Detailed Assessment for NO_2 Levels on Church Street and King Street, Magherafelt

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Local Authority Officer	Mr Robert Beattie Assistant Chief EHO

Department	Environmental Health Department
Address	Magherafelt District Council 50 Ballyronan Road Magherafelt BT45 6EN
Telephone	(028) 79397979
e-mail	r.beattie@magherafelt.gov.uk

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Executive Summary

Funding continues to be received from the Department of the Environment to carry out monitoring of nitrogen dioxide on an on-going basis in order to monitor trends over time and validate the conclusions drawn from previous reviews.

The overarching objective of the monitoring activity is to maintain or improve human health. This objective to date has been achieved in sites 3 - 8 as data collected confirms that levels of this pollutant met the standards set (objective limit of 40µg/m^3).

Based on monitoring data from 2008, it was evident that concentrations measured at site 2 exceeded the standard set and as a result additional monitoring sites were identified in the area of concern in order to assist with a Detailed Assessment to define the Air Quality Management Area (AQMA) boundary.

To date, examination of the monitoring data shows that this area in the vicinity of the Church Street / King Street junction exhibits exceedences of the objective limit and that therefore an AQMA should be declared.

1 Summary of Previous Review and Assessments

Magherafelt District Council in February 2001 submitted a "1st Stage Review and Assessment of Air Quality". Using DETR guidance documents, the Review and Assessment considered pollutants of concern to determine whether or not a Second Stage Review and Assessment was required. The results of the 1st Stage Review and Assessment are summarised below.

POLLUTANT	**2ND STAGE REVIEW AND ASSESSMENT NEEDED**
Carbon Dioxide	No
Benzene	No
1,3 Butadiene	No
Lead	No
Nitrogen Dioxide	Yes
Sulphur Dioxide	Yes
PM10	Yes

A "2nd Stage Review and Assessment of Air Quality" was submitted in April 2004. The pollutants highlighted above were subject to further scrutiny and the conclusion of the report in part prepared by NETCEN was that there was no need to proceed to a Stage 3 Review and Assessment for SO_2, NO_2 or PM_{10}.

A "Progress Report on Air Quality Management" was submitted in April 2005. A previous NETCEN report predicted exceedence of the air quality objective for nitrogen dioxide in 2005 at site 6, however it was stated that the proposed A6 Toome by-pass would ease the weight of traffic on that road significantly and that an exceedence would not be likely. The 2005 report confirmed that the by-pass takes the bulk of traffic away from it's original route thus reducing the impact of traffic on receptors close to the monitoring location. Results for site 6 showed a significant lowering of the annual average concentration in 2004 as opposed to the previous results. The new route runs through an area of open land in which there are no nearby receptors at present. Air quality objectives for SO_2 and PM_{10} continued to be met.

An 'Air Quality Update and Screening Assessment' report was submitted in April 2006. This report concluded that there was no necessity to carry out a Detailed Assessment in respect of NO_2, SO_2 or PM_{10}.

A "Progress Report on Air Quality Management" was submitted in April 2007. A review and assessment of pollutants showed the air quality objectives for NO_2, SO_2 and PM_{10} continued to be met throughout the district of Magherafelt.

A “Local Air Quality Management Grant Evaluation Form” was submitted in April 2008. Results for site 1 showed a clear exceedence for NO_2 and therefore this department were advised to undertake a Detailed Assessment.

A “Progress Report on Air Quality Management” was submitted in August 2008. Due to the exceedence to the NO2 standard set for site 1, it was the intention of this department to provide an additional tube in the vicinity of the nearest residential property for comparison purposes.

A “Local Air Quality Management Grant Evaluation Form” was submitted in April 2009. Results for previous years showed a clear exceedence at site 1 for NO_2 and so an additional tube (site 8) was provided in the vicinity of the nearest residential property for comparison purposes (from 4th September 2008). Results to date show that levels of this pollutant meet with standards set. Monitoring will therefore cease at site 1 as properties in the vicinity of this tube are now commercial or available for commercial use.

An ‘’Updating and Screening Assessment’’ was submitted in May 2009 which showed exceedences at sites 1 and 2 for the year 2008. Additional sites were selected prior to the completion of a Detailed Assessment.

A ‘’Progress Report on Air Quality Management’’ was submitted in July 2010. Site1 was de-commissioned as there was found to be no residential property at or near that location. Areas of concern were confirmed as sites 2, 9 and 10 which are in Church Street which is a main route into town and on which two roundabouts regulate the flow of traffic. Residential property is situated along that street directly of the pavement. The need for a Detailed Assessment was again highlighted.

2 Summary of Non-Automatic Monitoring Undertaken

Magherafelt District Council currently monitors NO_2 in various parts of the district using passive diffusion tubes. At present all sites are single tube sites, however consideration is presently being given to making the area of concern multiple tube sites and extending the monitoring area to increase confidence that the annual mean objective is being exceeded. Consideration has been given to various monitoring methods but it has been the decision of Magherafelt District Council that diffusion tubes are the most practicable monitoring method in the current economic climate.

All monitoring data used in this assessment is shown in Table 6.

All monitoring data was bias corrected where appropriate and as accepted in previous reports, use being made of national database bias adjustment factors where data represents at least 75% data capture for a particular calendar year in the absence of any co-location studies in the Magherafelt area.

The choice of using the national bias adjustment factor in each year is reinforced by considering the factors below:-

- Tube exposure is 4 or 5 weekly
- Tubes are placed in a ‘canyon’ situation, therefore it is more appropriate to use results from a variety of studies
- Diffusion tube studies are over 12 month periods
- National factor based on multiple sites using Gradko monitors

Where data did not represent at least 75% data capture for a particular calendar year, data was bias corrected based on the local study (Belfast).

3 QA/QC

As set out in Technical Guidance LAQM.TG(09), it is important that data obtained be accurate, precise, consistent and comply with national and international standards. In order to ensure that the above criteria are maintained, the following matters are adopted by the Gradko laboratory carrying out work on behalf of Magherafelt District Council.

The laboratory operates within the Workplace Analysis Scheme for Proficiency (WASP) which is an independent analytical performance testing scheme run by the Health and Safety Laboratory (HSL). A number of 'spiked' tubes are analysed and the results are reported to the HSL. A performance score is assigned to each laboratory's results based on any deviation from the known mass of nitrite in the material analysed.

The performance criteria are now based on the Rolling Performance Index (RPI) with laboratories awarded a performance designation of 'good', 'acceptable' or 'unacceptable'. The Gradko laboratory precision and WASP scheme performance assessed in accordance with 3.23 of LAQM TG(09) has been assessed as 'good' and therefore confidence can be placed on the reported results.

4 Details of Non-Automatic Monitoring Sites

Table 4

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA ?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location ?
Site 1	Main route through town	X 8958 Y 9048	NO2	No	No	1m	No
Site 2	Main route through town	X 8977 Y 9073	NO2	No	Yes (1m)	1m	Yes
Site 3	Adjacent traffic lights at junction	X 8531 Y 0043	NO2	No	Yes (1m)	1m	Yes
Site 4	Off main road leading to cul-de-sac	X 8989 Y 9078	NO2	No	Yes (10m)	20m	No
Site 5	Roadside location in village	X 9251 Y 9318	NO2	No	Yes (0m)	1m	Yes
Site 6	Area formerly adjacent to main arterial route	X 9887 Y 9085	NO2	No	Yes (25m)	1m	Yes
Site 7	Moderately used route into town centre	X 8982 Y 9069	NO2	No	Yes (15m)	1.5m	Yes
Site 8	Nearest residential property to site 1	X 8960 Y 9046	NO2	No	Yes (0m)	10m	Yes
Site 9	Adjacent roundabout in town centre	X 8974 Y 9073	NO2	No	Yes (10m)	1.5m	No
Site10	Adjacent mini-roundabout off town centre	X 8979 Y 9074	NO2	No	Yes (0m)	1.5m	Yes
Site 11	Moderately used route into town centre	X 8979 Y 9071	NO2	No	Yes(15m)	1.5m	No
Site 12	Main route through town	X 8989 Y 9075	NO2	No	Yes(15m)	1.5m	No

5 Percentage data captured for nitrogen dioxide tubes

Table 5

Site ID	Location	Within AQMA?	% Data Capture							
			2003	2004	2005	2006	2007	2008	2009	2010
1	Adjacent 36 Queen Street, Magherafelt	No	100	100	100	83	10	100	64	-
2	Adjacent 22 Church Street, Magherafelt	No	100	100	100	100	100	100	91	100
3	Adjacent 50 Main Street, Maghera	No	91	91	100	100	100	100	100	100
4	Wesleyan Mews, Magherafelt	No	91	100	100	100	100	100	100	100
5	Adjacent 15 Boyne Row, Castledawson	No	91	100	92	100	92	100	100	91
6	Adjacent 2 Bannside, Toomebridge	No	100	100	100	100	54	100	100	100
7	Adjacent 27 King Street, Magherafelt	No	100	100	100	100	100	100	100	100
8	Adjacent 42 Queen Street, Magherafelt	No	-	-	-	-	-	33	100	100
9	Adjacent 12 Church Street, Magherafelt	No	-	-	-	-	-	-	27	100
10	Adjacent 30 Church Street, Magherafelt	No	-	-	-	-	-	-	27	100
11	Adjacent 11 King Street, Magherafelt	No	-	-	-	-	-	-	27	91
12	Opposite entrance to Wesleyan Mews (Site 4)	No	-	-	-	-	-	-	27	100

In 2008, 100% monitoring data for the calendar year was obtained for sites 1 – 8 with 33% monitoring data for site 8 due to monitoring at this particular site only commencing September 2008.

In 2009, 100% monitoring data for the calendar year was obtained for sites 3 – 8. Site 1 was decommissioned September 2009 and monitoring data for sites 9 – 12 commencing September 2009. Site 2 had 91% monitoring data for the full year due to the NO_2 tube being removed between visits to this site.

In 2010 it can be seen that 100% monitoring data for the calendar year was obtained for all sites with the exception of sites 5 and 11. This was due to the NO_2 tube being removed between visits to these sites.

Magherafelt District Council therefore at present deems monitoring data for the implicated sites to be of a sufficient time period.

6 Monitoring Data

Table 6

Site ID	Location	Within AQMA?	Annual mean concentrations ($\mu g/m^3$)							
			2003	2004	2005	2006	2007	2008	2009	2010
1	Adjacent 36 Queen Street, Magherafelt	No	30	36	23	33	47* (45)	43* (47)	46* (53)	-
2	Adjacent 22 Church Street, Magherafelt	No	36	37	29	35	37 (35)	54* (59)	48* (53)	37 (40)
3	Adjacent 50 Main Street, Maghera	No	32	30	34	33	38 (36)	33 (36)	35 (39)	38 (41)
4	Wesleyan Mews, Magherafelt	No	17	15	15	17	18 (17)	20 (22)	21 (23)	18 (20)
5	Adjacent 15 Boyne Row, Castledawson	No	20	16	16	17	20 (19)	24 (26)	24 (27)	20 (22)
6	Adjacent 2 Bannside, Toomebridge	No	25	18	15	14	20 (20)	21 (23)	21 (23)	20 (22)
7	Adjacent 27 King Street, Magherafelt	No	22	22	18	19	22 (21)	25 (27)	24 (27)	22 (24)
8	Adjacent 42 Queen Street, Magherafelt	No	-	-	-	-	-	21 (27)	24 (27)	34 (37)
9	Adjacent 12 Church Street, Magherafelt	No	-	-	-	-	-	-	46* (53)	54* (59)
10	Adjacent 30 Church Street, Magherafelt	No	-	-	-	-	-	-	55* (63)	59* (64)
11	Adjacent 11 King Street, Magherafelt	No	-	-	-	-	-	-	39 (45)	40* (43)
12	Opposite entrance to Wesleyan Mews (Site 4)	No	-	-	-	-	-	-	35 (40)	39 (42)

Note - XY Indicates unbiased results
(XY) Indicates unbiased results
XY indicates bias adjusted results
* indicates exceedence

Lambeth Scientific Services Ltd., Arlington Lodge, 26 Wanless Road, London, SE24 0HW supplied and analysed NO2 diffusion tubes up until and including December 2007. In line with the approach adopted by NETCEN in their report dated May 2002,

when it was reported that there was a high variability in laboratory bias, both positive and negative, no bias correction has been made on 2003 – 2006 data.

Results for 2007 with the exception of site 6 are calculated based on the national database bias adjustment factor of 1.056 for Lambeth Scientific Services Ltd. The result for site 6 is based on the local study (Belfast) bias adjustment factor of 1.00. Bias adjustment factors were obtained from the Air Quality Review and Assessment website.

NO_2 diffusion tubes from and including 2008 were supplied and analysed by Gradko Environmental, St. Martins House, 77 Wales Street, Winchester, Hampshire, SO23 0RH. The preparation method used was 20% Triethanolamine / Deionised Water. As previously stated, Gradko laboratory precision and WASP scheme performance assessed in accordance with 3.23 of LAQM TG(09) has been assessed as 'good' and therefore confidence can be placed on the reported results.

2008 results for sites 1 - 7 are calculated based on the national database bias adjustment factor of 0.92 for Gradko Environmental. As site 8 was only introduced in September 2008 it is based on the local study (Belfast) bias adjustment factor of 0.79. Bias adjustment factors were obtained from the Air Quality Review and Assessment website.

2009 results for site 1 are calculated based on the local study (Belfast) bias adjustment factor of 0.87. Site 1 was de-commissioned September 2009. Site 8 represents the nearest residential accommodation in that locality, which is off-set from the roadside. Sites 2 - 8 are calculated based on the national database bias adjustment factor of 0.9 for Gradko Environmental. As sites 9 – 12 were only introduced in September 2009 they are calculated based the local study (Belfast) bias adjustment factor of 0.87. Bias adjustment factors were obtained from the Air Quality Review and Assessment website.

2010 results for sites 2 – 12 are calculated based on the national database bias adjustment factor of 0.92 for Gradko Environmental. This bias adjustment factor was obtained from the Air Quality Review and Assessment website.

7 Diffusion tube locations in potential AQMA

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Note - See Table 4 for site location details

8 Relevant Public Exposure

The area around the junction of Church Street and King Street which has been highlighted as exceeding air quality objectives contains eight dwellings which are in total occupied by ten people. Other dwellings lie outside the highlighted area on Church Street and King Street where sampling does not show exceedences, the occupants of which will nevertheless benefit should an AQMA be declared and improvements to air quality be achieved, as traffic management will impact on a greater area than around this one 'hotspot' junction.

9 Traffic flows

It is planned in the foreseeable future to construct the A31 Magherafelt by-pass scheme which is expected to have a dramatic effect on reducing the amount of traffic entering the town centre. Magherafelt District Council has issued a draft document entitled 'Magherafelt Town Centre Masterplan', which covers such topics as 'Traffic and Transport Assessment of Long Term Measures', 'Safe Routes to School', 'Cycle Provision Programme' and 'Public Transport Measures'.

Within this report, figures produced by the Department for Regional Development Roads Service illustrate projected two way traffic flows along Church Street and King Street for 2012. These figures and the differences expected after the by-pass is in operation are given below.

Church Street	**King Street**	
24893	5860	Do minimum
18784	3736	By-pass
-6110	-2124	Difference
-24.5%	-36.2%	% Difference

Along with the predicted reductions in traffic flows through the town centre, vehicle exhaust emissions are confidently expected to decline in future years, both factors which should lead to a significant reduction in measured pollutant levels.

Should however this construction be delayed it is expected that there will continue to be exceedences of the annual mean NO_2 objective.

10 Area to be designated AQMA

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It is the understanding of Magherafelt District Council that an AQMA can be designated by examining monitoring data for the area of concern or through detailed modelling, or a combination of both. As modelling is not a requirement of a Detailed Assessment, and in a location such as a narrow congested canyon-like street, the use of monitoring data alone is likely to provide adequate information on which to base a decision as to whether to declare an AQMA or not.

As a result the area to either side of the Church Street / King Street junction, shown above, has been chosen to form the centre of the designated AQMA. Traffic concentrations on Church Street where exceedences occur are made up of vehicles flowing both ways along Church Street and also King Street, with the consequence that consideration regarding traffic flow reductions needs to take place for both streets.

At present all sites are single tube sites, however consideration is presently being given to making the area of concern multiple tube sites and extending the monitoring area to increase confidence that the annual mean objective is being exceeded and only in the declared area. If necessary the AQMA will be re-assessed.

11 Conclusions

The results in Table 6 shows that there is a breach of the objective limit of 40 µg/m³ at sites 9 and 10 which are in Church Street, Magherafelt, and also at site 2 over the previous two years. Other locations in this vicinity are close to the objective limit, these levels would be expected to fall further also following the declaration of an AQMA.

12 Recommendations

The annual mean for the sites as set out in Section 10 are above the objective limit of 40µg/m³ and Magherafelt District Council should declare an AQMA for the area highlighted in Section 10.

13 References

i. The Environment (Northern Ireland) Order 2002

ii. Air Quality Regulations (Northern Ireland) 2003

iii. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2000

iv. DEFRA Local Air Quality Management Technical Guidance LAQM.TG(09)

v. Magherafelt District Council 1st Stage Review and Assessment of Air Quality 2001

vi. Magherafelt District Council 2nd Stage Review and Assessment of Air Quality 2002

vii. Magherafelt District Council Progress Report on Air Quality Management 2005

viii. Magherafelt District Council Air Quality Update and Screening Assessment 2006

ix. Magherafelt District Council Progress Report on Air Quality Management 2007

x. Magherafelt District Council Local Air Quality Management Grant Evaluation Form 2008

xi. Magherafelt District Council Progress Report on Air Quality Management 2008

xii. Magherafelt District Council Local Air Quality Management Grant Evaluation Form 2009

xiii. Magherafelt District Council Progress Report on Air Quality Management 2010

xiv. Magherafelt Town Centre Masterplan (Draft) 2011