

Armagh City and District Council

Detailed Assessment for NO₂ Diffusion Tubes
on Mall West, Armagh City.

November 2007

Executive Summary

Armagh City and District Council submitted their Updating and Screening Assessment to the Environment & Heritage Service in June 2006. The report concluded that the Council was not required to carry out any further detailed assessments for any of the prescribed pollutants under review.

However, a subsequent appraisal by the University of the West of England (UWE) completed on behalf of the Environment and Heritage Service, determined that there was a potential risk of the objective limits for NO₂ being breached at Mall West Terrace in Armagh City centre.

Following further consultation with UWE, the Council accepted that a further assessment of the emissions at Mall West would be required in order to determine a more accurate presentment of the NO₂ impact on air quality at that location.

In order to get a more accurate representation of the extent of NO₂ pollution within Mall West, 2 additional diffusion tubes were placed at this location to complement the existing tube. This was situated on a bus stop approximately 200m along Mall West from the junction with Barrack Street. The additional tubes were to be situated at the new location for an initial period of six months.

Following the six month evaluation of NO₂ pollution in Mall West it was determined in March 2007 that there may also be a possible breach of the objective limits at both Barrack Street and Railway Street. The decision was taken to transfer an existing diffusion tube located at Scotch Street to Railway Street (close to the Moy Road roundabout). This arrangement now gave the Council the opportunity to determine a linear representation of NO₂ levels along the busiest through-route in the city. Railway Street, Mall West and Barrack Street are all linked in this order running from North to South.

Another outcome of the six month evaluation was that the Council resolved that it would be more prudent to extend the monitoring period at Mall West for a further six months. This was based on the assertion that 12 months worth of data would be much more beneficial to the overall accuracy of the monitoring scheme and; that estimating annual average results using the method highlighted in LAQM TG(03) Box 6.5 could actually lead to an inaccurate estimation of the annual mean. Considering that previous diffusion tube results had demonstrated that the results for Mall West were critically close to breaching the objective limits for NO₂, a more cautious approach was required for greater acuity in concluding whether an AQMA should be declared or not.

The results of the 12 month monitoring period were subsequently adjusted using a bias factor that was derived from a co-location study that was already being carried out at the automatic monitoring station on Lonsdale Road. Three NO₂ diffusion tubes were placed in situ at the station in conjunction with the permanent NO₂ automatic analyser. The results gained from this study presented the Council with its own local bias adjustment factor of 0.78. Coincidentally, this factor is exactly equivalent to the bias factor given by the R&A Support section of The University of West England's

website, which determines a factor based on a number of studies across the UK in the given year.

Following the adjustment of the diffusion tube results by the bias factor gained from Armagh's own collocation study, it was found that none of the diffusion tubes at any of the locations studied had breached the objective limits for NO₂, >40ug/m².

It is therefore considered by Armagh City and District Council that an Air Quality Management Area (AQMA) **will not be** declared for Mall West.

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1.0 Introduction

Armagh City and District Council submitted their Updating and Screening Assessment to the Environment & Heritage Service in June 2006. The report concluded that the Council was not required to carry out any further detailed assessments for any of the prescribed pollutants under review.

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2.0 RESULTS

Presented in Table 1 below are the results of the NO₂ diffusion tube monitoring surveys carried out in Armagh from November 2006 to the end of September 2007.

Table 1: NO₂ Diffusion Tube Results For 10 sites in Armagh from November 06 to September 07 analysed by Harwell Scientifics Ltd

	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	Mallview Terrace (exsting)	Mallview Terrace A	Mallview Terrace B	SITE 7	SITE 8	Lonsdale Road A	Lonsdale Road B	Lonsdale Road C
NOVEMBER 2006	52	50	14	22	25	101	62	55	45	39	38	44	51
DECEMBER 2006	49	47	16	21	23	96	58	52	44	34	49	47	30
JANUARY 2007	42	38	12	19	19	80	51	46	34	37	40	34	37
FEBRUARY 2007	53	48	20	29	29	84	62	56	44	37	46	50	49
MARCH 2007	44	37	8	17	25	61	60	55	39	NR	38	43	48
APRIL 2007	41	52	16	19	65	74	53	45	45	41	43	39	44
MAY 2007	26	45	12	13	43	NR	48	42	37	35	31	27	30
JUNE 2007	26	40	12	12	49	50	45	41	NR	NR	35	41	37
JULY 2007	27	36	7	9	51	35	44	34	39	36	30	33	31
AUGUST 2007	34	33	9	13	56	43	45	41	39	38	35	35	37
SEPTEMBER 2007	38	40	11	18	27	30	55	49	22	25	21	23	22
AVERAGE	39	42	12	32	37	65	53	47	39	36	37	38	38
Bias Ave	29	31	9	23	28	48	29	26	27	28	28	39	35

Mall West and Lonsdale Road co-location study results

Table 2: Bias Adjusted Averages for Mallview Terrace and Lonsdale Road Sites in Armagh from November 2006 to end of September 2007

Month	Mallview Terrace (existing)	Mallview Terrace A	Mallview Terrace B	Lonsdale Road A	Lonsdale Road B	Lonsdale Road C
November 2006	101	62	55	38	44	51
December 2006	96	58	52	49	47	30
January 2007	80	51	46	40	34	37
February 2007	84	62	56	46	50	49
March 2007	61	60	55	38	43	48
April 2007	74	53	45	43	39	44
May 2007	NR	48	42	31	27	30
June 2007	50	45	41	35	41	37
July 2007	35	44	34	30	33	31
August 2007	43	45	41	35	35	37
September 2007	30	55	49	21	23	22
Mean	65	53	47	37	38	38
Bias Adjusted (0.74)	48	39	35	27	28	28

Table 2 above outlines the NO₂ diffusion tube results for Mallview Terrace and Lonsdale Road in Armagh. Mallview Terrace is the location where it was assumed that NO₂ levels were likely to breach the objective limits. The tubes at Lonsdale Road are part of a co-location study with the NO₂ automatic analyser. This co-location study was used to achieve the bias factor needed to adjust the raw data provided by Harwell Scientifics Ltd.

It is clear that the result for the 'existing' Mallview Terrace site is of a much higher value than Mallview Terrace sites A & B. This is due to the fact that the diffusion tube at the existing site is situated on a bus stop pole at the kerbside and not with the other two tubes on the façade of the nearest dwelling. Taking this into consideration it was decided not to use this tube in the overall evaluation of the level of NO₂ at Mallview Terrace, since the result would not be representative of the levels at the nearest sensitive receptor. However this tube does give the Council an indication of the 'drop out' of NO₂ emissions from the atmosphere at a distance of over 5 metres. Therefore only the results presented for Mallview Terrace A & B were used in this detailed assessment to determine if an AQMA would be declared. In future, the diffusion tube situated on the bus stop pole at Mall West will be relocated and placed with tubes A & B on the façade.

Bias Factor Determination

As previously stated, the bias factor used to re-adjust the raw data from the diffusion tube analysis carried out by Harwell Scientifics Ltd was generated from the co-location of triplicate sampling tubes at the Lonsdale Road monitoring site. AEA NETCEN ratified all of the monitoring data from the automatic analyser over the period November 2006 to September 2007, which is a matched period in line with the advisory note in Box 6.4 of LAQM TG(03). The average NO₂ result was **28 ug/m³**. (See Appendix 2). The average diffusion tube result of the co-located tubes was **38**

ug/m³. To obtain a bias adjustment factor it is necessary to divide the automatic monitoring results by the average diffusion tube result, in this instance giving **a bias factor of 0.74**. This method is highlighted in LAQM TG(03) in Box 6.4, section 6-7. This bias factor result is similar to the factor presented on the University of the West of England spreadsheet at <http://www.uwe.ac.uk/aqm/review/diffusiontube300907.xls>. The spreadsheet showed a result of 0.78. Given the similarity of both results, the Council felt confident enough to use its own bias factor from the co-location study. Furthermore, it was felt that the Lonsdale road co-location study was a better barometer of local air quality in Armagh City.

Table 3: Average NO₂ level at Mallview Terrace following bias adjustment

Month	Mallview Terrace A	Mallview Terrace B
November 2006	62	55
December 2006	58	52
January 2007	51	46
February 2007	62	56
March 2007	60	55
April 2007	53	45
May 2007	48	42
June 2007	45	41
July 2007	44	34
August 2007	45	41
September 2007	55	49
Mean	53	47
Bias Adjusted (0.74)	39	35
Average ug/m ³	37	

3.0 Conclusions

The result in Table 3 shows that there is not a breach of the objective limit of 40 $\mu\text{g}/\text{m}^3$ for NO_2 at Mallview Terrace, Armagh and Armagh City and District Council will not be declaring an AQMA for this location.

4.0 Recommendations

It is recommended that the Council continues to monitor NO_2 emissions at Mallview Terrace using the triplicate sampling method. From the 28th of November, the three diffusion tubes at Mallview Terrace will be put together at the one position on the façade of the building currently supporting two of the tubes.

The Council will also continue to co-locate three NO_2 diffusion tubes at the Lonsdale Road automatic monitoring site in order to achieve its own yearly local bias factor.

APPENDICES

Appendix 2: NO2 Automatic Analyser Data from AEA NETCEN

Average between two dates and times (GMT)										
Site name	Channel	Start date	Start time	End date	End time	Average	Number of records	Total concentration (units hours)	Data capture	Units
Armagh Lonsdale Road	Nitrogen Dioxide	03/10/2006	12	31/10/2006	12	42	673	26741	95.5	
Armagh Lonsdale Road	Nitrogen Dioxide	31/10/2006	12	28/11/2006	12	-	673	-	0	
Armagh Lonsdale Road	Nitrogen Dioxide	28/11/2006	12	03/01/2007	12	29	865	20145	80	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	03/01/2007	12	31/01/2007	12	33	673	21865	99.6	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	31/01/2007	12	28/02/2007	12	37	673	23947	95.8	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	28/02/2007	12	04/04/2007	12	21	841	17260	99.3	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	04/04/2007	12	02/05/2007	12	29	673	19598	99.7	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	02/05/2007	12	30/05/2007	12	25	673	17094	99.7	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	30/05/2007	12	04/07/2007	12	23	841	18752	99	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	04/07/2007	12	01/08/2007	12	22	673	14468	99.9	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	01/08/2007	12	29/08/2007	12	26	673	17396	99.4	µg m-3 (20°C 1013mb)
Armagh Lonsdale Road	Nitrogen Dioxide	29/08/2007	12	03/10/2007	12	31	841	26443	99.9	µg m-3 (20°C 1013mb)
Average						28				
Average NO2 Diffusion Tube Result					38					
Average NO2 Analyser Result					28					
Average of Both (BIAS FACTOR)					0.74					