AECOM

2009 Air Quality Updating and Screening Assessment for *Derry City Council*

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

June 2009

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Executive Summary

This report comprises the Update and Screening Assessment for the Derry City Council area, providing a review and assessment of new monitoring data and potential new sources of pollutants within the area.

There have been no new or significantly changed sources of pollutants identified which may cause potential exceedences of the Air Quality Strategy standards within the Local Authority, other than road transport.

This assessment has highlighted that a Detailed Assessment is required with regard to NO_2 derived from road transport for four narrow congested streets with residential properties close to the kerb:

- Collon Terrace;
- Spencer Road;
- Francis Street; and
- John Street.

For Spencer Road, Francis Street, and John Street, the Detailed Assessment should commence with a minimum of six months NO_2 diffusion tube monitoring, in worst case locations of relevant exposure. Depending upon the pollutant concentrations recorded, it may be necessary to proceed further, with detailed modelling. NO_2 monitoring has already been undertaken at Collon Terrace, and therefore detailed modelling will be necessary for the area.

Monitoring of PM_{10}, SO_2 and other pollutants has shown no exceedences of the Air Quality Strategy standards, and further assessment is subsequently not required for these pollutants. The assessment does not identify any other pollutant source of concern.

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1 Introduction

1.1 Description of Local Authority Area

Derry City is located on the coast, in the west of Northern Ireland, spreading across the banks of the River Foyle, with two bridges connecting the parts of the City. The City is very near the border with County Donegal in the Republic of Ireland, and is the second largest city in Northern Ireland.

Within the local authority boundaries lay Londonderry Port and the City of Derry Airport. Road transport emissions have previously been found to be the dominant source of air pollution within the Derry City Council area.

1.2 Purpose of 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 Environment (NI) Order (2002), 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.

Where the Updating and Screening Assessment has identified a risk that an air quality objective may be exceeded, the local authority must undertake a Detailed Assessment. The aim of this assessment is to determine with as much certainty as is possible whether or not an air quality objective will be exceeded. If an exceedence is predicted, the local authority should designate an AQMA to cover the area of the exceedence.

The Updating and Screening Assessment reviews any changes relating to air quality that have occurred since the previous round of review and assessment. These changes are assessed using appropriate screening methods.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in Northern Ireland are set out in the Air Quality Regulations (Northern Ireland) 2003, Statutory Rules of Northern Ireland 2003, no. 342, and are shown in Table 1.1. This table shows the objectives in concentration units of micrograms per cubic metre µg/m^3 (milligrams 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 Local Air Quality Management in Northern Ireland.

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene			
	16.25 µg/m^3	Running annual mean	31.12.2003
	3.25 µg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 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
Particles (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

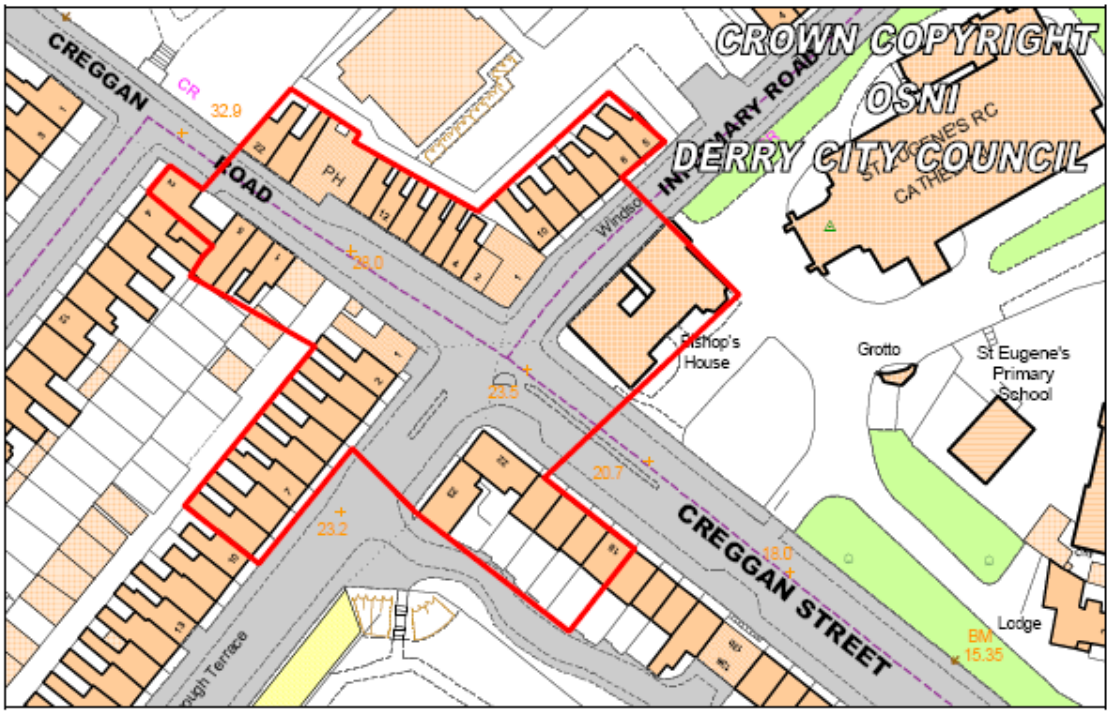
1.4 Summary of Previous Review and Assessments

Table 1.2 provides a summary of the previous reports completed by Derry City Council as part of the Local Air Quality Management Review and Assessment process. Figure 1.1 shows the AQMA in Derry City at the Creggan Road / Infirmary Road junction, which is designated for NO_2.

Table 1.2 Summary of Local Air Quality Management Review & Assessment reports

Report	Summary
2004 Detailed Air Quality Modelling of Domestic Fuel Use and Road Traffic Emissions in Derry (Stage 3)	Exceedences of the annual mean NO_2 concentrations were modelled at the Creggan Road / Infirmary Road junction, and DCC subsequently declared an AQMA in February 2005 (Figure 1.1), and a draft Air Quality Action Plan was released in November 2006. The 2004 Detailed Assessment concluded that PM_{10} exceedences were not expected; however it was not possible to rule out potential exceedences of the SO_2 or PM_{10} objectives due to the resolution of the modelling undertaken.
2005 Progress Report	The 2005 Progress Report provided a review of the most recent monitoring data within the Local Authority. Automatic monitoring of SO_2 and PM_{10} at Brandywell indicated a large drop in the number of 15-minute and daily mean exceedences, reflecting the decreased use of solid fuel in the area.
2006 Updating & Screening Assessment	The Updating & Screening Assessment identified 2 locations to consider for the Detailed Assessment of NO_2: Dale's Corner and the Buncrana Road / Racecourse Road Junction. It was concluded that no further assessment was required for carbon monoxide, benzene, 1,3-butadiene, lead or sulphur dioxide, however assessment was required for PM_{10} at a rural area near Claudy, and in the Culmore Point area.
2007 Detailed Assessment and Further Assessment	A Detailed Assessment was undertaken for Dale's Corner and Buncrana Road / Racecourse Road Junction. It was determined that a declaration of an AQMA at either location was not required as the air quality objectives were unlikely to be exceeded at locations of relevant exposure. A Further Assessment was undertaken for the existing AQMA at Creggan Road / Infirmary Road, and it was concluded that there was a continuing need for the AQMA, though no extension was considered necessary.
2008 Progress Report	Review of the most recent monitoring data recorded at the Creggan Road / Infirmary Road NO_2 AQMA confirmed the continuing need for the designation. Decreases were seen in concentrations of SO_2. The Progress Report proposed that detailed dispersion modelling be undertaken at the Dale's Corner junction due to exceedences of the NO_2 annual mean objective, recorded by diffusion tubes at no.5 Glendermott Road.
2008 Final Air Quality Action Plan	The Air Quality Action Plan included detailed dispersion modelling to quantify the potential impact of various scenarios which may be undertaken to reduce air pollution in the area of the Creggan Road / Infirmary Road Junction. Proposals include the removal of HGVs on specific road links within the AQMA.

Figure 1.1 Derry City Council NO_2 AQMA, Creggan Road / Infirmary Road Junction



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2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Table 2.1 provides details of the automatic monitoring sites within Derry City.
AEA Energy and Environment undertake the Quality Assurance/Quality Control (QA/QC) procedures at these monitoring sites, ensuring that measurements from the analysers are as accurate as possible, and that measurements recorded at each site may be compared with other sites.

Manual calibration of automatic monitors is undertaken every two weeks by Derry City Council officers. This allows the instrument drifts to be fully quantified and documented using traceable calibration gas standards and the results are used to scale data. All calibration records are sent to AEA Energy and Environment who conduct the QA/QC checks.

The analysers are checked and serviced every six months by suppliers, Enviro Technology Ltd. The reports are sent to AEA Energy and Environment who conduct the QA/QC checks.

Table 2.1 Details of Automatic Monitoring Sites

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 ?
Brooke Park	Urban background	X 242962 Y 417217	O_3, NO, NO_2, NO_X, SO_2, PM_{10} [a], $PM_{2.5}$ [a]	N	N (approx 50m, background site)	N/A	N/A
Dale's Corner	Roadside	X 244178 Y 416760	NO, NO_2, NO_X	N	Y	2m	Y
Brandywell	Urban background	X 242866 Y 416309	PM_{10}, SO_2	N	Y	N/A	Y
Culmore Point Road	Urban background	X 247855 Y 422556	PM_{10}	N	Y	N/A	Y

Note: [a] Particulate matter measured as total, volatile and non-volatile components (see below).

Particulate matter is monitored at the Brandywell and Culmore Point Road monitoring locations using TEOM instruments. The data is adjusted using a default correction factor of 1.3 to account for the loss of volatile and semi-volatile components due to its operation at a high temperature. The Brooke Park particulate analysers were upgraded to an FDMS (Filter Dynamics Measurement System) in March 2008, which measures both the core and volatile fractions of particulate matter.

2.1.2 Non-Automatic Monitoring

Tables 2.2a and 2.2b provide details of non-automatic monitoring locations within Derry City. The NO_2 diffusion tubes deployed were prepared and analysed by Lambeth Scientific until August 2006. From October 2006 until December 2008 Bureau Veritas labs prepared and analysed the diffusion tubes using the 10% TEA in water preparation. In accordance with the harmonisation of preparation and analysis of NO_2 diffusion tubes in the UK (AEA, 2008), Bureau Veritas changed their methodology to use 20% TEA in water in January 2009. Derry City Council has recently (April 2009) switched to use the Gradko labs for preparation and analysis of NO_2 diffusion tubes.

As two different laboratories were used for processing the tubes in 2006, annual means for 2006 are not presented in the tables below (further details are presented in the 2008 Progress Report, DCC, 2008). Monthly concentrations are given for 2006-8 in Appendix D.

For 2007 the bias adjustment factor (**0.88**) was obtained from the University of Western England (UWE) co-location spreadsheet available at the Review and Assessment website for the 10% TEA in water preparation (http://www.uwe.ac.uk/aqm/review/; v05/09, 06 May 2009). The bias adjusted results are presented in Table 2.4b.

For 2008, diffusion tube results were adjusted using both a national (**0.83**, UWE co-location spreadsheet, v05/09, 06 May 2009) and a local bias adjustment factor (**1.002**, calculated by Bureau Veritas using the roadside automatic monitoring site and co-located diffusion tubes at Dale's Corner – further details are presented in the 2009 Detailed Assessment (DCC, 2009)). The results using both factors are presented in Table 2.4a.

The Bureau Veritas laboratory participates in the field intercomparison scheme and the Workplace Analysis Scheme for Proficiency (WASP) programme, operated by the Health and Safety Laboratory (HSL). In 2008, 11 out of the 15 collocation studies undertaken by Bureau Veritas labs using 10% TEA in water methodology were considered to be good precision (based upon v05/09 spreadsheet). In 2007, 6 out of the 17 collocation studies undertaken by Bureau Veritas labs using 10% TEA in water methodology were considered to be good precision (based upon v05/09 spreadsheet).

Figures showing the locations of the 2008 diffusion tube monitoring sites are presented in Appendix C.

Table 2.2a Details of Non- Automatic Monitoring Sites

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 ?
Brooke Park								
A1 A2 A3	Brooke Park [a]	B	242962 417217	NO_2	N	N	N/A	N/A
Creggan Road Junction								
C1 C2	3 Creggan Rd [b]	K	242913 417144	NO_2	Y	Y	1m	Y
C3	6 Marlborough Terrace	R	242921 417101	NO_2	Y	Y	4m	Y
C4	22A Creggan Street	R	242959 417102	NO_2	Y	Y	3m	Y
C5a	10 Windsor Terrace [c]	R	242962 417142	NO_2	Y	Y	3m	Y
C5b	1 Windsor Terrace [c]	R	243017 417191	NO_2	N	Y	3m	Y
C6	14 Creggan Road	R	242928 417148	NO_2	Y	Y	3m	Y
Dale's Corner and Farren Park								
D1 D2 D3	Dale's Corner Automatic Monitor [a]	R	244178 416760	NO_2	N	Y	3m	Y
D4	52 Clooney Terrace	R	244210 416714	NO_2	N	Y	5m	Y
D5	5 Glendermott Road	K	244238 416753	NO_2	N	Y	1m	Y
F1 F3 F4	4 Ebrington Terrace [d]	R	244219 416794	NO_2	N	Y	4m	Y
F2	3 Farren Park	R	243884 418678	NO_2	N	Y	5m	Y

Note: B=Urban Background site; K=Kerbside site; R=Roadside site.
[a] Tubes present in triplicate at the Brooke Park AURN and Dale's Corner automatic monitor;
[b] Tubes present in duplicate at C1 and C2;
[c] C5 Changed to no.1 Windsor Terrace, Aug 2008;
[d] Monitoring commenced Jan 2008, tubes present in triplicate.

Table 2.2b Details of Non- Automatic Monitoring Sites (continued)

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 ?
Pennyburn								
P1	53 Messines Park	R	243449 419013	NO_2	N	Y	5m	Y
P2	57 Messines Park	R	243418 419016	NO_2	N	Y	5m	Y
P3	19 St Patricks Terrace	R	243480 418970	NO_2	N	Y	4m	Y
P4	5 Collon Terrace	R	243519 418921	NO_2	N	Y	4m	Y
Strand Road								
S1	99 Strand Road	R	243522 417894	NO_2	N	Y	3m	Y
S2	Rockmills	R	243607 418037	NO_2	N	Y	4m	Y
Abercorn Road								
AB1	63 Abercorn Road	R	243166 416211	NO_2	N	Y	1.5m	Y
AB2	8 Abercorn Road	R	243422 416230	NO_2	N	Y	1.5m	Y
Triangle								
TR1	1 Clooney Terrace [a]	R	244202 416493	NO_2	N	Y	9m	Y
TR2	17 Duddy's Court [a]	R	244202 416479	NO_2	N	Y	7m	Y

Note: B=Background site; K=Kerbside site; R=Roadside site.
[a] Monitoring commenced Nov 2008.

2.2 Comparison of Monitoring Results with AQ Objectives

Key monitoring data statistics are presented in this section for nitrogen dioxide, PM_{10}, and sulphur dioxide.

Appropriate temporal means are presented, in accordance with the Air Quality Strategy, and the number of exceedences of the Standards is given. Where the period of valid data is less than 90% of a full year, relevant percentile alternatives are also presented.

2.2.1 Nitrogen Dioxide

In 2008, exceedences of the annual mean objective for NO_2 of 40 µg/m^3 were recorded at the following sites, irrespective of the diffusion tube bias adjustment factor applied:

- Dale's Corner (automatic monitor, not collocated diffusion tube);
- *C1, C2: 3 Creggan Road;*
- *C4: 22A Creggan Street;*
- D5: 5 Glendermott Road;
- F1, F3, F4: 4 Ebrington Terrace;
- P3: 19 St Patricks Terrace; and
- P4: 5 Collon Terrace.

Sites in italics lie within the existing AQMA.

In addition, concentrations recorded at the following locations using diffusion tubes were found to exceed the NO_2 annual objective when the local bias adjustment factor was used, but not when the national factor was used:

- D1, D2, D3: Dale's Corner (Diffusion tubes)
- *C3: 6 Marlborough Terrace;*
- *C6: 14 Creggan Road;*
- S1: 99 Strand Road;
- S2: Rockmills;
- AB1: 63 Abercorn Road; and
- AB2: 8 Abercorn Road.

None of the automatic monitoring sites recorded more than 18 1-hour means above 200 µg/m^3, and neither did the 99.8th percentile of 1-hour mean concentrations exceed 200 µg/m^3 (where the period of valid data was less than 90% of a full year).

Automatic Monitoring Data

The annual mean NO_2 concentration recorded at Dale's Corner in 2008 just exceeded the Air Quality Strategy objective of 40 µg/m^3 (Table 2.3a). Concentrations in 2006 and 2007 at this site were below, but not well below (<75%) the standard. There were 11 exceedences of the hourly mean standard in 2008, below the objective of 18 times per year (Table 2.3b).

Annual mean concentrations of NO_2 recorded at Brooke Park have consistently been well below the annual mean objective (Table 2.3a). There were no exceedences of the hourly mean standard in 2008 (Table 2.3b).

Based on the past three years of data, it may be concluded that background and roadside NO_2 concentrations are increasing in the City.

Table 2.3a Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Annual mean concentration (µg/m^3)		
				2006	2007	2008
Brooke Park	X 242962 Y 417217	N	96.1	12.2 [a]	12.6 [b]	18.5
Dale's Corner	X 244178 Y 416760	N	96.9	36.9 [c]	38.5 [b]	**40.2**

Note: [a] Data capture 88%; [b] Data capture 89%; [c] Data capture 67%

Table 2.3b Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of Exceedences of hourly mean (200 µg/m^3) *For data capture less than 90% of a full year, the 99.8th %ile of hourly means has been provided in brackets.*		
				2006	2007	2008
Brooke Park	X 242962 Y 417217	N	96.1	0 (63) [a]	0 (63) [b]	0
Dale's Corner	X 244178 Y 416760	N	96.9	1 (146) [c]	0 (155) [b]	11

Note: [a] Data capture 88%; [b] Data capture 89%; [c] Data capture 67%

Diffusion Tube Monitoring Data

The following factors have been used to derive the adjusted concentrations that are presented in Tables 2.4a-b (national factors have been obtained from the UWE diffusion tube bias adjustment spreadsheet (v05/09)):

- 2008: **0.83** (national), and **1.002** (local); and
- 2007: **0.88** (national).

As identified in Tables 2.2a and 2.2b, all of the roadside locations are representative of public exposure. With the national bias adjustment factor applied, exceedences of the annual mean objective have been recorded outwith the AQMA at Ebrington Terrace (F1,3,4), Glendermott Road (D5), St Patrick's Terrace (P3) and Collon Terrace (P4). These exceedences suggest the potential need for AQMAs in these areas with regards to NO_2.

The monitoring locations on Ebrington Terrace and Glendermott Road lie within the area of Dale's Corner; a Detailed Assessment for NO_2 is currently underway for this area, and it is expected that an AQMA will be assigned shortly, encompassing the monitoring locations.

The monitoring locations at St Patrick's Terrace and Collon Terrace are in the Pennyburn area. Based upon the monitoring results a Detailed Assessment for NO_2 will be undertaken for this area.

Table 2.4a Results of Nitrogen Dioxide Diffusion Tubes, 2008

Site ID	Location	Within AQMA?	Data Capture 2008 %	2008 Annual mean concentrations (μg/m^3) Adjusted for bias	
				Local factor	National factor
A1	Brooke Park [a]	N	100	19	15
A2					
A3					
C1	3 Creggan Rd [b]	Y	100	**76**	**63**
C2					
C3	6 Marlborough Terrace	Y	100	**45**	37
C4	22A Creggan Street	Y	100	**49**	**41**
C5a	10 Windsor Terrace [c]	Y	33 [e]	36	30
C5b	1 Windsor Terrace	N	42 [e]	37	31
C6	14 Creggan Road	Y	100	**46**	38
D1	Dale's Corner [a]	N	100	**40**	33
D2					
D3					
D4	52 Clooney Terrace	N	100	33	27
D5	5 Glendermott Road	N	100	**64**	**53**
F1	4 Ebrington Terrace [a,d]	N	97	**57**	**47**
F3					
F4					
F2	3 Farren Park	N	100	35	29
P1	53 Messines Park	N	100	25	21
P2	57 Messines Park	N	92	31	26
P3	19 St Patricks Terrace	N	92	**51**	**42**
P4	5 Collon Terrace	N	100	**52**	**43**
S1	99 Strand Road	N	83	**44**	36
S2	Rockmills	N	83	**44**	37
AB1	63 Abercorn Road	N	67 [e]	**46**	38
AB2	8 Abercorn Road	N	100	**40**	33
TR1	1 Clooney Terrace	N	17 [f]	35	
TR2	17 Duddy's Court	N	17 [f]	32	

Note: Local adjustment factor=1.002; National adjustment factor=0.83.
[a] Tubes present in triplicate; [b] Tubes present in duplicate; [c] Changed to no.1 Windsor Terrace, August 2008; [d] Monitoring commenced Jan 2008; [e] Seasonal adjustment applied (see Appendix A); [f] Unadjusted results presented due to low data capture (monitoring commenced Nov 2008).

Table 2.4b Results of Nitrogen Dioxide Diffusion Tubes, 2007

Site ID	Location	Within AQMA?	Data Capture 2007 %	2007 Annual mean concentrations (µg/m^3) Adjusted for bias
A1	Brooke Park [a]	N	100	15
A2				
A3				
C1	3 Creggan Rd [b]	Y	100	**58**
C2				
C3	6 Marlborough Terrace	Y	100	31
C4	22A Creggan Street	Y	100	38
C5	10 Windsor Terrace	Y	100	25
C6	14 Creggan Road	Y	92	37
D1	Dale's Corner Automatic Monitor [a]	N	97	31
D2				
D3				
D4	52 Clooney Terrace	N	100	25
D5	5 Glendermott Road	N	100	**44**
F1	2 Farren Park	N	100	22
F2	3 Farren Park	N	92	25
F3	5 Farren Park	N	100	27
F4	9 Farren Park	N	100	20
P1	53 Messines Park	N	100	20
P2	57 Messines Park	N	100	27
P3	19 St Patricks Terrace	N	100	32
P4	5 Collon Terrace	N	100	37
S1	99 Strand Road	N	83	39
S2	Rockmills	N	92	29
AB1	63 Abercorn Road	N	42	33
AB2	8 Abercorn Road	N	58	27

Note: National adjustment factor=0.88.
[a] Tubes present in triplicate; [b] Tubes present in duplicate

2.2.2 PM_{10}

All PM_{10} monitoring data has been obtained from the Northern Ireland Air website (http://www.airqualityni.co.uk/index.php). With the exception of Brooke Park, a background AURN site, all automatic monitoring sites are representative of relevant public exposure, as outlined in Table 2.1.

Particulate matter is monitored at the Brandywell and Culmore Point Road locations using TEOM instruments. The data is adjusted using a default correction factor of 1.3 to account for the loss of volatile and semi-volatile components due to its operation at a high temperature. The Brooke Park particulate analysers were upgraded to an FDMS (Filter Dynamics Measurement System) in March 2008, which measures both the core and volatile fractions of particulate matter.

Following complaints about dust, a portable TEOM was sited at a residential location on Culmore Point Road, opposite Londonderry Port and Harbour, from December 2007 until December 2008. The 2008 annual mean and number of exceedences of the 24-hour mean are presented for the site in Tables 2.5a and b respectively, together with monitoring results recorded at the Brooke Park and Brandywell automatic monitoring sites.

Annual mean concentrations in excess of 40 µg/m^3 were not recorded at any of the sites in 2008. Neither have there been more than 35 24-hour exceedences of 50 µg/m^3, nor does the 90th percentile of 24-hour concentrations exceed 50 µg/m^3.

Table 2.5a Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Annual mean concentrations ($\mu g/m^3$)		
				2006	2007	2008
Brooke Park [c]	X 242962 Y 417217	N	77.0	23.1 [a]	20.6 [a]	23.2
Brandywell [d]	X 242866 Y 416309	N	98.6	21.1 [b]	21.3 [b]	22.1
Culmore Point Road [d]	X 247855 Y 422556	N	93.3	N/A	N/A	18.9

Note: [a] Data capture 97%; [b] Data capture 98%; [c] TEOM data multiplied by 1.3, replaced by FDMS March 2008; [d] TEOM data multiplied by 1.3.

Table 2.5b Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of Exceedences of 24 hour mean (50 $\mu g/m^3$) *For data capture < 90%, the 90th %ile of 24-hour means are provided in brackets.*		
				2006	2007	2008
Brooke Park [d]	X 242962 Y 417217	N	77.0	8 [a]	6 [b]	13 (36.7)
Brandywell [e]	X 242866 Y 416309	N	98.6	9 [c]	6 [c]	9
Culmore Point Road [e]	X 247855 Y 422556	N	93.4	N/A	N/A	4

Note: [a] Data capture 96%; [b] Data capture 95%; [c] Data capture 99%; [d] TEOM data multiplied by 1.3, replaced by FDMS March 2008; [e] TEOM data multiplied by 1.3.

2.2.3 Sulphur Dioxide

Automatic monitoring of sulphur dioxide (SO_2) is undertaken at the Brandywell and Brooke Park air quality monitoring stations. No exceedences of the 15-minute, hourly or daily mean standards or objectives were recorded in 2006, 2007 or 2008. The relevant data are provided in Tables 2.6a-c.

Table 2.6a Results of Automatic Monitoring for Sulphur Dioxide: Comparison with 15-minute Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of Exceedences of 15-min mean (266 $\mu g/m^3$) *For data capture < 90%, the 99.9th %ile of 15-min means are provided in brackets.*		
				2006	2007	2008
Brooke Park	X 242962 Y 417217	N	86.0	0 [a]	0 (24.0)[b]	0 (34.3)
Brandywell	X 242866 Y 416309	N	95.4	0 (35.0)[c]	0 [d]	0

Note: [a] Data capture 91%; [b] Data capture 73%; [c] Data capture 86%; [d] Data capture 97%

Table 2.6b Results of Automatic Monitoring for Sulphur Dioxide: Comparison with Hourly Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of Exceedences of hourly mean (350 $\mu g/m^3$) *For data capture < 90%, the 99.7th %ile of hourly means are provided in brackets.*		
				2006	2007	2008
Brooke Park	X 242962 Y 417217	N	87.7	0 [a]	0 (21.0)[b]	0 (21.0)
Brandywell	X 242866 Y 416309	N	96.8	0 (27.0)[c]	0 [d]	0

Note: [a] Data capture 93%; [b] Data capture 74%; [c] Data capture 87%; [d] Data capture 98%

Table 2.6c Results of Automatic Monitoring for Sulphur Dioxide: Comparison with Daily Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of Exceedences of daily mean (125 μg/m^3) *For data capture < 90%, the 99th %ile of 24-hour means are provided brackets.*		
				2006	2007	2008
Brooke Park	X 242962 Y 417217	N	87.7	0 [a]	0 (10.4) [b]	0 (11.2)
Brandywell	X 242866 Y 416309	N	97.8	0 (14.2) [c]	0 [d]	0

Note: [a] Data capture 93%; [b] Data capture 74%; [c] Data capture 88%; [d] Data capture 98%

2.2.4 Benzene

No monitoring of benzene is undertaken within the Local Authority. The 2006 USA considered concentrations recorded in the Belfast area, which were well below the Air Quality Strategy Standards. It was thus concluded that the Objectives in place for benzene were unlikely to be exceeded within Derry City (DCC, 2006), and this is still considered the case.

2.2.5 Other pollutants monitored

Additional pollutants are monitored at the Brooke Park AURN; ozone, carbon monoxide, and the volatile and non-volatile components of both PM_{10} and $PM_{2.5}$ (measured using the FDMS technology). Concentrations of these pollutants are presented below with respect to the relevant Air Quality Strategy limit/target. Monitoring of carbon monoxide ceased at the Brooke Park monitoring site in October 2007. With the exception of ozone, there have been no exceedences of the AQS targets for these pollutants within the period of time presented (2006-8).

Ozone

Table 2.7 Results of O_3 Automatic Monitoring: Comparison with 8-hr Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of Exceedences of 8-hour running mean (100 μg/m^3)		
				2006	2007	2008
Brooke Park	X 242962 Y 417217	N	97.8	**52** [a]	0 [b]	**125**

Note: [a] Data capture 82%; [b] Data capture 97%

Carbon monoxide

Table 2.8 Results of Carbon Monoxide Automatic Monitoring: Comparison with 8-hr Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of Exceedences of 8-hour running mean (10 mg/m^3)		
				2006	2007	2008
Brooke Park	X 242962 Y 417217	N	N/A	0.2 [a]	0.2 [b]	N/A

Note: [a] Data capture 95%; [b] Data capture 69%

Volatile and Non-volatile components of $PM_{2.5}$

Table 2.9 Results of $PM_{2.5}$ Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Component of $PM_{2.5}$	Data Capture 2008 %	2008 Annual mean concentration ($\mu g/m^3$) (target 25 $\mu g/m^3$)
Brooke Park	X 242962 Y 417217	Volatile	60.4	4.5
		Non-volatile	60.4	13.0
		Total	60.4	17.5

Volatile and Non-volatile components of PM_{10}

Table 2.10 Results of PM_{10} Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Component of PM_{10}	Data Capture 2008 %	2008 Annual mean concentration ($\mu g/m^3$)
Brooke Park	X 242962 Y 417217	Volatile	63.6	3.4
		Non-volatile	63.6	18.7
		Total	77.0 [a]	23.2

Note: [a] Data capture for total PM_{10} varies from non-volatile and volatile components as the TEOM instrument (measuring total PM_{10}) was replaced by an FDMS instrument in March 2008 (measuring volatile and non-volatile components).

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

There were no narrow congested streets with residential properties close to the kerb identified in the 2006 USA under the criteria outlined in LAQM.TG(03).

The following roads have been identified as satisfying the criteria outlined in the revised technical guidance, LAQM.TG(09):

- Collon Terrace;
- Dale's Corner/Glendermott Road;
- Spencer Road;
- Infirmary Road;
- Francis Street; and
- John Street.

3.1.1 Collon Terrace

There are residential properties within 2 metres of the kerb on Collon Terrace, in the Pennyburn area. Diffusion tube monitoring at a location outside 5 Collon Terrace (P4) has shown that annual mean concentrations of NO_2 were close to the annual mean objective in 2007, and above it in 2008 applying both the local and national bias adjustment factors (Table 2.4a).

The traffic flow on Collon Terrace is congested, and is known to be much greater than 5000 vehicles/day, hence satisfying the criteria for a narrow, congested street.

As monitoring is already undertaken within the area at a location of relevant exposure, and NO_2 concentrations exceeded the annual mean objective of 40 $\mu g/m^3$ in 2008, a Detailed Assessment will be undertaken for this area, for NO_2.

3.1.2 Dale's Corner/Glendermott Road

Automatic and diffusion tube monitoring of NO_2 is undertaken at Dale's Corner. Annual mean concentrations recorded at the diffusion tube location of 5 Glendermott Road (D5) have been in excess of the Air Quality Strategy objective in recent years.

A Detailed Assessment is currently being undertaken (by Bureau Veritas on behalf of the Council) for this area with regard to NO_2. The likely outcome is the designation of an AQMA at Dale's Corner.

3.1.3 Spencer Road

To estimate the daily traffic flow on Spencer Road, a congested shopping street with residential properties within 2 metres of the kerbside, a 5-minute count of road traffic vehicles was undertaken in the middle of the day, in accordance with LAQM.TG(09) Box 5.3. A total of 61 vehicles were counted between 14:08 and 14:13, and an average speed of 20mph was estimated. This indicates a likely flow of 5000 vehicles per day or more.

A Detailed Assessment will be undertaken for this area, for NO_2, commencing with the monitoring of NO_2 for a minimum of six months.

3.1.4 Infirmary Road

Infirmary Road is perpendicular to Creggan Road, and part of it lies within the existing AQMA. An NO_2 diffusion tube (C5) was relocated in August 2008 from 10 Windsor Terrace (residential property on Infirmary Road, within the AQMA) to 1 Windsor Terrace (outwith the AQMA). The bias adjusted (also

seasonally adjusted) annual mean concentrations recorded using diffusion tubes on Infirmary Road (C5a, C5b) are below the annual mean objective of 40 µg/m^3.

Given the proximity of the AQMA, following the collection of further NO_2 monitoring data during 2009, it may be appropriate to reconsider the extents of the existing AQMA. The 2009 monitoring data will be reported in the 2010 Progress Report.

3.1.5 Francis Street

Francis Street runs parallel to Infirmary Road, with residential properties within 2 metres of the kerb. A 5-minute count of road traffic was undertaken in the middle of the day, in accordance with LAQM.TG(09) Box 5.3, to estimate daily traffic flow. A total of 76 vehicles were counted, with an average speed of 18 mph. This indicates a likely flow of 5000 vehicles per day or more.

A Detailed Assessment will be undertaken for this area, for NO_2, commencing with the monitoring of NO_2 for a minimum of six months.

3.1.6 John Street

John Street is a narrow congested street, with an estimated 2-way AADT of 12,500, and an average speed of 18 mph.

A Detailed Assessment will be undertaken for this area, for NO_2, commencing with the monitoring of NO_2 for a minimum of six months. Provisional locations for the diffusion tubes have already been identified.

Derry City Council has identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, not adequately considered in previous rounds of Review and Assessment (Collon Terrace, Spencer Road, Francis Street and John Street), and **will need to proceed to a Detailed Assessment**.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

There were no busy streets where people may spend 1 hour or more close to traffic within the Local Authority boundaries identified in the 2006 USA under the criteria outlined in LAQM.TG(03).

These criteria have not changed in LAQM.TG(09), and again no roads have been identified within the Local Authority as satisfying these criteria.

Derry City Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

The 2006 USA did not identify any roads with a high flow of buses or HGVs according to the criteria outlined in LAQM.TG(03) (high proportion considered to be >25%).

Using the criteria as outlined in the revised technical guidance, LAQM.TG(09), where a high proportion is considered to be >20%, no new roads have been identified as roads with a high flow of buses and/or HGVs.

Derry City Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.4 Junctions

Two busy junctions, with relevant exposure within 10 metres of the kerb, which have not previously been assessed, have been identified, namely:

- Duncreggan Road / Northland Road; and
- Rosemount roundabout.

Traffic information has been gathered for these two junctions. The Design Manual for Roads and Bridges (DMRB) air quality screening tool has been used to predict the 2008 annual mean NO_2 and PM_{10} concentrations and the number of exceedences of the 24-hour limit value of 50 µg/m^3 for PM_{10}.

The predicted annual mean concentrations at relevant receptors at each junction were found to be well below the limit value of 40 µg/m^3 (further details can be found in Appendix B). There is hence no requirement to proceed to a Detailed Assessment for either area.

Derry City Council has assessed new/newly identified junctions meeting the criteria in Section A.4 of Box 5.3 in TG(09), and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.5 New Roads Constructed/Proposed Since the Last Round of Review and Assessment

No new/proposed roads have been identified within Derry City Council since the publication of the 2008 Progress Report (DCC, 2008).

An air quality impact assessment for the A2 Buncrana Road Improvements has been undertaken by Faber Maunsell (now AECOM). The detailed dispersion model, AAQuIRE, was used for the assessment. No exceedences of the Air Quality Strategy Standards were predicted with or without the road scheme in place (FM, 2008), however the model was verified against 2006 data, including NO_2 concentrations recorded at Collon Terrace which were below the annual objective at this time. Monitoring results were in excess of 40µg/m^3 at 2008, and a Detailed Assessment is to be undertaken for this area.

The Stage 2 air quality assessment for the A6 Londonderry to Dungiven Dualling Scheme is currently being finalised and is under review by DRD Roads Service. Therefore the outcome of the assessment is not yet known. If approved the scheme is not due to be operational until approximately 2016.

Derry City Council confirms that there are no new/proposed roads that require assessment at this time.

3.6 Roads with Significantly Changed Traffic Flows

A dualling scheme has been put in place at Glendermott Road, near to Dale's Corner (2006-7). A Detailed Assessment is currently being undertaken by Bureau Veritas, on behalf of Derry City Council. The designation of an AQMA at the junction is considered to be the likely outcome.

Derry City Council confirms that there are no new/newly identified roads with significantly changed traffic flows that require assessment at this time.

3.7 Bus and Coach Stations

There is a bus station close to Derry city centre. At the time of writing the last USA it was stated that there were substantially fewer than 1000 movements per day (DCC, 2006). The criterion for assessing bus and coach stations has now risen to 2500 movements per day (Defra, 2009a). The number of bus movements at Derry bus station remains substantially less than 2500 per day, and additional assessment is not required.

Derry City Council confirms that there are no relevant bus stations in the District.

4 Other Transport Sources

4.1 Airports

There are residential properties within 1000 m of Derry City Airport.

The estimated 2008 NO_X background concentration in the vicinity of the airport (grid square centred at 253500,422500) is 5.5 µg/m^3 (AQA, April 2009), well below the assessment threshold of 25 µg/m^3.

In 2004 Derry City Airport handled 238,000 passengers on scheduled and chartered flights, and there were no freight-only planes operating at the airport (DCC, 2006). Airport activity stated for Derry airport in Appendix C of LAQM.TG(09) is as follows:

- Air transport movements: 4748;
- Terminal passengers: 341719; and
- Freight lifted: N/A.

The total equivalent passenger throughput at Derry City Airport is well below the assessment criterion of 10 million passengers per annum, and hence does not require further assessment.

Derry City Council confirms that there are no airports in the District which satisfy the specified criteria.

4.2 Railways (Diesel and Steam Trains)

There is a small railway station in the District. In 2006 Translink operated a total of nine Monday-Saturday return services from Derry to Coleraine/Belfast, and four return services on Sunday (DCC, 2006). At the time of writing of the 2006 USA, the diesel engines running through the station were being replaced by newer, cleaner engines.

4.2.1 Stationary Trains

It is not anticipated that any diesel or steam locomotives will regularly be stationary within the authority boundaries for periods of 15 minutes or more.

There is no potential for regular outdoor exposure of members of the public within 15m of the stationary locomotives.

It is unlikely that there will be three or more occasions a day when a locomotive may be stationary with its engine running for 15 minutes or more.

Derry City Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

With reference to Table 5.1, LAQM.TG(09), the railway line running through Derry is not recognised as one of those lines in the UK which has heavy traffic of diesel passenger trains. It is hence not necessary to continue to a Detailed Assessment for NO_2 with regard to emissions from moving diesel locomotives.

Derry City Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

Londonderry Port at Lisahally lies within the boundaries of Derry City Council. At the time of writing the last USA it was stated that the port was undergoing continued expansion (DCC, 2006), however it was considered highly unlikely that ship movements would reach numbers making a Detailed Assessment necessary. The situation remains unchanged.

It is therefore concluded that there will be no risk of exceeding the 15-minute objective for sulphur dioxide for this source.

Derry City Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

No new/proposed industrial installations have been identified within the Local Authority since the last round of Review and Assessment.

Derry City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

No existing installations where emissions have increased substantially or new relevant exposure has been introduced have been identified within Derry City Council.

Derry City Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

No new or proposed industrial installations have been identified within Derry City Council.

INVISTA Textiles (UK) Ltd operates a Part A process in the Maydown area of Londonderry. It has proposed a change of fuel type from 100% coal to approximately 90% coal and10% clean wood chippings (March 2009). The operator anticipates that the change in fuel composition would lead to a decrease in total emissions of SO_2, NO_X and dust, which is supported by literature.

Derry City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

At the time of writing the 2006 USA, the LCC Oil Storage and Distribution Terminal was proposed at Maydown, in the port area (DCC, 2006). The site is now operational and the latest information for annual throughput is as follows:

- 16,000 tonnes of petroleum spirit;
- 16,000 tonnes of diesel;
- 20,000 tonnes of gas oil; and
- 24,000 tonnes of kerosene.

The terminal is approximately 860 metres from residential properties. Using the nomogram in LAQM.TG(09) (Figure 5.16), emissions of benzene would be required to be in excess of 4 tonnes per annum for an annual mean ground level concentration of 0.22g/m^3 to be reached at the residential

properties. This is considered highly unlikely based upon the annual throughput of fuels, and further assessment is not deemed necessary.

There is one major petrol storage depot within the Local Authority identified in Appendix E of LAQM.TG(09), operated by Shell UK Ltd (Defra, 2009a), located at OSNI 244335,418796. It has been confirmed with the local manager that storage of petrol has ceased, and no distribution has occurred within the past twelve months. The depot subsequently does not require any further assessment.

Derry City Council has assessed a major petrol storage depot, and concluded that it will not be necessary to proceed to a Detailed Assessment.

5.3 Petrol Stations

The 2006 USA identified no petrol stations in the Local Authority that satisfied the following criteria:

- With an annual throughput of >2000m^3;
- Close to a busy road (>30,000 vehicles per day); and
- With relevant exposure within 10m of the pumps.

The situation remains unchanged.

Derry City Council confirms that there are no petrol stations meeting the specified criteria**.**

5.4 Poultry Farms

No poultry farms satisfying the criteria laid out in LAQM.TG(09) have been identified.

Derry City Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

There are two premises within the Local Authority boundaries to be assessed.
The following information is required to screen the potential impact of a proposed biomass combustion appliance upon local air quality, in accordance with LAQM.TG(09) and 'Technical Guidance: Screening Assessment for Biomass Boilers', (AEA, 2008):

- Height of stack above ground;
- Diameter of stack;
- Dimensions of buildings within a distance from the stack of five times the stack height (above ground);
- Description of the combustion appliance; and
- Maximum rates of emission of particulate matter and oxides of nitrogen when operating at capacity.

Where emission rates are not available for the appliance which is to be screened, they can be estimated, based upon the maximum thermal capacity of the appliance using the EMEP/CORINAIR Emission Inventory Guidebook – 2007 (EEA, 2007).

Nomographs, presented in LAQM.TG(09), are used to assess whether the proposed biomass combustion installation is likely to lead to an exceedence of the Air Quality Strategy 24-hour PM_{10} objective or the annual mean objective for NO_2.

The following steps are undertaken using the nomographs to determine whether the biomass installation will require further assessment:

- The line in the nomograph corresponding to the stack diameter is identified;
- The point on the line which corresponds to the effective stack height (y-axis) is identified ;
- The corresponding threshold emission rate (x-axis) is determined; and
- The threshold emission rate is compared with the background-adjusted emission rate.

If the background-adjusted emission rate is greater than or equal to the threshold emission rate, a more detailed assessment of the biomass boiler should be considered.

6.1.1 Eglinton Timber, Longfield Industrial Estate

The following information has been provided with respect to the Eglinton Timber biomass boiler:

- The stack height is 16 m above the ground;
- The stack diameter is 0.5 m;
- The exit velocity is 9.5 m/s;
- The nearest building within 5 m is 7 m high;
- The biomass installation is a 1500 kW woodchip burner; and
- The maximum PM_{10} emission rate is 200 mg/m^3.

The information provided can be used to calculate a maximum emission rate of PM_{10} of 0.373 g/s, as follows:

Stack exhaust area = $\pi \times (0.5\ m/2)^2 = 0.2\ m^2$
Volume of gas emitted per second = $0.2\ m^2 \times 9.5\ m/s = 1.87\ m^3/s$
Mass emitted per second = $200\ mg/m^3 \times 1.87\ m^3/s = 373.06\ mg/s = 0.373\ g/s$

In accordance with the guidance, default emission factors (from the EMEP/CORINAIR Guidebook (EEA, 2007)) have been used to calculate a maximum emission rate of NO_2 from a wood boiler of this size:

Max. NO_2 emission rate = $150g/GJ \times 1500\ kW \times 10^{-6} = 0.225\ g/s$

Background concentrations for 2008 of both PM_{10} and NO_2 have been obtained from the Air Quality Archive 1×1 km background maps for the grid square centred at 253500, 421500 (boiler located at approximately 253716, 421550):

Background PM_{10} (2008) = 11.44 µg/m^3
Background NO_2 (2008) = 5.21 µg/m^3

'Background-adjusted' emission rates (E_A) are calculated using the following formulae, to assess the potential impacts of the biomass burner with regards to the Air Quality Strategy 24-hour mean objective for PM_{10} and the annual mean objective for NO_2, respectively, where E is the emission rate in g/s for the plant operating at capacity, and G is the annual average background concentration in µg/m^3:

PM_{10} E_A [1]: = E / (32 – G) = 0.373 g/s / (32 µg/m^3 – 11.44 µg/m^3) = 0.018 g/s;
NO_2 E_A [2]: = E / (40 – G) = 0.225 g/s / (40 µg/m^3 – 5.21 µg/m^3) = 6.47 × 10^{-3} g/s.

Table 6.1 shows the minimum effective stack height, below which further assessment of the boiler may be required. For the NO_2 annual mean objective, the effective stack height would have to be 4 metres or lower for further assessment to be considered. For the 24-hour mean objective for PM_{10}, the effective stack height would have to be 18 metres or below for further assessment to be considered.

The stack height should be assumed to be the actual height of the stack, unless its height above ground is less than 2.5 times the height of the building to which it is attached, or any other building within 5 times the stack height. If this is the case, the 'effective stack height', C, should be calculated using the following formula, where U is the actual stack height above the ground, and H is the height of the tallest building within a distance of 5 times the stack height:

C = 1.66(U – H) = 1.66 × (16 m – 7 m) = 15 m

Table 6.1: Emission rates and threshold emissions of biomass boiler at Eglinton Timber

Pollutant	**NO_2**	**PM_{10}**
Air Quality Objective	Annual mean	24-hour
Default emission factor (g/GJ)	150	n/a
Maximum emission rate (g/s)	0.2	0.4
2008 Background concentration (µg/m^3)	5.2	11.4
2008 Background-adjusted emission rate (g/s)	0.006	0.02
Minimum Effective Stack Height (m) [a]	*4*	*18*
Threshold background-adjusted emission rate for 15 metres effective stack height (g/s) [b]	*0.04*	*0.02*

Note: [a] Minimum effective stack height, below which further assessment of the boiler may be required.
[b] Threshold background-adjusted emission rate for a 15 m effective stack height, above which further assessment of the boiler may be required.

Based upon the current specification of the boiler, further assessment with regard to impacts upon local air quality from NO_2 are not necessary. With regard to PM_{10}, the screening study suggests that further assessment should be considered as the background-adjusted emission rate for PM_{10} (0.002 g/s) equals the threshold emission rate for an effective stack height of 15 metres.

However, it is considered highly unlikely that the boiler will have a significant impact upon local air quality with regard to PM_{10} concentrations as the emission rate used in the calculation is an upper limit. The 2007 Stack Emissions Testing Report for the site recorded an average particulate emission rate of 0.016 g/s, significantly less than the emission rate used in this assessment (0.373 g/s).

[1] 32 µg/m^3 represents the annual average concentration at which, given a typical distribution of concentrations, with time the 90th percentile of 24-hour means will exceed the objective.
[2] 40 µg/m^3 represents the annual mean objective.

As the results of the assessment are marginal using the emission rate limit, and as background concentrations of PM_{10} are also well below the annual mean objective in this area, and there are very few residential properties in the vicinity of the site, particularly downwind (assuming a prevailing south-westerly wind), no further assessment is proposed.

6.1.2 JWD Gilliland, Culmore Road

The following information has been provided with respect to the three Gillilands biomass boilers:

- The stacks are 12 m high, protruding 5 m from the building, in which they are located;
- The stack diameter for all stacks is 0.2 m; and
- The biomass installations are 100 kW, 180 kW and 280 kW woodchip/fallen wood burners.

As there is more than one stack, a cautionary approach is taken, whereby it is assumed that the total emissions are emitted from a single stack.

In accordance with the guidance, default emission factors (from the EMEP/CORINAIR Guidebook (EEA, 2007)) have been used to calculate a maximum emission rate of both NO_2 and PM_{10} from a wood boiler of this size:

Max. PM_{10} emission rate (100 kW) = 240g/GJ × 100 kW × 10^{-6} = 0.024 g/s;
Max. PM_{10} emission rate (180 kW) = 240g/GJ × 180 kW × 10^{-6} = 0.043 g/s;
Max. PM_{10} emission rate (280 kW) = 240g/GJ × 280 kW × 10^{-6} = 0.067 g/s;
Max. PM_{10} emission rate (ALL) = 0.024g/s + 0.043g/s + 0.067g/s = 0.134 g/s.

Max. NO_2 emission rate (100 kW) = 150g/GJ × 100 kW × 10^{-6} = 0.015 g/s;
Max. NO_2 emission rate (180 kW) = 150g/GJ × 180 kW × 10^{-6} = 0.027 g/s;
Max. NO_2 emission rate (280 kW) = 150g/GJ × 280 kW × 10^{-6} = 0.042 g/s;
Max. NO_2 emission rate (ALL) = 0.015g/s + 0.027g/s + 0.042g/s = 0.084g/s.

Background concentrations for 2008 of both PM_{10} and NO_2 have been obtained from the Air Quality Archive 1×1 km background maps for the grid square centred at 245500, 420500 (boilers located at approximately 245480, 420455):

Background PM_{10} (2008) = 14.73 µg/m^3;
Background NO_2 (2008) = 8.17 µg/m^3.

'Background-adjusted' emission rates (E_A) are calculated using the following formulae, to assess the potential impacts of the biomass burner with regards to the Air Quality Strategy 24-hour mean objective for PM_{10} and the annual mean objective for NO_2, respectively, where E is the emission rate in g/s for the plant operating at capacity, and G is the annual average background concentration in µg/m^3:

PM_{10} $E_{A\ 100kW}$: = E / (32 – G) = 0.024 g/s / (32 µg/m^3 – 14.73 µg/m^3) = 1.39 × 10^{-3} g/s;
PM_{10} $E_{A\ 180kW}$: = 0.043 g/s / (32 µg/m^3 – 14.73µg/m^3) = 2.49 × 10^{-3} g/s;
PM_{10} $E_{A\ 280kW}$: = 0.067 g/s / (32 µg/m^3 – 14.73µg/m^3) = 3.88 × 10^{-3} g/s;
PM_{10} $E_{A\ ALL}$: = 0.134 g/s / (32 µg/m^3 – 14.73µg/m^3) = 7.76 × 10^{-3} g/s;

NO_2 $E_{A\ 100kW}$ = E / (40 – G) = 0.015 g/s / (40 µg/m^3 – 8.17 µg/m^3) = 4.71 × 10^{-4} g/s;
NO_2 $E_{A\ 180kW}$: = 0.027 g/s / (40 µg/m^3 – 8.17 µg/m^3) = 8.48 × 10^{-4} g/s;
NO_2 $E_{A\ 280kW}$: = 0.042 g/s / (40 µg/m^3 – 8.17 µg/m^3) = 1.32 × 10^{-3} g/s;
NO_2 $E_{A\ ALL}$: = 0.084 g/s / (40 µg/m^3 – 8.17 µg/m^3) = 2.64 × 10^{-3} g/s.

Table 6.2 shows the minimum effective stack height, below which further assessment of the boiler may be required. For the NO_2 annual mean objective, the effective stack height would have to be 2 metres or lower for further assessment to be considered. For the 24-hour mean objective for PM_{10}, the effective stack height would have to be 11 metres or below for further assessment to be considered.

The stack height should be assumed to be the actual height of the stack, unless it's height above ground is less than 2.5 times the height of the building to which it is attached, or any other building within 5 times the stack height. If this is the case, the 'effective stack height', C, should be calculated using the following formula, where U is the actual stack height above the ground, and H is the height of the tallest building within a distance of 5 times the stack height:

C = 1.66(U – H) = 1.66 × (12 m – 5 m) = 11.62 m

Based upon the current specification of the boilers, the screening study suggests that further assessment with regard to impacts upon local air quality from NO_2 and PM_{10} are not necessary. The total background-adjusted emission rates (from all three stacks) for both NO_2 and PM_{10} are below the threshold emission rates for a 12 metre effective stack height.

Table 6.2: Emission rates and threshold emissions of biomass boilers at Gillilands

Pollutant	**NO_2**				**PM_{10}**			
Air Quality Objective	Annual mean				24-hour			
Biomass boiler (kW)	100	180	280	All	100	180	280	All
Default emission factor (g/GJ)	150			n/a	240			n/a
Maximum emission rate (g/s)	0.015	0.027	0.042	0.084	0.024	0.043	0.067	0.134
2008 Background concentration (µg/m^3)	8.2				14.7			
2008 Background-adjusted emission rate (g/s)	0.0005	0.0008	0.001	0.003	0.001	0.002	0.004	0.008
Minimum Effective Stack Height (m) [a]	*n/a*	*n/a*	*n/a*	*2*	*n/a*	*4*	*7*	*11*
Threshold background-adjusted emission rate for 12 metres effective stack height (g/s) [b]	*0.02*				*0.009*			

Note: [a] Minimum effective stack height, below which further assessment of the boiler may be required.
[b] Threshold background-adjusted emission rate for a 15 m effective stack height, above which further assessment of the boiler may be required.

Derry City Council has assessed two biomass combustion plants, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

No biomass installations satisfying the criteria laid out in LAQM.TG(09) have been identified.

Derry City Council confirms that there are no areas of high density biomass combustion plants in the District.

6.3 Domestic Solid-Fuel Burning

Derry City Council confirms that there are no areas of significant domestic fuel use in the District.

7 Fugitive or Uncontrolled Sources

There have previously been complaints regarding dust in the area of Culmore Point Road. Automatic monitoring of PM_{10} was undertaken using a portable TEOM at a residential location on Culmore Point Road, opposite Londonderry Port and Harbour, from December 2007 until December 2008. The 2008 annual mean and number of exceedences of the 24-hour mean were well below the Air Quality Strategy standards.

There have been no complaints regarding the quarries within the Local Authority boundaries.

Derry City Council confirms that there are no potential sources of fugitive particulate matter emissions in the District.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Automatic monitoring has indicated a marginal exceedence of the annual mean NO_2 objective at Dale's Corner. A Detailed Assessment is currently underway, and it is expected that the designation of an AQMA will be required.

Monitoring of NO_2 has been conducted at several locations using passive diffusion tubes. National bias adjustment factors have previously been used to adjust the annual mean, with factors taken from the UWE website (http://www.uwe.ac.uk/aqm/review/). For 2008, a local factor was also calculated by comparison of data recorded at the Dale's Corner roadside automatic monitor and the co-located diffusion tubes. Bias adjusted diffusion tube results for 2008 using both the local (1.002) and national (0.83) factors are presented in Table 2.4. Local adjustment factors have not previously been used for reasons such as low data capture.

The national bias adjustment factors for the 10% TEA in water methodology undertaken by Bureau Veritas were below unity in both 2007 and 2008. The use of the local factor, close to unity, hence results in higher calculated annual means for 2008. The application of this factor has highlighted more areas where exceedences of the annual mean NO_2 objective may be occurring.

Exceedences of the annual mean objective for NO_2 of 40 µg/m^3 were recorded at the following sites in 2008, irrespective of the diffusion tube bias adjustment factor applied (sites in italics lie within the existing AQMA):

- Dale's Corner (automatic monitor, not collocated diffusion tube);
- *C1, C2: 3 Creggan Road;*
- *C4: 22A Creggan Street;*
- D5: 5 Glendermott Road;
- F1, F3, F4: 4 Ebrington Terrace;
- P3: 19 St Patricks Terrace; and
- P4: 5 Collon Terrace.

Concentrations recorded at the following locations using diffusion tubes were found to exceed the NO_2 annual objective when the local bias adjustment factor was used, but not when the national factor was used:

- D1, D2, D3: Dale's Corner (Diffusion tubes)
- *C3: 6 Marlborough Terrace;*
- *C6: 14 Creggan Road;*
- S1: 99 Strand Road;
- S2: Rockmills;
- AB1: 63 Abercorn Road; and
- AB2: 8 Abercorn Road.

The monitoring locations on Creggan Road are within the current AQMA, confirming the continuing need for the AQMA. A Detailed Assessment is currently underway for Dale's Corner, and it is expected that the designation of an AQMA will be required. The Pennyburn area (including monitoring locations P3, P4) has been highlighted for a Detailed Assessment of NO_2 (see Section 8.2).

Monitoring of NO_2 should be continued at all locations, and a local bias adjustment factor should be calculated and applied to diffusion tube monitoring where possible in future years, so as to identify possible trends.

Monitoring of PM_{10}, SO_2 and other pollutants has shown no exceedences of the Air Quality Strategy standards, and further assessment is subsequently not required for these pollutants.

8.2 Conclusions from Assessment of Sources

There have been no new or significantly changed sources of pollutants identified which may cause potential exceedences within the Local Authority, other than road transport.

This assessment has highlighted that a Detailed Assessment is required with regard to NO_2 derived from road transport for three narrow congested streets with residential properties close to the kerb:

- Collon Terrace;
- Spencer Road;
- Francis Street; and
- John Street.

For Spencer Road, Francis Street and John Street, the Detailed Assessment should commence with a minimum of six months NO_2 diffusion tube monitoring, in worst case locations of relevant exposure. Depending upon the pollutant concentrations recorded, it may be necessary to proceed further, with detailed modelling. NO_2 monitoring has already been undertaken at Collon Terrace, and therefore detailed modelling will be necessary for the area.

8.3 Proposed Actions

A 2010 Detailed Assessment is required for NO_2 from road traffic for the area of Collon Terrace.

Monitoring is to continue at the current site locations, with additional monitoring of NO_2 to be undertaken using diffusion tubes in the following locations for a minimum of six months:

- Spencer Road;
- Francis Street; and
- John Street.

Should additional monitoring show that there are exceedences of the Air Quality Strategy annual mean standard of 40 µg/m^3, it will be necessary to progress to a Detailed Assessment for these areas.

A Progress Report will be submitted for all pollutants in 2010.

9 References

AEA Energy & Environment (2008) Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users, AEA/ENV/R/2504 – Issue 1a
AEA Energy & Environment (2009). Technical Guidance: Screening Assessment for Biomass Boilers.
Air Quality Archive (http://www.airquality.co.uk/archive/index.php) Accessed April 2009
Defra (2009) Local Air Quality Management, Technical Guidance LAQM.TG (09)
Derry City Council (2004) Detailed Air Quality Modelling of Domestic Fuel Use and Road Traffic Emissions in Derry (Stage 3)
Derry City Council (2005) Progress Report 2005
Derry City Council (2006) Local Air Quality Management Updating and Screening Assessment
Derry City Council (2007) Detailed Assessment and Further Assessment
Derry City Council (2008a) Progress Report 2008
Derry City Council (2008b) Final Air Quality Action Plan
Derry City Council (2009) Detailed Assessment 2009
European Environment Agency (2007) EMEP/CORINAIR Emission Inventory Guidebook, Chapter B216: Non-Industrial Combustion Plants. (http://www.eea.europa.eu/publications/EMEPCORINAIR5/B216v2.pdf)
Faber Maunsell (2008) A2 Buncrana Road Improvements, Detailed Air Quality Assessment (Red Route)

Appendices

Appendix A: QA/QC Data

Appendix B: DMRB Calculations

Appendix C: Monitoring Location Maps

Appendix D: Diffusion Tube Monthly Data

Appendix A: QA/QC Data

Diffusion Tube Bias Adjustment Factors

The NO_2 diffusion tubes deployed in the Local Authority were prepared and analysed by Lambeth Scientific until August 2006. From October 2006 until December 2008 Bureau Veritas labs prepared and analysed the diffusion tubes using the 10% TEA in water methodology. In accordance with the harmonisation of preparation and analysis of NO_2 diffusion tubes in the UK (AEA, 2008), Bureau Veritas changed their methodology to use 20% TEA in water in January 2009. Derry City Council has recently (April 2009) switched to use the Gradko labs for preparation and analysis of NO_2 diffusion tubes.

The Bureau Veritas laboratory participates in the field intercomparison scheme and the Workplace Analysis Scheme for Proficiency (WASP) programme, operated by the Health and Safety Laboratory (HSL). In 2008, 11 out of the 15 collocation studies undertaken by Bureau Veritas labs using 10% TEA in water methodology were considered to be good precision (based upon v05/09 spreadsheet). In 2007, 6 out of the 17 collocation studies undertaken by Bureau Veritas labs using 10% TEA in water methodology were considered to be good precision (based upon v05/09 spreadsheet).

For 2007 the bias adjustment factor was obtained from the University of Western England (UWE) co-location spreadsheet available at the Review and Assessment website for the 10% TEA in water methodology, **0.88** (http://www.uwe.ac.uk/aqm/review/; v05/09, 06 May 2009).

For 2008, diffusion tube results were adjusted using both a national (**0.83**, UWE co-location spreadsheet, v05/09, 06 May 2009) and a local bias adjustment factor (**1.002**, calculated by Bureau Veritas using the roadside automatic monitoring site and co-located diffusion tubes at Dale's Corner). Details of the calculation of the co-location factor are to be presented in the 2009 Detailed Assessment for Dale's Corner (DCC, 2009).

Discussion of Choice of Factor to Use

In previous years diffusion tube data has been bias adjusted using national co-location factors obtained from the UWE website. For 2008 a local co-location factor was also calculated for Derry using the roadside automatic monitoring site and co-located diffusion tubes at Dale's Corner (see 2009 Detailed Assessment for calculations; DCC, 2009).

In this report, bias adjusted diffusion tube data has been presented using both the local (1.002) and national (0.83) factors for 2008. This allows for the comparison of trends from previous years (using the national factor), whilst also presenting the 'worst case' values which are calculated using the local factor (close to unity). The application of the 'worst case' local factor for 2008 shows more exceedences of the NO_2 annual mean objective, however based upon LAQM.TG(09) guidance, and consistent with the 2009 Detailed Assessment, recommendations are made based upon diffusion tube monitoring with the national factor applied.

PM Monitoring Adjustment

Particulate matter is monitored at the Brandywell and Culmore Point Road (Dec 2007 – Dec 2008) locations using TEOM instruments. The data is adjusted to gravimetric equivalence using a default correction factor of 1.3 to account for the loss of volatile and semi-volatile components due to its operation at a high temperature. The Brooke Park particulate analyser has been upgraded to an FDMS (Filter Dynamics Measurement System), which measures both the core and volatile fractions of particulate matter.

Short-term to Long-term Data adjustment

There is only one urban background automatic monitoring location within 50 metres of the diffusion tube monitoring which are to be adjusted for seasonal bias. This is the Brooke Park AURN monitoring location. Period means for the automatic monitoring for the relevant periods are given in the following tables. Period means have also been calculated and presented for appropriate diffusion tubes which are located nearby using unbiased measurements. These ratios are presented for comparison

purposes, given that only one automatic monitoring site was used, and have not been used in the seasonal adjustment of data.

Site	Site Type	Annual Mean (2008)	Period Mean [a]	Ratio
Brooke Park (automatic monitor)	Urban Background	18.5	17.2	1.1
C1 (DT) [b]	Roadside	75.2	74.3	1.0
C2 (DT) [b]	Roadside	76.8	70.0	1.1

Note: [a] Period mean for February, April-June (C5a, 10 Windsor Terrace); [b] Nearby diffusion tube factors calculated and presented for comparison using unbiased results – ratio *not* used in adjustment

Site	Site Type	Annual Mean (2008)	Period Mean [a]	Ratio
Brooke Park (automatic monitor)	Urban Background	18.5	21.4	0.9
C1 (DT) [b]	Roadside	75.2	84.0	0.9
C2 (DT) [b]	Roadside	76.8	87.4	0.9

Note: [a] Period mean for August-December (C5b, 1 Windsor Terrace); [b] Nearby diffusion tube factors calculated and presented for comparison using unbiased results – ratio *not* used in adjustment

Site	Site Type	Annual Mean (2008)	Period Mean [a]	Ratio
Brooke Park (automatic monitor)	Urban Background	18.5	19.7	0.9
AB2 (DT) [b]	Roadside	39.8	42.9	0.9

Note: [a] Period mean for January-May, September-October, December (AB1, 63 Abercorn Road); [b] Nearby diffusion tube factors calculated and presented for comparison using unbiased results – ratio *not* used in adjustment

QA/QC of automatic monitoring

AEA Energy and Environment undertake the Quality Assurance/Quality Control (QA/QC) procedures at these monitoring sites, ensuring that measurements from the analysers are as accurate as possible, and that measurements recorded at each site may be compared with other sites.

Manual calibration of automatic monitors is undertaken every two weeks by Derry City Council officers. This allows the instrument drifts to be fully quantified and documented using traceable calibration gas standards and the results are used to scale data. All calibration records are sent to AEA Energy and Environment who conduct the QA/QC checks.

The analysers are checked and serviced every six months by the suppliers, Enviro Technology Ltd. The reports are sent to the National Physical Laboratory/Environmental Research Group of King's College, London (NPL/ERG) who conduct the QA/QC checks (since March 2009).

QA/QC of diffusion tube monitoring

The Bureau Veritas laboratory participates in the field intercomparison scheme and the Workplace Analysis Scheme for Proficiency (WASP) programme, operated by the Health and Safety Laboratory (HSL). In 2008, 11 out of the 15 collocation studies undertaken by Bureau Veritas labs using 10% TEA in water methodology were considered to be good precision (based upon v05/09 spreadsheet). In 2007, 6 out of the 17 collocation studies undertaken by Bureau Veritas labs using 10% TEA in water methodology were considered to be good precision (based upon v05/09 spreadsheet). Gradko Ltd. now undertake this service (since March 2009).

Appendix B: DMRB Calculations

DMRB calculations were made to assess the annual mean concentrations of NO_2 and PM_{10} at locations of relevant exposure at the following junctions, where properties were within 10 metres of the kerb, and average daily vehicle flow exceeded 10,000 vehicles:

- Duncreggan Road / Northland Road; and
- Rosemount roundabout.

One worst-case receptor of relevant exposure was identified for each junction, and the DMRB air quality screening spreadsheet (Version 1.03c (July 2007)) was used to predict concentrations of NO_2 and PM_{10} in 2008.

Annual mean concentrations of NO_2 and PM_{10} were calculated to be below the Air Quality Strategy objectives, and the predicted number of exceedences of the 24-hour mean for PM_{10} was well within the target of 35 times per year (see Table B3) at the chosen receptors (27c Northland Rd / 8 Duncreggan Rd, 8 Rosemount Roundabout).

Input Data

Table B1: Background concentrations used in DMRB assessment of junctions

Location/ Receptor	Grid Ref	Background Concentrations (µg/m^3)			
		Year	NO_X	NO_2	PM_{10}
27c Northland Rd / 8 Duncreggan Rd	243216, 418102	2008	12.5	10.1	18.8
8 Rosemount Roundabout	242514, 417413	2008	10.3	8.4	18.9

Table B2: Input data used in DMRB assessment of junctions

Location/ Receptor	Link number	Distance from link centre to receptor (m)	Traffic flow & speed		Traffic composition		
			AADT (combined, veh/day)	Annual average speed (km/h)	Road type (A,B,C,D)	Total % LDV (<3.5t GVW)	Total % HDV (>3.5t GVW)
27c Northland Rd / 8 Duncreggan Rd	**1**	17.2	10115	19	A	96.9	3.1
	2	19.5	15000	19	A	96.9	3.1
8 Rosemount Roundabout	**1**	15.0	4665	19	A	98.2	1.8
	2	17.5	13570	19	A	98.2	1.8

Verification

Model verification was not possible for the DMRB calculations above as no monitoring of NO_2 or PM_{10} is undertaken in the vicinity of the junctions assessed. The results presented are hence unverified.

Results

Table B3: Results of DMRB assessment of junctions

Location / Receptor	Year	Total NO_X [1]	Rd NO_X [2]	Adj Rd NO_X [3]	Adj Total NO_X [4]	Adj Rd NO_2 [5]	Adj Total NO_2 [6]	PM_{10}	
		Annual mean µg/m^3							Days >50 µg/m^3
27c Northland Rd / 8 Duncreggan Rd	2008	38.5	26.0	n/a	n/a	11.8	21.9	22.5	7
8 Rosemount Roundabout	2008	26.0	15.7	n/a	n/a	7.5	15.8	21.3	5

[1] Total NOx = direct from DMRB local output sheet
[2] Rd NOx = Total NOx – Background NOx
[3] Adj Rd NOx = Rd NOx x verification factor (state verification factor used)
[4] Adj Total NOx = Adj Rd NOx + Background NOx
[5] Adj Rd NO_2 = from NOx to NO_2 calculator (available LAQM Tools)
[6] Adj Total NO_2 = Adj Rd NO_2 + Background NO_2

Maps of Locations

Figure B1: Northland Road / Duncreggan Road Junction

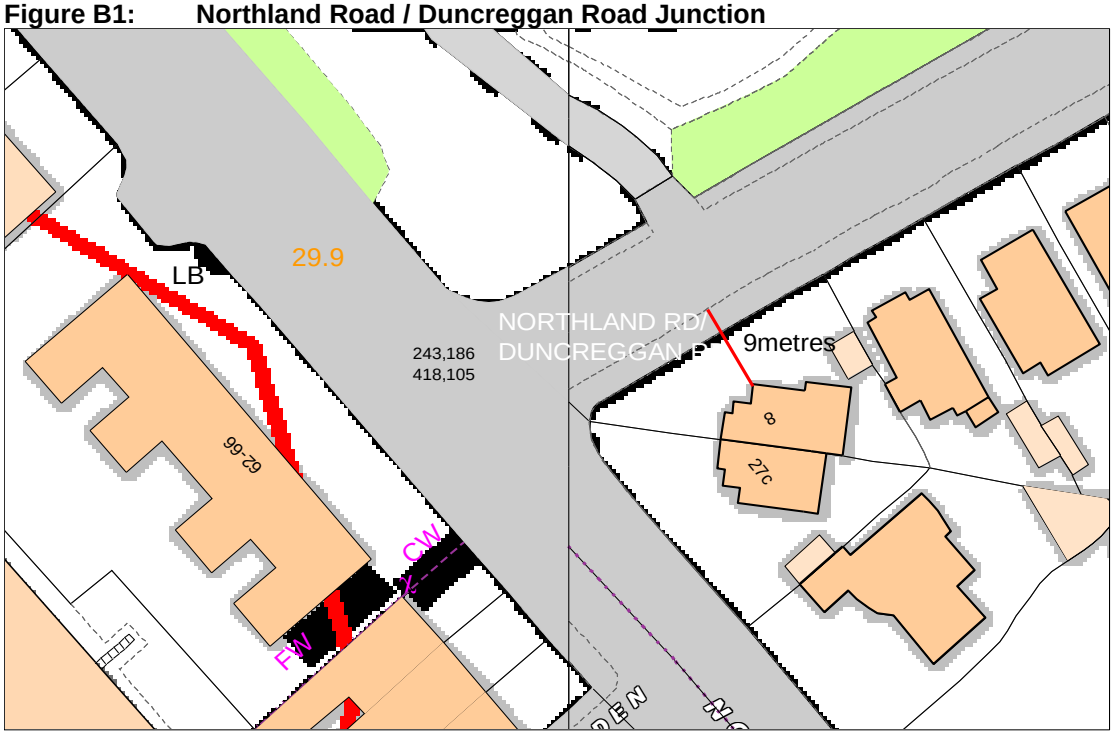
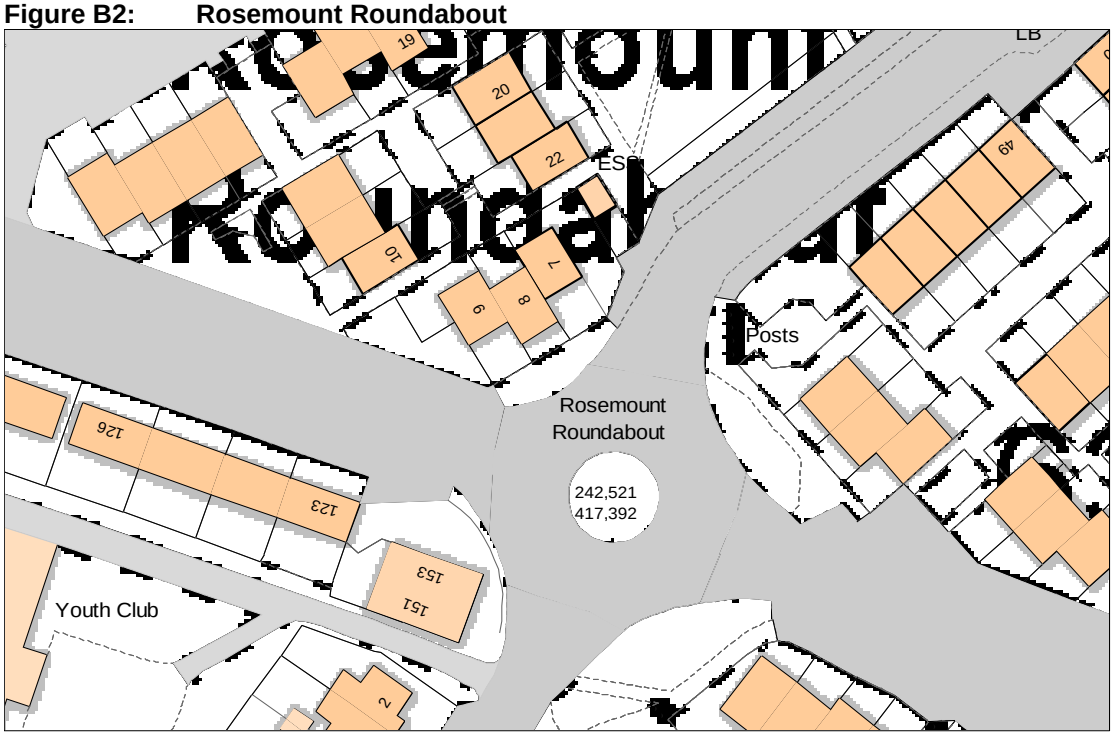


Figure B2: Rosemount Roundabout



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Appendix C: Monitoring Location Maps

Figure C1: Derry City Council District Monitoring Locations

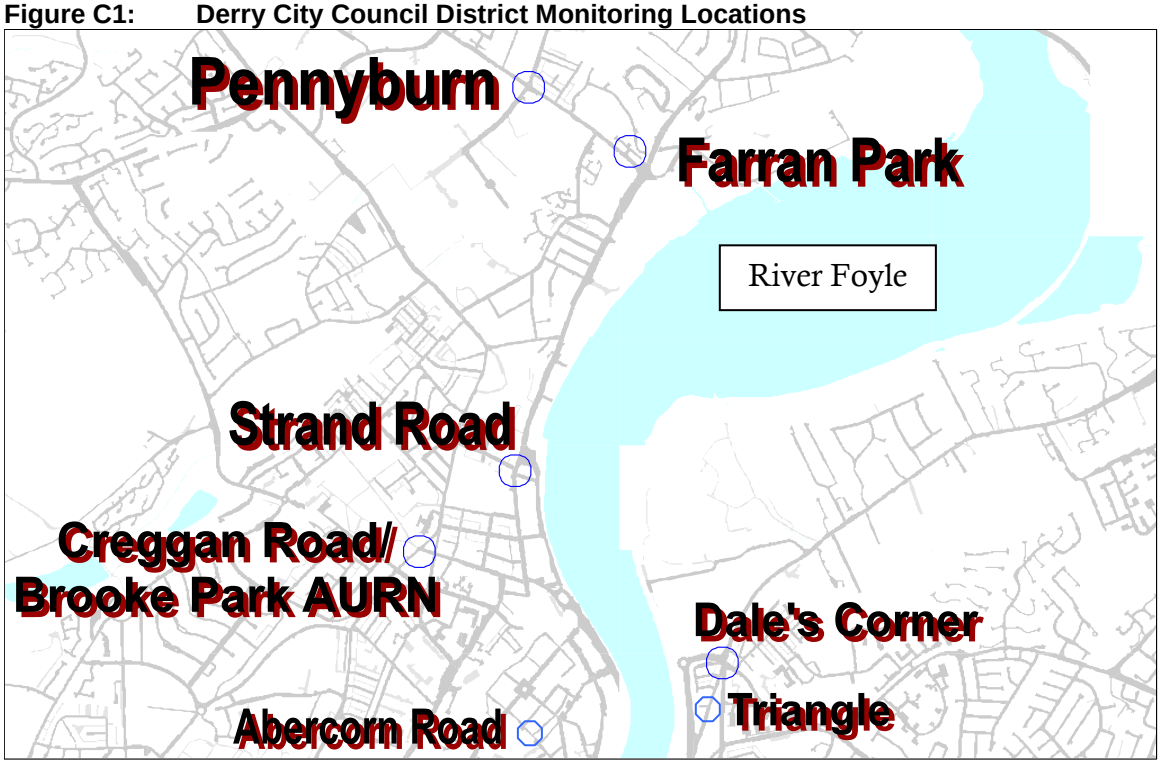

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Figure C2: Brooke Park and Creggan Road Junction, with AQMA

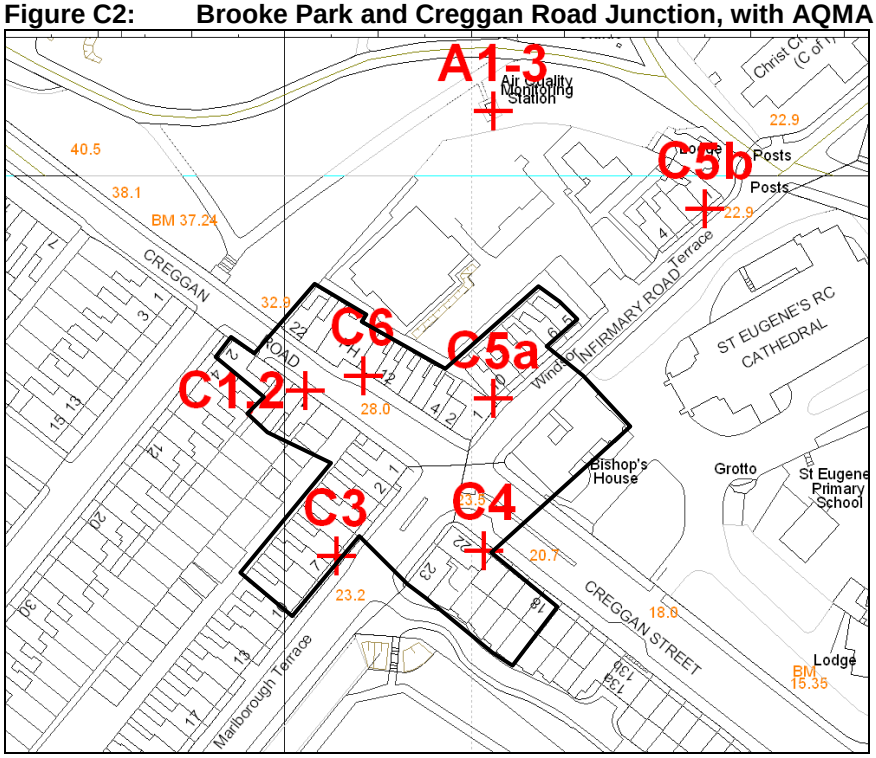

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Figure C3: Strand Road

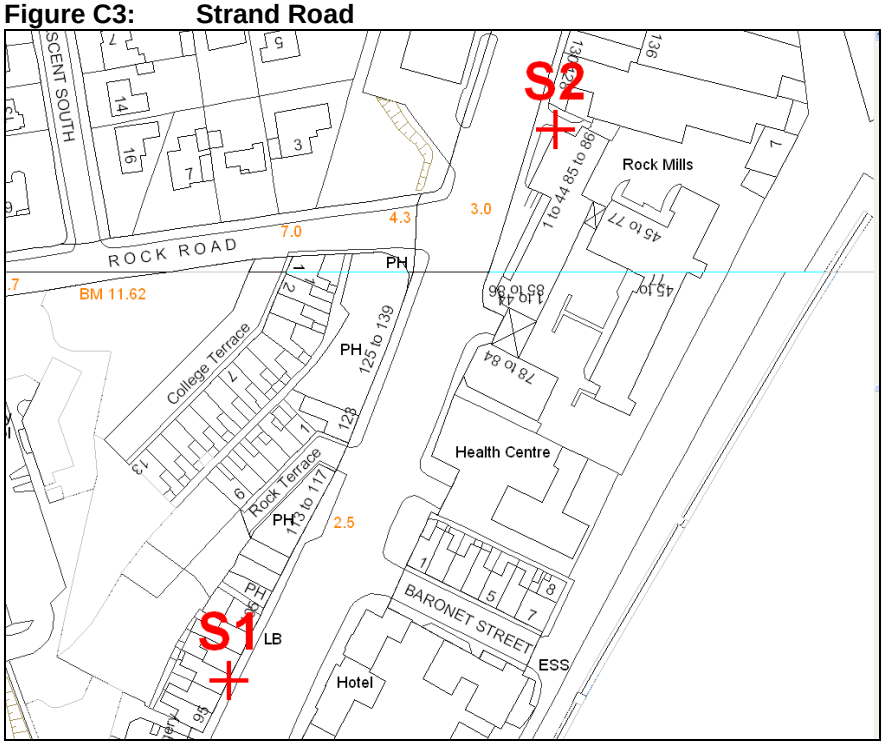

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Figure C4: Dale's Corner

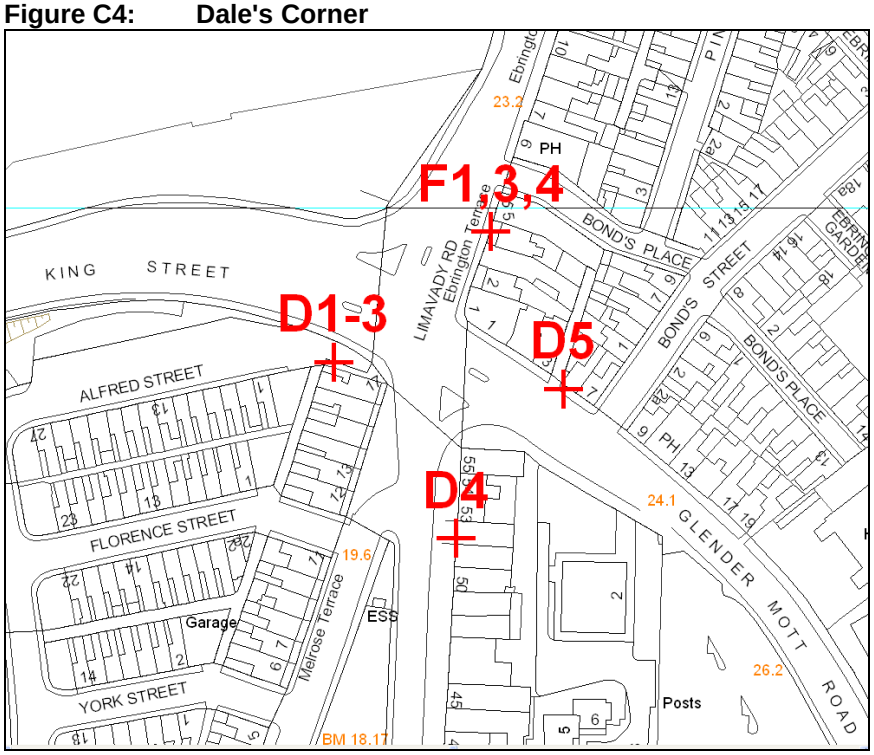

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Figure C5: Triangle

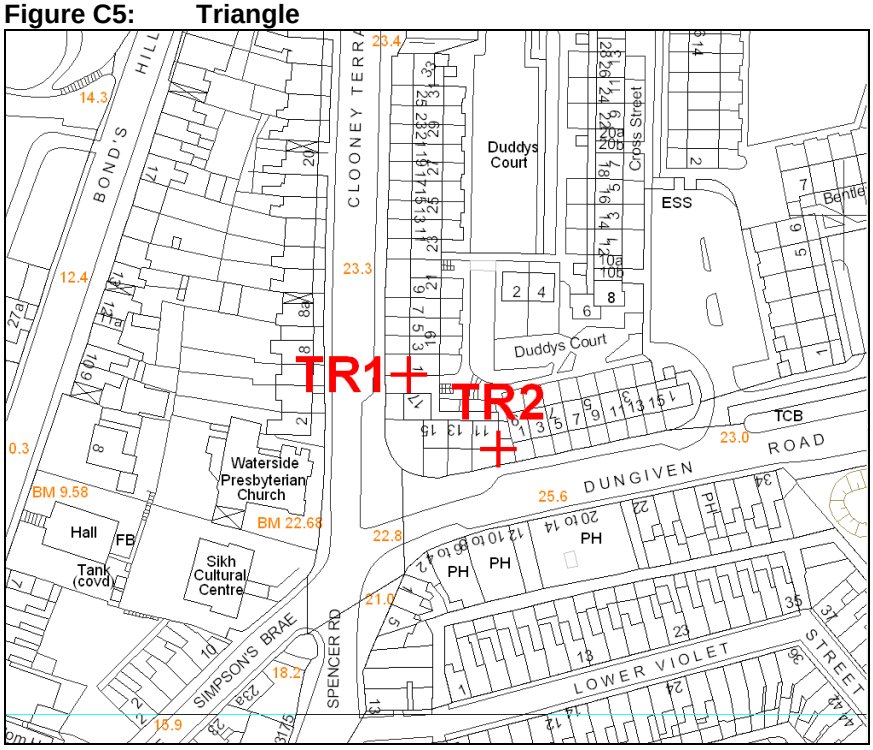

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Figure C6: Farran Park

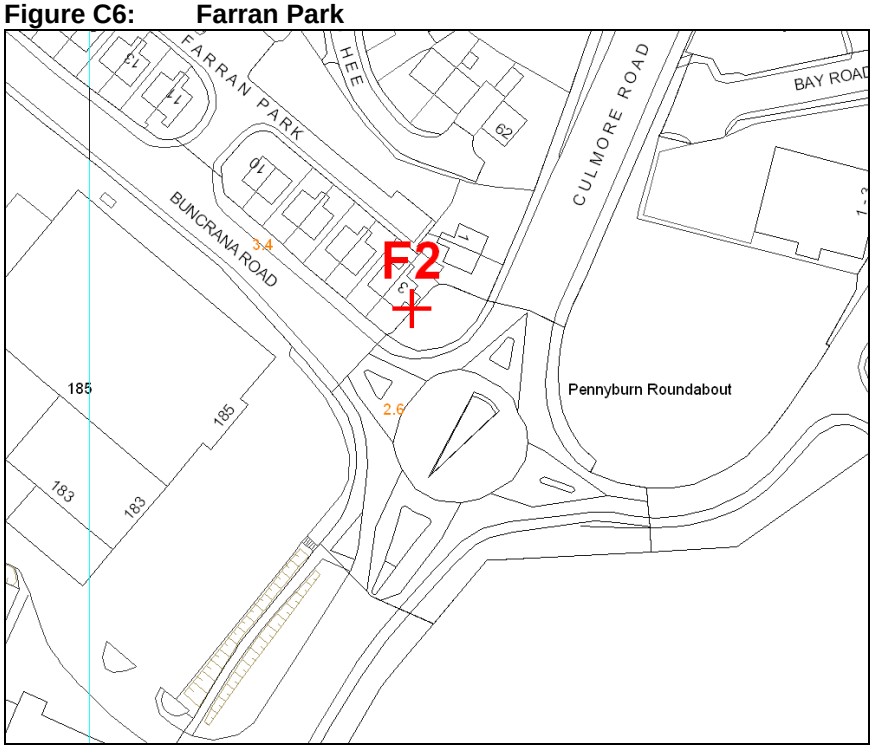

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Figure C7: Pennyburn

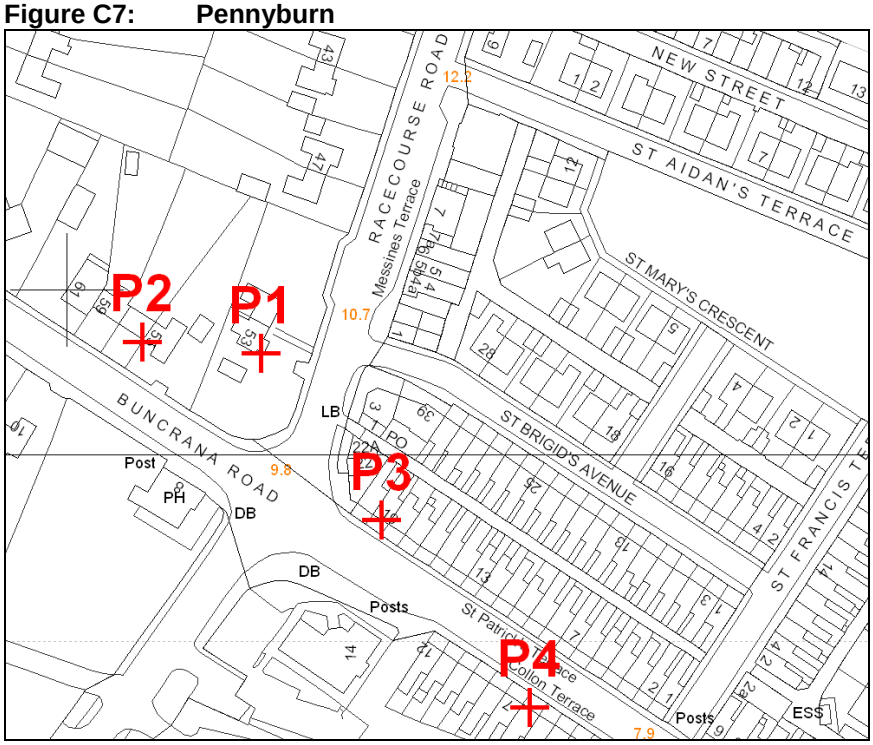

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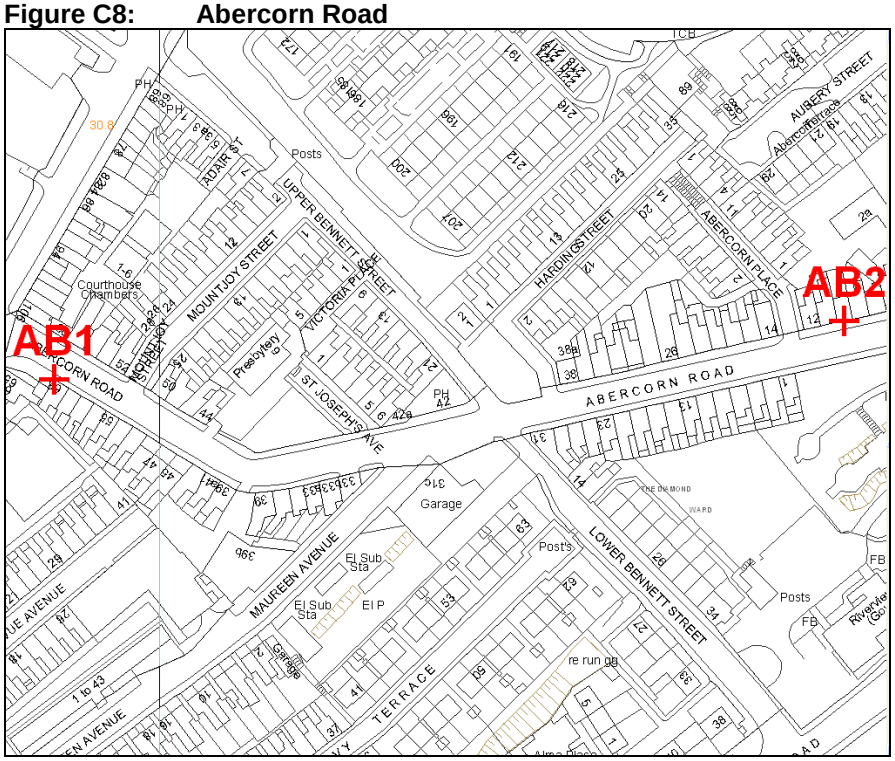
Figure C8: Abercorn Road



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Appendix D: Diffusion Tube Monthly Data

Table D1: Nitrogen dioxide diffusion tube results 2008 (µg/m^3)

Site Ref	Address	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
A1	Brooke Park AURN	23	27	17	16	13	12	10	11	16	19	23	35
A2		26	25	21	15	17	11	11	11	16	22	21	37
A3		22	26	17	15	17	10	10	9	15	18	21	37
C1	3 Creggan Rd	73	97	85	67	62	71	27	60	78	80	91	111
C2		70	82	81	66	60	72	54	64	74	94	89	116
C3	6 Marlborough Terrace	40	42	51	36				55	43	40	43	55
C4	22A Creggan Street	51	59	52	44	40	37	46	37	45	44	59	73
C5a	10 Windsor Terrace		39		34	30	32						
C5b	1 Windsor Terrace								48	35	35	42	55
C6	14 Creggan Road	36	48	49	55	46	38	31	33	47	39	56	71
D1	Dale's Corner automatic monitor	43	47	42	40	32	35	27	29	40	49	30	59
D2		46	47	41	40	42	28	26	30	38	32	48	58
D3		43	43	42	36	40	34	35	31	37	38	44	56
D4	52 Clooney Terrace	30		55	29	40	23	20	21	30	27	33	50
D5	5 Glendermott Road	85	61	62	62	58	45	52	58	58	54	75	94
F1	4 Ebrington Terrace	56	54	55	67	63	34	52	46	54	49	60	75
F3		58	59	51	55	81	50	50	53	53	51	65	74
F4		58	63	56	52	63	50	45	44	56	47		77
F2	3 Farren Park	42	44	32	27	31	25	21	24	28	41	42	59
P1	53 Messines Park	32	32	26	26	27	18	17	18	10	22	28	44
P2	57 Messines Park		37	33	30	43	26	24	23	13	23	34	52
P3	19 St Patricks Terrace	105	41	40	48	77	29	35		41	38	47	61
P4	5 Collon Terrace	55	61	59	45	37	44	34	40	46	56	66	77
S1	99 Strand Road	41	44	51		36	35	28	36		47	57	62
S2	Rockmills	51	48	50	42	29	40	28		49		45	61
AB1	63 Abercorn Road	35	49	42	43	43				67	46		69
AB2	8 Abercorn Road	45	40	42	41	39	33	29	26	47	34	47	55
TR1	1 Clooney Terrace											30	40
TR2	17 Duddy's Court											27	37

Table D2: Nitrogen dioxide diffusion tube results 2007 (µg/m^3)

Site Ref	Address	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
A1	Brooke Park AURN	18	21	14	14	16	8	8	19	13	25	19	22
A2		23	20	18	19	12	6	7	13	12	25	23	24
A3		19	24	19	13	9	8	11	11	16	26	21	21
C1	3 Creggan Rd	70	60	62	83	62	40	65	68	63	88	112	66
C2		57	57	80	54	54	32	47	61	69	76	97	66
C3	6 Marlborough Terrace	39	32	30	42	31	23	24	24	37	40	57	41
C4	22A Creggan Street	50	39	45	1	95	33	40	32	36	52	54	42
C5	10 Windsor Terrace	36	34	24	34	28	14	26	28	37	43	2	31
C6	14 Creggan Road	36	38	33	51	43	43	45	52	45	39	43	
D1	Dale's Corner automatic monitor	42	36	36		42	32	30	27	32	43	54	42
D2		39	33	28	37	33	27	30	22	22	41	56	33
D3		35	36	36	32	29	22	32	26	33	41	41	39
D4	52 Clooney Terrace	27	30	27	30	18	18	17	18	31	36	35	54
D5	5 Glendermott Road	50	45	52	53	43	42	55	61	49	61	83	1
F1	2 Farren Park	23	28	30	24	20	17	17	4	26	41	30	37
F2	3 Farren Park	34	32		36	22	16	19	23	18	44	39	33
F3	5 Farren Park	31	31	32	34	22	16	19	24	37	42	41	42
F4	9 Farren Park	29	30	23	11	20	9	14	12	25	36	33	34
P1	53 Messines Park	23	28	24	28	14	11	12	15	21	32	40	30
P2	57 Messines Park	31	38	26	37	22	28	20	16	31	41	36	36
P3	19 St Patricks Terrace	38	45	32	53	1	38	35	31	37	38	49	39
P4	5 Collon Terrace	42	48	49	46	41	20	26	39	37	53	61	49
S1	99 Strand Road	56	40	41	34			25	48	33	47	71	47
S2	Rockmills	36	47	27	36	26	24	24	25	30	47	43	
AB1	63 Abercorn Road						32	1			58	48	49
AB2	8 Abercorn Road						21	37	29	27	30	45	25

Table D3: Nitrogen dioxide diffusion tube results 2006 (µg/m^3)

Site Ref	Address	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
A1	Brooke Park AURN	23	19	18	9	9	5	5	6		16	19	23
A2		22	25	11	8	10	5	5	4		14	19	19
A3		18	10	15	11	12	5	5	3		16	20	18
C1	3 Creggan Rd	56	50	40	54	21	55	48	16		52	72	68
C2		39	24	40	56	34	49	41	27		55	5	70
C3	6 Marlborough Terrace	16	25	28	26	27	25	24	15		30	37	33
C4	22A Creggan Street	39	37	29	36	31	34	28	16		43	43	34
C5	10 Windsor Terrace	14	26	22	29	17	21	19	10		32	32	25
C6	14 Creggan Road	25	38	28	26	14	23	25	12		43	35	29
D1	Dale's Corner automatic monitor	26	24	29	28	19	21	28	9		30	45	33
D2		31	16	21	24	23	26	21	9		36	37	33
D3		32	32	17	24	10	20	27	8		33	53	40
D4	52 Clooney Terrace	32	18	11	16	15	11	18	8		30	27	24
D5	5 Glendermott Road	30	44	38	41	32	31	32	20		41	31	44
F1	2 Farren Park	24	24	21	12	15	19	14	10		32	28	32
F2	3 Farren Park	33	27	20	21	17	17	17	10		26	33	31
F3	5 Farren Park	27	25	21	22	17	11	22	9		22	20	25
F4	9 Farren Park	15	20	14	17	15	15	18	7		20	24	
P1	53 Messines Park	8	9	17	10	11	13	18	7		21	18	25
P2	57 Messines Park	18	18	30	13	19	25	29	11		25	24	28
P3	19 St Patricks Terrace	32	34	26	26	26	24	22	12		31	27	26
P4	5 Collon Terrace	17	15	29	40	29	28	35	14		39	49	49
S1	99 Strand Road	32	25	32	25	35	31		14		41	36	37
S2	Rockmills	39	31	25	9	25	22	27	6		32	21	48

Note: Lambeth Scientific used Jan-Aug 2006. Burea Veritas used Oct-Dec 2006