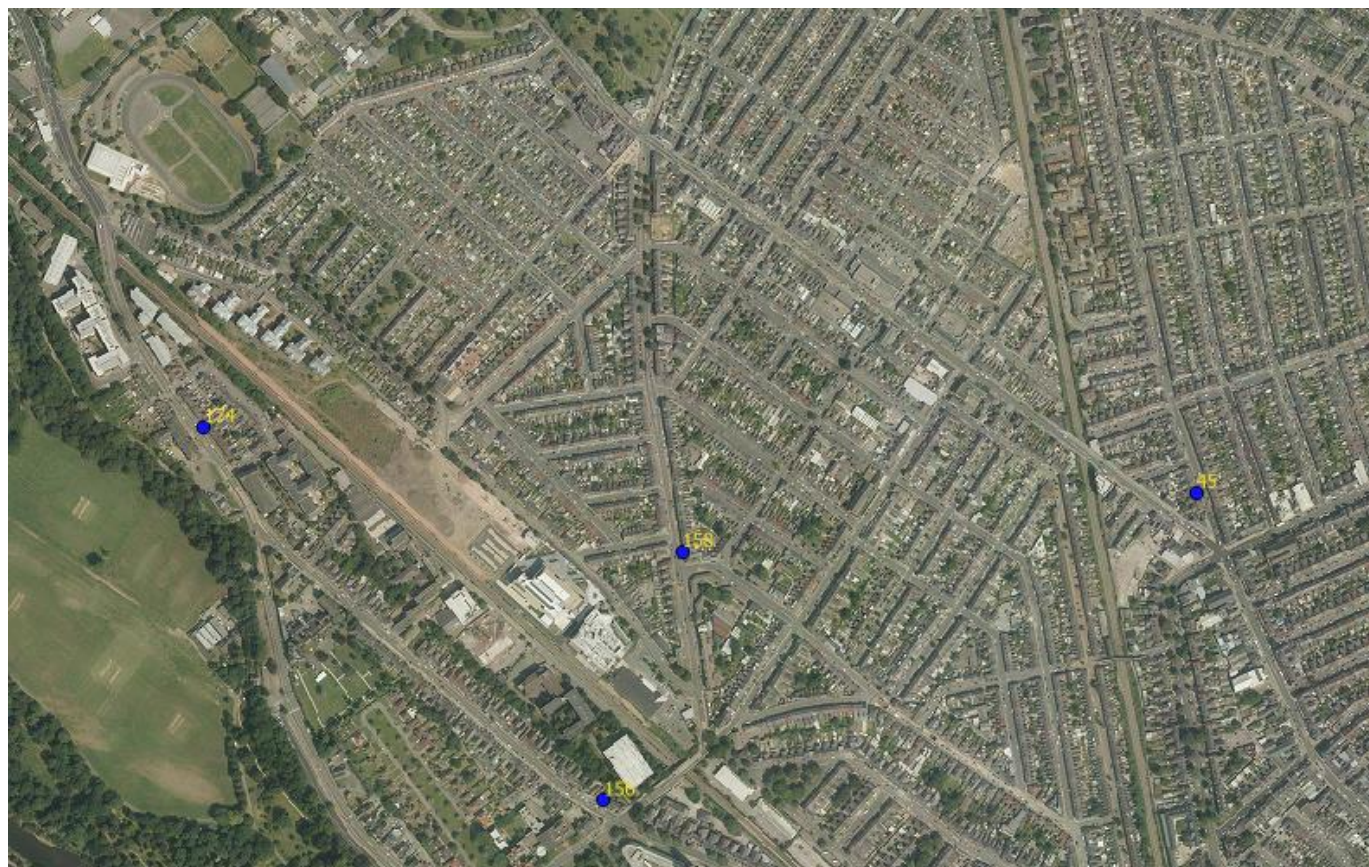
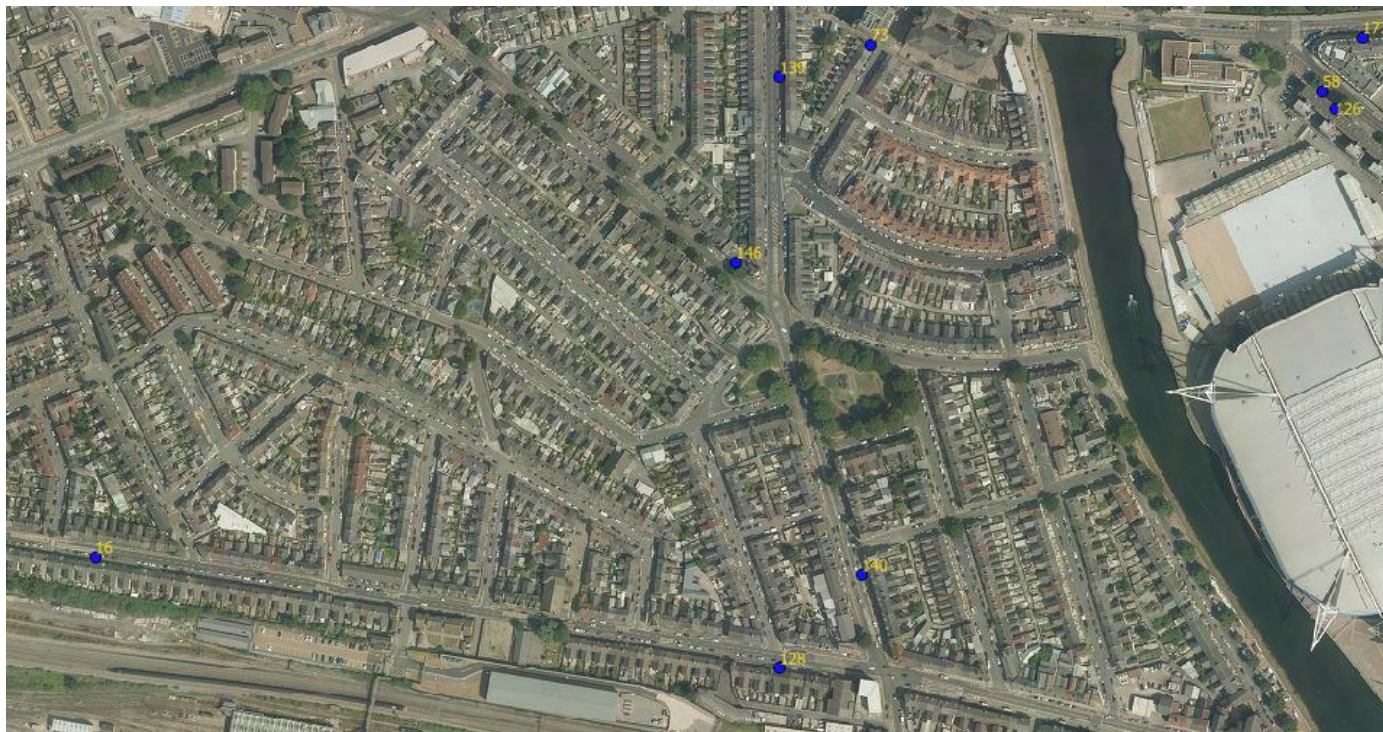




Figure 2.8 Map Showing Location of Diffusion Tubes in Riverside area



**Figure 2.9 Map Showing Location of Diffusion Tube at Cowbridge Road West**





Figure 2.10 Map Showing Location of Diffusion Tubes in Fairoak Road





Figure 2.11 Map Showing Location of Diffusion Tubes in Heath area

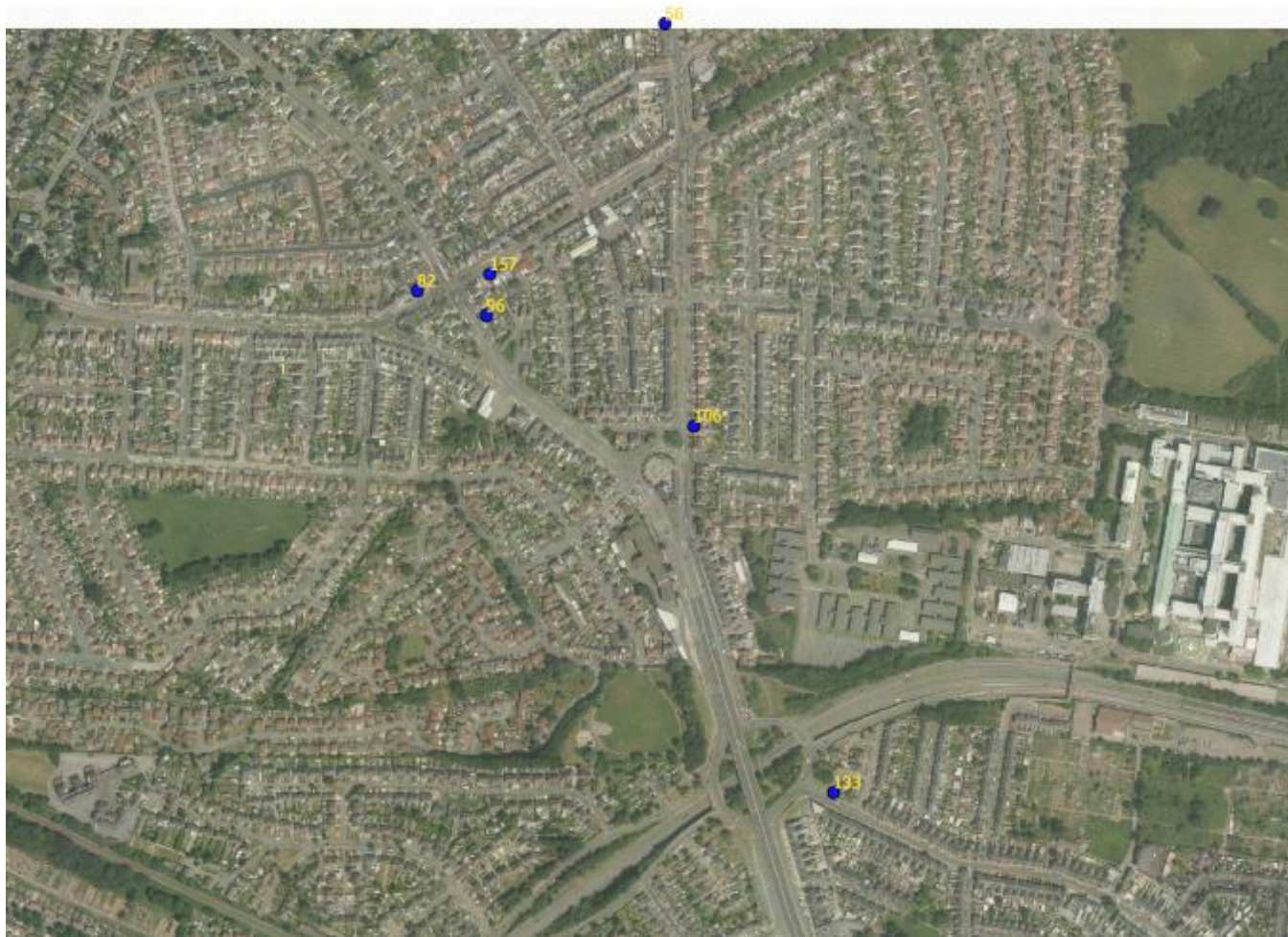


Figure 2.12 Map Showing Location of Diffusion Tube in James Street





Figure 2.13 Map Showing Location of Diffusion Tubes in Leckwith area



Figure 2.14 Map Showing Location of Diffusion Tube in East Tyndall Street





Figure 2.15 Map Showing Location of Diffusion Tubes in the Tremorfa Area & Newport Road

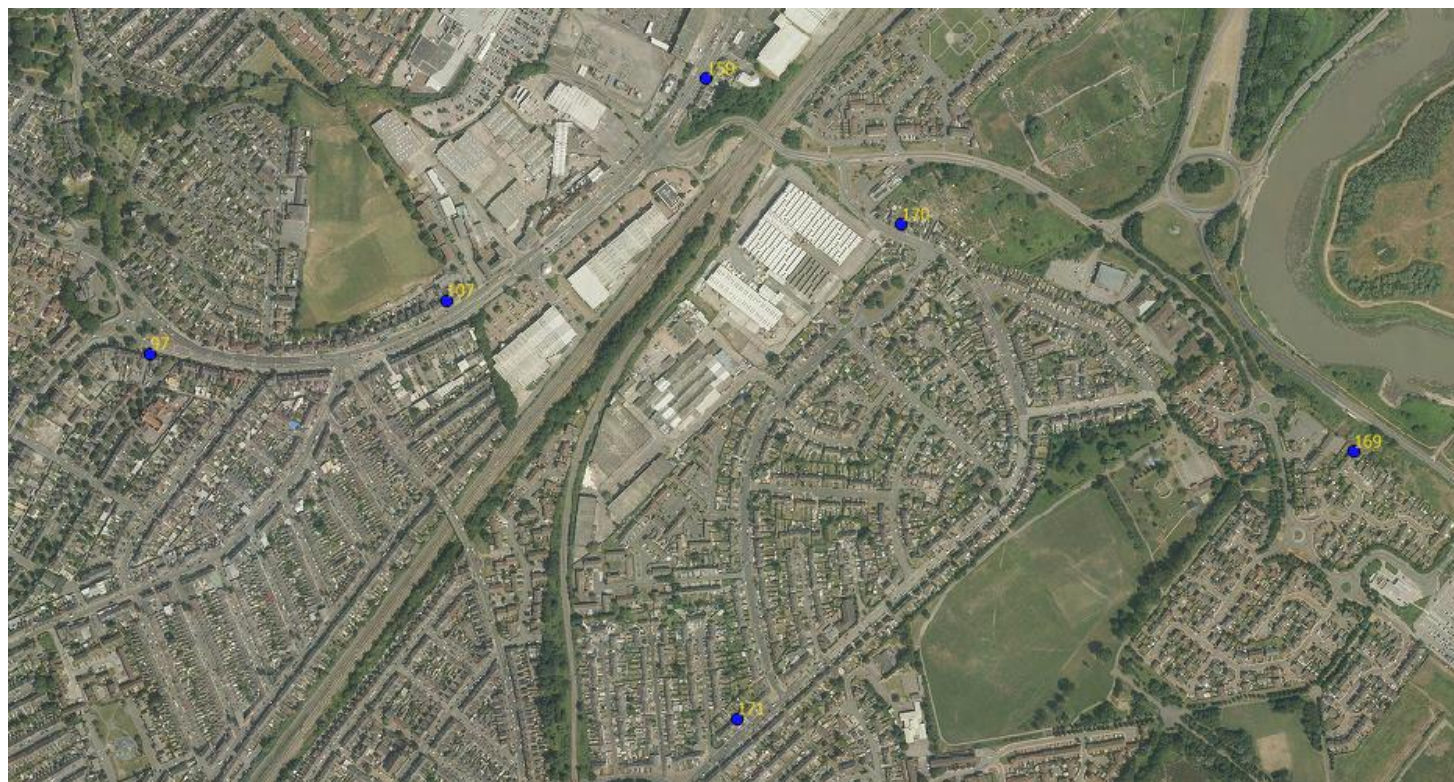




Figure 2.16 Map Showing Location of Diffusion Tubes in Penarth Road area

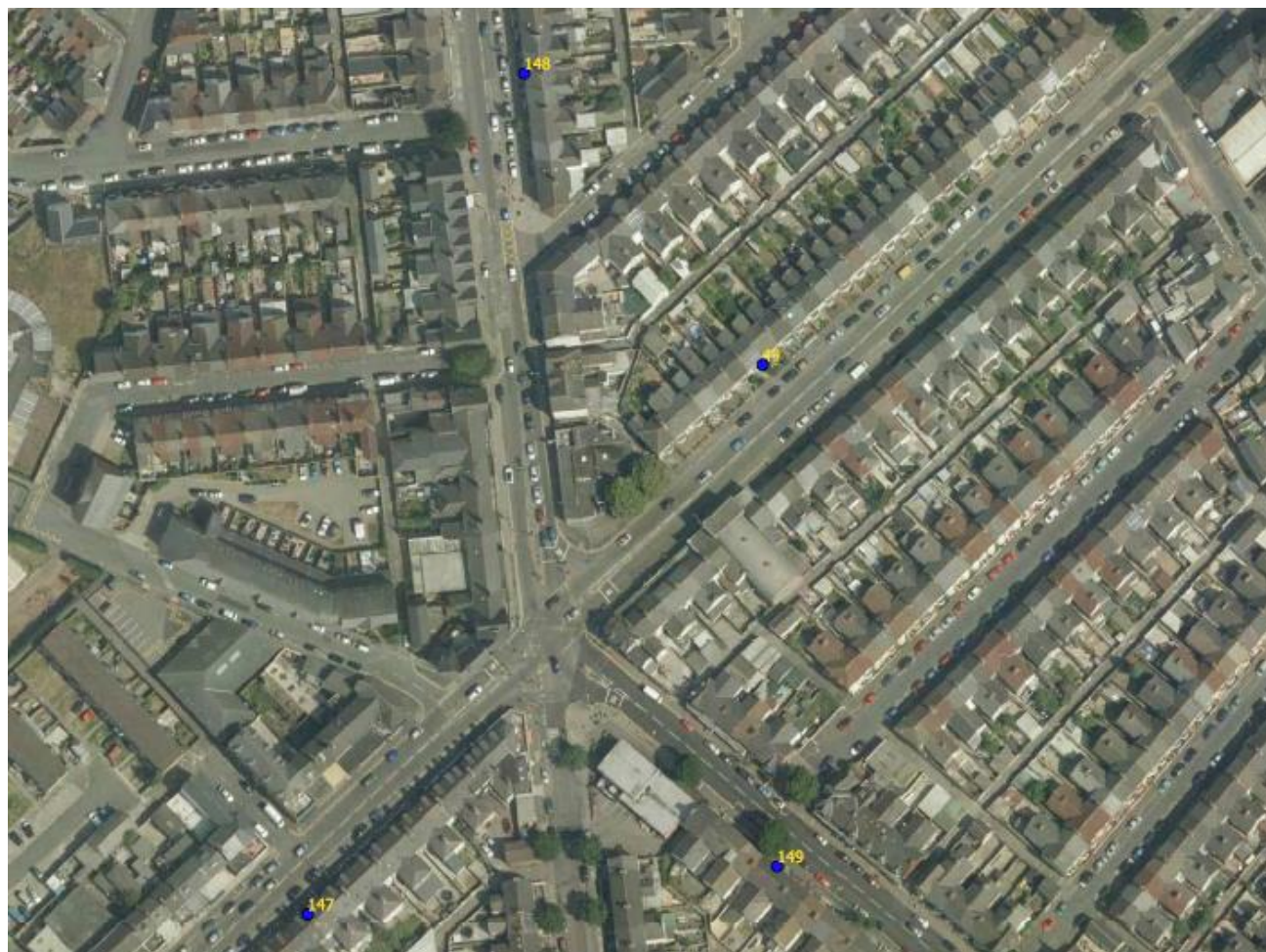


Figure 2.17 Map Showing Location of Diffusion Tubes in Cowbridge Road East and Llandaff Road





Figure 2.18 Map Showing Location of Diffusion Tubes in Ocean Way





**Figure 2.19 Map Showing Location of Diffusion Tubes in area of former Papermill, Canton**



*Area outlined in red is boundary of Ely Bridge AQMA*

## **2.2 Comparison of Monitoring Results with Air Quality Objectives**

During 2016 monitoring was carried out for Nitrogen Dioxide and Particulate Matter (PM<sub>10</sub>). There was no monitoring undertaken for benzene or 1-3-butadiene.

### **2.2.1 Nitrogen Dioxide (NO<sub>2</sub>)**

Nitrogen Dioxide was measured during 2016 at one site equipped with an automatic analyser and by a network of 77 passive diffusion tubes. The results are given and discussed below.

### **2.2.2 Automatic Monitoring Data**

The annual mean nitrogen dioxide concentrations at Cardiff Council's City Centre AURN site is summarised in Table 2.3, for the years 2012 to 2016. The annual mean nitrogen dioxide concentration was below the objective in 2016. In addition there were no exceedences of the 1- hour mean objective (Table 2.4).

**Table 2.3 – Results of Automatic Monitoring for NO<sub>2</sub>: Comparison with Annual Mean Objective**

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % <sup>a</sup>	Valid Data Capture 2016 % <sup>b</sup>	Annual Mean Concentration µg/m <sup>3</sup>				
					2012	2013	2014	2015	2016
Cardiff Centre AURN	Urban Background	N	100	98	27	26	25	27	23

<sup>a</sup> i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

<sup>b</sup> i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

Figure 3.0 – Trends in Annual Mean NO<sub>2</sub> Concentrations Measured at Automatic Monitoring Sites

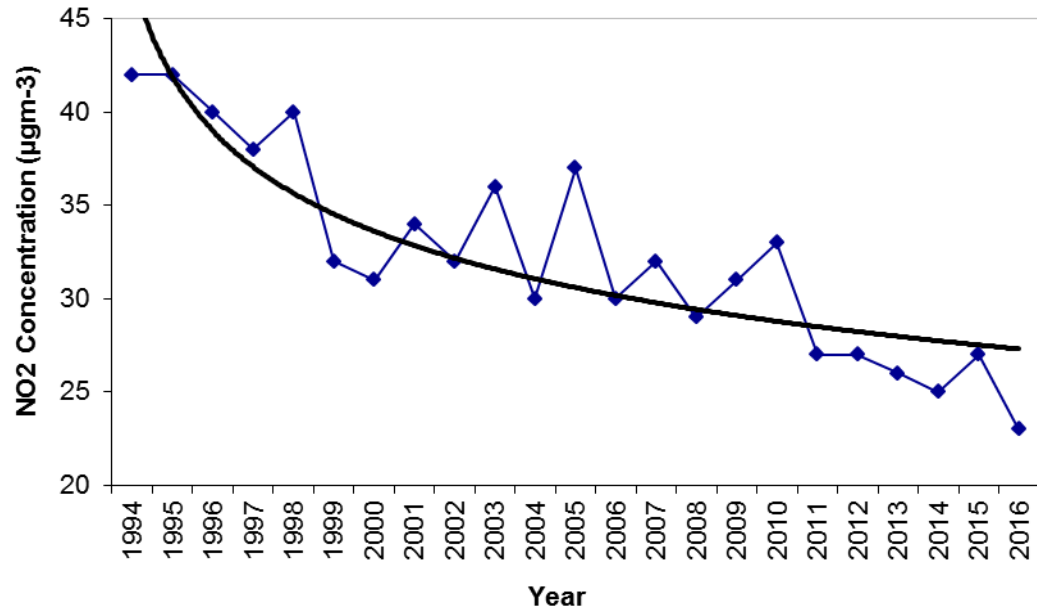


Figure 3.0 indicates that annual average NO<sub>2</sub> background levels continue to improve with a decreasing trend visible.

**Table 2.4 – Results of Automatic Monitoring for NO<sub>2</sub>: Comparison with 1-hour Mean Objective**

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % <sup>a</sup>	Valid Data Capture 2016 % <sup>b</sup>	Number of Hourly Means > 200µg/m <sup>3</sup>				
					2012* <sup>c</sup>	2013* <sup>c</sup>	2014* <sup>c</sup>	2015 <sup>c</sup>	2016
Cardiff Centre AURN	Urban Background	N	100	98	0	5	0	0 (14.98)	0

<sup>a</sup> i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

<sup>b</sup> i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

<sup>c</sup> If the data capture for full calendar year is less than 90%, include the 99.8<sup>th</sup> percentile of hourly means in brackets

\* Number of exceedences for previous years is optional

### 2.2.3 Diffusion Tube Monitoring Data

The nitrogen dioxide diffusion tube data is summarised in Table 2.5. The full dataset (monthly mean values) is included in Appendix A1. All data has been bias adjusted and where necessary distance corrected to account for relevant exposure. The applied bias adjustment factor was 0.78, as described in Appendix A2. The national bias correction factor was utilized as it would provide results representative of a worst case scenario. The bias correction factor of 0.78 was obtained from the following website: <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

Where the year data capture is less than 75% (9 months), the Bias Corrected Annual Mean Concentrations have been "annualised" following the method as in Box 7.9 & 7.10 of LAQM.TG16. Evidence of the sites annualised can be seen in Appendix A2.

Table 2.5 shows that 11 of the 77 monitoring sites recorded a concentration of NO<sub>2</sub> above the 40µg/m<sup>3</sup> annual mean Objective in 2016. Of these 11 sites, 7 are inside one of the four AQMAs.

Of the 11 sites (Sites 172, 180, 181, 185) are not currently in an AQMA where the measured concentration of NO<sub>2</sub> was above the 40µg/m<sup>3</sup> annual mean objective in 2016. However, there is reasoning for these recorded exceedences.

Site 172 is placed on Ocean Way to monitor potential impacts of traffic resulting from industrial developments in the area. The site is not representative of relevant exposure, the nearest being >650m away.

Sites 180 & 181 were implemented due to new developments with the potential for adverse air quality impacting the amenity of future occupants (Windsor House, Windsor Lane & Fitzalan Court, Newport Road). Both developments were under construction in 2016, therefore influencing any datasets recorded. Only recently has the student accommodation at Windsor House been completed and construction still continues at the Fitzalan Court site.

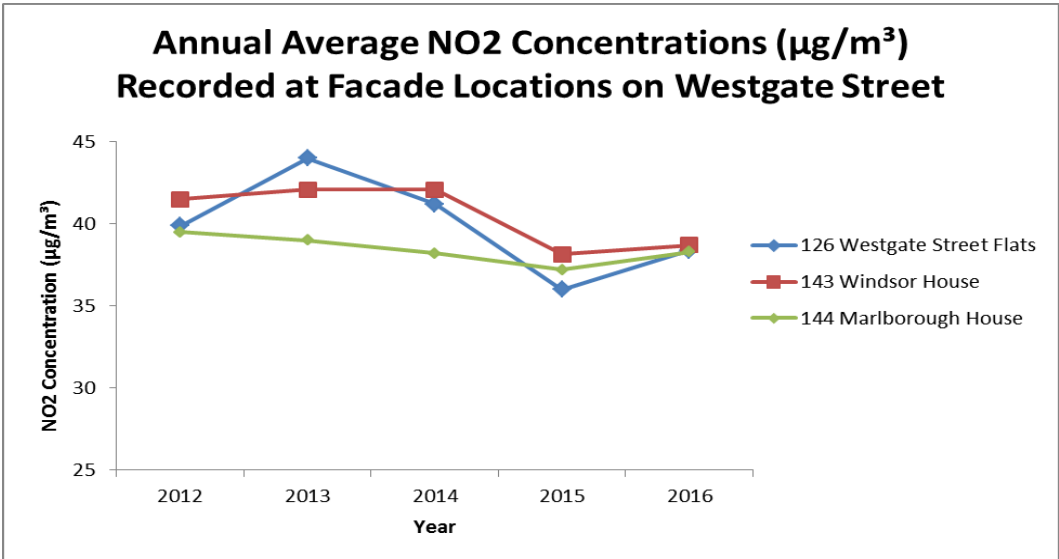
Sites 185, along with sites 186, 187 & 188 (Northgate House, Dempsey's Public House, Angel Hotel and Westgate Street 45 apartments) were commissioned in January 2016 following improvements to certain diffusion tube monitoring locations (Sites 175- 178). Site 175 was renamed as site 185, relocated at the façade of Northgate House, Kingsway. Sites 176 and 177 were commissioned to monitor concentrations along the Kingsway/Castle Street/Duke Street road link past Cardiff Castle to Westgate Street and the Cardiff City Centre AQMA. For 2016 Sites 176 and 177 were moved to

locations of improved relevant exposure (now labelled Sites 186 & 187). Site 188 was moved to the façade of 45 apartments Westgate Street. Due to their relocation, sites 186, 187 & 188 all fall within the boundary of the City Centre AQMA.

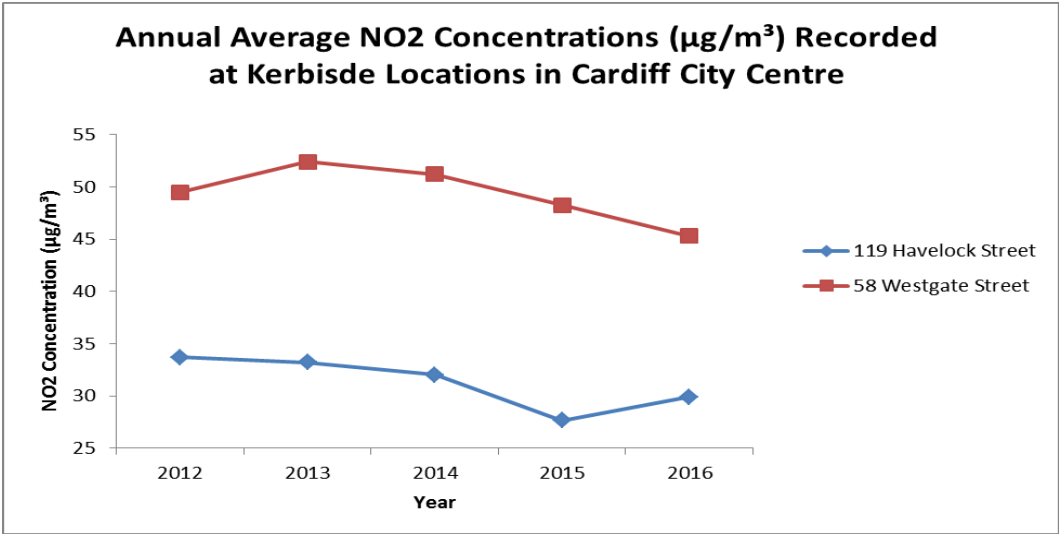
Sites 185, 186, 187 & 188 are not representative of relevant exposure and do not apply to the annual mean objective set for NO<sub>2</sub>. At each monitoring location there is no residential accommodation located at ground floor level. Where residential accommodation is present at these monitoring locations, it is located >3m above ground floor level. Therefore, datasets collected at these monitoring locations would apply to the 1-hour objective set for NO<sub>2</sub>

Examining Tables 2.5/ 2.6 & Figures 3.1/3.2, it is apparent that annual average NO<sub>2</sub> datasets in the City Centre, in and around the AQMA, continue to be elevated in 2016. Annual levels of NO<sub>2</sub> at residential accommodation on Westgate Street (Sites 126, 143 & 144) are approaching the objective with concentrations >38µg/m<sup>3</sup>, a 2µg/m<sup>3</sup> increase from the previous year (2015). Figure 3.2 represents kerbside monitoring locations used to examine traffic flow patterns and associated air quality levels. The graph shows little improvement in levels, in fact an increase in levels has been recorded at the monitoring site on Havelock Street.

**Figure 3.1- Trends in Annual Average NO<sub>2</sub> Concentrations Recorded at Façade Locations on Westgate Street**



**Figure 3.2- Trends in Annual Average NO<sub>2</sub> Concentrations Recorded at Kerbside Locations in Cardiff City Centre**

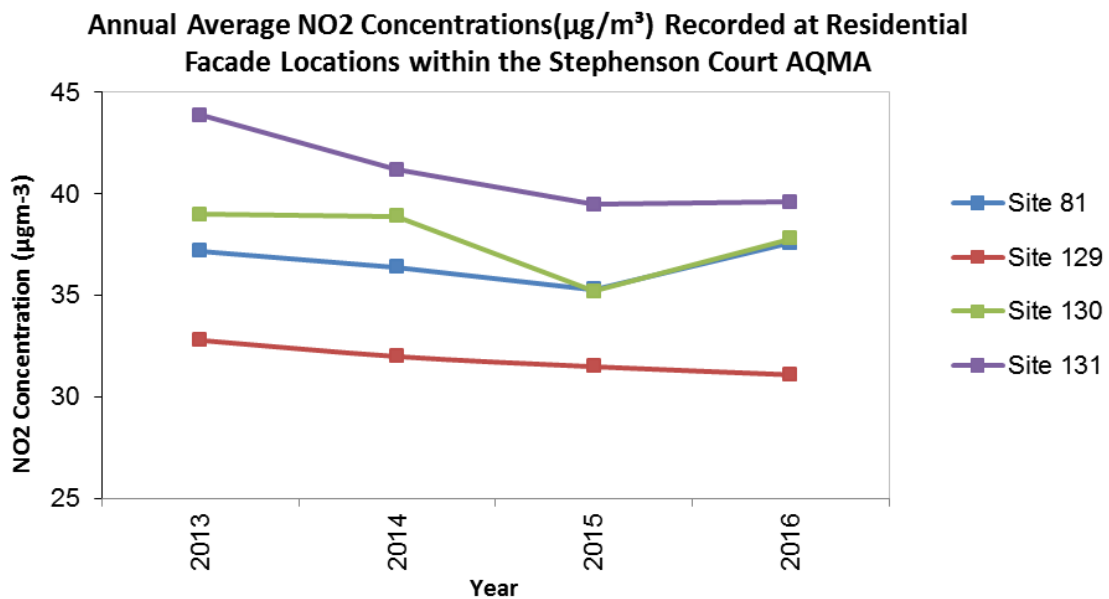


Monitoring undertaken within the Ely Bridge AQMA, at the façade of residential property (Site 117) indicates exceeding levels. This is potentially due to construction works in preparation for a residential development of the former Ely Paper Mill site.

Residential monitoring locations with the Llandaff AQMA (Sites 99 and 161) showed compliance with the annual average objective, both results recorded at 34.8µg/m<sup>3</sup> & 35µg/m<sup>3</sup>. Due to a foreseeable major residential development scheduled to commence in the area, the recorded levels are not regarded as low enough to initiate the revocation of the AQMA.



**Figure 3.3- Trends in Annual Average NO<sub>2</sub> Concentrations Recorded at Residential Façade Locations within the Stephenson Court AQMA.**



All four sites within the Stephenson Court AQMA (Sites, 81, 129, 130 & 131) showed compliance with the annual average objective, however these results are elevated. Figure 3.4 displays the noticeable increase in annual average readings in 2016 at sites 81, 130 & 131.

There are 10 façade-based diffusion tube sites with complete annual mean datasets from 2002, i.e. from when the Council started determining an annual bias-adjustment factor. These sites are numbers 16, 49, 81, 82, 85, 86, 96, 97, 99 and 100. Bias-adjusted nitrogen dioxide concentrations from these 10 sites have been averaged for each year and plotted in Figure 3.5 to give a combined, representative trend over the years since 2002.

The plot seems to indicate a very slow, gradual increase in nitrogen dioxide concentrations in earlier years, possibly influenced by the noticeable concentration peaks in 2003, 2007 and 2010. It is evident that average concentrations dropped significantly for years 2014 & 2015, with a slight increase in 2016. Monitoring at all these sites continues in 2017.

In accordance with LAQM best practise guidance; there are no monitoring sites in the district with annual average concentrations above 60µg/m<sup>3</sup> in 2016. Therefore this indicates it is unlikely that the hourly nitrogen dioxide objective was exceeded.

Table 2.6 shows the nitrogen dioxide diffusion tube data for Cardiff Council for 2012 – 2016 for comparison purposes.

**Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2016**

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) <sup>a</sup>	2016 Annual Mean Concentration ( $\mu\text{g}/\text{m}^3$ ) - Bias Adjustment factor = 0.78
16	Ninian Park Road	Roadside	N	N	100	28.9
33	Mitre Place	Kerbside	Y	N	100	<b>47.6</b>
44	City Road	Kerbside	N	N	83	31.3
45	Mackintosh Place	Kerbside	N	N	100	36.0
47	Ely Bridge	Kerbside	Y	N	92	<b>49.7</b>
49	Penarth Road	Roadside	N	N	100	30.4
56	Birchgrove Village	Roadside	N	N	100	32.5
58	Westgate Street	Kerbside	Y	N	100	<b>45.3</b>
73	Green Street	Kerbside	N	N	83	24.4
81	Stephenson Court	Roadside	Y	N	100	37.6
82	104 Birchgrove Road	Roadside	N	N	100	28.4

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) <sup>a</sup>	2016 Annual Mean Concentration ( $\mu\text{g}/\text{m}^3$ ) - Bias Adjustment factor = 0.78
85	497 Cowbridge Road West	Roadside	N	N	92	26.8
86	19 Fair oak Road	Roadside	N	N	100	35.6
96	Manor Way Junction	Roadside	N	N	83	36.9
97	Newport Road (premises)	Roadside	N	N	100	31.2
98	Western Avenue (premises)	Roadside	N	N	100	28.4
99	Cardiff Road Llandaff	Roadside	Y	N	100	34.8
100	188 Cardiff Road	Roadside	N	N	100	30.3
101	Cardiff Centre AURN	Urban Centre	N	Y	100	23.1
102	Cardiff Centre AURN	Urban Centre	N	Y	100	22.5
103	Cardiff Centre AURN	Urban Centre	N	Y	100	23.2
106	30 Caerphilly Road	Roadside	N	N	92	32.2

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) <sup>a</sup>	2016 Annual Mean Concentration ( $\mu\text{g}/\text{m}^3$ ) - Bias Adjustment factor = 0.78
107	Lynx Hotel	Roadside	N	N	50	35 <sup>a</sup>
111	98 Leckwith Road	Roadside	N	N	100	23.3
112	17 Sloper Road	Roadside	N	N	100	29.5
115	21 Llandaff Road	Roadside	N	N	100	32.8
117	25 Cowbridge Road West	Roadside	Y	N	100	<b>41.3</b>
119	Havelock Street	Kerbside	N	N	100	29.9
124	287 Cowbridge Road East	Roadside	N	N	100	24.2
126	Westgate Street Flats	Roadside	Y	N	92	38.4
128	117 Tudor Street	Roadside	N	N	100	31.2
129	Stephenson Court 2	Roadside	Y	N	92	31.1
130	Burgess Court	Roadside	Y	N	100	37.8
131	Dragon Court	Roadside	Y	N	92	39.6
133	St Mark's Avenue	Roadside	N	N	83	35.7

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) <sup>a</sup>	2016 Annual Mean Concentration ( $\mu\text{g}/\text{m}^3$ ) - Bias Adjustment factor = 0.78
134	Sandringham Hotel	Roadside	Y	N	58	38.2 <sup>a</sup>
139	Lower Cathedral Road	Kerbside	N	N	100	31.1
140	Clare Street	Kerbside	N	N	100	37.3
141	Fairoak Road 2	Roadside	N	N	67	36.3 <sup>a</sup>
143	Windsor House	Roadside	Y	N	92	38.7
144	Marlborough House	Roadside	Y	N	100	38.3
145	Tudor Street Flats	Roadside	N	N	100	29.9
146	Neville Street	Roadside	N	N	100	27.5
147	211 Penarth Road	Roadside	N	N	92	28.8
148	161 Clare Road	Roadside	N	N	100	29.2
149	10 Corporation Road	Roadside	N	N	83	31.2
152	James Street	Roadside	N	N	92	29.3
153	Magic Roundabout	Roadside	N	N	100	30.1

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) <sup>a</sup>	2016 Annual Mean Concentration ( $\mu\text{g}/\text{m}^3$ ) - Bias Adjustment factor = 0.78
156	2a/4 Colum Road	Roadside	N	N	100	29.7
157	47 Birchgrove Road	Roadside	N	N	100	28.2
158	64/66 Cathays Terrace	Roadside	N	N	100	29.0
159	IMO façade replacement	Roadside	N	N	100	35.5
160	High Street Zizzi	Urban Centre	Y	N	83	31.7
161	52 Bridge Road	Roadside	Y	N	83	35.0
162	58 Cardiff Road	Roadside	N	N	92	26.1
163	118 Cardiff Road	Roadside	N	N	100	25.7
164	725 Newport Road	Roadside	N	N	100	20.0
165	6 Heol Tyrrell	Roadside	N	N	100	17.0
166	163 Lansdowne Road	Roadside	N	N	100	33.2
167	359 Lansdowne Road	Roadside	N	N	92	29.8

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) <sup>a</sup>	2016 Annual Mean Concentration ( $\mu\text{g}/\text{m}^3$ ) - Bias Adjustment factor = 0.78
168	570 Cowbridge Road East	Roadside	N	N	92	27.7
169	43 Clos Hector	Urban Centre	N	N	100	18.4
170	11 Pengam Green	Roadside	N	N	92	21.9
171	23 Tweedsmuir Road	Roadside	N	N	100	22.0
172	Ocean Way 1	Roadside	N	N	100	<b>48.8</b>
173	Ocean Way 2	Roadside	N	N	67	28.7 <sup>a</sup>
174	76 North Road	Kerbside	N	N	92	33.3
179	Altolusso, Bute Terrace	Roadside	N	N	67	39.7 <sup>a</sup>
180	Fitzalan Court, Newport Road	Kerbside	N	N	50	<b>48.1<sup>a</sup></b>
181	Windsor House, Windsor Lane	Kerbside	N	N	83	<b>43.3</b>
182	Admiral House, Newport Road	Roadside	N	N	92	33.6
183	Station Terrace	Kerbside	N	N	75	35.9
184	Hopouse, St Mary Street	Roadside	Y	N	75	<b>41.4</b>



Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) <sup>a</sup>	2016 Annual Mean Concentration ( $\mu\text{g}/\text{m}^3$ ) - Bias Adjustment factor = 0.78
185	Northgate House, Duke Street	Roadside	N	N	92	37.1
186	Dempsey's Public House, Castle Street	Roadside	Y	N	92	<b>47.5</b>
187	Angel Hotel	Roadside	Y	N	75	<b>50.7</b>
188	Westgate Street (45 Apartments)	Roadside	Y	N	67	<b>49.8<sup>a</sup></b>

**In bold**, exceedence of the NO<sub>2</sub> annual mean AQS objective of 40 $\mu\text{g}/\text{m}^3$

<sup>a</sup> Result has been annualised in accordance with Boxes 7.9 and 7.10 of LAQM.TG16 as data capture for the year was less than 75%.

<sup>b</sup> NO<sub>2</sub> exceedence is measured at a monitoring site not representative of public exposure. NO<sub>2</sub> concentration at the nearest relevant exposure calculated based on the "NO<sub>2</sub> fall-off with distance" calculator (<http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html>).

**Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes (2012 to 2016)**

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2012 (Bias Adjustment Factor = 0.86)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.84)	2015 (Bias Adjustment Factor = 0.79)	2016 (Bias Adjustment Factor = 0.78)
16	Roadside	N	30.9	31.3	32.4	27.86	28.9
33	Kerbside	Y	<b>49.8</b>	<b>49.6</b>	<b>51.2</b>	<b>46.94</b>	<b>47.6</b>
44	Kerbside	N	34.8	33.2	29.7	27.08	31.3
45	Kerbside	N	36.8	36.8	37.8	32.09	36.0
47	Kerbside	Y	<b>51.1<sup>a</sup></b>	<b>48.0</b>	<b>47.1</b>	<b>41.35</b>	<b>49.7</b>
49	Roadside	N	27.9	32.1	32.6	29.35	30.4
56	Roadside	N	33.9	35.4	35.8	29.64	32.5
58	Kerbside	Y	<b>49.5</b>	<b>52.4</b>	<b>51.2</b>	<b>48.25</b>	<b>45.3</b>
73	Kerbside	N	25.6	24.9	26.8	22.05	24.4
74	Kerbside	N	<b>50.1</b>	<b>47.8</b>	<b>47.3</b>	<b>41.64</b>	<b>N/A</b>
81	Roadside	Y	<b>40.6</b>	37.2	36.4	35.29	37.6
82	Roadside	N	28.5	32.1	27.6	23.79	28.4
85	Roadside	N	27.3	26.7	27.2	22.36	26.8
86	Roadside	N	<b>40.3</b>	38.8	38.9	34.85	35.6
96	Roadside	N	35.4	35.5	34.4	31.05	36.9
97	Roadside	N	37.8	34.5	33.6	30.49	31.2
98	Roadside	N	26.9	28.3	29.8	25.44	28.4
99	Roadside	Y	34.5	38.9	39.6	29.84	34.8
100	Roadside	N	33.7	32.6	31.8	28.86	30.3
101	Urban Centre	N	25.8	26.5	24.4	20.28	23.1
102	Urban Centre	N	26.1	26.9	24.2	21.06	22.5
103	Urban Centre	N	25.8	26.2	24.4	20.72	23.2

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2012 (Bias Adjustment Factor = 0.86)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.84)	2015 (Bias Adjustment Factor = 0.79)	2016 (Bias Adjustment Factor = 0.78)
106	Roadside	N	35.7	34.8	34.9	29.41	32.2
107	Roadside	N	37.6	34.6	34.8	30.70	35 <sup>a</sup>
111	Roadside	N	23.7	25.2	24.7	21.34	23.3
112	Roadside	N	30.6	30.7	28.8	27.06	29.5
115	Roadside	N	37.7	35.5	36.3	32.47	32.8
117	Roadside	Y	<b>42.6</b>	<b>44.9</b>	<b>42.3</b>	39.54	<b>41.3</b>
119	Kerbside	N	33.7	33.2	32.0	27.65	29.9
124	Roadside	N	25.5	26.1	26.3	22.48	24.2
126	Roadside	Y	39.9	<b>44.0</b>	<b>41.2</b>	36.00	38.4
128	Roadside	N	35.1	34.7	36.5	29.57	31.2
129	Roadside	Y	34.9	32.8	32.0	31.45	31.1
130	Roadside	Y	<b>41.5</b>	39.0	38.9	35.23	37.8
131	Roadside	Y	<b>47.9</b>	<b>43.9</b>	<b>41.2</b>	39.48	39.6
133	Roadside	N	39.3	37.8	37.5	31.89	35.7
134	Roadside	Y	37.2 <sup>a</sup>	33.4 <sup>a</sup>	34.5	32.07	38.2 <sup>a</sup>
139	Kerbside	N	34.3	34.1	35.5	29.42	31.1
140	Kerbside	N	<b>41.7</b>	<b>42.2</b>	<b>42.9</b>	36.32	37.3
141	Roadside	N	<b>47.6</b>	37.7	37.0	32.28	36.3 <sup>a</sup>
142	Kerbside	Y	<b>47.6</b>	<b>46.3</b>	<b>44.9</b>	<b>41.83</b>	<b>N/A</b>
143	Roadside	Y	<b>41.5</b>	<b>42.1</b>	<b>42.1</b>	38.16	38.7
144	Roadside	Y	39.5	39.0	38.2	37.22	38.3
145	Roadside	N	33.8	34.5	32.6	29.90	29.9
146	Roadside	N	29.5	30.9	29.7	26.57	27.5
147	Roadside	N	31.0	32.0	31.3	27.70	28.8
148	Roadside	N	27.8	29.3	29.1	27.53	29.2
149	Roadside	N	33.0	34.5	33.2	33.56	31.2

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) µg/m <sup>3</sup>				
			2012 (Bias Adjustment Factor = 0.86)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.84)	2015 (Bias Adjustment Factor = 0.79)	2016 (Bias Adjustment Factor = 0.78)
152	Roadside	N	32.5	31.0	29.7	27.60	29.3
153	Roadside	N	36.2	33.0	33.2	28.99	30.1
156	Roadside	N	32.6	34.9	31.4	25.92	29.7
157	Roadside	N	31.6	29.0	29.7	27.16	28.2
158	Roadside	N	28.8	30.2	29.1	25.50	29.0
159	Roadside	N	39.9	38.8	39.2	33.96	35.5
160	Urban Centre	Y	31.4	30.3	28.3	27.03	31.7
161	Roadside	Y	<b>43.0</b>	39.1	37.2	32.28	35.0
162	Roadside	N	28.5	27.6	27.6	24.47	26.1
163	Roadside	N	27.5	25.4	28.2	23.22	25.7
164	Roadside	N	-	25.4	23.9	20.31	20.0
165	Roadside	N	-	19.4	17.4	15.10	17.0
166	Roadside	N	-	34.9	36.6	32.05	33.2
167	Roadside	N	-	31.7	31.5	28.26	29.8
168	Roadside	N	-	27.9	27.7	24.26	27.7
169	Urban Centre	N	-	18.0	18.1	16.27	18.4
170	Roadside	N	-	22.1	21.9	19.08	21.9
171	Roadside	N	-	22.5	20.8	18.06	22.0
172	Roadside	N	-	<b>49.5</b>	<b>47.8</b>	<b>44.50</b>	<b>48.8</b>
173	Roadside	N	-	33.7	33.3	28.40	28.7 <sup>a</sup>
174	Kerbside	N	-	-	33.9	28.65	33.3
175	Kerbside	N	-	-	<b>46.8</b>	<b>42.00 (34.7)<sup>b</sup></b>	<b>N/A</b>
176	Roadside	N	-	-	<b>55.0</b>	<b>53.06 (47.8)<sup>b</sup></b>	<b>N/A</b>
177	Roadside	N	-	-	<b>51.8</b>	<b>48.09</b>	<b>N/A</b>
178	Kerbside	N	-	-	<b>51.6</b>	<b>54.32 (45.4)<sup>b</sup></b>	<b>N/A</b>

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2012 (Bias Adjustment Factor = 0.86)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.84)	2015 (Bias Adjustment Factor = 0.79)	2016 (Bias Adjustment Factor = 0.78)
179	Roadside	N	-	-	-	-	39.7 <sup>a</sup>
180	Kerbside	N	-	-	-	-	<b>48.1<sup>a</sup></b>
181	Kerbside	N	-	-	-	-	<b>43.3</b>
182	Roadside	N	-	-	-	-	33.6
183	Kerbside	N	-	-	-	-	35.9
184	Roadside	Y	-	-	-	-	<b>41.4</b>
185	Roadside	N	-	-	-	-	37.1
186	Roadside	Y	-	-	-	-	<b>47.5</b>
187	Roadside	Y	-	-	-	-	<b>50.7</b>
188	Roadside	Y	-	-	-	-	<b>49.8<sup>a</sup></b>

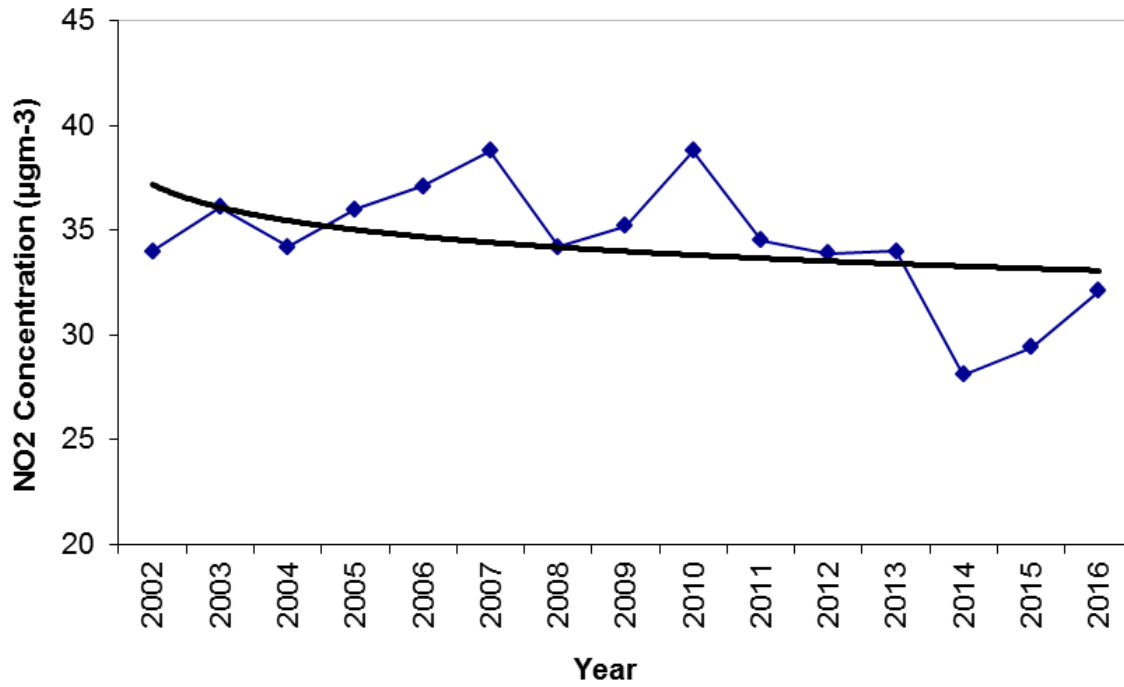
**In bold**, exceedence of the NO<sub>2</sub> annual mean AQS objective of 40 $\mu\text{g}/\text{m}^3$

<sup>a</sup> Result has been annualised in accordance with Boxes 7.9 and 7.10 of LAQM.TG16 as data capture for the year was less than 75%.

<sup>b</sup> NO<sub>2</sub> exceedence is measured at a monitoring site not representative of public exposure. NO<sub>2</sub> concentration at the nearest relevant exposure calculated based on the “NO<sub>2</sub> fall-off with distance” calculator (<http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html>).



Figure 3.4 – Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites



#### **2.2.4 Particulate Matter (PM<sub>10</sub>)**

During 2016 PM<sub>10</sub> was measured at the Cardiff Centre AURN monitoring site and the summary data is given in Tables 2.7 and 2.8 below.

As described in previous sections, due to technical issues, low data capture for PM<sub>10</sub> was measured by the onsite TEOM- FDMS sampler. The total data capture for the year was 47.1%. As outlined in LAQM (TG16) the data from the sampler has been annualised in accordance with box 7.9 and the 90.4<sup>th</sup> Percentile value has been given to examine the 24 hour objective.

The results of the monitoring indicate that recorded PM<sub>10</sub> concentrations at the Cardiff City Centre AURN monitoring station are compliant with both the annual mean (40µg/m<sup>3</sup>) and 24-hour mean (>50 µg/m<sup>3</sup> not to be exceeded more than 18 times per year) AQS objectives set for PM<sub>10</sub>.

Annual and 24-hour average PM<sub>10</sub> concentrations (where available) displayed in Tables 2.7 & 2.8 for the years 2012 to 2016 show compliance with the AQS objectives.

**Table 2.7 – Results of Automatic Monitoring for PM<sub>10</sub>: Comparison with Annual Mean Objective**

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2016 %	Confirm Gravimetric Equivalent (Y or N/A)	Annual Mean Concentration (µg/m <sup>3</sup> )				
						2012	2013	2014	2015	2016
Cardiff Centre AURN	Urban Background	N	100	47.1	Y	18	19	16	16	15.1 <sup>a</sup>

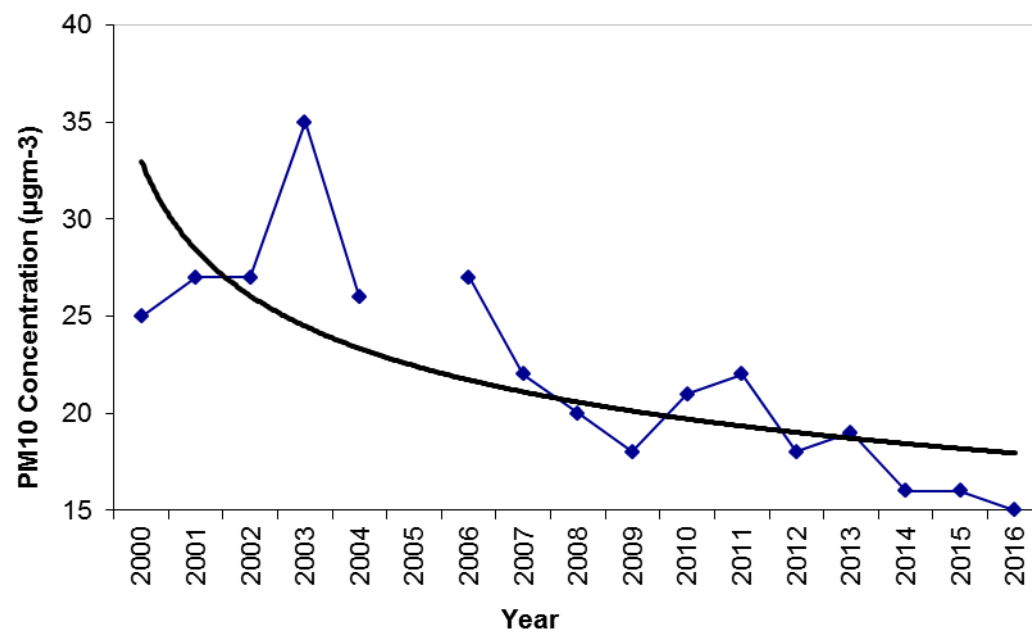
<sup>a</sup> Result has been “annualised” in accordance with Box 7.9 of TG(16) as data capture for the year was less than 75%

**Table 2.8 – Results of Automatic Monitoring for PM<sub>10</sub>: Comparison with 24-hour Mean Objective**

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2016 %	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m <sup>3</sup>				
						2012	2013	2014	2015	2016
Cardiff Centre AURN	Urban Background	N	100	47.1	Y	5	3	4	5 (25.4)	1 (30.52)

<sup>a</sup> 90.4<sup>th</sup> percentile of 24-hour means shown in brackets due to <90% data capture for the year

Figure 3.5 – Trends in Annual Mean PM<sub>10</sub> Concentrations



The displayed datasets indicate a downward trend in Cardiff's background PM<sub>10</sub> levels.

### **2.2.5 Sulphur Dioxide (SO<sub>2</sub>)**

Sulphur dioxide was measured at the Cardiff Centre AURN automatic monitoring site during 2016. The site is classified as “Urban Background” and is a relevant location for the 15-minute and 1-hour Objectives. Data for the monitoring is given in Table 2.9 below.

There were no exceedences of Objectives during 2016.



**Table 2.9 – Results of Automatic Monitoring for SO<sub>2</sub>: Comparison with Objectives**

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2016 %	Number of: <sup>a</sup>		
					15-minute Means > 266µg/m <sup>3</sup>	1-hour Means > 350µg/m <sup>3</sup>	24-hour Means > 125µg/m <sup>3</sup>
Cardiff Centre AURN	Urban Background	N	100	99.5	0	0	0

<sup>a</sup> As data capture for full calendar year is less than 90%, result in brackets represents required percentile (in µg/m<sup>3</sup>): 15-min mean = 99.9<sup>th</sup> ; 1-hour mean = 99.7<sup>th</sup> ; 24-hour mean = 99.2<sup>th</sup> percentile

### **2.2.6 Benzene**

No monitoring of Benzene was undertaken by SRS on behalf of Cardiff Council in 2016.

### **2.2.7 Other Pollutants Measured**

During 2016 monitoring for ozone and carbon monoxide was carried out in Cardiff. Details are in the following sections

#### **Carbon Monoxide**

Carbon monoxide was monitored at Cardiff Centre AURN during 2016.

Data capture at for the whole year at the Cardiff Centre AURN site was 98.6% and there were no exceedences of the Objective.

There continues to be no risk of the National Air Quality Standard being exceeded.

**Table 2.10: Results of Automatic Monitoring of Carbon Monoxide (2016)**

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2016 %	Number of 8 hour Means > 10µg/m <sup>3</sup>
					2016
Cardiff Centre AURN	Urban Background	N	100	98.6	0

## **Ozone (O<sub>3</sub>)**

Cardiff Council monitors Ozone due to its potential correlations with other pollutants. In 2016, ozone was measured at the Cardiff City Centre, Frederick Street AURN site. Although Ozone is not included in the Local Air Quality Management system, the results are included in Table 2.9 for completeness.

The results are compared with the running 8-hour mean objective as set by the Expert Panel on Air Quality Standards (EPAQs) which states the running 8-hour mean should not exceed 100µg/m<sup>3</sup> on more than 10 days per year. There are two exceedences of the ozone objective in Cardiff in 2016.

**Table 2.11: Results of Automatic Monitoring of Ozone (2016)<sup>a & b</sup>**

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2016 %	Number of days where the 8-hour mean >100µg/m <sup>3</sup>
					2016
Cardiff Centre AURN	Urban Background	N	100	98.2	2

a Exceedences are shown in bold

b Where annual data capture is less than 90%, the 97<sup>th</sup> percentile of the maximum daily 8-hour running mean is shown in brackets.

## **2.2.8 Summary of Compliance with AQS Objectives**

Shared Regulatory Services have reviewed the results from the monitoring undertaken across the Cardiff in 2016.

The datasets indicate that the annual average objective for NO<sub>2</sub> was breached at monitoring locations outside of the existing AQMAs (Sites 180, 181 & 185).

It is felt that at this stage no further detailed assessments are required;

Sites 180 & 181 were implemented to monitor air quality levels and therefore the potential impacts to future occupants at new development sites. These developments were still under construction in 2016 and therefore datasets collected will be negatively influenced.

The 1-hour objective for NO<sub>2</sub> need only apply to site 185 as the ground floor level monitored is used only for commercial use.



## **3 New Local Developments**

### **3.1 Road Traffic Sources**

SRS on behalf of Cardiff Council continue to work and engage with the Transport and Highways team in Cardiff Council, consulting upon any road network proposals that has the potential to influence local air quality levels.

#### **3.1.1 Narrow Congested Streets with Residential Properties Close to the Kerb**

Cardiff Council has considered road traffic sources extensively in both this and each year in earlier reports; the monitoring network is very largely focused on measuring concentrations of nitrogen dioxide close to many of them. These have been discussed either in previous reports or earlier in this report.

There are no newly identified road traffic sources which need to be considered.

For 2016 SRS on behalf of Cardiff Council confirms that there are no new/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.

#### **3.1.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic**

Datasets collected from improved monitoring locations along Kingsway/ Duke Street/ Castle Street Link area have been compared to the 1-hour objective set for NO<sub>2</sub> due to the fact each site is known for commercial use at ground floor level. Levels are shown to be compliant with the objective.

There are no new locations identified since the Council's 2016 Progress Report was submitted and there is no need to consider this further at this time.

SRS on behalf of Cardiff Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

#### **3.1.3 Roads with a High Flow of Buses and/or HGVs.**

The 2012 USA reported that the closure of High Street and St Mary Street appeared to have displaced buses and coaches heading to Central Bus Station onto Westgate Street meaning that approximately 25% of the traffic using Westgate Street is buses and coaches. Monitoring data for

Westgate Street indicates that there is a nitrogen dioxide issue in the area and Westgate Street is now part of the Cardiff City Centre AQMA. A Further Assessment for the Westgate Street area of the AQMA was submitted in 2014.

Other than Westgate Street, there are no roads in Cardiff where buses, coaches and HDVs account for >20% of road traffic, where flow of these vehicles is >2500 and there is relevant exposure within 10m of the kerb.

SRS on behalf of Cardiff Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

#### **3.1.4 Junctions**

Junctions have been fully considered in previous annual reviews and assessments.

The end of 2015 marked the the completion of engineering works within the Stephenson Court AQMA (realignment of the junction in order to reduce queuing on City Road & relocation of bus stops outside residential accommodation to positions further east). NO<sub>2</sub> datasets collated in 2016, in the vicinity of the outlined area indicate a negative impact on air quality levels. The Stephenson Court AQMA experienced an increase in annual mean NO<sub>2</sub> at 3 out of 4 monitoring locations.

As discussed previously, SRS on behalf of Cardiff Council are coordinating and developing a Clean Air Strategy & Action Plan for Cardiff City. The document will look to improve overall air quality in Cardiff. With the implementation of correct long term measures all highlighted road networks and identified AQMAs should be able to benefit from improved air quality.

SRS on behalf of Cardiff Council can confirm that there are no new/newly identified busy junctions/busy roads where exceedences of either the nitrogen dioxide or PM<sub>10</sub> objectives are likely.

### **3.1.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment**

Since the 2016 Annual Progress Report, in June 2017 a new section of the Eastern Bay Link road has been built and opened between the A4232 and Rover Way. The new link road does not impact on air quality negatively and there is no relevant exposure.

The only other road developments constructed are those small, local roads in residential developments.

The 2009 USA reported the notable alterations on Leckwith Road in association with the then newly constructed Cardiff City FC stadium. Monitoring at nearby residential accommodation remains ongoing and has not revealed any significant alteration in concentrations of nitrogen dioxide as a result of this development.

SRS on behalf of Cardiff Council can confirm that there are no new/proposed roads.

### **3.1.6 Roads with Significantly Changed Traffic Flows**

Ratified traffic data has been examined and there are no roads in Cardiff which have experienced traffic flow (AADT) growth of 25% or more in the preceding three years.

There is increasing evidence from the traffic measurements both locally and regionally to suggest that, for economic and other reasons, traffic growth on major routes has stopped year-on-year and may even have declined recently. This has, for example, resulted in a number of air quality assessments submitted with planning applications assuming current levels of road traffic as a worst-case scenario.

It should be noted that Cardiff Council is actively implementing its traffic management policy of a 50:50 modal split, i.e. 50% of journeys being made other than by the private car. This is not just for new developments but also for the local road network as a whole.

The Council is currently considering planning applications for significant housing and mixed use developments at a number of "strategic sites" across the city. Potentially the most significant of these are three "strategic sites" centred on Llantrisant Road to the west of the Llandaff AQMA. The largest of these three sites includes several thousand new residences and this site is the closest of

the three to the Llandaff AQMA. There is also a recent planning application for residential accommodation at the current site of the BBC Wales TV studios on Llantrisant Road immediately to the west of the AQMA.

The potential impact of the three “strategic sites” is being considered as a whole rather than individual applications due to the potential for significant traffic impact along Llantrisant Road. Air Quality Assessments have been submitted for these sites and each of them takes into account the other sites and their potential traffic impact. The application for the BBC Wales TV studios also has the benefit of an Air Quality Assessment.

In the case of the “strategic sites” the developments could take up to a decade to complete. None of the four sites mentioned above have commenced development at the time of writing and there is therefore no significantly altered traffic flows to assess currently.

SRS on behalf of Cardiff Council can confirm that there are no new/newly identified roads with significantly changed traffic flows.

### **3.1.7 Bus and Coach Stations**

Exposure at Cardiff Central Bus Station has been considered in previous reports with the conclusion that exceedence of the objectives was unlikely. Nothing has changed in this regard.

Since 2015’s USA Cardiff Central Bus Station has been closed and redevelopment has begun.

An Environmental Statement which included an Air Quality Chapter was submitted in November 2016 in support of the Cardiff Central Interchange proposal. Following a review of the report and its outcomes it was decided that additional mitigation measures needed to be investigated and assessed and included in a revised AQA which should be submitted and reviewed. A revised AQA was submitted which included additional sensitivity test scenarios which looked at alleviating increased an exceeding levels of NO<sub>2</sub> as a result of the proposal. A number of planning conditions have been implemented to mitigate against any air quality impacts. These are detailed in Section 5.1 of this report.

In November 2016 consent was granted for a Cardiff West Bus Interchange. Please see Section 5.4 for more information.

SRS on behalf of Cardiff Council can confirm that there are no relevant bus stations in the Local Authority area

## **3.2 Other Transport Sources**

### **3.2.1 Airports**

There are no airports in Cardiff. The nearest airport is Cardiff International which is located approximately 15 miles to the west of Cardiff in The Vale of Glamorgan Council's area.

There are no airports planned or proposed within the Council's area and nowhere to put one.

SRS on behalf of Cardiff Council confirms that there are no airports in the Local Authority area.

### **3.2.2 Railways (Diesel and Steam Trains)**

Cardiff is well-served by passenger rail transport. The main Swansea to London Paddington line is served by Cardiff Central Station. Additionally, there is a network of local-line services running, in the main, to the valleys north of Cardiff.

LAQM.TG(16) suggests that SO<sub>2</sub> emissions from diesel locomotives may be significant if there are outdoor locations where locomotives are regularly stationary for more than 15minutes and where members of the public could be regularly exposed over this period at such locations.

LAQM.TG(16) also requires consideration exposure to nitrogen dioxide within 30m of certain specified railway lines in those areas where the annual mean background concentration is above 25µgm<sup>-3</sup>.

### **3.2.3 Stationary Trains**

Stationary trains have been considered fully in earlier reports with regard to potential exceedences of the sulphur dioxide objective. No potential exceedences were found and nothing has changed in this regard since then. There is no need to further assess this source.

It should be recorded that works are now underway in preparation for the electrification of the main Swansea/Cardiff to London Paddington line. The effects of this on local emissions can be only beneficial.

Discussions with regard to the electrification of the local line network are ongoing.



SRS on behalf of Cardiff 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.

#### **3.2.4 Moving Trains**

LAQM.TG(09) introduced a new requirement to assess the potential for exceedence of nitrogen dioxide objectives. The assessment criteria are in relation to large numbers of diesel locomotive movements where there is relevant exposure within 30metres of the track in areas where the background annual mean concentration of nitrogen dioxide is above  $25\mu\text{m}^{-3}$ .

This assessment was carried out for the 2009 USA and nothing has changed in the intervening period. There is no need to further assess this source.

It should be recorded that works are now underway in preparation for the electrification of the main Swansea/Cardiff to London Paddington line. The effects of this on local emissions can be only beneficial.

Discussions with regard to the electrification of the local line network are ongoing.

SRS on behalf of Cardiff Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

#### **3.2.5 Ports (Shipping)**

The 2012 USA reported:

“Cardiff docks are not a ferry terminal, there is no Ro-Ro usage and no cruise liners use the port. There is some container traffic using the port and the docks handle bulk cargoes such a sand and grain. Coal-handling operations ceased some years ago.”

In accordance with LAQM.TG(16) guidance threshold of 5000 movements per annum, with relevant exposure within 250m of the berths and main areas or 15,000 large ship movements per annum, with relevant exposure within 1km of these areas is not close to being approached and the risk of exceedence of the  $\text{SO}_2$  objectives is considered very small.

Nothing has changed in this regard since the last 2015 USA report that time and there is no need to consider this source further.

SRS on behalf of Cardiff Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area

### **3.3 Industrial Sources- Industrial Installations**

#### **3.3.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out**

In terms of neighbouring authorities and any major proposed industrial installations, on the 31<sup>st</sup> July 2015 the Vale Council approved planning permission for the construction and operation of a biomass gasification facility at Woodham Road, Barry, CF63 4JE (Grid Reference ST 12610 67683). The approval is subject to a number of stringent planning conditions, including further air quality monitoring assessments to be undertaken once operational.

The proposed development is a renewable energy generation facility which has been designed to recover energy from pre-prepared mixed waste wood feedstocks using gasification. The gasification facility is an Advanced Thermal Treatment (ATT) process that will produce a combustible synthesis gas, which is then used to raise steam and generate electricity, through steam cycle turbine generation.

The Advanced Thermal Treatment (ATT) plant is designed to process shredded mixed waste wood feedstock to produce heat to raise steam in a conventional tube boiler for utilisation in a steam turbine for the production of renewable electricity with an export capacity up to 10MWe.

The Installation has been designed to process approximately 86,400 tonnes of pre-processed non-hazardous mixed waste wood per annum.

At the time of writing this report, Natural Resources Wales (NRW) are currently going through a second round of consultation in regards to a permit application for the proposed operation, submitted by Biomass UK NO.2 Ltd. This second round of consultation was formed as a result of a Section 5 amendment direction sanctioned by NRW; "NRW Schedule 5 notice re Biomass requesting more information" dated 4 May 2017. As part of the amendment a revised air quality assessment (AQA) was submitted in July 2017. SRS on behalf of VoGC have submitted a response in regards to this revised modelling. A final decision whether the proposed facility will be granted approval for its permit application is yet to be decided, therefore an update will be provided in the Vale's 2018 Annual Progress Report, depending on the outcome of any decision by Natural Resources Wales.

### **3.3.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been introduced**

The 2016 Annual Progress Report (APR) highlighted a S106 proposed amendment made for the Energy from Waste (EfW) site operated by Viridor Tremorfa (Cardiff Planning Application 16/02384/MJR). The proposal requested the removal of an obligation that only waste derived from the South East Wales Region could be processed at the development. The submitted Air Quality Assessment in accordance with the proposal concluded that the potential air quality effects resulting from the proposed increase in tonnage at the ERF and the removal of the catchment restriction will not be significant, either alone or in combination.

There are no existing industrial processes in Cardiff which have substantially increased emissions to air since the 2016 APR.

There is no need for further consideration of this aspect of the assessment further.

SRS on behalf of Cardiff Council can confirm there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

### **3.3.3 New or Significantly Changed Installations with No Previous Air Quality Assessment**

There are no new or significantly changed industrial installations for which previous air quality assessments have not been carried out and which could give rise to potentially significant emissions of regulated pollutants either within Cardiff or within neighbouring local authorities.

SRS on behalf of Cardiff Council can confirm that there are new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

### **3.3.4 Major Fuel (Petrol) Storage Depots**

As reported in the 2012 USA, there is one major fuel (petrol) storage depot in Cardiff. This is the Chevron Terminal located in Cardiff Docks which was assessed in previous reports. This installation is subject to an EPR Permit and regulated by the Council. Capacity and throughput at this site has not altered significantly for the worse since the last assessment and no new relevant exposure exists.

SRS on behalf of Cardiff Council can confirm that there are major fuel (petrol) storage depots within the Local Authority area, but these have been considered in previous reports

### **3.3.5 Petrol Stations**

There are no new petrol stations in Cardiff with throughputs greater than 2000m<sup>3</sup> per annum with a busy road nearby where there is relevant exposure within 10m of the pumps.

It is not necessary, therefore, to consider this further.

SRS on behalf of Cardiff Council can confirm that there are no petrol stations meeting the specified criteria.

### **3.3.6 Poultry Farms**

The criteria for assessing poultry farms are set out in Table 7.3, point 4 of TG(16) (Defra, 2016). No farms exceeding the relevant criteria (turkey units with greater than 100,000 birds, naturally ventilated units with greater than 200,000 birds or mechanically ventilated units with greater than 400,000) have been identified.

SRS on behalf of Cardiff Council can confirm that there are no poultry farms meeting the specified criteria.

## **3.4 Commercial and Domestic Sources**

### **3.4.1 Biomass Combustion – Individual Installations**

No large combustion plants burning biomass materials in Cardiff, no known service sector biomass boilers and no community heating schemes using biomass boilers have been identified since the 2016 APR. No residential areas with extensive solid fuel heating have been identified in previous reports.

It is not necessary to consider this further at this time. However, the Council is aware of the potential impact of biomass burning and will be keeping a register of such plant and installations for which planning approval is granted.

SRS on behalf of Cardiff Council can confirm that there are no biomass combustion plants in the Local Authority area.

### **3.4.2 Biomass Combustion – Combined Impacts**

Previous reports have confirmed that there are no known areas in Cardiff where coal or solid fuel burning provides a significant level or primary household heating. Nothing has changed in this regard since the 2016 APR, despite the potential for increasing popularity of solid fuel heating with increased fossil-fuel prices, and there is no need to consider this further at this time.

SRS on behalf of Cardiff Council can confirm that there are no biomass combustion plants in the Local Authority area.

### **3.4.3 Domestic Solid-Fuel Burning**

Previous reports have confirmed that there are no known areas in Cardiff where coal or solid fuel burning provides a significant level or primary household heating. Nothing has changed in this regard since the 2016 APR, despite the potential for increasing popularity of solid fuel heating with increased fossil-fuel prices, and there is no need to consider this further at this time.

It should be noted that the Council receives a number of enquiries each year from residents in respect of national or local requirements were they to wish to install log-burners or similar appliances in their homes. There are no smoke control area in Cardiff and hence no legal requirements with regard to appliances that may be installed. However, residents are always

reminded of the legislation in respect of statutory smoke nuisance and, where they can't be persuaded otherwise for reasons of air quality and health, recommended to seek out an appliance certified for use in a smoke control area.

SRS on behalf of Cardiff Council can confirm that there are no areas of significant domestic fuel use in the Local Authority area.

### **3.5 New Developments with Fugitive or Uncontrolled Sources**

There are no new locations where fugitive could occur which have not been covered by previous rounds of review and assessment and no locations where new relevant exposure has been introduced to existing locations.

It is not considered necessary to consider this further at this time.

SRS on behalf of Cardiff Council can confirm that there are no potential sources of fugitive particulate matter emissions in the Local Authority area.



## 4 Local / Regional Air Quality Strategy

### Cardiff's Conceptual Air Quality Strategy

SRS on behalf of Cardiff Council are currently co-ordinating and developing a Clean Air Strategy for Cardiff with its main purpose to improve air quality to protect public health. The document will identify and implement strategic actions to deliver significant improvements to air quality in Cardiff, whilst supporting the sustainable economic growth of the City and wider region. This will involve a review of existing strategies, policies and plans which either have a direct or indirect impact on air quality in Cardiff.

Clean air is essential for a good quality of life, and poor air quality is considered the largest environmental risk to public health in the UK (WHO 2014). High on the agenda for UK Government is to tackle air pollution and protect the health and well-being of the UK population.

However, a multi-sectorial approach is needed to develop and effectively implement long term policies and strategies that reduce risks of air pollution to health (WHO Regional Office for Europe 2013). This approach is supported across Wales through the Wellbeing of Future Generations (Wales) Act 2015 (National Assembly for Wales 2015), that includes goals to achieve a healthier Wales, that is more globally responsible and equal, through thinking more about the long-term, looking to prevent problems and taking a more joined-up approach.

The Council's Capital Ambition recognises that Cardiff is one of the UK's fastest growing cities, and that it is crucial that this growth is well planned and sustainable. One of the current administration's top priorities is getting the Transport System right, in order to address congestion and improve the quality of the air in Cardiff. Therefore in line with the Capital Ambition, Cardiff's Clean Air Strategy will help implement and deliver the priorities set out in the Capital Ambition with an overarching aim to **improve air quality and improve public health in Cardiff.**

Current air quality monitoring undertaken by Cardiff Council and modelled projections from Welsh Government indicate that Cardiff will continue to breach Air Quality Standards beyond 2020.

In order to improve the air quality in Cardiff, action needs to be taken across the City as whole and it is acknowledged that Road Traffic Emissions are the **primary** contributing factor to poor air quality in Cardiff.

As such in order to achieve improvements in air quality and achieve the aim of this Strategy the following are deemed to be **strategic measures** which need to be implemented across the City, through a detailed set of Actions;

- Enhance Cardiff's Transport Infrastructure
- Increase the uptake of sustainable and active transport
- Implement Renewable Fuels Strategy and Improve OLEV Capacity
- Public Information and Behaviour Change Initiatives
- Regulatory Interventions

The Clean Air Strategy will outline strategic actions to implement these measures in order to deliver significant improvements to air quality in Cardiff, whilst supporting the sustainable economic growth of the City and wider region. This will include a review of existing strategies, policies and plans which either have a direct or indirect impact on air quality in Cardiff.

## 5 Planning Applications

The Council continues to monitor the impact of proposed developments and recent developments already underway or in use.

The following developments may either be of significance in respect of local air quality or be a proposed development where air quality is a consideration.

### 5.1 Central Business District

Planning application (16/02731/MJR) was submitted in November 2016. The application detailed;

**ERECTION OF A TRANSPORT INTERCHANGE WITH AN ASSOCIATED CONCOURSE AND ANCILLARY RETAIL/COMMERCIAL UNITS (USE CLASSES A1/A2/A3), 195 RESIDENTIAL APARTMENTS (USE CLASS C3), 12,052 SQ M (GIA) OFFICE FLOORSPACE (USE CLASS B1), A 227-SPACE CAR PARK AND A CYCLE HUB, PUBLIC REALM AND RELATED INFRASTRUCTURE AND ENGINEERING WORKS | LAND TO THE NORTH OF CARDIFF CENTRAL RAILWAY STATION AND SAUNDERS ROAD, SOUTH OF WOOD STREET AND WEST OF GREAT WESTERN LANE, CARDIFF**

An Environmental Statement which included an Air Quality Chapter was submitted in November 2016 in support of the proposal. Following a review of the report and its outcomes it was decided that additional mitigation measures needed to be investigated and assessed and included in a revised AQA which should be submitted and reviewed. A revised AQA was submitted which included additional sensitivity test scenarios which looked at alleviating increased and exceeding levels of NO<sub>2</sub> as a result of the proposal. The following planning conditions have now been put in place which address air quality;

***Plan of operation of the interchange:*** Prior to beneficial occupation of the interchange a plan of operation for the bus station shall be submitted to and approved in writing by the LPA. The plan of operation shall detail the number and frequency of services using the interchange and specify those services accessing and exiting the interchange via Westgate Street and those services accessing and exiting the interchange via Saunders Road. The bus station shall be operated in accordance with the approved plan of operation unless otherwise agreed in writing with the LPA. Reason: To control the number and frequency of services using the interchange in the interests of public safety and amenity.

***Increase in bus movements:*** Any increase in the number and/ or frequency of bus services using the interchange in relation to the approved plan of operation shall be accompanied by an air quality assessment (details of the extent and scope of the assessment to be agreed with the Council) that demonstrates that there is no significant adverse impact on air quality

arising from buses using the Interchange on Westgate Street and at the Westgate Street/ Castle Street junction, within the interchange, or on the Saunders Road access. Reason: To control potential air pollution arising from an increase in bus movements to and from the Interchange in the interests of public safety and amenity.

**On-site combustion plant:** An Air Quality Assessment (AQA) that takes into account emissions from the proposed on-site combustion plant at agreed sensitive receptors for the year of opening of the bus station shall be submitted and approved in writing by the LPA. Should the AQA indicate that the development will negatively impact upon air quality of the local environment details of appropriate mitigation measures shall be submitted and approved in writing by the LPA prior to commencement of above-ground floor slab development. The scheme of mitigation shall be implemented in accordance with the approved details prior to beneficial occupation of the interchange building. Reason: To ensure that the development does not have a detrimental impact on the local environment and public health.

**Mechanical Ventilation System (MVS):** Details of the operation and efficiency of the MVS in terms of pollutant reduction for NO<sub>2</sub> shall be submitted and approved by the LPA before the commencement of works above ground floor slab. The approved MVS shall be implemented in accordance with the approved details prior to beneficial use of the bus station. Reason: To ensure that the development does not have a detrimental impact on and public health.

A decision is yet to be made on the proposal.

## **5.2 Cardiff Gate- Construction of Fire Behaviour Training Facility (CFBT) & Welfare Building**

Planning application (16/02659/MJR) was received in November 2016. The proposed development will consist of a new CFBT building, along with a small ancillary welfare building within land immediately adjacent to the existing training centre. The CFBT will allow 'real fire' conditions to be replicated in an enclosed, training environment and this involves real combustion generating real smoke. The CFBT training will form part of the wider training programme which is already being provided at the site and thus there will be no increase in vehicle movements. This assessment thus focuses on the potential for emissions from the CFBT facility itself to affect air quality for nearby residents and members of the public.

The proposed development site is located approximately 800 m to the south of Junction 30 of the M4 motorway. It is immediately to the east of the Cardiff Gate Training and Development Centre and is currently bordered to the south, east, and north, by open countryside.

An Air Quality Assessment was submitted in November 2016 which made the following conclusions;

The impacts of emissions arising from combustion within the training rooms and within the thermal oxidiser have been assessed. The assessment has taken account of the existing land use in the area, and also of the planned construction of new residential properties.

- In terms of the principal pollutants of concern generated within the training rooms, emissions will be comparable with those from one or two individual residential dwellings with open fires and, as such, are considered to be insignificant.
- In terms of nitrogen oxides, which will primarily be generated within the thermal oxidiser itself, the impacts have been shown to be *negligible* and thus insignificant.
- The overall air quality impacts are thus considered to be insignificant. The proposed development is consistent with PPW and also conforms with both Policy KP18 and Policy EN13 of Cardiff City Council's LDP.

In March 2017 the application was approved in accordance with the application and plans submitted and subject to compliance with the specified conditions.

### **5.3 Mixed Development at Land North and South of Llantrisant Road, North West Cardiff**

Planning application (14/02157/MJR) received September 2014 has been granted planning consent (August 2016) in accordance with the application and plans submitted and subject to compliance with the specified conditions.

The application detailed;

**DEVELOPMENT OF UP TO 630 RESIDENTIAL DWELLINGS (USE CLASS C3, INCLUDING AFFORDABLE HOMES), PRIMARY SCHOOL (USE CLASS D1), VISITOR CENTRE/COMMUNITY CENTRE (USE CLASS D1), COMMUNITY CENTRE (USE CLASS D1), OPEN SPACE (INCLUDING CHILDREN'S PLAY SPACES), LANDSCAPING, SUSTAINABLE URBAN DRAINAGE, VEHICULAR ACCESSES, BUS LANES, PEDESTRIAN AND CYCLE ACCESSES AND RELATED INFRASTRUCTURE AND ENGINEERING WORKS**

In order to support the Council's local air quality monitoring within the area, a Section 106 agreement has been accepted for a sum of £3,150.

### **5.4 Cardiff West Interchange- Bus Transport Hub**

Planning application (16/01565/MNR) was submitted in August 2016 by Cardiff Council's City Operations Team.

The site is located in the north western side of Cardiff and is currently known as Waungron Road Waste Transfer Depot, the site is currently non-operational and used for storage of household refuse bins for future distribution.

The aspirations of City Operations are to change the land use from a waste transfer depot to a transport hub specifically for buses. This involves providing an access / egress onto Western Avenue and improving the existing access / egress at Waungron Road, this will be specifically for bus use.

Detailed in the submitted Design and Access Statement;

“The design for the new transfer hub has given consideration to buses, pedestrians and cyclists, with facilities provided for the pulling in and over-stay for buses and the inclusion of bus shelters with digital real-time information displays. Pedestrians and cyclists are accommodated with the provision of a wide shared footway / cycleway which joins Waungron Road with Western Avenue, controlled crossing areas with easy access to bus and trains services with Waungron Road station being in close proximity.”

In November 2016 the application was granted consent in accordance with the application and plans submitted and subject to compliance with the specified conditions. Condition 5 relates to Air Quality and states;

**No part of the approved development shall proceed until detailed assessments of any potential noise and air quality impacts that the development may have on the local environment are submitted and approved by the LPA. Should the assessments indicate that the development will negatively impact upon noise and air quality of the local environment, then appropriate mitigation measures must be developed and their effectiveness assessed and be approved by the LPA prior to the development commencing. If appropriate mitigation measures to protect the local environment from the impacts of the development cannot be implemented to ensure compliance with existing statutory environmental requirements, then the development will not proceed.**

**Reason: To ensure that the development does not have a detrimental impact on the local environment as per Detailed Policy EN13 of the Cardiff LDP 2006-2026.**

To date, no air quality assessment has been submitted, although a scope of works required by the Specialist Team has been submitted to relevant persons for consideration.

## **5.5 West Wing, Cardiff Royal Infirmary, Newport Road Lane, Adamsdown**

Planning application (16/01808/MJR) was submitted in July 2016 for the demolition of existing buildings on site and the proposed construction of student accommodation comprising up to 646 rooms, two retail units and external amenity space on land adjacent to Glossop Road and Moira Terrace in Cardiff.

An air quality assessment was submitted as part of the proposal. This report presented the findings of the assessment, which addresses the potential air quality impacts during both the construction and operational phases of the proposed development. For both phases the type, source and significance of potential impacts were identified, and the measures that should be employed to minimise these proposed. The methodology followed in this study was discussed and agreed with the Environmental Health Officer of the City of Cardiff Council.

This identified that there is a High to Medium Risk of impacts on local air quality due to demolition and on-site construction activities. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and fine particulate matter releases would be significantly reduced. The residual effects of the demolition and construction phase are considered to be negligible.

The potential for future residents of the proposed development to be exposed to poor air quality, given the site's location close to an Air Quality Management Area, has also been undertaken. The pollutants considered in this part of the assessment were nitrogen dioxide and fine particulate matter. The results of this assessment showed that concentrations of both pollutants were below the relevant UK Air Quality Strategy objectives on the Proposed Development site, and therefore future residents will not be exposed to poor air quality.

## **5.6 Goitre Fach Farm, Llantrisant Road**

Planning application (16/00106/MJR) was submitted in January 2016. The proposal relates to 10.01 hectares (24 acres) of land located to the south of the A4119 Llantrisant Road close to Radyr, approximately 8km to the north west of Cardiff City Centre.

The proposal sought outline planning permission for the demolition of the derelict farm buildings and construction of up to 300 homes. All matters are reserved except access. The permission for access sought is for the strategic or main site access off Llantrisant Road only.



An Environmental Statement was published and submitted in accordance with the proposal. Chapter 10 addresses air quality impacts associated with the development. The main conclusions to be made from the report were;

- Impacts during the construction phase, such as dust generation and plant vehicle emissions, are predicted to be of short duration and only relevant during the construction phase. The results of the risk assessment of construction dust impacts undertaken using the IAQM guidance, indicates that before the implementation of mitigation and controls, the risk of dust impacts will be low. Implementation of the highly-recommended mitigation measures described in the IAQM construction dust guidance should reduce the residual dust effects to a level categorised as “not significant”.
- The operational impact of the Goitre Fach development on existing receptors in the local area is predicted to be ‘negligible’ taking into account the changes in pollutant concentrations and absolute levels. Using the criteria adopted for this assessment together with professional judgement, the overall impact on the area as a whole is categorised as ‘negligible’.
- The Goitre Fach development does not, in air quality terms, conflict with national or local policies, or with measures set out in Cardiff Council’s Air Quality Action Plan. There are no constraints to the development in the context of air quality.

In April 2017 the application was approved in accordance with the application and plans submitted and subject to compliance with the specified conditions.

In order to support the Council’s local air quality monitoring within the area, a Section 106 agreement has been accepted for a sum of £1,500. As sighted in the S106 agreement documentation;

“Air Quality Contribution” shall mean the sum of £1,500 (One thousand five hundred pounds) Indexed

## **1. Air Quality Contribution**

On Implementation of the Planning Permission to pay the Air Quality Contribution to the Council to be used by the Council for the purposes of monitoring air quality within the Site, within the vicinity of Llantrisant Road and within the wider Strategic Site C

## 6 Air Quality Planning Policies

At the time of writing this report Cardiff Council has adopted a new Local Development Plan (2006-2026). The plan was adopted on the 28<sup>th</sup> January 2016 and upon adoption it now forms the development plan and will be the basis for decisions on land use planning in Cardiff.

The plan contains two policies of relevance to air quality;

-KP18 deals with Natural Resources. It states:

*“In the interests of the long-term sustainable development of Cardiff, development proposals must take full account of the need to minimise impacts on the city’s natural resources and minimise pollution, in particular the following elements.....minimising air pollution from industrial, domestic and road transportation sources and managing air quality.”*

-EN13 which addresses air, noise, light pollution and contaminated land states

*“Development will not be permitted where it would cause or result in unacceptable harm to health, local amenity, the character and quality of the countryside, or interests of nature conservation, landscape or built heritage importance because of air, noise, light pollution or the presence of unacceptable levels of land contamination.”*

The Cardiff LDP replaces several existing plans, including the South Glamorgan (Cardiff Area) Replacement Structure Plan 1991- 2011, City of Cardiff Local Plan and the Cardiff Unitary Development Plan (UDP) (to 2016).

Environmental Policy EV4 of the Replacement Structure Plan states that:

*“Proposals which have an unacceptable effect on local communities or important natural resources by virtue of air, land, water or waste pollution will not be permitted.”*

Policy 2.64 of the Cardiff UDP concerns air, noise and light pollution, and states that:

*“Development will not be permitted where it would cause or result in unacceptable harm to health, local amenity, the character and quality of the countryside, or interests of nature conservation or landscape importance because of air, noise or light pollution.”*

And Paragraph 2.64.6 stipulates that:

*“Planning permission will not be granted for development that would contribute to poor air quality as a result of traffic emissions.”*

## 7 Local Transport Plans and Strategies

**The Local Transport Plan (LTP) 2015- 2020.** The implementation of this policy followed Welsh Government's decision to replace Regional Transport Plans with LTPs. Cardiff's LTP policy identifies key transport issues and strategies to tackle these issues. The LTP focuses on a range of measures common to all parts of Cardiff which will have an impact upon traffic movements, growth and emissions (and hence air quality). The programmes highlighted in the LTP include walking and cycling infrastructure, bus network and junction improvements, Cardiff Capital Region Metro Schemes, 20mph limits and road safety schemes. LTP programmes will compliment transport infrastructure provided in conjunction with development brought forward through the LDP. LTP programmes include;

- Walkable Neighbourhoods programme
- Cardiff Strategic Cycle Network (Enfys) programme
- Bus programme (Strategic Bus Network)- junctions improvements, bus prioritisation, extending the range of destination via bus.
- Cardiff Capital Region Metro programme- phased implementation of proposed rapid transit link between Cardiff Bay and Cardiff Central and rapid transit corridor in NW Cardiff to Pontyclun, Rhondda Cynon Taff
- Improve access to local stations programme
- Park and Ride programme- Proposed facility at Junction 33. Designed to intercept traffic on A470, north of Cardiff
- Highway programme- strategic junction improvements and strategic highway improvements
- Road Safety programme

The Council has published an Annual Progress Report for Transport each year since 2002. These are available here:

<http://www.keepingcardiffmoving.co.uk/your-sustainable-travel-city>

## 8 Climate Change Strategies

The Council published the “Carbon Lite Cardiff Action Plan” in June 2010.

Carbon Lite has run its course and has been superseded by “One Planet Cardiff” which has its own dedicated website with the vision document and delivery plan. Links to both the Cardiff Council website and the One Planet Cardiff website are below:

*<http://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Sustainable-Development-and-Energy/Pages/Sustainable-Development-and-Energy.aspx>*

*<http://www.oneplanetcardiff.co.uk/>*

## 9 Implementation of Action Plans

Currently there are four established AQMAs within Cardiff:

1. **Cardiff City Centre**- declared 1<sup>st</sup> April 2013
2. **Llandaff**- declared 1<sup>st</sup> April 2013
3. **Stephenson Court**- declared 1s December 2010
4. **Ely Bridge**- declared 1<sup>st</sup> Feb 2007

Each of these AQMAs was declared as a result of road-traffic derived Nitrogen Dioxide (NO<sub>2</sub>).

SRS on behalf of Cardiff Council has a statutory requirement to produce an Air Quality Action Plan (AQAP) for each identified AQMA within the local authority area. However previous experience in implementing singular actions plans in Cardiff has not proven to be sufficiently successful. The main issue with this particular approach is that the AQAP focuses on introducing local measures to individual road links/ areas, which only targets at improving air quality within the identified AQMA itself.

Whilst such measures have been successful in improving air quality within the individual AQMA (High Street/ St Mary's Street Action Plan) such localised measures can, and have led to adverse impacts on air quality in surrounding areas and result in more widespread air quality issues. These plans have not been sufficient enough in looking at the primary cause of the problem, this being road traffic derived emissions, resulting in air quality levels being detrimentally increased in neighbouring areas.

SRS on behalf of Cardiff Council recognises that in order to tackle these known pockets of poor air quality, it is deemed a more suitable and constructive approach to target the whole of the Cardiff, improving overall air quality. With the implementation of correct long term measures all highlighted road networks and identified AQMAs should be able to benefit from improved air quality.

It has been highlighted that any formal AQAP need to be devised via the involvement and input of various influencing sectors across local authority bodies. Cardiff Council has acknowledged this approach which will allow for increased awareness within the council and fundamentally will produce an effective AQAP, supporting the desirable outcome of reaching lowest levels reasonably practicable.

The AQAP will form an integral section of the Clean Air Strategy proposed for Cardiff, looking to appoint measures that will improve overall air quality in Cardiff. The AQAP will outline the baseline situation in Cardiff with regards to key pollutants, set out proposed measures to improve air quality, and present an appraisal of these measures in terms of their air quality impacts, cost and timescale for implementation. The AQAP will essentially replicate many of the measures already sighted within Cardiff Council's strategies and policies. However, it will identify further measures and additional measures which would impact solely on the AQMA areas.

Progress against meeting air quality objectives will primarily be measured using existing air quality monitoring procedures. However, as described above, the AQAP will implement decisive indicators/ measures that will be used to review any progress on air quality levels. These indicators will provide valuable data in monitoring the progress and relative success in the implementation of proposed air quality measures against the overall aim to reduce pollutant concentrations and have a positive impact on health. Such measures would include;

- Record numbers of bus patronage
- Traffic flows during peak travel times
- Record numbers of cycle trips
- Investigate modal share associated with school journeys

In order to manage and assess the effectiveness of the Clean Air Strategy and AQAP, especially in the City Centre, consideration will be given to extending the City Centre AQMA which would encompass the Stephenson Court AQMA and any linking road networks. This approach would be seen as reasonable given the fact both sites should see similarities in any progress made through the strategies' and AQAP's measures.



# 10 Conclusions and Proposed Actions

## 10.1 Conclusions from New Monitoring Data

Monitoring data for 2016 indicates that annual mean concentrations of nitrogen dioxide recorded at sites of relevant exposure, within the already established AQMAs, continue to be elevated or exceed the annual mean NO<sub>2</sub> Air Quality Standard (40µg/m<sup>3</sup>). As discussed previously annual levels of NO<sub>2</sub> at residential accommodation on Westgate Street (Sites 126, 143 & 144) and Stephenson Court (Sites 81, 130, 131) show a noticeable increase in levels from 2015.

At this moment in time, it was determined that the City Centre AQMA does not need to be extended to encompass Kingsway/ Duke Street/ Castle Street Link area. The current use of buildings within this proposed extension link area is for commercial use at ground floor level. Residential properties are located at elevated levels >3m. The datasets collected since 2014 have therefore been compared to the 1-hour NO<sub>2</sub> objective (**200µg/m<sup>3</sup>, not to be exceeded more than 18 times per year**), whereby compliance is met.

Following this report, the finalisation of Cardiff Council's Air Quality Strategy and AQAP is a priority. It is scheduled that the FINAL publication be available by March 2018.

## 10.2 Conclusions relating to New Local Developments

Section 5 details a number of local developments which have either gained planning consent recently or for which a planning application has been received.

These applications have been handled accordingly where Air Quality Assessments have been produced and conditions applied accordingly.

## 10.3 Other Conclusions

There are no other conclusions to be drawn from the information provided herein.

## 10.4 Proposed Actions

As a result of the information provided herein it is proposed to

1. Produce and publish Cardiff Council's Clean Air Strategy and AQAP in 2018.
2. Continue monitoring within and around the existing AQMAs and other areas of concern. The diffusion tube network appointed by SRS on behalf of Cardiff Council will be examined.
3. Continue to drive Air Quality as a major aspect to be considered during any planning applications, most importantly Cardiff Central Development.
4. Submit an Annual Progress Report (APR) in 2018.

# 11 References

1. Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138)
2. Air Quality (Amendment)(Wales) Regulations 2002, No. 3182 (Wales 298)
3. The County Council of the City and County of Cardiff (The Philog Air Quality Management (NO<sub>2</sub>)) Order 2000
4. The County Council of the City and County of Cardiff (The Newport Road Air Quality Management (NO<sub>2</sub>)) Order 2000
5. The County Council of the City and County of Cardiff (The Cardiff West Air Quality Management (NO<sub>2</sub>)) Order 2000
6. The County Council of the City and County of Cardiff (The St Mary Street Air Quality Management (NO<sub>2</sub>)) Order 2002
7. The County Council of the City and County of Cardiff (Ely Bridge Air Quality Management (NO<sub>2</sub>)) Order 2007
8. The County Council of the City and County of Cardiff (Stephenson Court Air Quality Management (NO<sub>2</sub>)) Order 2010
9. The County Council of the City and County of Cardiff (Cardiff City Centre Air Quality Management (NO<sub>2</sub>)) Order 2013
10. The County Council of the City and County of Cardiff (Llandaff Air Quality Management (NO<sub>2</sub>)) Order 2013
11. Welsh Government, Local air quality management in Wales, Policy Guidance, June 2017
12. Cardiff Council 2003 Updating and Screening Assessment
13. Cardiff Council 2004 Progress Report
14. Cardiff Council 2005 Progress Report
15. Cardiff Council 2006 Updating and Screening Assessment
16. Cardiff Council 2007 Progress Report
17. Cardiff Council 2008 Progress Report
18. Cardiff Council 2009 Updating and Screening Assessment
19. Cardiff Council 2010 Progress Report
20. Cardiff Council 2011 Progress Report
21. Cardiff Council 2012 Updating and Screening Assessment
22. Cardiff Council Detailed Assessment for Stephenson Court
23. Cardiff Council 2012 Further Assessment for Stephenson Court
24. Cardiff Local Transport Plan 2000-2016
25. Cardiff Annual Progress Report for Transport 2009
26. Regional Transport Plan for South Wales
27. Cardiff Council Ely Bridge Air Quality Action Plan 2009
28. Cardiff Council St Mary Street Air Quality Action Plan 2010
29. Cardiff Council Detailed Assessment for Llandaff
30. Cardiff Council Detailed Assessment for Westgate Street
31. Cardiff Council 2014 Further Assessment for Cardiff City Centre
32. Cardiff Council 2014 Further Assessment for Llandaff
33. Cardiff Council 2014 Detailed Assessment for Fair oak Road Roundabout
34. Cardiff Council 2014 Progress Report
35. City of Cardiff Council Local Transport Plan 2015- 2020
36. Cardiff Local Development Plan 2006- 2026

37. Cardiff Council 2015 Updating and Screening Assessment
38. Cardiff Council 2016 Progress Report

# Appendices

## Appendix A: Diffusion Tube Monitoring Data 2016

Site	WAQF site id	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave	Biased Adjusted
16	CCC-036	45.9	42.1	34.7	40.1	33.6	31.5	27.3	28.4	34.2	34.7	42.4	50.4	37.1	28.9
33	CCC-054	72.9	58.8	60.0	60.9	60.8	54.8	53.3	54.6	56.8	53.7	69	77.2	61.1	47.6
44	CCC-078	42.5	41.2	42.2	35.4	30.2	29.5			38	40.7	47.7	54.5	40.2	31.3
45	CCC-079	60.1	58.5	48.2	41.8	38.8	34.2	33.2	34.2	46.2	46.1	53.7	58.9	46.2	36.0
47	CCC-081	74.8	62.9	65.8	70.7	65.2	63	39.4	43.5	61.3	75.8		78.8	63.7	49.7
49	CCC-083	40.1	44.5	46.2	38.1	36.1	36.1	29	30.3	37.2	41.7	43.9	44.8	39.0	30.4
56	CCC-090	55.8	40.2	48.9	42.5	39.3	34.5	31.4	29.6	41.9	38.4	46.7	50.3	41.6	32.5
58	CCC-092	54.3	65.5	61.6	61.2	47.4	54.4	55.8	49.3	58.1	54.4	65.8	68.9	58.1	45.3
73	CCC-107	34.8	31.0	36.0	27.8	22.8	23.5	17.4			33.8	38.4	47.6	31.3	24.4
74	CCC-108	71.6													
81	CCC-115	49.9	53.0	51.4	55.8	45.6	43	39.7	42.9	39.9	47.5	53.8	56.0	48.2	37.6
82	CCC-116	40.5	37.4	41.7	39.5	30.3	32.7	21.3	24.4	29.7	40.5	45.5	54.0	36.5	28.4
85	CCC-119	37.4	36.6	35.6	40.4		29.3	25.3	25.9	29.3	33.3	41.2	43.4	34.3	26.8
86	CCC-120	55.6	52.2	48.4	48.7	43.6	40	39.5	37.4	43	39.9	47.8	50.9	45.6	35.6
96	CCC-130	49.7	51.9	48.6	49.4	45.4	45.7	31.2	34			53.6	63.1	47.3	36.9
97	CCC-131	50.2	46.6	36.4	40.4	32.3	31.9	27.3	30.9	34.8	44.9	46.6	58.0	40.0	31.2
98	CCC-132	43.6	39.0	39.1	38.3	33.4	31.2	22.7	25.3	31.7	38.1	43.1	51.8	36.4	28.4
99	CCC-133	47.8	42.7	45.1	51.5	45	45.6	25.2	28.6	36.1	58.5	50.9	57.8	44.6	34.8
100	CCC-134	35.3	44.9	38.0	39.2	34.5	34.4	29.1	33	35.1	42.4	45	55.7	38.9	30.3
101	CCC-135	34.9	32.8	33.2	29.9	23.3	23.2	17.9	18.8	26	35.7	43.5	36.8	29.7	23.1
102	CCC-136	31.2	32.4	30.3	27.9	20.0	21.5	17.8	18.6	24.7	34.8	40	46.2	28.8	22.5
103	CCC-137	34.3	33.8	33.8	25.9	19.5	22.2	17.6	18.9	26.3	35.6	43.7	44.9	29.7	23.2
106	CCC-140	52	47.2	45.5	37.6	27.2	33.5		30.4	40.6	38.7	47.5	54	41.3	32.2
107	CCC-141	47.8				41.9		30.3	31.0		49.5	51.5		42.0	32.8
111	CCC-145	33.1	32.7	33.8	33.1	25.7	29.1	14.6	18.7	27.7	35.8	32.8	41.4	29.9	23.3
112	CCC-146	37.4	41.9	41.8	38.5	34.2	34.2	26.3	25.6	34.2	40.6	48.4	50.1	37.8	29.5
115	CCC-149	54.3	39.0	41.8	43.1	37.2	37.9	34.1	34.9	39.3	39.2	45.1	58.9	42.1	32.8
117	CCC-151	60.6	44.6	50.7	57.9	53.6	51.1	30.6	36.8	49.6	61.8	61.9	75.9	52.9	41.3
119	CCC-153	41.8	39.3	44.2	41.5	32.9	33.9	24.4	23.5	35.1	40.1	54.6	48.6	38.3	29.9
124	CCC-158	36.9	30.5	34.6	34.2	26.3	26.2	18.9	22.0	27	32.6	38.1	45.7	31.1	24.2
126	CCC-160	55.3	49.6	47.2	51.5	40.4	47.4	40.2		49	48.6	54.9	57.9	49.3	38.4
128	CCC-162	40.7	44.8	41.1	42.0	36.5	35.3	29.8	31.3	38.3	39.9	46.2	54.6	40.0	31.2
129	CCC-163	43.7	45.3	44.2	44.3	39.1	35.9	33.8	31.5	36.3		41.4	43.5	39.9	31.1
130	CCC-164	52.7	56.3	46.4	44.2	46.6	44.2	39.6	41.1	47.2	46.6	56.3	61	48.5	37.8
131	CCC-165	52	56.7	49.2		44.9	49.9	47.1	49.1	49.6	53	56.2	50.2	50.7	39.6
133	CCC-167	51.4	49.0	46.2	55.3	42.1	37.6		34.7	39.7	46.3	54.8		45.7	35.7
134	CCC-168	58.1	51.9				38.6		35.4		50.9	66.4	60.2	51.6	40.3
139	CCC-173	45.8	38.0	41.5	47.6	34.8	36.3	22.6	26.2	35.8	48.7	50.1	51.3	39.9	31.1
140	CCC-174	49.3	49.4	54.4	59.4	47.4	41.5	31.6	36.3	39	43.2	56.9	65.1	47.8	37.3
141	CCC-175	54.7		46.0	45.2	40.3		40.7	38.6	41.5		52.9		45.0	35.1
142	CCC-176	66.1													
143	CCC-177	54.4	50.3	52.3	49.3		47.1	40.9	44.6	48.2	44.7	57.8	56.1	49.6	38.7
144	CCC-178	55.4	43.8	48.9	47.8	45.8	43.4	56.8	46.7	44	46	60.3	51	49.2	38.3
145	CCC-179	35.9	45.4	47.2	44.2	34.3	34.7	29.2	32.5	35.5	44	52.2	50.5	38.3	29.9
146	CCC-180	45.3	43.3	38.0	42.1	28.5	32.1	20.1	26.9	32.3	43.4	48.6	50.6	35.2	27.5
147	CCC-181	41.6	45.7		42.2	41.2	37.6	21.4	25	32.8	45.2	46.4	55.2	37.0	28.8
148	CCC-182	40.5	41.7	42.6	48.4	31.8	35.5	20.9	25.2	33.5	40.7	44.1	45	37.5	29.2
149	CCC-183	47.3			42.0	41.3	40.4	34.3	33.6	39	42.4	47.1	51.4	40.0	31.2
152	CCC-186	44.9		43.5	33.4	39.8	30.7	24.8	24.9	32.1	43.5	45.6	49.5	37.5	29.3
153	CCC-187	44.6	41.2	36.9	37.2	28.8	33.3	30.6	34	36.4	38.9	50.7	50.4	38.6	30.1
156	CCC-190	39.7	44.4	42.9	36.9	35.3	32.2	18.9	23.5	29.3	49.7	47.8	55.8	38.0	29.7
157	CCC-191	43	40.7	36.8	39.9	32.1	31	29.2	29.6	36.4	34.2	35	45.9	36.2	28.2
158	CCC-192	44.3	40.8	42.3	42.9	27.9	31.6	19.1	18	34.4	43.7	48.1	52.5	37.1	29.0
159	CCC-193	54	54.1	52.1	46.5	42.3	44.8	33	33	45.6	43.5	53.2	44.6	45.6	35.5
160	CCC-194	43.3		39.7	39.3	27.6	33.8		30.4	35.9	40.6	54.8	60.5	40.6	31.7
161	CCC-195	37.3	51.2	45.0	55.0	39.2	39.3	32.8	31.7			58.7	58.5	44.9	35.0
162	CCC-196	44.2	34.7	32.9	36.9		26.6	22.1	24.3	30.7	31.7	38.8	45.8	33.5	26.1
163	CCC-197	45.2	41.6	34.1	34.0	32.9	24.7	22	22.1	28.8	34.3	37.5	38.4	33.0	25.7
164	CCC-198	34.4	30.2	24.8	26.6	18	19.2	14.2	14.3	23.4	26.8	37	39	25.7	20.0
165	CCC-199	28.7	25.2	25.9	19.8	14.3	16.3	11	12.2	14.2	26.2	30.5	37.8	21.8	17.0
166	CCC-200	57.1	41.1	44.0	46.3	37	39.9	34.9	34	42.4	37.9	40.9	55.5	42.6	33.2
167	CCC-201	44.9	40.8	37.9	39.8	30.8		30.6	29.3	35.9	39.2	41.9	48.5	38.1	29.8
168	CCC-202	39.5	37.2	39.3		30.4	33.6	26.2	27.8	30.3	38	40.5	47.5	35.5	27.7
169	CCC-203	26.7	25.6	26.7	25.6	23.9	18.1	12.9	13.7	19.4	26.4	27.9	36.5	23.6	18.4
170	CCC-204	30.7	28.8	31.1	29.4	22.2	21.8		20.6	24.4	31.2	29.6	38.6	28.0	21.9
171	CCC-205	33	32.2	31.7	26.8	21.1	21.5	17.3	19.8	24.1	31	36.2	43.5	28.2	22.0
172	CCC-206	75.8	69.3	54.8	82.3	51.8	55.5	58.7	58.4	60.2	47.3	68.5	68.6	62.6	48.8
173	CCC-207	50.5		37.0	37.4	29.9	31.4	29.4			37.4	44.2		37.2	29.0
174	CCC-208	36	46.2	44.7	49.4	41.5	38.4	20.8		31.9	50.7	56.4	53.8	42.7	33.3
175	CCC-209	62.9													
176	CCC-210	76.6													
177	CCC-211	78.3													
178	CCC-212	77													
179	CCC-213		49.5	63.7	61.6			40.2	47.9	53.8	62.5		53.8	54.1	42.2
180	CCC-214		57.5	55.6	45.7	48.9						83.5	62.1	58.9	45.9
181	CCC-215		49.5	57.3	65	44.8		51.2	47.8	45.3	50.9	62.8	79.9	55.5	43.3
182	CCC-216		54.4	43	43.4	35.9	33.6	31	30.8	39.1	49.7	52.1	60.9	43.1	33.6
183	CCC-217			50.2	52.6		43.5	24.7	33.4	41.4	56.9	60.3	51.7	46.1	35.9
184	CCC-218		69.9		57.4	55.3	50	34.7	41.9	49.1	56.4		63.4	53.1	41.4
185	CCC-219		62.9	49.2	47.8	43	43.6	26.7	30.7	39.1	58.6	55.9	65.3	47.5	37.1
186	CCC-220		53.9	64.6	62.4	58.2	60.7	50.6	53.5	54.2	59.1	77.2	75.8	60.9	47.5
187	CCC-221		57.2	63.1		65.8		50.4	54.7	69.5	70.3	72.9	81	65.0	50.7
188	CCC-222		47.6	61.2	66.8	59.6		52.5		56.7	57.1	72.5		59.3	46.2

## Appendix B: QA/QC Data

### Diffusion Tube Bias Adjustment Factors

A database of bias adjustment factors determined from Local Authority co-location studies throughout the UK has been collated by the LAQM Helpdesk. The National Diffusion Tube Bias Adjustment Factor Spreadsheet (Version 06/17) was used to obtain an overall adjustment factor of 0.78 from the input data shown in the following screen-shot. This overall factor is based on 38 co-location studies where the tube preparation method and analysis laboratory used were the same as those used by Cardiff Council.

Figure B.1: National Diffusion Tube Bias Adjustment Factor Spreadsheet

National Diffusion Tube Bias Adjustment Factor Spreadsheet							Spreadsheet Version Number: 06/17			
Follow the steps below <b>in the correct order</b> to show the results of <b>relevant</b> co-location studies							This spreadsheet will be updated at the end of September 2017 <a href="#">LAQM Helpdesk Website</a>			
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods										
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet										
This spreadsheet will be updated every few months; the factors may therefore be subject to change. This should not discourage their immediate use.										
The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.							Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.			
Step 1:		Step 2:		Step 3:		Step 4:				
Select the Laboratory that Analyses Your Tubes from the Drop-Down List		Select a Preparation Method from the Drop-Down List		Select a Year from the Drop-Down List		Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor <sup>2</sup> shown in blue at the foot of the final column.				
If a laboratory is not shown, use have no data for this laboratory.		If a preparation method is not shown, use have no data for this method at this laboratory.		If a year is not shown, use have no data.		If you have your own co-location study then see footnote <sup>1</sup> . If uncertain what to do then contact the Local Air Quality Management Helpdesk at <a href="mailto:LAQMHelpdesk@uk.bureauveritas.com">LAQMHelpdesk@uk.bureauveritas.com</a> or 0800 0327953				
Analysed By <sup>1</sup>	Method	Year <sup>2</sup>	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) ( $\mu\text{g}/\text{m}^3$ )	Automatic Monitor Mean Conc. (Cm) ( $\mu\text{g}/\text{m}^3$ )	Bias (B)	Tube Precision <sup>3</sup>	Bias Adjustment Factor (A) (Cm/Dm)
ESG Didcot	50% TEA in acetone	2016	R	City of York Council	12	33	25	33.4%	G	<b>0.75</b>
ESG Didcot	50% TEA in acetone	2016	R	City of York Council	12	41	27	51.2%	G	<b>0.66</b>
ESG Didcot	50% TEA in acetone	2016	KS	Leeds City Council	9	66	55	20.1%	S	<b>0.83</b>
ESG Didcot	50% TEA in acetone	2016	R	Leeds City Council	12	57	44	27.8%	S	<b>0.78</b>
ESG Didcot	50% TEA in acetone	2016	R	City and County Swansea	9	35	31	12.7%	G	<b>0.89</b>
ESG Didcot	50% TEA in acetone	2016	R	North East Lincolnshire Council	10	36	30	20.0%	G	<b>0.83</b>
ESG Didcot	50% TEA in acetone	2016	R	North East Lincolnshire Council	10	57	42	37.3%	G	<b>0.73</b>
ESG Didcot	50% TEA in acetone	2016	R	North East Lincolnshire Council	11	44	29	52.0%	G	<b>0.66</b>
ESG Didcot	50% TEA in acetone	2016	SU	Reigate and Banstead BC	12	27	20	33.8%	G	<b>0.75</b>
ESG Didcot	50% TEA in acetone	2016	B	Reigate and Banstead BC	12	20	17	20.7%	G	<b>0.83</b>
ESG Didcot	50% TEA in acetone	2016	KS	Slough Borough Council	11	42	33	27.8%	G	<b>0.78</b>
ESG Didcot	50% TEA in acetone	2016	R	Wrexham County Borough Council	9	20	18	8.2%	G	<b>0.92</b>
ESG Didcot	50% TEA in acetone	2016		<b>Overall Factor<sup>2</sup> (38 studies)</b>					<b>Use</b>	<b>0.78</b>

### Discussion of Choice of Factor to use

The bias adjustment factor applied to all 2016 data is 0.78. The applied bias adjustment factor has been calculated using the national diffusion tube bias adjustment factor spreadsheet version 06/17. The individual bias adjustment factor calculated using the Cardiff City Centre AURN automatic monitoring system and the co-located triplicate diffusion tubes has not been adopted as the bias adjustment factor derived from the study was slightly less than the figure generated by the national, 0.76 compared to 0.78. Therefore it was deemed good practise to use the nationally derived bias adjustment factor as this would reflect a “worst-case scenario”.

## PM Monitoring Adjustment

The Frederick Street Automatic Monitoring Station uses a TEOM- FDMS (Tapered Element Oscillating Microbalance Filter Dynamics Measurement System) to monitor PM<sub>10</sub> & PM<sub>2.5</sub>. In accordance with Section 7.146 of the LAQM TG(16) the local authority can use this analyser without the need for correction for slope or intercept.

## Short-term to Long-term Data Adjustment

### AMS Adjustment

The Cardiff City Centre AURN site had poor annual data capture for Particulate Matter (PM<sub>10</sub>) (47.1%). As a result, the PM<sub>10</sub> data presented in this report from this monitor has been annualised according to the methods presented in Boxes 7.9 & 7.10 of LAQM TG(16). Two long-term AURN urban background continuous monitoring sites, within a distance of approximately 50 miles from Cardiff were selected; Newport and Bristol St Paul's.

**Table B.1 – Long term AURN sites used for calculation of PM<sub>10</sub> annualisation ratio for Cardiff City Centre AURN**

Site	Site Type	Annual Mean (µg/m <sup>3</sup> )	Period Mean (µg/m <sup>3</sup> )	Ratio
Newport AURN	Urban Background	15.15	15.58	0.97
Bristol St Paul's AURN	Urban Background	15.20	15.71	0.97
Average Ratio				0.97

### Diffusion Tubes Adjustment

The nitrogen dioxide (NO<sub>2</sub>) obtained via the use of passive diffusion tubes during January to December 2016 were annualised via the method described in Boxes 7.9 & 7.10 of LAQM TG(16). As Cardiff City Centre AURN is defined by DEFRA as an Urban Background location, this site was selected to annualise any applicable data.

**Table B.2 – Long term AURN site used for calculation of nitrogen dioxide annualisation ratio for Diffusion Tube 107**

Site	Site Type	Annual Mean (µg/m <sup>3</sup> )	Period Mean (µg/m <sup>3</sup> )	Ratio
Cardiff City Centre AURN	Urban Background	22.42	20.97	1.07

**Table B.3 – Long term AURN site used for calculation of nitrogen dioxide annualisation ratio for Diffusion Tube 134**

Site	Site Type	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	Period Mean ( $\mu\text{g}/\text{m}^3$ )	Ratio
Cardiff City Centre AURN	Urban Background	22.42	23.66	0.95

**Table B.4 – Long term AURN site used for calculation of nitrogen dioxide annualisation ratio for Diffusion Tube 141**

Site	Site Type	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	Period Mean ( $\mu\text{g}/\text{m}^3$ )	Ratio
Cardiff City Centre AURN	Urban Background	22.42	21.65	1.04

**Table B.5 – Long term AURN site used for calculation of nitrogen dioxide annualisation ratio for Diffusion Tube 173**

Site	Site Type	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	Period Mean ( $\mu\text{g}/\text{m}^3$ )	Ratio
Cardiff City Centre AURN	Urban Background	22.42	22.60	0.99

**Table B.6 – Long term AURN site used for calculation of nitrogen dioxide annualisation ratio for Diffusion Tube 179**

Site	Site Type	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	Period Mean ( $\mu\text{g}/\text{m}^3$ )	Ratio
Cardiff City Centre AURN	Urban Background	22.42	23.81	0.94

**Table B.7 – Long term AURN site used for calculation of nitrogen dioxide annualisation ratio for Diffusion Tube 180**

Site	Site Type	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	Period Mean ( $\mu\text{g}/\text{m}^3$ )	Ratio
Cardiff City Centre AURN	Urban Background	22.42	21.42	1.05

**Table B.8 – Long term AURN site used for calculation of nitrogen dioxide annualisation ratio for Diffusion Tube 188**

Site	Site Type	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	Period Mean ( $\mu\text{g}/\text{m}^3$ )	Ratio
Cardiff City Centre AURN	Urban Background	22.42	20.79	1.08



## QA/QC of Diffusion Tube Monitoring

The diffusion tubes are supplied and analysed by Environmental Scientifics Group Didcot, using the 50% triethanolamine (TEA) in water method. Environmental Scientifics Group Didcot participates in the Annual Field Inter-Comparison Exercise and Workplace Analysis Scheme for Proficiency (WASP) inter-comparison scheme for nitrogen dioxide diffusion tube analysis. From April 2014 the WASP Scheme was combined with the STACKS scheme to form the new AIR scheme, which Environmental Scientifics Group participates in. The AIR scheme is an independent analytical proficiency testing scheme operated by LGC Standards and supported by the Health and Safety Laboratory (HSL).

The laboratory Environmental Scientifics Group Didcot is regarded ranked as the highest rank of satisfactory in relation to the WASP intercomparison scheme for spiked Nitrogen Dioxide diffusion tubes. Information regarding tube precision can be obtained via <http://laqm.defra.gov.uk/diffusion-tubes/precision.html> Information regarding WASP results can be obtained via <http://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html>

## **Uncertainties**

All values presented in this report are the best possible estimates, but uncertainties in the results might cause over-or under-predictions. All of the measured concentrations presented have an intrinsic margin of error. DEFRA and the Das suggest that this is of the order of plus or minus 20% for diffusion tube data and plus or minus 10% for automatic measurements.

The UK Government's Air Quality Expert Group (AQEG) has published a report on trends in primary nitrogen dioxide in the UK (AQEG, 2007). This examines evidence that shows that while NO<sub>x</sub> emissions have fallen in line with predictions made a decade previously, the composition of NO<sub>x</sub> has, in some urban environments, changed. This may have caused nitrogen dioxide levels at some locations to fall less rapidly than was expected. The latest guidance from DEFRA and the DAs (2009) has been followed regarding NO<sub>x</sub> to NO<sub>2</sub> relationships.

The limitations to the assessment should be borne in mind when considering the results set out in preceding sections.