ENVIRONMENTAL HEALTH DEPARTMENT

AIR QUALITY REVIEW AND ASSESSMENT

October 2005

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Executive Summary

Since 1998 Limavady Borough Council has been reviewing and assessing air quality within the Borough. Initially a "desktop" assessment highlighted possible exceedences of three pollutants namely,

nitrogen dioxide (NO_2) – from traffic sources
sulphur dioxide (SO_2) – from the burning of solid/smokeless fuel, and,
particulate matter (PM_{10}) – from the burning of solid/smokeless fuel

Further modelling and monitoring of these pollutant levels has been conducted and data would suggest that the national air quality objectives for both sulphur dioxide and particulate matter will be achieved. It is intended that this local continuous data will be used to validate dispersion modelling carried out in 2004.

Monitoring of nitrogen dioxide concentrations would suggest that traffic emissions within one small area of Dungiven are contributing to elevated levels of nitrogen dioxide. One diffusion tube which had been located at the junction of the main A6 and B68 roads indicated elevated levels of nitrogen dioxide. The tube was placed at the façade of dwellings which are close to the roadside. Council would now propose declaring an air quality management area (AQMA) within this area. Further monitoring will be carried out within this area. This study would involve the exposure of several sets of tubes at the facades of dwellings adjacent to the road over a period of twelve months.

With regard to the other pollutants update screening and assessment will be conducted to ensure that concentrations do not exceed those set out in the air quality objectives.

Introduction

Following agreement on a Common Position on the Air Quality Daughter Directives (AQDD), in June 1998 at the European Union Environment Council, the government published its proposals for a review of the National Air Quality Strategy (in 1999). Subsequently the Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in January 2000.

The Environment (NI) Order came into operation in January 2003 and implements both the European Air Framework Directive 96/62EC and the UK Air Quality Strategy. The Expert Panel on Air Quality Standards (EPAQS) has proposed new national air quality standards for the UK. The Environment (NI) Order 2002 provides the framework for district councils to review air quality and for implementation of an Air Quality Management Area (AQMA) if required. It was issued by the Department of the Environment in Northern Ireland under Article 16 of the Environment (NI) Order 2002. Under article 16 of the order, District Councils and other relevant authorities are required to have regard to this guidance when carrying out any of their duties under, or by virtue of Part III of the order. The guidance the document sets out is outlined in Table 1 below.

Table 1: NI Environment Order 2002 key guidance:

- The statutory background and the legislative framework within which relevant authorities have to work
- The new principles behind reviews and assessments of air quality up to 2010 and the recommended steps that relevant authorities should take
- The timetable for reviews and assessments up to 2010
- How district councils should handle the designation of Air Quality Management Areas (AQMA)
- How relevant authorities should handle the drawing up and implementation of action plans
- Recommendations and suggestions on taking forward the development of local and regional air quality strategies
- Suggestions of how relevant authorities should consult and liaise with others
- Local transport measures which Roads Service might wish to consider
- The general principles behind air quality and land use planning; and
- How enforcing authorities should use powers of entry under Article 19 of the Order

Overview of the principles and main elements of the National Air Quality Strategy

The main elements of the Air Quality Strategy can be summarised as follows:

- The use of a health effects based approach using national air quality standards and objectives.
- The use of policies by which the objectives can be achieved and which include the input of important actors such as industry, transportation bodies and local authorities.
- The predetermination of timescales with target dates of 2003, 2004, 2005, 2008 and 2010 for the achievement of objectives and a commitment to review the Strategy every three years.

It is intended that the air quality strategy will provide a framework for the improvement of air quality that is both clear and workable. In order to achieve this, the Strategy is based on several principles which include:

- the provision of a statement of the Government's general aims regarding air quality;
- clear and measurable targets;
- a balance between local and national action and
- a transparent and flexible framework.

Co-operation and participation by different economic and governmental sectors is also encouraged within the context of existing and potential future international policy commitments.

National Air Quality Standards

At the centre of the air quality strategy is the use of national air quality standards to enable air quality to be measured and assessed. These also provide the means by which objectives and timescales for the achievement of objectives can be set. Most of the proposed standards have been based on the available information concerning the health effects resulting from different ambient concentrations of selected pollutants and are the consensus view of medical experts on the Expert Panel on Air Quality Standards (EPAQS). These standards and associated specific objectives to be achieved between 2003 and 2010 are shown in Table 2. The table shows the standards in $\mu g\ m^{-3}$ with the number of exceedences that are permitted (where applicable).

Specific objectives relate either to achieving the full standard or, where use has been made of a short averaging period, objectives are sometimes expressed in terms of percentile compliance. The use of percentiles means that a limited number of exceedences of the air quality standard over a particular timescale, usually a year, are permitted. This is to account for unusual meteorological conditions or particular events such as Halloween. For example, if an objective is to be complied with at the 99.9th percentile, then 99.9% of measurements at each location must be at or below the level specified.

Table 2 Air Quality Objectives

Pollutant	Objective Concentration	Measured as	To be achieved by
Benzene	16.25$\mu g/m^3$ (5ppb)	running annual mean	31 December 2003
1,3-Butadiene	2.25$\mu g/m^3$ (1ppb)	running annual mean	31 December 2003
Carbon monoxide	11.6$\mu g/m^3$ (10ppm)	running 8 hour mean	31 December 2003
Lead	0.5$\mu g/m^3$	annual mean	31 December 2004
	0.25$\mu g/m^3$	annual mean	31 December 2008
Nitrogen dioxide	200µg/m^3 (105ppb) not to be exceeded more than 18 times a year	1 hour mean	31 December 2005
	40$\mu g/m^3$ (21ppb)	annual mean	31 December 2005
Particles (PM_{10})	50$\mu g/m^3$ not to be exceeded more than 35 times a year	24 hour mean	31 December 2004
	40$\mu g/m^3$	annual mean	31 December 2004
Sulphur dioxide	350$\mu g/m^3$ (132ppb) not to be exceeded more than 24 times a year	1 hour mean	31 December 2004
	125$\mu g/m^3$ (47ppb) not to be exceeded more than 3 times a year	24 hour mean	31 December 2004
	226$\mu g/m^3$ (100ppb) not to be exceeded more than 35 times a year	15 minute mean	31 December 2005

A first stage review and assessment was carried out by Council in 2000 in accordance with LAQM Technical Guidance document TG4(00). This guidance set out how Councils should assess each of these pollutants and their potential sources to determine if exceedences were likely to occur.

This initial assessment highlighted possible exceedences of the nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and particulate matter (PM_{10}) thresholds. In light of these findings further assessment was required to establish if significant levels of pollutants were present in the vicinity of relevant locations. For the year April 2004- March 2005 the following objectives were set:

- Locate passive diffusion tubes within Limavady Borough to monitor NO_2 levels at two locations which would appear to have pollutant levels at or above the objective level set.
- Carry out dispersion modelling to assess if elevated PM_{10} levels within one area of Limavady exist and in light of these findings carry out continuous monitoring of this pollutant over a six month winter period.

Nitrogen Dioxide and Particulate Matter emissions from traffic

The initial assessment suggested that traffic volumes at various locations within the borough may be contributing to elevated levels of NO_2 and PM_{10}. To establish if this was indeed the case modelling and monitoring were carried out. Council commissioned a DMRB assessment which was carried out on its behalf by NETCEN and passive diffusion tubes were sited at various locations throughout the Borough in close proximity to roads where daily traffic flows exceeded 10000 vehicles per day.

The DMRB assessment concluded that the strategy objectives for nitrogen dioxide would be achieved by 2005 within Limavady Borough. Emissions arising from road transport were not predicted to cause exceedances. It was therefore recommended that a Stage 3 Review and Assessment was not necessary for this pollutant. With regard to particulate matter (PM_{10}) emissions from traffic were not envisaged to cause an exceedence of the PM_{10} objectives in 2004 and in view of this it was felt that a stage 3 review and assessment was not required for this pollutant.

However with regard to nitrogen dioxide, monitoring suggested otherwise. Of the eight sites where monitoring was carried out over a twelve month period three were found to have levels impinging on the annual mean level of $40\mu g/m^3$ .These results are documented in Appendix 1.

It was decided that whilst the monitoring data conflicted with the findings of the DMRB assessment further monitoring of nitrogen dioxide levels should be undertaken.

A further five passive diffusion tubes were installed at locations throughout the Borough where previous monitoring had indicated possible exceedences of the NO_2 annual mean threshold i.e. Main Street, Dungiven and Irish Green Street, Limavady A further three tubes were located at Derry City Councils NO_2 monitor for the purposes of collocation. A ninth tube was not exposed and was used as a control. Tubes 1, 2 and 3 were all placed at the facades of buildings occupied by relevant locations. Tubes 4 and 8 were used to

measure background concentrations. The locations of these monitoring sites are listed in Table 3.

Table 3: Locations of diffusion tubes

Tube number	Location
1	Junction of Irish Green Street / Connell Street, Limavady
2	Junction of Main Street / Ballyquin Road Dungiven
3	Junction of Main Street / Garvagh Road, Limavady
4	Recreation Centre, Dungiven
5	Collocated - Dale's Corner, Derry
6	Collocated - Dale's Corner, Derry
7	Collocated - Dale's Corner, Derry
8	Council Car Park, Connell Street, Limavady
9	Control- not exposed

Monitoring was carried out over a six - month period from June 2004 until December 2004. The results of this monitoring can be seen in Table 4 below.

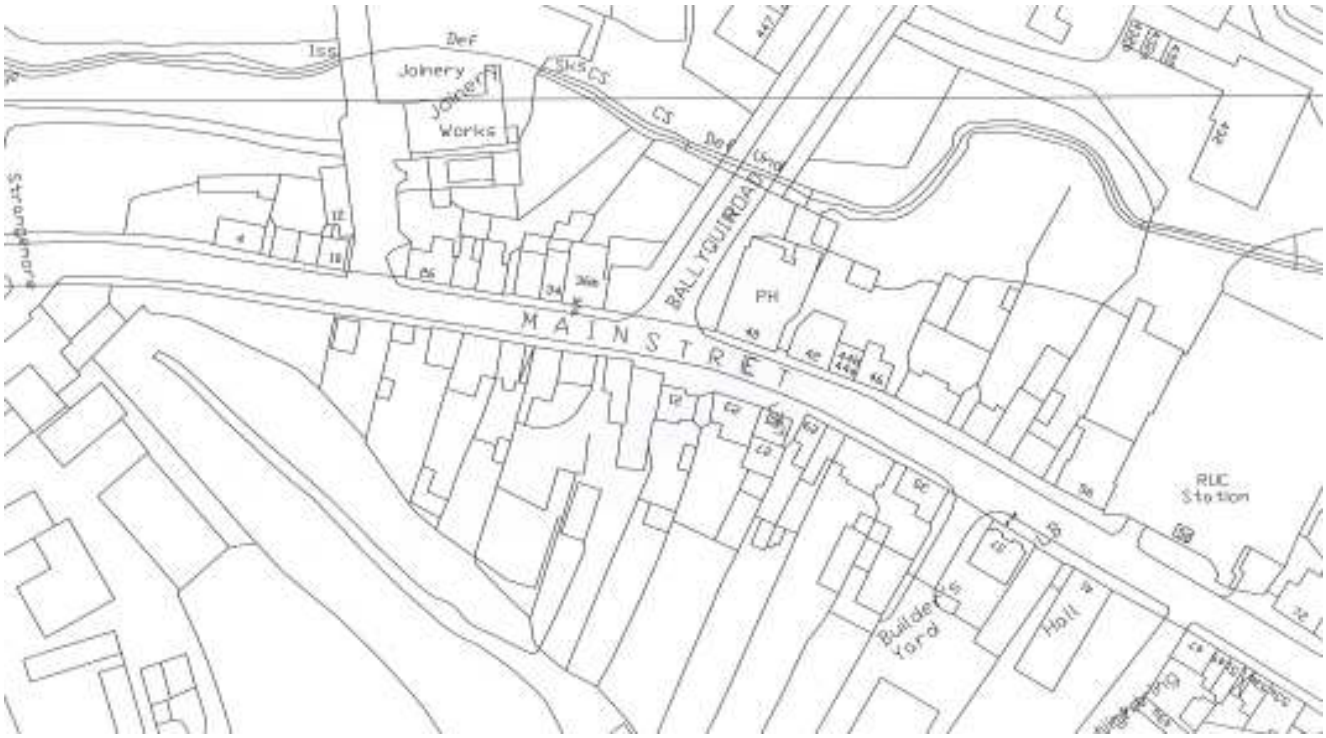
Table 4 Results of Nitrogen Dioxide Monitoring using Passive Diffusion tubes

Location	Tube No	July	August	September	October	November	December
Irish Green St Limavady	1	25.77	33.11	-	33.75	-	28.61
Main St Dungiven	2	40.93	41.58	-	54.31	59.25	41.40
Main St Dungiven	3	31.79	22.39	-	37.27	37.63	31.71
Recreation Centre Dungiven	4	6.06	9.34	-	-	7.53	6.75
Collocation tube Derry	5	15.66	35.66	-	37.49	35.48	37.55
Collocation tube Derry	6	21.73	32.01	-	40.13	36.56	39.62
Collocation tube Derry	7	27.79	30.13	-	39.51	29.03	34.61
Connell St Limavady	8	7.04	9.30	-		13.72	12.14
	9	-	-	-	-	-	-

* all figures in ug/m^3
- indicates missing tube
** bias as stated in University of West England website www.uwe.ac.uk/aqm/review/links.html (overall factor 0.95 (2004 data) Gradko 20%TEA in water).

Passive diffusion tubes located at site 2 at the lower end of Main Street Dungiven have shown elevated levels of nitrogen dioxide. The tube was located next to the façade of a dwelling and there are several others dwellings in this vicinity. This area is shown on map 1 below.

Map1: Lower Main Street Dungiven



As can be seen the Ballyquin Road converges in this locality with Main Street. Main Street forms part of the main road between Belfast and Londonderry and there is no alternate route for traffic to use through this village. At this lower end of Main Street dwellings are within 1 metre of the kerbside. Traffic volumes can become heavy throughout the day and traffic may idle whilst waiting to emerge from Ballyquin Road onto Main Street and *vice versa*. Photographs 1-4 in Appendix 2 show this area.

Sulphur Dioxide and Particulate Matter

The technical guidance stated that where the burning of solid/smokeless fuel in domestic premises exceeded 300 properties per $1km^2$ levels of these pollutants were likely to exceed the national air quality objective levels as detailed in Table 2. Revised technical guidance which was issued in 2003 stated that this exceedence may occur where densities of coal/ smokeless fuel burning properties were greater than 50 in a 500m x 500m area.

To establish if the burning of such fuels was contributing to elevated levels of these pollutants a fuel use survey was carried out within three residential areas of the Borough, two within Limavady town itself and a third in Dungiven. The fuel use survey results indicated that these objective levels may be exceeded in one residential area of Limavady town. The findings of this survey are detailed below. Table 5 details responses received and the fuel use is documented in the summary below

Table 5: Fuel use survey – response data

Area No.	Area	Area Density	Sample (25%)	Target Response rate	Achieved rate	Not at home/ refused
1	Limavady	1471	368	276	276	518
2	Limavady	663	166	126	128	290
3	Dungiven	841	210	158	164	389
	Total	2975	744	560	568	1197

Summary of Results

Area 1: Limavady

- 29% of households surveyed within this area used coal/ solid fuel as their primary fuel. This equates to approximately 426 households over the whole of area 1.
- 66% of dwellings used oil and,
- the remaining 5% used electricity

Area 2: Limavady

- 5% of dwellings used solid/smokeless fuel as their primary source of heating which equates to only 31 dwellings in the entire 1km x 1km area.
- 93% of properties used oil as their primary heating source, and
- 2% used electricity

Area 3: Dungiven

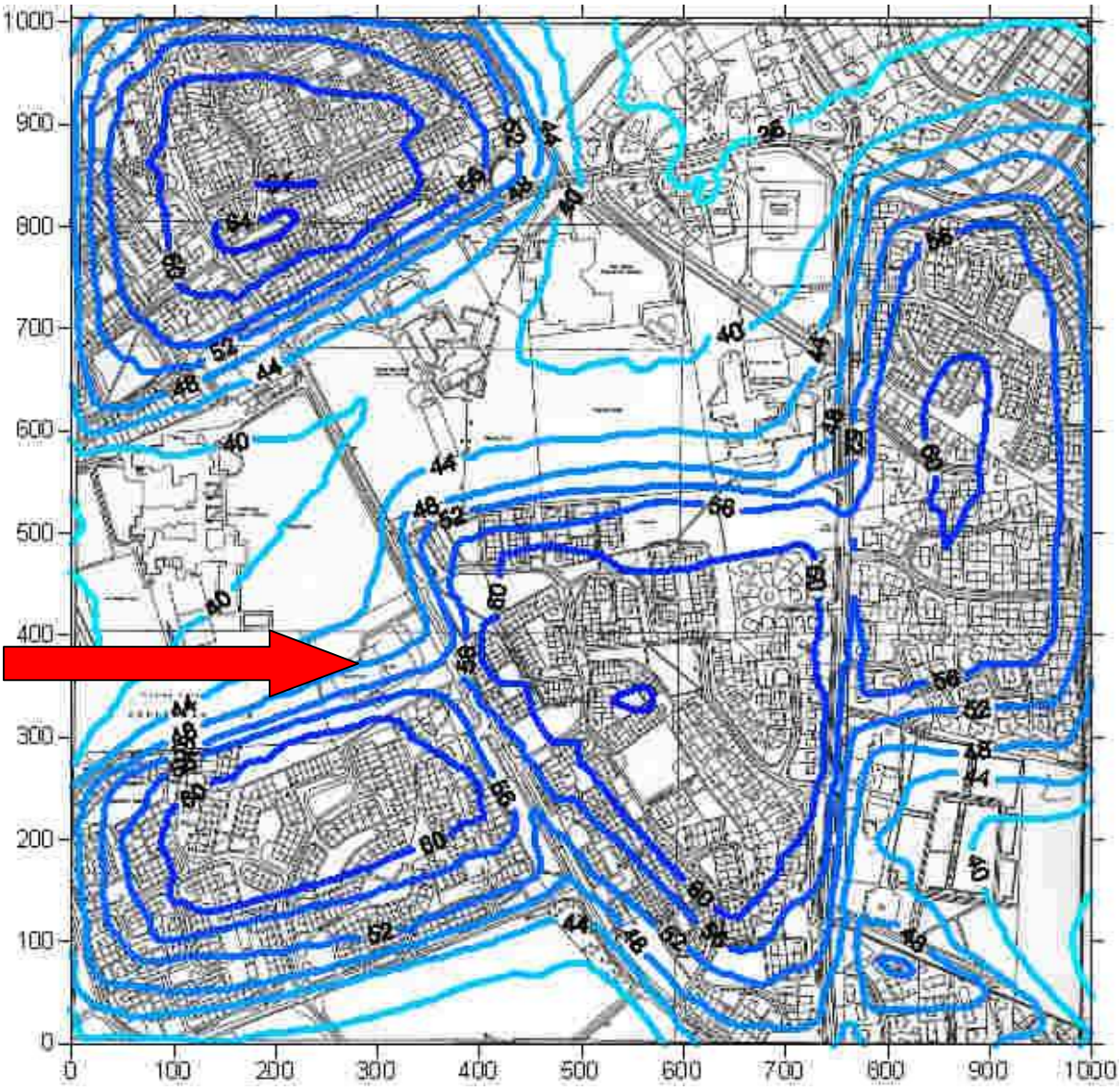
- 87% of dwellings used oil as their primary source of fuel
- 13% used coal/ smokeless fuel as their main means of heating. This equates to approximately 108 dwellings in the area burning coal or smokeless fuel.

On the basis of primary fuel use only it was evident that the thresholds as set out in the technical guidance were possibly exceeded in two areas, namely area 1 in Limavady and area 3 in Dungiven. With this guidance in mind it was felt that dispersion modelling for SO_2 and PM_{10} should be undertaken within area 1 in Limavady and in area 3 in Dungiven. This modelling would predict pollutant concentrations for 2005.

Dispersion Modelling: Results

Dispersion modelling suggested that whilst SO_2 levels were unlikely to be significant in either area examined PM_{10} levels were likely to exceed the stated thresholds within the Limavady area. In light of these results continuous monitoring was proposed. A suitable location within this area was selected and a TEOM continuous monitor was installed to monitor pollutant levels over a six month winter period when consumption of solid/smokeless fuel is potentially at its greatest. Figure 1 below shows the monitors location with respect to predicted 90.4 percentile daily mean PM_{10} concentrations within the one area of Limavady where exceedences were envisaged. Figure 2 shows it in-situ.

Figure 1 – Map of predicted 90.4 percentile daily mean PM_{10} concentrations for the Limavady grid (model results corrected for bias using monitoring data from Strabane in 1999) and location of PM_{10} monitor



(The red arrow indicates the TEOM's location within the 1km^2 area)

Figure 2: TEOM continuous PM_{10} monitor, Civic amenity site, Ballyquin Road, Limavady

Monitoring commenced on 7 October 2004 and continued until 11 April 2005. NETCEN was commissioned by council to provide QA/QC and data management.

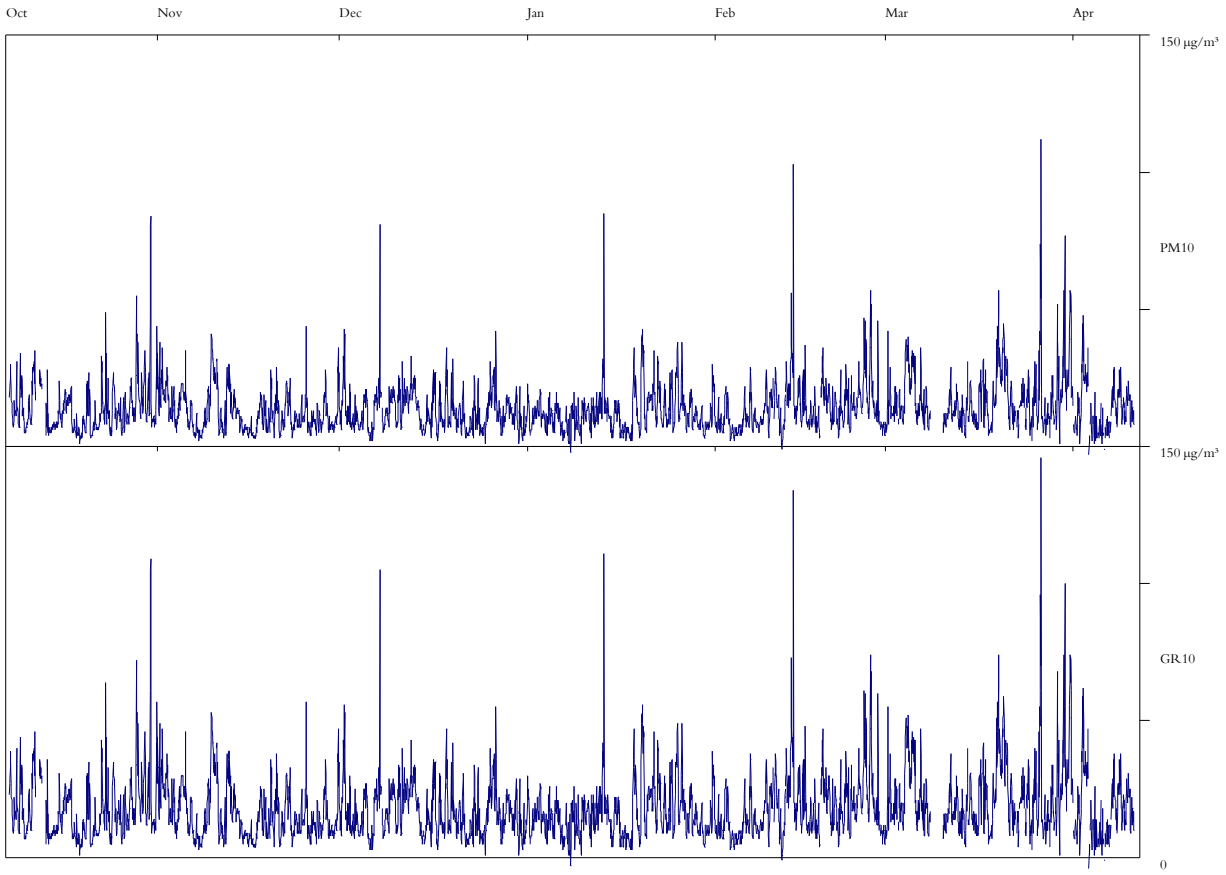
Results of continuous PM10 monitoring (Oct 2004 – April 2005)

POLLUTANT	PM_{10}	GR_{10}*
Number Very High	0	-
Number High	0	-
Number Moderate	0	-
Number Low	4331	-
Maximum 15-minute mean	194 µg m^{-3}	252 µg m^{-3}
Maximum hourly mean	112 µg m^{-3}	146 µg m^{-3}
Maximum running 8-hour mean	53 µg m^{-3}	69 µg m^{-3}
Maximum running 24-hour mean	35 µg m^{-3}	45 µg m^{-3}
Maximum daily mean	32 µg m^{-3}	42 µg m^{-3}
Average	14 µg m^{-3}	18 µg m^{-3}
Data capture	96.0 %	96.0 %

* GR_{10} in gravimetric units
All mass units are at 20'C and 1013mb

Pollutant	Air Quality Regulations (Northern Ireland) 2003	Exceedences	Days
PM_{10} Particulate Matter (Gravimetric)	Daily mean > 50 µg m^{-3}	0	0
PM_{10} Particulate Matter (Gravimetric)	Annual mean > 40 µg m^{-3}	0	-

Hourly Mean Data for 07 October 2004 to 11 April 2005



New Developments

There have been no new developments within the Borough which will impact on the pollutants considered. There has been no significant development within the areas considered and it is unlikely that there will be in the near future. There have been no new "permitted" processes which would fall under the Industrial Pollution Prevention and Control regime and there has been no substantial change to any existing ones. Council will however continue to monitor the situation and note any proposals for such development.

Expenditure

Total expenditure for this work totalled £5754. This covered the following:

- QA/QC for PM_{10} monitor £2212.50
- Purchase and analysis of NO_2 tubes £282
- PM_{10} relocation costs £468
- NIE link up £63.90
- Staff costs £2727.28

Conclusions

Extensive monitoring/modelling of nitrogen dioxide, particulate matter and sulphur dioxide levels have now been undertaken. Results of would suggest the following:

- The burning of solid/smokeless fuel in domestic premises is not producing elevated levels of particulate matter or sulphur dioxide within residential areas in the Borough. The one area highlighted by the dispersion modelling as having potentially elevated levels has been shown to have levels which fall below both national air quality objective limits. No exceedences of either the 24-hour mean or annual mean thresholds were observed. Sulphur dioxide levels are well within the objective levels also. The data obtained from the continuous monitoring will be used to validate the dispersion modelling carried out previously in 2004.

- With regard to nitrogen dioxide levels from traffic one area where an exceedence of the 24-hour mean has occurred has been identified. Passive diffusion tubes located at site 2 (Lower Main Street, Dungiven) have indicated exceedences of the annual mean threshold of 40μg/m^3. In view of these findings an AQMA will be declared for this area and a period of consultation will be undertaken. An action plan will be developed and further monitoring will be undertaken.

APPENDIX 1

Appendix 1: Results of analysis of NO_2 Passive diffusion monitoring (March 2002 – December 2003)

Year	Month	Tube 1	Tube 2	Tube 3	Tube 4	Tube 5	Tube 6	Tube 7	Tube8
2002	March - April	-	-	-	-	40.41	14.01	-	31.79
	April - May	35.38	30.18	17.67	-	38.45	-	-	33.30
	May - June	-	-	-	27.54	40.67	20.02	-	20.59
	June - July	-	-	-	25.08	36.91	24.20	15.00	37.15
	July- Aug	29.69	26.45	-	26.92	42.59	-	15.07	22.50
	Aug - Sept	40.05	44.50	20.88	32.37	47.86	28.61	19.83	46.27
	Sept - Oct	44.96	34.37	12.40	21.48	37.51	32.83	20.24	21.01
	Oct	38.93	38.93	-	26.50	-	28.31	18.90	-
	Nov - Dec	46.05	39.83	19.50	32.33	-	34.89	24.89	51.09
2003	Jan - Feb	33.49	32.82	11.39	26.12	48.14	25.41	19.39	43.46
	Feb - March	42.82	40.50	24.27	32.35	46.29	45.71	-	53.65
	March - April	35.02	37.41	14.24	27.10	39.24	24.50	-	-
	April - May	50.19	51.34	17.28	36.87	-	28.84	-	51.34
	May- June	36.59	34.64	15.61	26.35	44.40	20.49	18.54	35.62
	June- July	32.26	42.05	16.70	28.23	-	21.86	43.71	16.70
	July - Aug	39.60	33.86	-	-	-	-	18.23	37.51
	Aug- Sept	38.86	37.26	21.25	29.82	-	18.11	21.30	38.81
	Sept - Oct	40.16	37.22	17.95	30.21	-	21.02	21.02	-
	Oct - Nov	46.97	44.00	19.03	35.68	-	29.73	26.16	45.79
	Nov - Dec	42.01	46.81	14.40	28.21	-	27.01	23.41	45.01

* all figures in ug/m^3
- indicates missing tube

Annual mean concentrations of NO_2

Tube	1	2	3	4	5	6	7	8
Annual mean	36.8	39.81	17.42	30.29	44.5	27.05	24.07	41.89

* All figures in ug/m^3

Tube locations are stated below:

TUBE	LOCATION
No: 1	Junction of Ballyquin Road / Main Street Dungiven
No: 2	Junction of Garvagh Road / Main Street Dungiven
No: 3	Clooney Road Greysteel
No: 4	Main Street Ballykelly
No: 5	Linenhall Street Limavady
No: 6	Junction of Broad Road / Scroggy Road
No: 7	Greystone Road roundabout
No: 8	Junction of Irish Green Street / Connell Street, Limavady
No: 9	Blank

APPENDIX 2

Photograph 1: Illustrating proximity of dwellings on Main Street to road side.

Photograph 2: Junction of Ballyquin Road/Main Street, Dungiven.

Photograph 3: Proximity of dwellings to road.

Photograph 4: Proximity of dwellings to road.