

Part IV Environment Act 1995

Review and Assessment of Air Quality Round 3

**Detailed Assessment of nitrogen dioxide
(April 2007)**

Air Quality
DETAILED ASSESSMENT (APRIL 2007)

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SUMMARY

This document has been produced in response to the requirements of the Welsh Assembly Government for a third round of the review and assessment of air quality. This review under part IV of the Environment Act 1995 consists of two stages. The first stage is an updating and screening assessment of all seven pollutants designated for the purposes of local air quality management, which has been completed. The second stage is a detailed assessment of individual pollutants if the first stage screening assessment indicates that it is needed.

The previously submitted Updating and Screening Assessment (April 2006) identified that a detailed assessment was required for nitrogen dioxide. This requirement arose because several road links could not be assessed using the Design Manual for Roads and Bridges (DMRB) model, in the absence of accurate speed information. A programme of monitoring using diffusion tubes was therefore carried out in order to directly measure the nitrogen dioxide concentrations at these sites. Nine months worth of data has been collected at these new sites, which shows that it will not be necessary to declare new Air Quality Management Areas in respect of nitrogen dioxide.

The detailed assessment shows that no sites currently exceed the Air Quality Objectives for nitrogen dioxide. But, two sites are currently close to doing so and merit close scrutiny.

Detailed assessment of nitrogen dioxide

Introduction

The Government and Devolved Administrations have adopted two Air Quality Objectives for nitrogen dioxide. An annual mean concentration of 40 µg/m³ and a 1-hour mean concentration of 200 µg/m³ not to be exceeded more than 18 times per year. Both objectives are to be achieved by the end of 2005.

In addition, the first Air Quality Daughter Directive also sets limit values for nitrogen dioxide, which have been translated into UK legislation. A 1-hour limit of 200 µg/m³ applies, not to be exceeded by more than 18 times per year. An annual mean limit value of 40 µg/m³ also applies, both to be achieved by the 1st January 2010.

Detailed assessment

The checklist approach suggested by Defra for the Updating and Screening Assessment (USA) has been used again for the Detailed Assessment. It also takes into account revised bias correction factors and additional diffusion tube sites since the USA was completed. The checklist is shown below:

Box 1: Summary of the Updating and Screening checklist for nitrogen dioxide	
Reference No.	Source, location or data that need to be assessed
A	Monitoring data outside an AQMA
B	Monitoring data within an AQMA
C	Narrow congested streets with residential properties close to the kerb
D	Junctions
E	Busy streets where people may spend 1-hour or more close to the traffic
F	Roads with high flow of buses and/or HGVs
G	New roads constructed or proposed since first round of review and assessment
H	Roads with significantly changed traffic flows or new exposure
I	Bus stations
J	New industrial sources
K	Industrial sources with significantly increased emissions
L	Aircraft

Sections B, C, F, G, H, I, J, K, & L have not been updated for the detailed assessment, as they did not reveal any issues during the USA.

Section A - Monitoring data outside an AQMA

1. *Collation of monitoring data*

Nitrogen dioxide is continuously measured at Groeswen Hospital, Margam. The instrument used is a model M200 manufactured by Advanced Pollution Instruments. Data for the calendar years 2006/7 is considered for the purposes of this study.

The authority continued to operate the ten existing nitrogen dioxide monitoring tubes for 2006. These diffusion tubes had previously formed part of the national nitrogen dioxide network, but the number of tubes had also been expanded in the vicinity of the Victoria Gardens, a busy junction with nitrogen dioxide levels close to the annual Objective level.

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Ratification of monitoring data

The continuous nitrogen dioxide analyser is part of the Advanced Urban Rural Network (AURN) and is subject to the calibration and quality assurance to the standards of that network. The data used for 2006 was downloaded from the AEA Technology website.

The diffusion tubes are provided by Harwell Scientifics Limited. The tubes are prepared using 20% TEA in Water and are subject to a WASP quality assurance scheme. Harwell have been carrying out a co-location study with a chemiluminescence analyser since the start of 2003. Harwell's bias adjustment factor was typically about 0.75 during 2006, but the value used here is 0.78 as this is the average figure obtained from several co-location studies. The factor was obtained from the spreadsheet at the following location <http://www.uwe.ac.uk/aqm/review/diffusiontube300307.xls>.

2. Calculate annual means from the data and identify highest values

The annual mean concentration of nitrogen dioxide in 2006 at the Groeswen Hospital continuous monitoring station was 18 µg/m³. The corresponding value for 2007 was 18 µg/m³, although it must be noted that this is based upon partly ratified data.

The annual average concentrations for the diffusion tube sites are shown in the table below:

Table 1. Bias corrected nitrogen dioxide tube data for 2006

Site Id	NO2 µg/m3	Tube Count	Site Type	Site Address
E2/10/10	18.3	11	Urban background	Civic Centre, Neath
E2/10/12	12.1	11	Urban background	Cwmnedd Primary School, Glynneath.
E2/10/18	41.0	11	Kerbside	Eastland Road, Neath
E2/10/19	30.0	10	House frontage	8 Victoria Gardens, Neath
E2/10/20	32.7	11	House frontage	28 Eastland Road, Neath
E2/10/3	28.7	10	Kerbside	Margam Road, Margam
E2/10/4	17.2	11	Urban background	21, Rice Street, Port Talbot
E2/10/6	18.1	11	Urban background	11, College Green, Margam
E2/10/7	23.9	11	Kerbside	11 High Street, Pontardawe
E2/10/9	34.9	11	Kerbside	6, Victoria Gardens, Neath

The bias corrected values were obtained by multiplying the reported values by the bias correction factor.

3. Estimate the annual mean concentrations in 2010.

The concentrations of the kerbside sites for 2010 are calculated using the following equation:

$$\text{Conc}(2010) = \text{Conc}(2006) * (\text{Correction factor for 2010}) / (\text{Correction factor for year of measurement})$$

$$\text{Conc}(2010) = \text{Conc}(2006) * 0.734 / 0.863$$

The calculated values for 2010 are shown in Table 3 below:

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Table 3. Estimate of 2010 annual means from 2006 data.

Site Id	NO2 $\mu\text{g}/\text{m}^3$
E2/10/10	15.6
E2/10/12	10.5
E2/10/18	35.0
E2/10/19	25.6
E2/10/20	28.2
E2/10/3	24.4
E2/10/4	14.9
E2/10/6	15.6
E2/10/7	20.5
E2/10/9	30.1

All estimated values are well below the 40 $\mu\text{g}/\text{m}^3$ limit.

4. Calculate the number of 1-hour exceedences of 200 $\mu\text{g}/\text{m}^3$ in a full year, or the 99.8th percentile of hourly means.

The maximum 1-hour average during 2006 at the Groeswen Hospital site was 92 $\mu\text{g}/\text{m}^3$, well below the 200 $\mu\text{g}/\text{m}^3$ limit. The corresponding figure for the first three months of 2007 was also 92 $\mu\text{g}/\text{m}^3$ (provisional data).

5. Calculate exceedences.

Item 2 above shows that there were no exceedences of the 40 $\mu\text{g}/\text{m}^3$ limit at the frontages of residential properties where exposure could be regarded as 'relevant'. Projections do not indicate the likelihood of any exceedences by 2010.

There were also no exceedences of the 200 $\mu\text{g}/\text{m}^3$ limit at the AURN monitoring station.

Sections D & E – Busy Junctions and Roads

1. Collation of monitoring data

The 2006 Updating and Screening Assessment identified a number of junctions and road links that appeared to meet the criteria for proximity of properties or relevant exposure within 10 metres of the kerb. One of the junctions was a location already studied using existing diffusion tubes. A number of junctions were also found to correspond with identified road links. In a few cases, physical inspection of the road link sites revealed that the expected relevant exposure did not agree with the desk studies. Consequently house frontages at the following 19 locations were monitored for a total of 9 months between May 2006 and January 2007.

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Ratification of monitoring data

The diffusion tubes were also provided by Harwell Scientific Services Ltd. and are subject to the same quality assurance as described above.

2. Calculate annual means from the data and identify highest values

Table 4. Diffusion tube monitoring locations and results

Road ID	Road Monitored	Vehicle Flow (AADT)	Location	NO2 $\mu\text{g}/\text{m}^3$ (9 months)	NO2 $\mu\text{g}/\text{m}^3$ (12 months) (corrected)	NO2 $\mu\text{g}/\text{m}^3$ (2010)	Tube Count
3	M4	63936	32 Dyffryn Road, Neath	20.4	20.2	17.2	9
5	M4	61424	105 Llewellyn Street, Port Talbot	26.7	26.4	22.5	9
16	A4241	25000	121 Water Street, Port Talbot	40.1	39.7	33.8	9
19	A474	24000	2 Henry Street, Neath	26.0	25.7	21.9	9
29	A4067	18500	47 Derwen Road, Alltwen, Pontardawe	19.5	19.3	16.4	9
42	A474	15000	Moby's, 193 Neath Road, Briton Ferry	37.0	36.6	31.1	8
43	A4230	15000	26 – 38 New Road, Skewen	29.8	29.5	25.1	9
46	A474	14500	3 Pant yr Heol, Briton Ferry	33.4	33.1	28.2	9
48	A474	14000	49 Pen-y-wern Road, Neath	21.1	20.9	17.8	9
52	M4slip	12600	52 Heol y Nant, Baglan, Port Talbot	24.1	23.9	20.3	8
53	B4286	12500	68 Cwmafan Rd, Port Talbot	34.5	34.2	29.1	9
54	B4287	12000	97 Cimla Road, Neath	32.7	32.4	27.6	8
57	A4230	12000	65 – 87, New Road, Skewen	23.0	22.8	19.4	9
59	A4107	12000	160 Tan-y-Groes Street, Port Talbot	30.4	30.1	25.6	9
60	B4434	11800	97 Windsor Road, Neath	27.0	26.7	22.7	9
66	A4107	11000	133 Tan y Groes Street, Port Talbot	25.1	24.8	21.1	9
68	A48	10500	162 Margam Road, Port Talbot	23.6	23.4	19.9	9
69	B4434	10500	2 Riverside Drive, Neath	19.6	19.4	16.5	9
70	C Port Talbot	10300	154 Water Street, Port Talbot	25.1	24.8	21.1	5

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This data shows that one site located at 121 Water Street, Port Talbot marginally exceeded the 40 $\mu\text{g}/\text{m}^3$ limit. But, a correction is necessary in order to derive an annual mean from nine months of actual monitoring data. The approach described in Local Air Quality Management guidance TG(03) was used and three monitoring sites were chosen as follows:

Table 5. Monitoring sites used for correction of short-term diffusion tubes

Site Id	Local Authority / Location	Network / Monitoring type	Site Type
A	Cardiff Cardiff Briardene	Welsh Air Quality Forum Chemiluminescence	Urban background
B	Pembrokeshire Narberth	AURN Chemiluminescence	Rural remote
C	Gwynedd Marchlyn Mawr	Welsh Air Quality Forum Chemiluminescence	Remote

The annual means (AMs) for each site for the calendar year of 2006 were obtained as were the period means (PMs) for May 2006 to January 2007 inclusive. Ratios of the annual mean to the period mean (AM/PM) were obtained and an average of these ratios was derived from these figures as shown below:

Table 6. Ratios for correction of short-term diffusion tube data

Site Id	Annual Mean 2006 (Am)	Period Mean (Pm)	Ratio
A	27.4	27.3	1.00
B	5.3	4.8	1.11
C	15.3	17.7	0.86
		Average	0.99

The corrected mean values are shown in Table 4 above. The application of the average ratio reduced the mean at 121 Water Street to be slightly below the 40 $\mu\text{g}/\text{m}^3$ limit.

3. Estimate the annual mean concentrations in 2010.

The annual means in 2010 were calculated using the same method shown above. The resulting projected concentrations are shown in Table 4 above.

The corrected annual means are shown in Table 4 above, all of which are less than the 40 $\mu\text{g}/\text{m}^3$ limit.

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Conclusion

The detailed assessment shows that it is predicted that the Air Quality Objective for nitrogen dioxide will not be exceeded and therefore there is no need to declare an Air Quality Management Area for nitrogen dioxide at this time. However, the site at 121 Water Street, Port Talbot is currently very close to an exceedance and will need to be closely monitored in future. The site at 193 Neath Road, Briton Ferry should also be monitored as it may be at risk of an exceedance.