



2013 Air Quality Progress Report for Vale of Glamorgan

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

2013

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Executive Summary

Overall air quality across the Vale of Glamorgan complies with regulations to protect human health.

However, data for 2012 continues to highlight some locations where road traffic emissions of **nitrogen dioxide (NO₂)** are at, or close to, the relevant annual average concentration of 40 ug/m³, at

- Windsor Road Penarth
- Cogan Roundabout
- Railway Terrace, Cardiff Road, Dinas Powys
- Tynewydd Rd, Barry
- Culverhouse Cross

Data obtained in 2012 supports recommendations within previous review and assessments, to consult on the declaration of an Air Quality Management Area (AQMA) for a portion of Windsor Rd Penarth, due to emissions of nitrogen dioxide from road traffic.

Air Quality along Holton Road, where there is a trend for outdoor dining complied with the NO₂ annual objective in 2012.

Indicative monitoring of **Particulate Matter PM₁₀** at the 'Streetbox' station located at Windsor Road, Penarth complied with the regulations in 2012 whereas in 2011 it did not. It is still recommended to undertake PM₁₀ equivalence monitoring within the proposed AQMA to provide equivalence comparative data.

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1 Introduction

1.1 Description of Local Authority Area

The Vale of Glamorgan Council (Vale) is a rural coastal area (Figure 1) adjoining to the east, City and County of Cardiff, to the north, Rhondda Cynon Taff County Council (RCT) and to the west, Bridgend County Borough Council (Bridgend).

The boundaries to the east and north are major road links for the area namely the Ely Link Road to the east, a peripheral distribution road for the western end of Cardiff and the M4 motorway to the north, which joins Cardiff to Bridgend. Small sections of each of those major links are within the area of the Vale.

To the south is the Bristol Channel across which (about 20 kilometres) are large population centres. To the west the boundary from the M4 to the Bristol Channel at Ogmore by Sea is the Ewenny River which leads to the sea via the Ogmore River.

The major population centres in the Vale are mainly to the South and comprise Wenvoe, Penarth, Dinas Powys, Barry town, Llantwit Major, Rhoose, St Athan and Cowbridge.

All but two of the Part A processes are concentrated in an area to the south of Barry (chemical complex), the other two are about a kilometre apart in Aberthaw. The Part B processes are spread about from east to west. There are two aerodromes, one military and one civilian about two kilometres apart and a port where shipping, though not busy, is regular.

1.2 Purpose of Progress Report

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

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

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

1.3 Air Quality Objectives

The air quality objectives applicable to 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, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in Wales

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m ³	Running annual mean	31.12.2003
	5.00 µg/m ³	Annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m ³	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m ³	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m ³	Annual mean	31.12.2004
	0.25 µg/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m ³	Annual mean	31.12.2005
Particulate Matter (PM ₁₀) (gravimetric)	50 µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m ³	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

The 2012 Updating & Screening Assessment (USA) and Detailed Assessment (DA) concluded...

Nitrogen Dioxide (NO₂)

- Continue monitoring nitrogen dioxide concentrations at existing locations, and expand network to include locations at façades of properties along Windsor Road.
- No annual mean concentrations above 60 ug/m³ have been identified at locations of relevant exposure, and thus exceedences of the 1-hour mean objective are unlikely.
- Seek to declare an Air Quality Management Area (AQMA) including residential properties with concentrations above 36 µg/m³ along Windsor Road, Penarth.
- Proceed with Further Assessment at Windsor Rd within 12 months of the declaration of an AQMA.
- Review data at Holton Road where there is a trend for outdoor dining.

Particulate Matter (PM₁₀)

- Continue to monitor indicative Particulate Matter (PM₁₀) at Windsor Road and consider deployment of a gravimetric or other method sampler that meets European equivalence criteria in order to directly compare with relevant objective

General

- Proceed to Progress report for 2012

A summary of previous rounds of Review and Assessment are summarised in *Appendix D*.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Automatic monitoring sites operated within the Vale of Glamorgan are described in table 2.1 below

The Vale of Glamorgan Council employs a third party (Ricardo-AEA) to access and ratify data from its sites at Fonmon, Dinas Powys and Penarth

Ratified data (i.e. has been subjected to appropriate quality control) summaries for each monitor are available in *Appendix A*

The 'Streetbox' (SignalAmbitech) is an indicative, continuous monitor using electrochemical sensors. An explanation of its operation is provided in *Appendix A*

The Partisol is a gravimetric equivalence monitor, operated in accordance with the manufacturer's instructions. Exposed filters are analysed by a third party laboratory (Environmental Scientific Group) that is UKAS accredited.

RWE nPower operated two automatic monitors at Sea View, Aberthaw and their Pumping Station at Fontygary.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring Technique PM ₁₀	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?	Quality Control by
Penarth (Vale)	Roadside	317551	171482	NO ₂ , O ₃		N	N	5 m	N	AEA
Dinas Powys Infant School (Vale)	Roadside	315840	171526	NO ₂		N	Y (adjacent)	7 m	Y	AEA
Penarth (Vale)	Roadside	317635	172361	NO ₂ , PM ₁₀	Streetbox (indicative) electrochemical	N	Y (4m)	<1m	Y	Vale
Fonmon, Highwayman Inn (Vale)	Other (power station)	305736	167335	NO ₂ , SO ₂ , PM ₁₀ , O ₃	TEOM & FDMS	N	N	1000 m to main road	N	AEA
Cardiff Road, Barry (Vale)	Roadside	313502	168867	PM ₁₀	Partisol 2025 (Gravimetric)	N	Y (14m)	4m	N	Vale Filters UKAS analysed by ESG
Sea View (RWENpower)	Other (power station)	300341	167472	NO ₂ , SO ₂		N	N	68 metres to main road	N	RWE Bureau Veritas HS&E Ltd
Pumping Station, Fontygary (RWENpower)	Other (power station)	305221	166133	NO ₂ , SO ₂		N	N	2 metres to road	N	RWE Bureau Veritas HS&E Ltd

2.1.2 Non-Automatic Monitoring Sites

The Vale of Glamorgan has a network of nitrogen dioxide diffusion tubes to measure annual average concentrations.

In 2012 the tubes were prepared and supplied by Cardiff Scientific Services, whose quality control procedures are detailed in *Appendix A*

Active sites in 2012 are listed in Table 2.3

In 2012 the following **new sites were commissioned**. Site numbers 38, 64, 65, 67, 68, 69, 70 & 71

Sites described as type 'Other' provide baseline / background concentration data in advance of permitted developments e.g. around Barry Waterfront

Diffusion tube locations decommissioned in 2012 are included in Table 2.4

Table 2.2 Details of Non-Automatic Monitoring Sites 2012

ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	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?
4	Gwenog Ct Barry	Urban Background	310475	168457	NO ₂	N	N	Y	20m	N
7	Millbrook Rd/Cardiff Rd, Dinas Powys	Roadside	315773	171514	NO ₂	N	N	Y (15m)	5m	N
72 a,b,c, Triplicate	Dinas Powys Infants School	Roadside	315841	171527	NO ₂	N	Y	Y (<1m)	7m	Y
47	Dinas Powys Health Centre	Urban Background	315710	171385	NO ₂	N	N	Y (4m)	16m	N
8	Tynewydd Road, Barry	Roadside	311797	168503	NO ₂	N	N	Y (4m)	1m	N
62	Windsor Road (nr 154), Penarth	Roadside	317636	172359	NO ₂	N	N	Y (3m)	2m	Y
73 a. b c Triplicate	Penarth Monitor, Windsor Rd	Other	317550	172483	NO ₂	N	Y	N	4.5m	Y

ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	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?
46	Cardiff Rd, Dinas Powys	Roadside	315745	171390	NO ₂	N	N	Y (8m)	3m	N
56	Andrew Rd, Llandough	Kerbside	316814	172443	NO ₂	N	N	N	<1m	Y
87	110 Dock View Rd, Barry	Roadside	312663	168289	NO ₂	N	N	Y (0m)	9m	N
24	Port Road East, Barry	Roadside	310813	169693	NO ₂	N	N	N	2m	N
41	Dispenser Road, Sully	Urban Background	315278	168451	NO ₂	N	N	N	128m	N
66	17 Churchill Tce	Roadside	313342	168823	NO ₂	N	N	Y (4m)	1.5m	Y
65	Riverside Mews Cowbridge	Roadside	299614	174592	NO ₂	N	N	Y (1m)	3m	Y
67	2, Mathew Tce	Roadside	316488	172004	NO ₂	N	N	Y (1m)	2.5m	Y

ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	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?
22	Stanwell Road, Penarth	Roadside	318505	171496	NO ₂	N	N	Y (8m)	<1m	M
75	Catalina Y Rhodfa. Barry Waterfront	Other	312142	167529	NO ₂	N	N	Y (4m)	58m	N
76	160 Windsor Road, Penarth	Roadside	317627	172371	NO ₂	N	N	Y (0m)	2.5m	Y
29	Cogan Roundabout,	Roadside	317406	172796	NO ₂	N	N	N	3m	Y
53	168 Windsor Road Penarth	Roadside	317589	172411	NO ₂	N	N	Y (0m)	5m	Y
39	Cambrian Caravan Park, Wenvoe	Urban Background	311968	174577	NO ₂	N	N	N	110m	N
38 (new)	2 Horseshoes Cross, Wenvoe (was Ruhr)	Roadside	311872	174526	NO ₂	N	N	N	2m	N
77	Culverhouse Cross, Wenvoe	Roadside	311622	174772	NO ₂	N	N	N	4m	N

ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	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?
68	99, Penlan Rd Llandough	Roadside	316886	172561	NO ₂	N	N	Y		Y
43	Groundhog, Fonmon	Other	305736	167329	NO ₂	N	Y	N	900m	N
57& 58	Groundhog Fonmon	Other	305736	167329	NO ₂	N	Y	N	NA	N
54	High St, Cowbridge	Kerbside	299270	174737	NO ₂	N	N	N (5m)	<1m	N
55	Windsor Rd (nr 161) Penarth	Roadside	317587	172441	NO ₂	N	N	Y (5m)	2m	Y
82	98b Windsor Rd, Penarth	Roadside	318061	171944	NO ₂	N	N	Y (0m)	8m	N
78	Chelmsford Cottage, Plassey St, Penarth	Roadside	318006	172070	NO ₂	N	N	Y (0m)	5m	N
74	110 Windsor Rd, Penarth	Roadside	317718	172252	NO ₂	N	N	Y (3m)	2.5m	Y

ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	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?
79	Marine Scene, Windsor Rd, Penarth	Roadside	317549	172572	NO ₂	N	N	N	1.2m	Y
80	113 Plassey St, Penarth	Roadside	318150	172043	NO ₂	N	N	Y (0m)	5.4m	Y
81	Paget, Penarth	Roadside	318738	172333	NO ₂	N	N	Y (0m)	0.3m	Y
61	Railway Terrace, Dinas Powys	Roadside	316433	171932	NO ₂	N	N	Y(0m)	2m	Y
83	24 Cardiff Road, Barry	Roadside	313597	168829	NO ₂	N	N	Y(0m)	2.5m	N
84	Bendricks Road, Barry	Urban Background	313407	167477	NO ₂	N	N	Y (0m)	144m	N
85	Thalasa, Dyfrig Street, Barry	Urban Background	311980	166965	NO ₂	N	N	Y (0m)	39m	N
86	Holton Road, Barry	Roadside	311768	168101	NO ₂	N	N	Y	2m	N

ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	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?
71 (new)	High Street Barry	Roadside	310764	167505	NO2	N	N	Y	2m	Y
70 (new)	Ty Isaf Penarth	Roadside	316731	172391	NO2	N	N	Y	3m	Y
69 (new)	65 Penlan Rd	Roadside	316847	172948	NO2	N	N	Y	7.5m	Y
64 (new)	Bennys Holton Road	Roadside	311690	168042	NO2	N	N	Y	3m	Y

Table 2.3 Details of Decommissioned Diffusion Tube Locations in 2012

Old IDs Incl WAQF	Name	Type	Easting	Nothing	Pollutant	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road <i>N/A if not applicable</i>	Does this location represent worst-case exposure?
S, 38	Rhur Cross	Roadside			NO2	N	N	N		N
B,4	Sully Road, Sully	Rural	316318	168765	NO ₂	N	N	N	800m	N
DA, 8	Ty Newydd Rd David Davies House	Roadside	311948	168348	NO2	N	N	Y (0m)	4m	N
N, 27	Adenfield, Rhoose	Other	305005	166584	NO2	N	N	Y (9m)	66m	N
W1, 70	Higher End, St Athan	Other	301121	168022	NO2	N	N	N	400m	N
OA, 28	Flemingston Rd, St Athan	Rural	301678	169327	NO2	N	N	Y (12m)	66m	N
OB, 28	Court House, Flemingston	Rural	301758	169994	NO2	N	N	Y (10m)	800m	N
(U, 69)	Ty Hafan, Sully	Urban Background	314325	167700	NO2	N	N	N	200m	N

W1	St Brides Major	Rural	289490	174761	NO2	N	N	Y (7m)	1.5m	N
W3	Cogan Leisure Centre, Penarth	Roadside	317485	172447	NO2	N	N	N	80m	N
E1	96 Colcot Road, Barry	Other	310861	169063	NO2	N	N	Y (0m)	14m	N
68 (number reassigned)	r/o Hayes Rd Sully	Other	313627	167767	NO ₂	N	N	N	39m	N
65 (number reassigned)	St Teilo Ave, Barry	Urban Background	311464	168852	NO ₂	N	N	N	<1m	N

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide (NO₂)

Results of both automatic and diffusion tube monitoring of NO₂ are provided in tables 2.4, 2.5 and 2.6

Automatic Monitoring data concluded that there were:-

- **no exceedences of the annual average objective**
- **no exceedences of the 1 – hour average objective**

Diffusion tube data is used to compare with the annual average concentration objective of 40ugm³. Raw / uncorrected tube data is available in *Appendix C*.

Table 2.5 shows the bias factor (BF) adjusted data. An explanation of the choice of BF is given within *Appendix B*.

The BFs applied are the:-

- Average BF of all three co-location studies,
- BF derived at Penarth co-location study (outliers removed)

Diffusion tube monitoring concluded that:-

- **Concentrations across the majority of the Vale of Glamorgan comply with the annual average nitrogen dioxide (NO₂) objective of 40 ugm³**
- **No annual mean concentrations above 60ug/m³ were recorded at locations of relevant exposure, thus exceedences of the 1-hour mean objective are unlikely.**

- **NO₂ concentrations along Windsor Road, Penarth, remain close to, at, or above the annual average objective of 40 ug/m³. which supports recommendations within previous review and assessments to consult upon the declaration of an Air Quality Management Area (AQMA).**

- **An new diffusion tube at Mathew Terrace, Cardiff Rd, Dinas Powys complied with the annual average objective whereas nearby Railway Terrace did not.**

- **Two monitoring locations along Holton Road, Barry where there is a trend for outdoor dining, complied with the annual objective.**

- **Continues to highlight some locations where road traffic emissions are at, or close to, the relevant annual average objective at**
 - **Windsor Road Penarth (relevant exposure)**
 - **Cogan Roundabout (traffic)**
 - **Railway Terrace, Cardiff Road , Dinas Powys (relevant exposure)**
 - **Tynewydd Rd Barry (relevant exposure)**
 - **Culverhouse Cross (traffic monitoring)**

Table 2.4 Results of Automatic Monitoring for NO₂: Comparison with Annual Mean Objective

Site	Within AQMA?	Valid Data Capture for period of monitoring % ^a	Valid Data Capture 2012 % ^b	Annual Mean Concentration µg/m ³				
				2008* ^c	2009* ^c	2010* ^c	2011 ^c	2012
Penarth (Vale)	N		98	25	27	31	21	26
Dinas Powys Infant School (Vale)	N		99.1	24	24	26	24	24
Penarth (Streetbox) (Vale)	N				28	37	42	34
Fonmon (Vale)	N		98.8	11	11	12	13	13
Pumping Station Fontygary (RWE)	N		95	17	15	15	12	13
Sea View (RWE)	N		CLOSED		14.6	14	11	

In bold, exceedence of the NO₂ annual mean AQS objective of 40µg/m³

Table 2.5 Results of Automatic Monitoring for NO₂: Comparison with 1-hour Mean Objective

Site	Within AQMA?	Valid Data Capture for period of monitoring % ^a	Valid Data Capture 2012 % ^b	Number of Exceedences of Hourly Mean (200 µg/m ³) If the period of valid data is less than 90% of a full year, include the 99.8 th percentile of hourly means in brackets.				
				2008* ^c	2009* ^c	2010* ^c	2011 ^c	2012
Penarth (Vale)	N		98.0	0 (103)	0 (97)	0 (111)	0	0
Dinas Powys Infant School (Vale)	N		99.1	0 (94)	0 (75)	0 (90)	0	0
Penarth Streetbox (Vale)	N				0 (74.7)	1 (154.9)	0 (124.4)	0
Fonmon (Vale)	N		98.8	0 (74)	0 (49)	0 (61)	0 (57)	0
Pumping Station, Fontygary (RWE)	N		95.0	0 (94)	0 (74)	0	0 (76)	0
Sea View (RWE)	N		Closed		0 (75)	0	0 (58)	

In bold, exceedence of the NO₂ hourly mean AQS objective (200µg/m³ – not to be exceeded more than 18 times per year)

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

^b 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%)

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

Table 2.6 Results, NO₂ Diffusion Tubes Bias Factor Corrected 2008 to 2012 (rounded to nearest decimal points)

Site ID	Location	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$						
				2008* (BF=0.86)	2009* (BF=0.88)	2010* (BF=0.85)	2011 (BF=0.86) Average	2011 (BF = 0.93) Highest @Penarth	2012 (BF=0.88) Average	2013 (BF=0.88) Highest @ Penarth
7	Millbrook	Roadside	N	24	26	26	26	29	27	27
72 abc	Dinas Powys Inf (average)	Roadside	N	25	25	24	23	24	27	27
64	Benny's, Holton Rd	Roadside	N						26	
47	Dinas Powys, health centre	Urban background	N	15	17	18	16	17	21	
8	Tynewydd Rd	Roadside	N			35	30	33	35	
65	Riverside Mews	Urban background	N						21	
62	154, Windsor Rd	Roadside	N	39	41	39	38	41	36	
73abc	Penarth Monitor (average)	Other	N	22	24	28	21	23	24	
4	Gwenog Court	Urban background	N	13	14	17	14	15	15	
46	46, Cardiff Rd	Roadside	N	29	31	32	30	32	22	
56	Andrew Rd	Kerbside	N	33	35	39	36	39	37	
87	110, Dock View	Roadside	N		17	20	17	19	18	
24	Port Rd East	Roadside	N	22	23	26	24	26	24	
41	Dispenser Rd	Urban background	N	15	14	16	14	15	15	
66	17, Churchill Tce	Roadside	N						35	
22	Stanwell Rd	Roadside	N	25	26	28	25	27	27	
75	Catalina	Other	N		18	18	17	18	19	
76	Windsor Rd	Roadside	N	37	39	39	37	41	39	
29	Cogan roundabout	Roadside	N	32	34	36	36	39	35	
53	168, Windsor Road	Roadside	N	30	29	31	30	32	34	
39	Cambrian Holiday Park	Urban Background	N	16	17	19	16	17	17	
67	2, Mathew Tce	Roadside	N						27	
38	2 Horseshoe	Roadside	N	25	29	28	27	29	27	
77	Culver	Roadside	N	30	33	32	33	36	34	
68	99, Penlan Rd	Other	N						19	
43	Groundhog	Other	N	13	14	14	12	13	13	
69	65, Penlan Rd,	Urban background	N	11	11	12	11	11	18	
54	High St, Cowbridge	Kerbside	N	19	22	25	22	23	24	

Site ID	Location	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$						
				2008* (BF=0.86)	2009* (BF=0.88)	2010* (BF=0.85)	2011 (BF=0.86) Average	2011 (BF = 0.93) Highest @Penarth	2012 (BF=0.88) Average	2013 (BF=0.88) Highest @Penarth
55	161, Windsor Rd	Roadside	N	33	33	38	32	35	35	35
70	Ty Isaf	Roadside	N						21	
82	98b, Windsor	Roadside	N	18	19	22	19	21	20	
71	76, High St. Barry	Roadside	N	15	19	22	18	19	19	
78	Chelmsford Cottage	Roadside	N						26	
74	110, Windsor	Roadside	N	35	36	38	35	38	38	
79	Marine Scene	Roadside	N				37	40	44	
80	113, Plassey St	Roadside	N				14.	15	18	
81	Paget Road	Roadside	N				15	16	20	
61	Railway Tce	Roadside	N	34	39	40	38	41	37	
65	Riverside Mews, Cowbridge	Roadside	N						21	
83	24, Cardiff Rd	Roadside	N	21	29	30	26	28	27	
84	Bendricks Rd	Other	N		14	17	14	15	13	
85	Thalasa	Other	N		13	14	13	14	14	
86	Holton Rd	Other	N		26	27	29	31	32	

Figures in bold are at or above annual average concentration of 40 $\mu\text{g}/\text{m}^3$

2.2.2 Particulate Matter (PM₁₀)

Table 2.7 Results of Automatic Monitoring for PM₁₀: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % ^a	Valid Data Capture 2012 % ^b	Confirm Gravimetric Equivalent (Y or NA)	Annual Mean Concentration µg/m ³				
						2008* ^c	2009* ^c	2010* ^c	2011 ^c	2012
Fonmon	Rural	N	83.6		Y	20.2	19.1	19	22	16
Penarth	Roadside <i>Indicative</i>	N			N		24	22.8	28.7	20.4
Barry	Roadside	N			Y			22	25.8	21.8

Table 2.8 Results of Automatic Monitoring for PM₁₀: Comparison with 24-hour Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % ^a	Valid Data Capture 2011 % ^b	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean (50 µg/m ³)				
						2008*	2009*	2010*	2011	2012
Fonmon	Rural	N		91.8	Y	9 (36.8)	6 (33.4)	3 (28.3)	10	2
Penarth	Roadside <i>Indicative</i>	N		89%	N		22 (38)	15 (44.7)	40 (52.6)	16
Barry	Roadside	N		77%	Y					15

In bold, exceedence of the PM₁₀ daily mean AQS objective (50µg/m³ – not to be exceeded more than 35 times per year)

^a *i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year*

^b *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%)*

^c *if data capture for full calendar year is less than 90%, include the 90.4th percentile of 24-hour means in brackets*

- **PM10 concentrations in 2012 did not exceed the relevant objectives**
- **Data capture has been low this period for the Partisol site at Cardiff Road, Barry**

2.2.3 Sulphur Dioxide (SO₂)

Table 2.9 Results of Automatic Monitoring for SO₂: Comparison with Objectives

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % ^a	Valid Data Capture 2012 % ^b	Number of: ^c		
					15-minute Means > 266µg/m ³	1-hour Means > 350µg/m ³	24-hour Means > 125µg/m ³
Fonmon	Rural	N	99.0%	99.0%	0	0	0

c. exceedence of the relevant AQS objective (15-min mean = 35 allowed/year; 1-hour mean = 24 allowed/year; 24-hour mean = 3 allowed/year)

- **SO₂ concentrations in 2012 did not exceed the relevant objective.**

2.2.4 Benzene

The Vale does not monitor Benzene as concluded under previous LAQM. There were no new sources identified in 2012.

2.2.5 Other Pollutants Monitored

The vale has the capability to monitor **Ozone (O₃)** and does so due its potential correlation with other pollutants.

Table 2.10

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % ^a	Valid Data Capture 2012 % ^b	Number of: ^c	
					Running 8hr means >100ugm3	No. Days
Fonmon	Rural	N	99.0%	99.0%	43	5

- **In 2012 measured Ozone concentrations did not exceed the relevant Human Health Objective**

3 New Local Developments

3.1 The Vale of Glamorgan Council confirms that in 2012 there were **no new** developments or newly identified sources of pollutants which may have an impact on air quality within its area.

4 Conclusions and Proposed Actions

4.1 Conclusions from New Monitoring Data

- Overall, air quality across the Vale of Glamorgan complies with regulations to protect human health.
- However, diffusion tube data has highlighted some locations where road traffic emissions of nitrogen dioxide (NO₂) are at, or close to, the annual average objective concentration of 40 ug/m³ namely:-
 - Windsor Road Penarth (relevant exposure)
 - Cogan Roundabout (traffic)
 - Railway Terrace, Cardiff Road , Dinas Powys (relevant exposure)
 - Tynewydd Rd Barry (relevant exposure)
 - Culverhouse Cross (traffic monitoring)
- Nitrogen dioxide concentrations at Windsor Road, Penarth continue to support the conclusions of previous Detailed Assessment i.e. to consult on the declaration of an Air Quality Management Area.
- Nitrogen dioxide concentrations at two diffusion tube sites along Holton Road Barry (close to shopping and outdoor dining) were within the objective limits
- PM₁₀ concentrations in 2012 did not exceed the relevant objectives
- Indicative monitoring of PM₁₀ at Windsor Road, Penarth complied with the relevant objectives in 2012
- Sulphur dioxide (SO₂) concentrations did not exceed the relevant objective
- Ozone concentrations did not exceed the relevant Human Health Objective

4.2 Proposed Actions

- Continue to monitor at the majority of current locations.
- Review nitrogen dioxide diffusion tube placement. Re-locate tubes to property facades where practicable. Identify tubes with consistently low, compliant concentrations, to redeploy elsewhere.
- Place additional tubes at locations with relevant exposure where nitrogen dioxide concentrations are consistently close to the annual average objective. Establish extent of those concentrations and to identify any need for Detailed Assessment i.e. Railway Terrace, Cardiff Road, Dinas Powys.
- Propose and consult on the declaration of Air Quality Management Area (AQMA) for the section of Windsor Road identified by previous Detailed Assessment.
- Relocate Penarth's automatic monitor from existing location (open aspect) to within the proposed AQMA, (where domestic properties are close to the road and may limit dispersion of pollutants).
- Replace indicative PM10 monitor (Streetbox) with equivalence, gravimetric PM10 monitor within proposed AQMA.
- Improve performance of Partisol PM10 automatic monitor.
- Proceed to Progress Report 2014.

5 References

1. 2012 Air Quality Updating and Screening Assessment for The Vale of Glamorgan Council In fulfillment of Part IV of the Environment Act 1995 Local Air Quality Management Date April 2012.
2. Detailed Assessment of Air Quality in Cogan for Vale of Glamorgan Council May 2012 Air Quality Consultants.
3. Air Quality Review and Assessment. Round 4- Progress Report 2010, Vale of Glamorgan Council, June 2010.
4. Local Air Quality Management, Technical Guidance LAQM.TG (09). Defra and Devolved Administrations, February 2009.
5. Indicative Monitoring with Streetbox, Unpublished works, Signal Group Ltd Ambitech Division, July 2006.

<http://www.signal-group.com/index.php/technology-used-for-gas-anaylsis-and-emissions-monitoring/melectrochemical/roadside-pollution-monitoring-electrochemical-cell-technology>

6. Vale of Glamorgan Planning Link
<http://vog.planning-register.co.uk/plaDetails.aspx>

7. UK National Air Quality Archive LAQM
<http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

Appendix A: QA:QC Data

Automatic monitors

Produced by Ricardo-AEA on behalf of Vale of Glamorgan

V GLAMORGAN DINAS POWYS ROADSIDE 01 January to 31 December 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	NO _x	NO	NO ₂
Number Very High	-	-	0
Number High	-	-	0
Number Moderate	-	-	0
Number Low	-	-	8703
Maximum 15-minute mean	909 µg m ⁻³	528 µg m ⁻³	124 µg m ⁻³
Maximum hourly mean	756 µg m ⁻³	433 µg m ⁻³	97 µg m ⁻³
Maximum running 8-hour mean	362 µg m ⁻³	206 µg m ⁻³	67 µg m ⁻³
Maximum running 24-hour mean	270 µg m ⁻³	143 µg m ⁻³	58 µg m ⁻³
Maximum daily mean	267 µg m ⁻³	141 µg m ⁻³	52 µg m ⁻³
Average	46 µg m ⁻³	15 µg m ⁻³	24 µg m ⁻³
Data capture	99.1 %	99.1 %	99.1 %

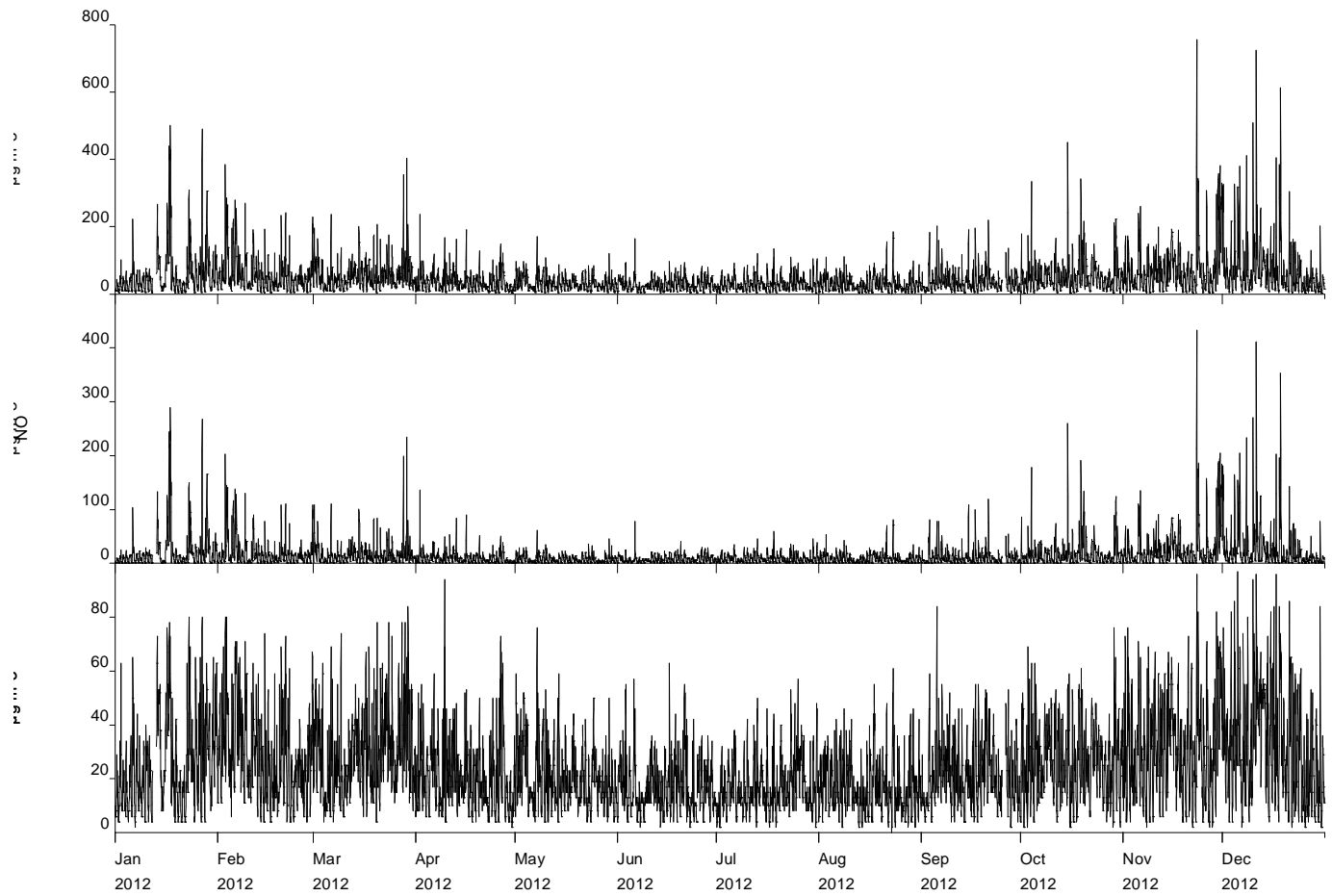
All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.

NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality (Wales) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0

Produced by Ricardo-AEA on behalf of Vale of Glamorgan

V Glamorgan Dinas Powys Roadside Hourly Mean Data for 01 January to 31 December 2012



Produced by Ricardo-AEA on behalf of Vale of Glamorgan

V GLAMORGAN FONMON 01 January to 31 December 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	NO _x	NO	NO ₂	SO ₂	O ₃	PM ₁₀ *+
Number Very High	-	-	0	0	0	0
Number High	-	-	0	0	0	0
Number Moderate	-	-	0	0	103	4
Number Low	-	-	8681	34170	8631	7299
Maximum 15-minute mean	590 µg m ⁻³	323 µg m ⁻³	118 µg m ⁻³	152 µg m ⁻³	152 µg m ⁻³	101 µg m ⁻³
Maximum hourly mean	432 µg m ⁻³	244 µg m ⁻³	84 µg m ⁻³	88 µg m ⁻³	150 µg m ⁻³	101 µg m ⁻³
Maximum running 8-hour mean	173 µg m ⁻³	95 µg m ⁻³	53 µg m ⁻³	30 µg m ⁻³	139 µg m ⁻³	80 µg m ⁻³
Maximum running 24-hour mean	93 µg m ⁻³	41 µg m ⁻³	50 µg m ⁻³	13 µg m ⁻³	110 µg m ⁻³	65 µg m ⁻³
Maximum daily mean	78 µg m ⁻³	36 µg m ⁻³	50 µg m ⁻³	13 µg m ⁻³	108 µg m ⁻³	57 µg m ⁻³
Average	17 µg m ⁻³	3 µg m ⁻³	13 µg m ⁻³	3 µg m ⁻³	56 µg m ⁻³	16 µg m ⁻³
Data capture	98.8 %	98.8 %	98.8 %	98.9 %	99.0 %	83.6 %

+ PM₁₀ as measured by an FDMS no correction applied

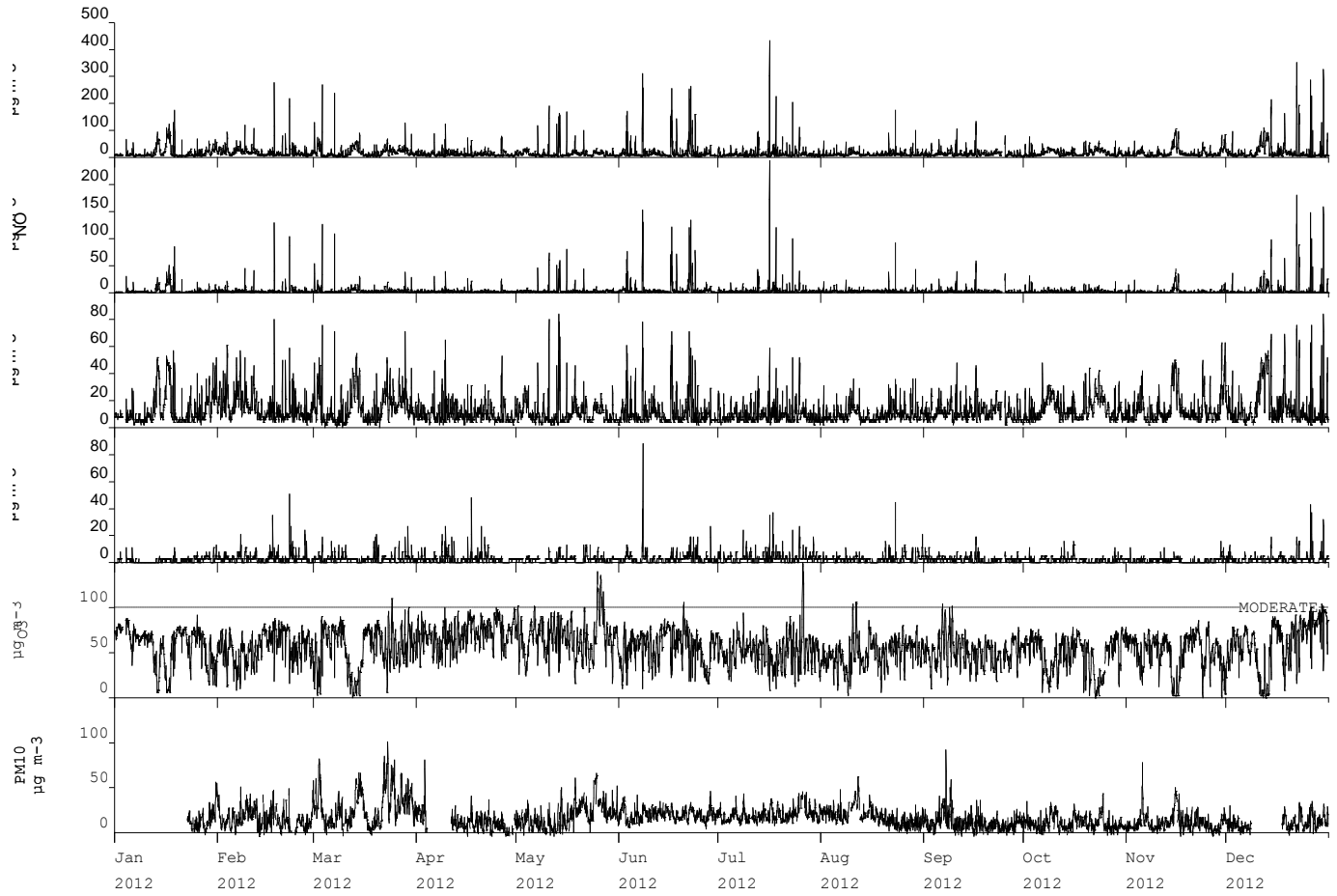
All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.

NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality (Wales) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0
Sulphur Dioxide	15-minute mean > 266 µg m ⁻³	0	0
Sulphur Dioxide	Hourly mean > 350 µg m ⁻³	0	0
Ozone	Running 8-hour mean > 100 µg m ⁻³	43	5
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	2	2
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 40 µg m ⁻³	0	-

Produced by Ricardo-AEA on behalf of Vale of Glamorgan

V Glamorgan Fonmon Hourly Mean Data for 01 January to 31 December 2012



Produced by Ricardo-AEA on behalf of Vale of Glamorgan

V GLAMORGAN PENARTH 01 January to 09 October 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	NO _x	NO	NO ₂	O ₃
Number Very High	-	-	0	0
Number High	-	-	0	0
Number Moderate	-	-	0	57
Number Low	-	-	6658	6650
Maximum 15-minute mean	965 µg m ⁻³	570 µg m ⁻³	210 µg m ⁻³	144 µg m ⁻³
Maximum hourly mean	865 µg m ⁻³	509 µg m ⁻³	162 µg m ⁻³	132 µg m ⁻³
Maximum running 8-hour mean	684 µg m ⁻³	391 µg m ⁻³	118 µg m ⁻³	120 µg m ⁻³
Maximum running 24-hour mean	453 µg m ⁻³	246 µg m ⁻³	87 µg m ⁻³	100 µg m ⁻³
Maximum daily mean	445 µg m ⁻³	241 µg m ⁻³	86 µg m ⁻³	98 µg m ⁻³
Average	50 µg m ⁻³	16 µg m ⁻³	26 µg m ⁻³	47 µg m ⁻³
Data capture	98.0 %	98.0 %	98.0 %	98.5 %

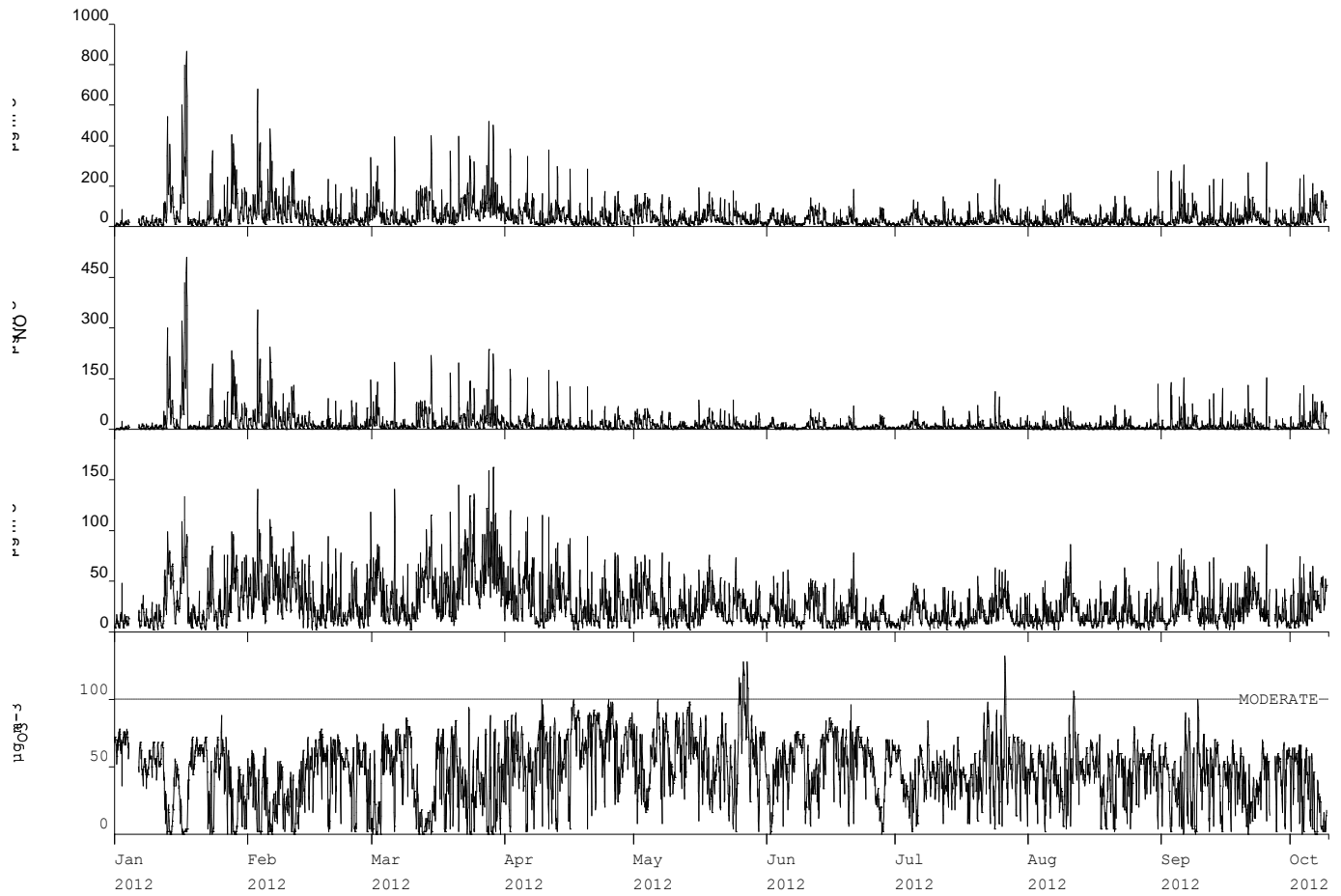
All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.

NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality (Wales) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0
Ozone	Running 8-hour mean > 100 µg m ⁻³	32	4

Produced by Ricardo-AEA on behalf of Vale of Glamorgan

V Glamorgan Penarth Hourly Mean Data for 01 January to 09 October 2012



Partisol 2025

- This PM10 analyser is a gravimetric sampler and meets the equivalence criteria.
- It is operated in accordance with the user manual guide.
- Emfab (Teflon coated glass fibre) filters are weighed and supplied by Environmental Scientific Group who are UKAS accredited.

Signal Ambitech 'Streetbox' operation

- NO_x gas sensors are electrochemical sensors. Gas to be measured undergoes a chemical reaction within the cell, producing a small current across the cell electrodes. This current, which is proportional to gas concentration, is then converted into a voltage and measured by the electronics. The fitting of a second anode further enhances the sensor by cancelling the effects of electrical or other random noise. An internal container holds the chemical material in place and a weatherproof membrane protects the electrolyte from the elements
- One trade off with this type of construction is the fact that the sensor will always be exposed to external conditions such as temperature and moisture of the sample itself. These can effect the viscosity of the electrolyte, which in turn effect the results obtained. The Streetbox compensates for this by introducing calibration characteristics that are added to the results prior to recording. These calibration characteristics are stored within the logger unit and take into account the effects of ageing and temperature.
- All gaseous sensors fitted to the StreetBox are calibrated using a specially developed test process, which characterises the cells. The two factors affecting the accuracy of any gaseous sensor are its overall linearity (span), its relative position to true zero values (baseline) and its temperature profile over its operating temperature of -10°C to +50°C.
- For each sensor the baseline and span are plotted separately with temperature for increasing and decreasing values, to produce an operating profile for each sensor. This profile is incorporated in the calibration file associated with the sensor, and is identified by a 6-figure number. The calibration file is loaded to the sensor data logger and is then used to compensate the raw cell output.
- Particulate sensor uses light scatter from suspended particulate samples to provide a continuous real-time measurement of airborne particulate. Devices using this technique are referred to as nephelometers, and in the case of the StreetBox, the light source used is a visible laser diode.
- Ambient air is sampled and then physically separated through the use of a sharp-cut cyclone device for either the PM10 or the PM2.5 fraction depending upon the cyclone device selected. The PM10 or PM2.5 fraction entrained in ambient air is then passed into a sample chamber at a sampling rate of two litres per minute. A collimated laser beam is directed into the chamber, where it is scattered and then detected by a silicon photo diode.
- The electrical signal produced by the detector is proportional to the mass, chemical composition and particle size distribution of the particulate matter

and as such can be used to generate a concentration reading for any particulate present.

- To assure stable concentration data the StreetBox automatically carries out an hourly zero cycle, whereby a second pump is used to generate a reverse flow. A series of low pressure check valves redirects the flow path through a 0.2-micron filter element and the filtered air is then used to flush the optical chamber and remove any airborne particulate. A measurement is made of clean filtered air and a baseline established. The nephelometer is also equipped with an optical span checking device that is energised once a day to prove operation.

Studies have shown that high RH levels can affect concentration measurements of particulate matter using optical techniques, but the StreetBox helps prevent this through a unique heated inlet that uses an internal RH sensor. The RH of the incoming air is measured and, at a predetermined set point, the inlet heater is activated to keep the RH from changing the measured concentration.

Diffusion Tube Monitoring

1. Sampler – Acrylic tube (diffusion) – 71mm length, 11mm internal diameter with stainless steel grids, 4mm mesh and diameter 12.5 mm, 2 grids per tube
2. Absorbent – triethanolamine (TEA)
3. Tube preparation – DIPPING METHOD – Each grid is dipped in 50% v/v triethanolamine in Acetone, placed on a filter paper for a minimum time possible to allow acetone to evaporate. Two grids assembled on top of each other in blue cap on each tube. Laboratory blanks and Travel blanks are also prepared monthly. The NO_x tubes are prepared in accordance with “Diffusion Tubes for Ambient NO₂ Monitoring: Practical Guidance for Laboratories and Users Issue 1A” The mesh grids are coated using the 50% TEA in acetone option.
4. Levels are determined as nitrite (NO₂) and expressed as µg/m³. The determination is based on colorimetric method using a variation of the Griess reaction and is developed in the tubes. The tubes are extracted with distilled water and the colour development is produced by use of Sulphanilimide/phosphoric acid buffer (forms diazonium compound) followed by aqueous solution of N-1 Naphthalene diamine (produces azodyes). The absorbance of the colour solution is measured at 540nm and concentration read from prepared calibration graph using standard sodium nitrite solutions. Laboratory and travel blanks are also determined in each batch of samples.
5. Analysis by Cardiff Laboratory Services, Crofts Street, Cardiff Laboratory Method does not come under the scope of their Formal Accreditation, BS 9001:2000 or UKAS, ISO 17025 UKAS accreditation.
6. On 17th September 2010 AEA prepared WASP – Annual Performance Criteria for NO₂ Diffusion Tubes used in Local Air Quality Management (LAQM), 2008 onwards, and Summary of Laboratory Performance in Rounds 105-109. The WASP (Workplace Analysis Scheme for Proficiency) scheme is operated by the Health and Safety Laboratory (HSL) and involves analysis by the participating laboratories of four artificially spiked diffusion tubes of known quantities of nitrite. The Performance Index (PI) statistic is calculated from the four sample results in each round. The Rolling Performance Index allows long term trends in performance to be monitored and is calculated as the best four Performance Index (RPI) values from the most recent five rounds.

The Performance Criteria set by HSL at present are as based the z-score method and not the PI or RPI but equates to :

- **GOOD:** Results obtained by the participating laboratory are on average within 13% of the assigned value. **≡ RPI of 169 or less**
- **ACCEPTABLE:** Results obtained by the participating laboratory are on average within 13-26% of the assigned value. **≡ RPI of 169 – 676**
- **WARNING:** Results obtained by the participating laboratory are on average within 27-39% of the assigned value. **= RPI of 676 – 1521**

- **FAILURE:** Results obtained by the participating laboratory differ by more than 39% of the assigned value. \equiv **RPI of greater than 1521**

As of round 111 (October 2010) the performance criteria set by HSL will be based upon RPI statistic and will be tightened to the following:

GOOD: Results obtained by the participating laboratory are on average within 7.5% of the assigned value. \equiv **RPI of 56.25 or less**

ACCEPTABLE: Results obtained by the participating laboratory are on average within 15% of the assigned value. \equiv **RPI of 225 or less**

UNACCEPTABLE: Results obtained by the participating laboratory differ by more than 15% of the assigned value. \equiv **RPI of greater than 225**

Based on both the above Performance Criteria set by HSL the performance of the Cardiff Laboratory used by the Vale during April 2009 – April 2010 was **GOOD** (full documentation can be found at <http://www.laqmsupport.org.uk/index.php>).

7. Recoveries were also carried out using the laboratories own prepared doped tubes within each set of samples analysed and the results ranged between 95 and 109%.

Appendix B Diffusion Tube Bias Factor (BF) Selection

The choice of Bias Factor (BF) is significant. Given the number of possible factors to apply it could easily influence the direction of compliance.

Options included:-

- BFs derived using from AEA model calculations (below) with data from three co-location studies at Penarth, Dinas Powys & Fonmon. With this option it is possible to use either the average BF and / or an individual study BF
- Based on triplicate collation study at Penarth – where the highest BF has been derived. This co-location study is of a more open aspect when compared with the ‘canyon’ like properties nearby (where the highest uncorrected diffusion tube data concentrations are recorded).
- Notably the diffusion tubes with greatest measured concentrations are placed higher-up than the co-location study tubes and usually out of reach. It could be hypothesised that concentrations closer to human exposure would be greater than those higher-up on lamp posts.
- Evidence from DEFRA’s own help pages <http://laqm.defra.gov.uk/laqm-faqs/faq69.html>, that concluded

“Although in many cases, using an overall correction factor derived from as many collocation studies as possible will provide the best estimate of the true annual mean concentration, it is important to recognise that there will still be uncertainty associated with this bias adjusted annual mean. One analysis has shown that the uncertainty for tubes bias adjusted in this way is $\pm 20\%$ (at 95% confidence level). This compares with a typical value of $\pm 10\%$ for chemiluminescence monitors subject to appropriate QA/QC procedures.

The BFs finally chosen to include in this report were:-

- Average BF of all three co-location studies = (0.89)

Co- location site	Bias Factor	95% Confidence Interval
Penarth	1.03	0.84 - 1.33
Fonmon	0.88	0.78 – 1.02
Dinas Powys	0.77	0.74 – 0.81
AVERAGE	0.89	

- Highest BF derived at Penarth = **1.03**
- The highest BF option ensures that any risk of exceedence of the annual average could be identified.

Penarth co-location study data (outlier removed tube 3 period7)

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1			24.0	30.0	28.0	27	3.1	11	7.6
2	29/02/2012	28/03/2012	27.0	32.0	33.0	31	3.2	10	8.0
3	28/03/2012	24/04/2012	36.0	35.0	35.0	35	0.6	2	1.4
4	24/04/2012	30/05/2012	31.0	27.0	26.0	28	2.6	9	6.6
5	30/05/2012	27/06/2012	25.0	24.0	24.0	24	0.6	2	1.4
6	27/06/2012	01/08/2012	19.0	20.0	16.0	18	2.1	11	5.2
7	01/08/2012	29/08/2012	17.0	17.0		17	0.0	0	0.0
8	29/08/2012	26/09/2012	18.0	18.0	17.0	18	0.6	3	1.4
9	26/09/2012	31/10/2012	20.0	21.0	22.0	21	1.0	5	2.5
10			30.0	29.0	29.0	29	0.6	2	1.4
11			34.0	32.0	32.0	33	1.2	4	2.9
12			32.0	32.0	31.0	32	0.6	2	1.4
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
		Good	
43	99.4	Good	Good
34	99.5	Good	Good
25	99.8	Good	Good
17	99.7	Good	Good
17	96	Good	Good
17	99.7	Good	Good
23	99.1	Good	Good
24	34.5	Good	or Data Captu
		Good	
		Good	
		Good	

Overall survey --> Good precision Good Overall DC

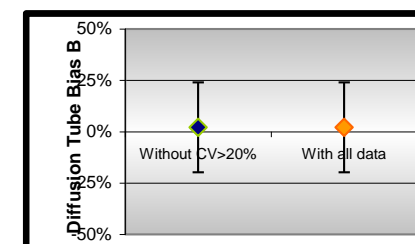
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Penarth
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Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 7 periods of data	
Bias factor A	1.03 (0.84 - 1.33)
Bias B	-3% (-25% - 19%)
Diffusion Tubes Mean:	24 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	25 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	25 (21 - 33) μgm^{-3}

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

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 7 periods of data	
Bias factor A	1.03 (0.84 - 1.33)
Bias B	-3% (-25% - 19%)
Diffusion Tubes Mean:	24 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	25 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	25 (21 - 33) μgm^{-3}



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Version 03 - November 2006

Fonmon co location study

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1			17.0	18.0	17.0	17	0.6	3	1.4
2			17.0	20.0	17.0	18	1.7	10	4.3
3	29/02/2012	28/03/2012	22.0	18.0	19.0	20	2.1	11	5.2
4	28/03/2012	24/04/2012	12.0	14.0	14.0	13	1.2	9	2.9
5	24/04/2012	30/05/2012	11.0	10.0	9.0	10	1.0	10	2.5
6	30/05/2012	27/06/2012	16.0	14.0	13.0	14	1.5	11	3.8
7	27/06/2012	01/08/2012	10.0	8.0	8.0	9	1.2	13	2.9
8	01/08/2012	29/08/2012	7.0	8.0	8.0	8	0.6	8	1.4
9	29/08/2012	26/09/2012	10.0	11.0	11.0	11	0.6	5	1.4
10	26/09/2012	31/10/2012	16.0	19.0	16.0	17	1.7	10	4.3
11	31/10/2012	28/11/2012	15.0	16.0	14.0	15	1.0	7	2.5
12	28/11/2012	02/01/2013	21.0	23.0	22.0	22	1.0	5	2.5
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
		Good	
		Good	
15	99.9	Good	Good
11	99.8	Good	Good
11	99	Good	Good
12	99.4	Good	Good
9	99.5	Good	Good
10	99.6	Good	Good
12	95.7	Good	Good
13	99.2	Good	Good
13	97.9	Good	Good
16	99.1	Good	Good

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

Overall survey -->

Good precision	Good Overall DC
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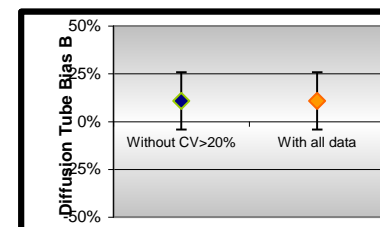
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Fonmon
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Precision	12 out of 12 periods have a CV smaller than 20%
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Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	0.88 (0.78 - 1.02)
Bias B	13% (-2% - 28%)
Diffusion Tubes Mean:	14 μgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	12 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	12 (11 - 14) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.88 (0.78 - 1.02)
Bias B	13% (-2% - 28%)
Diffusion Tubes Mean:	14 μgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	12 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	12 (11 - 14) μgm^{-3}



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Version 03 - November 2006

Dinas Powys co-location data

Checking Precision and Accuracy of Triplicate Tubes

Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1									
2			32.0	28.0	34.0	31	3.1	10	7.6
3	2/29/2012	3/28/2012	36.0	33.0	36.0	35	1.7	5	4.3
4	3/28/2012	4/24/2012	27.0	28.0	27.0	27	0.6	2	1.4
5	4/24/2012	5/30/2012	26.0	22.0	25.0	24	2.1	9	5.2
6	5/30/2012	6/27/2012	23.0		24.0	24	0.7	3	6.4
7	6/27/2012	08/01/2012	21.0	21.0	22.0	21	0.6	3	1.4
8	08/01/2012	8/29/2012	23.0	25.0	23.0	24	1.2	5	2.9
9	8/29/2012	9/26/2012	29.0	28.0	27.0	28	1.0	4	2.5
10	9/26/2012	10/31/2012	36.0	32.0	26.0	31	5.0	16	12.5
11	10/31/2012	11/28/2012	42.0	42.0	43.0	42	0.6	1	1.4
12	11/28/2012	01/02/2013	39.0	38.0	39.0	39	0.6	1	1.4
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
		Good	
29	99.9	Good	Good
22	99.5	Good	Good
20	99.1	Good	Good
17	99	Good	Good
17	99.6	Good	Good
17	99.7	Good	Good
21	96.1	Good	Good
24	99	Good	Good
30	99.6	Good	Good
32	99.8	Good	Good
Overall survey -->		Good precision	Good Overall DC

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

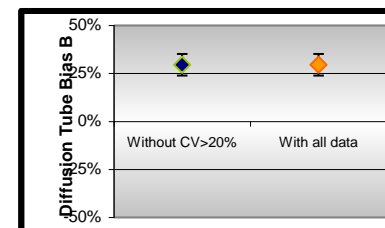
Site Name/ ID:	Dinas Powys
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Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	0.77 (0.74 - 0.81)
Bias B	29% (23% - 35%)
Diffusion Tubes Mean:	30 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	23 μgm^{-3}
Data Capture for periods used: 99%	
Adjusted Tubes Mean:	23 (22 - 24) μgm^{-3}

Precision	11 out of 11 periods have a CV smaller than 20%
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Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.77 (0.74 - 0.81)
Bias B	29% (23% - 35%)
Diffusion Tubes Mean:	30 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	23 μgm^{-3}
Data Capture for periods used: 99%	
Adjusted Tubes Mean:	23 (22 - 24) μgm^{-3}

(Check average CV & DC from Accuracy calculations)



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Appendix C Diffusion Tube data 2012

Tube	old ref	Location	Grid Ref	Previous Location	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	AVE (Jan to Dec)	BF	1.03		BF
4	G	Cwm Parc, Barry (F)			21	17	22	14	15	18	11	11	13	17	19	23	16.8	17.3		16.8	14.91
7	A	Dinas Powys, Cardiff Road/Millbrook	310475 168457	Plas Cleddau, Cardiff Rd, Dinas (310475, 168457)	27	34	38	28	29	26	20	27	24	33	41	40	30.6	31.5		30.6	27.22
8	D	Tynwydd Road, Barry	311797 168503		44	m	42	m	37	m	31	m	m	41	44	m	39.8	41.0		39.8	35.45
22	L	Stanwell Road, Penarth	318505 171496		33	36	32	26	16	24	m	22	30	35	38	38	30.0	30.9		30.0	26.70
24	J	Port Road East, Barry (LP)	310813 169693		24	24	32	22	22	29	15	26	22	36	34	31	26.4	27.2		26.4	23.51
29	M	Cogan Roundabout or Elizabethan Ct??	317406 172796		42	42	49	33	22	34	27	35	38	47	51	49	39.1	40.3		39.1	34.78
38	S	2 Horseshoes, New Bungalow, Brooklands Terrace, Culver	311892 174513	Yhur Cross, Wenvoe on lampost for Jan & Feb	29*	38*	35	28	21	24	26	28	33	33	39	35	30.2	31.1		30.2	26.88
39	R	Cambrian Caravan Park, Wenvoe	311968 174577		23	25	26	18	15	13	14	m	18	m	m	m	19.0	19.6		19.0	16.91
41	K	Dispenser Rd, Sully	315278 168451		27	22	24	13	9	12	13	11	13	17	20	21	16.8	17.3		16.8	14.98
43	T	Groundhog, Fonmon	305736 167329		17	17	22	12	11	16	10	7	10	16	15	21	14.5	14.9		14.5	12.91
46	H	Cardiff Road, Dinas Powys	315747 171369	Cardiff Rd, Dinas Powys (LP) (315747, 171369) for Jan	32*	26	31	23	22	20	m	19	19	27	29	31	24.7	25.4		24.7	21.98
47	C	Dinas Powys Health Centre (F)	315710 171385		18	22	26	16	16	14	11	33	15	20	22	27	20.0	20.6		20.0	17.80
53	P	168 Windsor Road House, Penarth (F)	317589 172411		42	46	45	35	31	32	31	31	38	35	41	46	37.8	38.9		37.8	33.60
54	V	High Street, Cowbridge	299270 174737		31	34	37	27	23	20	18	21	26	27	31	26	26.8	27.6		26.8	23.81
55	W	Windsor Road, Penarth (LP)	317587 172441		34	39	45	38	34	m	m	36	36	42	42	45	39.1	40.3		39.1	34.80
56	I	Andrew Road, Llandough	316814 172443		46	34	46	40	31	33	34	40	39	50	58	53	42.0	43.3		42.0	37.38
57	X	Groundhog, Fonmon	305736 167329		18	20	18	14	10	14	8	8	11	19	16	23	14.9	15.4		14.9	13.28
58	Y	Groundhog, Fonmon	305736 167329		17	17	19	14	9	13	8	8	11	16	14	22	14.0	14.4		14.0	12.46
61	Z	Railway Terrace, Dinas Powys (F)	316433 171932		43	46	43	43	28	34	34	38	42	48	48	50	41.4	42.7		41.4	36.86
62	F	154 Windsor Road, Penarth (F)	317633 172357		47*	36	48	Scaffolding	41	31	37	35	38	43	45	48	40.5	41.7		40.5	36.05
64		24 Holton Rd (next to Bennys), Barry (F),	311690 168042				34	24	m	22	19	46	m	m	m	33	29.7	30.6		29.7	26.40
65		1 Riverside Mews, High St, Cowbridge	299614 174592				28	20	m	18	18	21	m	24	26	36	23.9	24.6		23.9	21.25
66		17 Churchill Terrace, Barry	313342 168823				47	40	29	33	33	35	37	41	47	49	39.1	40.3		39.1	34.80
67		2 Matthew Terrace, Dinas Powys (F)	316488 172004				36	32	32	25	11	28	28	35	37	36	30.0	30.9		30.0	26.70
68		Glen View, 99 Penlan Rd, Llandough	316886 172561	Tesco, Culverhouse X (LP) (311564, 174843)			27	19	18	16	14	18	18	25	31	28	21.4	22.0		21.4	19.05
69		65 Penlan Rd, Llandough	316847 172948				27	21	16	15	12	16	16	24	25	27	19.9	20.5		19.9	17.71
70		Ty-Isaf, Penarth	316731 172391				34	32	23	19	7	20	17	30	34	24	24.0	24.7		24.0	21.36
71		76 High St (O'Donovans), Barry (F)	310764 167505				30	20	21	19	17	19	17	24	m	28	21.7	22.3		21.7	19.28
72a	A1	Dinas Powys Infants School	315841 171527		M	32	36	27	26	23	21	23	29	36	42	39	30.4	31.3		30.4	27.02
72b	A2	Dinas Powys Infants School	315841 171527		M	28	33	28	22	m	21	25	28	32	42	38	29.7	30.6		29.7	26.43
72c	A3	Dinas Powys Infants School	315841 171527		M	34	36	27	25	24	22	23	27	26	43	39	29.6	30.5		29.6	26.38
																	29.9	30.8		29.9	26.61
73a	FA	Windsor Road Monitor	317550 172483		24	27	36	31	25	19	17	18	20	30	34	32	26.1	26.9		26.1	23.21
73b	PA	Windsor Road Monitor	317550 172483		30	32	35	27	24	20	17	18	21	29	32	32	26.4	27.2		26.4	23.51
73c	WA	Windsor Road Monitor	317550 172483		28	33	35	26	24	16	43	17	22	29	32	31	28.0	28.8		28.0	24.92
																	26.8	27.6		26.8	23.85
74	W5	Lampost, nr 110 Windsor Road, Penarth	317718 172252		M	M	47	39	35	m	37	34	38	48	55	49	42.4	43.7		42.4	37.78
75	LA	Catalina, Y Rhodia, Barry Waterfront	312142 167529	Archer Rd, Penarth (LP) (318044, 171113)	32	26	28	20	13	17	18	14	23	21	22	26	21.7	22.3		21.7	19.28
76	LB	160 Windsor Rd, Penarth (F)	317627 172371	Clinton Rd, Penarth (LP)	47	49	50	35	38	m	m	m	m	m	m	m	43.8	45.1		43.8	38.98
77	SA	A48, Culverhouse (Tesco)	311622 174772		35	43	46	36	36	33	26	34	31	40	52	43	37.9	39.1		37.9	33.75
78	W4	Chlemsford Cottage, Plassey st, Penarth (F)	318006 172070		30	35	35	27	21	22	22	23	28	30	38	36	28.9	29.8		28.9	25.74
79	W6	Marine Scene, Windsor Rd, Penarth (LP)	317549 172572		49	51	58	50	45	44	38	45	44	58	58	55	49.6	51.1		49.6	44.13
80	W7	113 Plassey St, Penarth (F)	318150 172043		25	26	28	20	15	14	12	13	17	22	25	26	20.3	20.9		20.3	18.02
81	W8	Paget Road/Terrace, Penarth (LP)	318738 172333		25	27	32	22	19	15	16	14	21	25	29	30	22.9	23.6		22.9	20.40
82	W2	98b Windsor Rd, Penarth (F)	318061 171944		23	27	32	22	17	16	14	18	18	27	30	30	22.8	23.5		22.8	20.32
83	Z1	24 Cardiff Road, Barry (LP)	313597 168829		36	40	36	31	19	m	21	27	26	32	m	39	30.7	31.6		30.7	27.32
84	Z2	Bendricks Road, Barry (F)	313407 167477	200 meters - 100m from the site - see also the site map for location	M	M	M	17*	4	12	12	12	13	20	21	21	14.4	14.8		14.4	12.79
85	Z3	Thalasa', Dyfrig Street, Barry Is (F)	311980 166965		26	20	21	16	11	10	10	14	13	16	17	20	16.2	16.7		16.2	14.39
86	DB	Holton Road, Barry (LP)	311768 168101		41	35	40	30	21	m	m	27	18	m	68	40	35.6	36.6		35.6	31.64
87 (was 59)	IA	110 Dock View Rd, Barry (F)	312663 168289	Andrew Rd, Llandough (F) (316805, 172430)	23	20	29	18	16	17	17	14	14	19	23	26	19.7	20.3		19.7	17.50

0.89

Appendix D Summary of Previous Review & Assessments

	C6H6	1.3-C4H6	Pb	CO	NO2	SO2	PM ₁₀	Other
STAGE 1 (Jan 1999)	No need to proceed	No need to proceed	No need to proceed	Proceed to stage 1/2	Proceed to stage ½	Proceed to stage ½	Proceed to stage ½	
STAGE 2 (Aug 2000)				No need to proceed	No need to proceed continue to monitor	Proceed to stage 2/3 and monitor	Proceed to stage 2/3	
STAGE 3 (Jun 2001)						No AQMA declared but monitor	No exceedences likely but monitor	
ROUND2 Update and Screening 2003 (Jun 2003)	No need to proceed	No need to proceed	No need to proceed	No need to proceed	No exceedence likely but continue to monitor	Suggested Detailed Assessment for 15 min limit in Rhose and continue to monitor	No exceedences likely but continue to monitor	
ROUND 2 Progress Report 2004 (Jun 2004)					No exceedence likely but continue to monitor	Breach of 15 min limit unlikely but continue to monitor	No exceedences likely but continue to monitor	Ozone, EPAQS Standard unlikely to be exceeded
ROUND 2 Progress Report 2005 (Apr 2005)					No exceedence likely but continue to monitor New continuous monitor t Penarth	51 exceedences of 15 min mean, recommend Detailed Assessment in Rhose and continue to monitor	No exceedences likely but continue to monitor	Ozone, unlikely to exceed Expert Panel on Air Quality Standard

	C6H6	1.3-C4H6	Pb	CO	NO2	SO2	PM ₁₀	Other
ROUND 2 Detailed Assessment 2005 (Dec 2005)						15 min Objective not exceeded in 2005, no declaration of AQMA but continue monitor		
ROUND 2 - Update and Screening 2006 (Jun 2006)	No Need to Proceed	No Need to Proceed	No Need to Proceed	No Need to Proceed	No exceedence likely, NO2 close to limit at Penarth due to road works, Detailed Assessment if no change,	Authority be prepared to declare for 15 min mean if need be,	No exceedences likely but continue to monitor	
ROUND 2 Progress Report 2007 (Jun 2007)					No exceedence likely, NO2 close to limit at Penarth, Detailed Assessment not recommended but continue to Monitor	15 min mean unlikely to be exceeded, but continue to monitor.	No exceedences likely but continue to monitor. FDMS added to TEOM to meet European Equivalence Criteria	Ozone, EPAQS Standard exceeded, upward trend thus continue to monitor

	C6H6	1.3-C4H6	Pb	CO	NO2	SO2	PM ₁₀	Other
ROUND 3 Progress Report 2008 (Jun 2008)					Exceedence possible for NO2 close to limit at Penarth. Detailed Assessment recommended Continue to monitor	15 min mean unlikely to be exceeded as FGD plant due on stream, continue to monitor.	No exceedences likely but continue to Monitor.	Ozone, EPAQS Standard exceeded, upward trend thus continue to monitor
Detailed Assessment NO2 Penarth Area (Dec 2008)					No exceedence of either limit, but continue to monitor			
ROUND 4 Update and Screening (June 2009)	Assessed and No need to Proceed Further	Not Assessed	Not Assessed	Not Assessed	Measured by Vale and RWE Npower No exceedence of either limit. Annual mean at Windsor Rd, Penarth close to Annual Limit	Measured by Vale and RWE Npower. No exceedence of 15 minute, hourly nor 24 hour means.	Measured by Vale and RWE Npower. 6 exceedences of the daily mean (35 exceedences allowed per annum) No exceedence of annual mean	Ozone exceeded EPAQS Standard on 21 days.

	C6H6	1.3-C4H6	Pb	CO	NO2	SO2	PM ₁₀	Other
2011 Air Quality Progress April, 2011	Not Assessed	Not Assessed	Not Assessed	Not Assessed	<p>Continue to monitor to inform decision for Detailed Assessment where NO2 concentrations are increasing / close to objective</p> <p>Provide baseline data prior to large scale developments</p> <p>Monitor impact of any change in road infrastructure</p> <p>Provide reassurance despite no expedience of objectives</p>	<p>No exceedence of 15 minute, 1 hour or 24 hour mean in Aberthaw / Fonmon area.</p> <p>Unlikely exposure would exceed objectives.</p> <p>Continue to monitor due to proximity of emitters</p>	<p>No exceedences of annual mean in Fonmon, Penarth and Barry.</p> <p>However a number of exceedences of the 24 hour mean in Fonmon and Penarth but within the permitted 35 days per annum.</p> <p>Relevant exposures in those areas unlikely to exceed the 24 hour mean and annual mean Objectives.</p> <p>Continue to monitor.</p>	<p>Ozone at Fonmon showed a number of exceedences, but number of days was within the permitted EPAQS limit of 10days p/a</p> <p>No exceedence of the EPAQS limit observed at Penarth.</p> <p>Monitoring should continue.</p>

	NO2	PM10
USA 2012	<p>DA recommended. Continued monitoring nitrogen dioxide concentrations at existing locations, and expand network to include locations at façades of properties along Windsor Road.</p> <p>Seek to declare an Air Quality Management Area AQMA including residential properties with concentrations above 36 µg/m³. along Windsor Road</p> <p>Proceed with Further Assessment in Cogan within 12 months of the declaration of an AQMA.</p> <p>Welsh Government advised a review NO2 data at Holton Road where shopping and outdoor dining etc</p>	<p>Continue to monitor indicative Particulate Matter (PM10) at Windsor Road and consider deployment of a gravimetric or other method sampler that meets European equivalence criteria in order to directly compare with relevant objective</p>
DA Penarth 2011	<p>Identified annual mean nitrogen dioxide objective likely to be exceeded at a small number of relevant locations on Windsor Road.</p> <p>No annual mean concentrations above 60 µg/m³ identified at locations of relevant exposure, thus exceedences of the 1-hour mean objective are unlikely.</p> <p>Uncertainty surrounding both measured and modelled concentrations. Therefore recommended that AQMA is declared to include, as a minimum, residential properties with concentrations above 36 µg/m³.</p> <p>Continue monitoring nitrogen dioxide concentrations at existing locations, and expand network where possible to include monitoring locations at the façade of properties on Windsor Road. Monitoring results can be used to inform Further Assessment.</p> <p>Proceed with the completion of a Further Assessment for air quality in Cogan within 12 months of the declaration of an AQMA.</p>	