Armagh City and District Council

Detailed Assessment for NO_2 Pollution at Greenpark Terrace, Armagh City.

AUGUST 2011

Executive Summary

Armagh City and District Council submitted a Progress Report to the Department of Environment Northern Ireland in June 2010. The report concluded that the Council was required to carry out a detailed assessment for Greenpark Terrace in Armagh City to determine if there was a consistent breach of Nitrogen Dioxide (NO_2) levels at that site during 2009.

In order to get a more accurate representation of the extent of NO_2 pollution within Greenpark Terrace, 2 additional diffusion tubes were placed at this location in September 2010 to complement the existing tube. This was situated on a drain pipe at the façade of No 1 Greenpark Terrace. The additional tubes were to be situated at the new location for an initial period of seven months for the purposes of this detailed assessment.

An outcome of the seven month evaluation was that the Council resolved that it would be more prudent to continue the program of triplicate monitoring at Greenpark Terrace indefinitely. Considering that previous diffusion tube results had demonstrated that the results for Greenpark Terrace were critically close to breaching the objective limits for NO_2, a more cautious approach was required for greater acuity in concluding whether an AQMA should be declared or not.

The NO_2 diffusion tubes were prepared and analysed by Harwell Scientifics Limited. The tubes are prepared by coating the grids in a 50% v/v solution of the absorbent, triethanolamine (TEA) in Acetone. Analysis is carried out using a colorimetric technique.

Following the adjustment of the diffusion tube results by the bias factor gained, it was found that the site at Greenpark Terrace had breached the objective limits for NO_2 (>40ug/m^2) with a result of 57µg/m^3. The site recorded a result of 52µg/m^3 for the annual average as part of the 2009 monitoring programme and 54µg/m^3 during 2010.

It is therefore considered by Armagh City and District Council that an Air Quality Management Area (AQMA) **will be** declared for Greenpark Terrace.

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1.0 Introduction

Armagh City and District Council submitted a Progress Report to the Department of Environment Northern Ireland in June 2010. The report concluded that the Council was required to carry out a detailed assessment for Greenpark Terrace in Armagh City to determine if there was a consistent breach of Nitrogen Dioxide (NO_2) levels at that site during 2009.

In order to get a more accurate representation of the extent of NO_2 pollution within Greenpark Terrace, 2 additional diffusion tubes were placed at this location in September 2010 to complement the existing tube. This was situated on a drain pipe at the façade of No 1 Greenpark Terrace. The additional tubes were to be situated at the new location for an initial period of six months.

An outcome of the six month evaluation was that the Council resolved that it would be more prudent to continue the program of triplicate monitoring at Greenpark Terrace indefinitely. Considering that previous diffusion tube results had demonstrated that the results for Greenpark Terrace were critically close to breaching the objective limits for NO_2, a more cautious approach was required for greater acuity in concluding whether an AQMA should be declared or not.

2.0 RESULTS

Table 1: NO_2 Diffusion Tube Results For 16 sites in Armagh from January 2009 to December 2009 analysed by Harwell Scientifics Ltd

Site ID	Location	Within AQMA?	Data Capture for monitoring period[a] %	Data Capture for full calendar year 2009[b] %	Annual mean concentrations (µg/m^3)		
					2007 [c, d]	2008 [c,]	2009 [c]
Lonsdale Road (x3)	Armagh City	Y	100	100	31	26	32
Mallview Terrace (x3)	Armagh City	Y	92	92	43	35	**43**
25 Railway St	Armagh City	Y	100	100	32	31	32
1 Barrack St	Armagh City	Y	100	100	34	29*	38
11 Desert Lane	Armagh City	N	100	100	10	9	14
19 Folly Lane	Armagh City	N	100	100	25	12	14
1 Green Park Terrace	Armagh City	N	100	100	31	25	**52**
19 Portadown Road	Armagh City	N	100	100	30	25	29
80 Railway Street	Armagh City	Y	100	100	N/A	N/A	**48**
20 Victoria St	Armagh City	N	100	100	N/A	N/A	28
3 Barrack Hill	Armagh City	N	100	100	N/A	N/A	32
44 Barrack Hill	Armagh City	N	100	100	N/A	N/A	25
Drumadd House	Armagh City	N	100	100	N/A	N/A	24
10 Orangefield	Armagh City	N	100	100	N/A	N/A	16
Cathedral Terrace	Armagh City	N	100	100	N/A	N/A	21
Dawson Street	Armagh City	N	100	100	N/A	N/A	**52**

The results in Table 1 show the nitrogen dioxide level of 52µg/m^3 for Greenpark Terrace during 2009. The requirement for a detailed assessment is based on this result.

Greenpark Terrace study results

Table 2: Bias Adjusted Averages for Greenpark Terrace and comparison with other AQMA sites in Armagh from September 2010 to March 2011.

MONTH	1 Greenpark Terr	1 Barrack St	80 Railway St	Mallview Terrace	Lonsdale Rd
SEPTEMBER	**60**	51	61	56	36
OCTOBER	**63**	45	62	55	41
NOVEMBER	**82**	60	68	64	60
DECEMBER	**80**	55	73	67	58
JANUARY	**85**	56	75	67	60
FEBRUARY	**74**	59	68	65	49
MARCH	**67**	50	66	64	46
AVERAGE	**73**	54	68	63	50
BIAS ADJUSTED	**57**	42	53	49	39

Table 2 above outlines the NO_2 diffusion tube results for Greenpark Terrace and the other AQMA sites in Armagh. Greenpark Terrace is the location where it was assumed that NO_2 levels were likely to breach the objective limits.

The table shows that during 7 months of triplicate diffusion tube sampling, Greenpark Terrace recorded the highest level of Nitrogen Dioxide (NO_2) pollution.

Bias Factor Determination

The bias factor used to adjust the diffusion tube results was taken from the UWE Review and Assessment Website. The bias factor used to adjust the diffusion tubes is 0.78

Although Armagh City and District Council has diffusion tubes co-located with an automatic analyser at Lonsdale Road in Armagh City, a bias factor could not be derived from that site as the automatic analyser has suffered from technical problems during 2010 and therefore any bias factor obtained from the site may not have been accurate.

The details of Harwell Scientifics WASP results are provided in Appendix B.

3.0 Conclusions

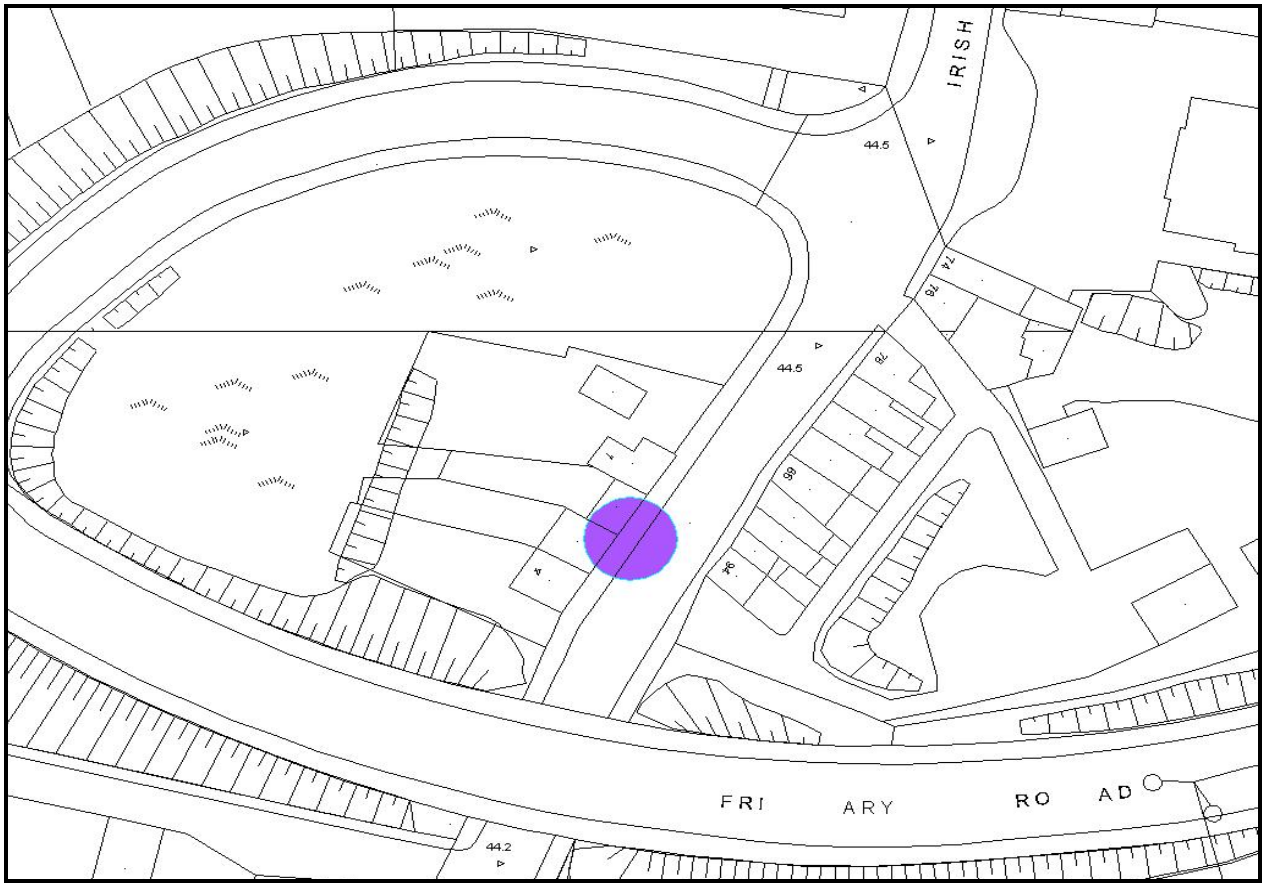
The result in Table 2 shows that there is a breach of the objective limit of 40 µg/m^3 for NO_2 at Greenpark Terrace, Armagh and Armagh City and District Council will be declaring an AQMA for this location.

4.0 Recommendations

It is recommended that the Council continues to monitor NO_2 emissions at Greenpark Terrace using the triplicate sampling method and provide an AQMA Action Plan for the site within 18 months of the declaration.

APPENDIX 1
Greenpark Terrace Sampling Location

Appendix 1 – Greenpark Terrace Sampling Location



Appendix 2

Harwell Scientifics WASP Data

Current best 4 from 5 current Z-score average:	0.19

Year	WASP Round	Period	Samples Dispatched	Results Deadline	HSL Calculations (Pre-Sendout) Sample A		Harwell Analysis Tubes A					
					Calculated Spiked Value	Measured Value	Result Tube 1	Result Tube 2	Average	Standard Deviation	RSD	Z-Score
2011	115	Sept-Dec										
	114	Jul-Aug										
	113	Apr-Jun										
	112	Jan-Mar	17/01/2011	04/03/2011								
2010	111	Sept-Dec			1.84	1.85	1.821	1.821	1.821	0.000	0	0.1
	110	Jul-Aug			0.99	1	0.972	0.987	0.980	0.011	1.1	0
	109	Apr-Jun			1.03	1.06	1.053	1.053	1.053	0.000	0	0.3
	108	Jan-Mar			1.92	1.91	1.921	1.896	1.910	0.018	0.9%	-0.1
2009	107	Oct-Dec			2.03	2.04	1.905	1.914	1.910	0.007	0.4%	-0.8
	106*	Jul-Sept			1.84	1.84	1.880	1.439	1.660	0.312	18.8%	-1.3
	106*	Jul-Sept			1.84	1.84	1.880	1.880	1.880	0.000	0.0%	

	105	Apr-Jun				1.68	1.69		1.795	1.784	1.790	0.008	0.4%	0.8
	104	Jan-Feb				2.02	2.01		2.017	2.047	2.032	0.022	1.1%	0.0
2008	103	Sept-Dec				1.22	1.22		1.242	1.234	1.238	0.006	0.5%	0.1
	102	Jun-Aug				1.37	1.38		1.470	1.472	1.471	0.043	2.9%	0.5
	101	Apr-Jun				0.92	0.94		0.974	0.991	0.983	0.013	1.3%	0.5
	100	Jan-Mar				1.36	1.37		1.395	1.384	1.390	0.008	0.6%	0.2
2007	99	Oct-Nov				2.15	2.16		2.242	2.235	2.239	0.005	0.2%	0.3
	98	Jul-Sept				1.83	1.85		1.877	1.854	1.866	0.013	0.7%	0.2
	97	Apr-Jun				0.89	0.87		0.920	0.918	0.919	0.002	0.2%	0.2

HSL Calculations (Pre-Sendout)			Harwell Analysis					
Sample B			Tubes B					
Calculated Spiked Value	Measured Value		Result Tube 1	Result Tube 2	Average	Standard Deviation	RSD	Z-Score
1.54	1.57		1.512	1.482	1.497	0.022	1.5	-0.4
2.37	2.47		2.367	2.394	2.381	0.020	0.8	0.1
1.27	1.27		1.265	1.268	1.267	0.003	0.2	0
1.47	1.47		1.409	1.422	1.420	0.009	0.6%	-0.5
2.20	2.20		2.049	2.046	2.048	0.003	0.1%	-0.9
1.42	1.44		1.880	1.429	1.655	0.319	19.3%	2.1
1.42	1.44		1.439	1.429	1.434	0.007	0.5%	
0.96	0.96		1.031	1.035	1.033	0.003	0.3%	0.9
1.22	1.19		1.269	1.230	1.252	0.024	1.9%	0.2
0.94	0.95		0.957	0.951	0.954	0.005	0.5%	0.1
2.28	2.3		2.435	2.386	2.411	0.035	1.5%	0.4
1.86	1.93		1.947	1.958	1.953	0.008	0.4%	0.4
1.47	1.45		1.511	1.516	1.514	0.004	0.3%	0.2
0.84	0.84		0.906	0.901	0.904	0.004	0.4%	0.6
1.19	1.2		1.229	1.223	1.226	0.005	0.4%	0.2
1.58	1.59		1.619	1.640	1.630	0.015	0.9%	0.2