# Air Quality Progress Report 2005

Larne Borough Council

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## EXECUTIVE SUMMARY

Local air quality management was introduced by the first air quality strategy in 1997. Following review the UK National Air Quality Strategy was published in 2000, with the aim of improving air quality in the UK.

Local authorities have a major role in this process, which was formalised as a statutory duty in the Environment (Northern Ireland) Order 2002.

The first stage of Larne Borough Council's review and assessment of air quality, which identified the main sources of seven key air pollutants, was published in July 2001.

This was followed by the Second and Third Stage Review and Assessment, published in June 2004, which further scrutinised three pollutants which were potentially of concern, namely nitrogen dioxide, sulphur dioxide and particulates. The Second and Third Stage Report concluded that it was unlikely that the air quality objectives would be exceeded and it was not necessary for Larne Borough Council to declare any Air Quality Management Areas.

This Progress Report essentially brings air quality work up to date by determining whether air quality objectives continue to be met in Larne Borough and will identify if any further measures are required to improve air quality.

Since the last round of review and assessment there have been no new local developments that would have a significant, detrimental effect on air quality. Assessment of recent monitoring data indicates that the air quality standards set by Government for nitrogen dioxide, sulphur dioxide and particulate matter continue to be met. Consequently, it will not be necessary for Larne Borough Council to declare any Air Quality Management Areas.

The next round of air quality reviews and assessments will be carried out in two steps. These steps will be an Updating and Screening Assessment followed by a Detailed Assessment to be completed no later than 2007.

## 1. INTRODUCTION

The UK National Air Quality Strategy was published in 2000 and detailed the Government's plans to improve ambient air quality in the UK. The Environment (Northern Ireland) Order 2002 formalised the statutory duty for district councils in Northern Ireland to review and assess air quality within their district and designate air quality management areas where air quality objectives are likely to be exceeded.

**Table 1 Air Quality Objectives for the purpose of Local Air Quality Management**

| Pollutant | Air Quality Objective | | Date to be Achieved By |
|---|---|---|---|
| | **Concentration** [1] | **Measured As** | |
| Benzene | 16.25 µg/m$^3$ (5ppb)<br>3.25 µg/m$^3$ | Running annual mean<br>Running annual mean | 31.12 2003<br>31.12.2010 |
| 1,3 Butadiene | 2.25 µg/m$^3$ 1ppb) | Running annual mean | 31.12.2003 |
| Carbon monoxide | 10 mg/m$^3$ | Maximum daily running 8-hour mean | 31.12.2003 |
| Lead | 0.5 µg/m$^3$<br>0.25 µg/m$^3$ | Annual mean<br>Annual mean | 31.12.2004<br>31.12.2008 |
| Nitrogen dioxide[1] | 200 µg/m$^3$ (105ppb) Not to be exceeded more than 18 times a year<br><br>40 µg/m$^3$ (21ppb) | 1 hour mean<br><br>Annual mean | 31.12.2005<br><br>31.12.2005 |
| Particles ($PM_{10}$)[2] | 50 µg/m$^3$ (gravimetric) not be exceeded more than 35 times a year<br><br>40 µg/m$^3$ (gravimetric) | 24 hour mean<br><br>Annual mean | 31.12.2004<br><br>31.12.2004 |
| Sulphur dioxide | 350 µg/m$^3$ (132ppb) not to be exceeded more than 24 times a year<br><br>125 µg/m$^3$ (47ppb) not to be exceeded more than 3 times a year<br><br>266 µg/m$^3$ (100ppb) not to be exceeded more than 35 times a year | 1 hour mean<br><br>24 hour mean<br><br>15 minute mean | 31.12.2004<br><br>31.12.2004<br><br>31.12.2005 |
| 1. The objectives for nitrogen dioxide are provisional<br>2. $PM_{10}$ measured using the European gravimetric transfer sampler or equivalent. | | | |

The purpose of review and assessment is to ascertain the quality of air within the borough with respect to seven pollutants known to be the cause of certain health effects, which are summarised over page in table 2.

**Table 2 Pollutant Health Effects**

| Pollutant | Main Sources | Health Effects |
|---|---|---|
| Benzene | Combustion and distribution of petrol | Genotoxic human carcinogen (leukaemia) |
| 1,3-Butadiene | Combustion of petrol | Genotoxic human carcinogen (lymphomas and leukaemia's) |
| Carbon Monoxide | Incomplete combustion of carbon containing fuels (mainly petrol engined vehicles) | Formation of carboxyhaemoglobin, reducing the capacity of the blood to carry oxygen |
| Lead | Industrial applications. Use of leaded petrol. | Toxic. Can cause problems in synthesis of haemoglobin, effects on kidneys, gastrointestinal tract, joints and reproductive systems. Acute or chronic damage to nervous system. |
| Nitrogen Dioxide | All combustion processes including road transport | Can cause inflammation of the airways at high concentrations. Enhances the response to allergens in sensitive individuals |
| Particulate Matter ($PM_{10}$) | Primary particles from combustion sources (mainly road traffic & residential coal burning). Secondary particles formed by chemical reactions in the atmosphere (mainly sulphates and nitrates). Coarse particles, eg suspended soils/dusts/sea salt | Affects respiratory and cardiovascular systems. Particularly significant for those with pre-existing lung or heart disease |
| Sulphur Dioxide | Combustion of sulphur containing fossil fuels, principally coal and heavy oils | Causes constriction of the airway. Particularly affects those suffering from asthma or chronic lung disease |

To date the review and assessment process took a three- stage approach, whereby each stage increased in detail and complexity. The first stage of the process was a desktop exercise which involved the compilation of data on emissions from transport, industrial and domestic sources and assessing the likelihood of air quality objectives being breached.

On completion of this stage, pollutants, which were unlikely to exceed the objectives, could be excluded from any further scrutiny. The remaining pollutants were then assessed at the second and third stages of the process using more sophisticated screening techniques including monitoring, air pollution dispersion modelling and predictions.

If, on completion of the third stage review and assessment it appeared that any air quality objectives were not likely to be achieved in a local authority's district then the area affected **must**, by order, have been designated as an Air Quality Management Area (AQMA).

Once on AQMA has been declared the local authority is required to carry out a further assessment of existing and likely future air quality and the respects in which it appears the objectives are not likely to be achieved. The local authority must then prepare a written action plan within 12 months with a view to achievement of the air quality objectives detailing related timescales.

The first stage review and assessment report for Larne Borough Council, completed in July 2001, concluded that the air quality objectives for benzene, 1,3-butadiene, carbon monoxide and lead were likely to be achieved at all locations in Larne by the end of 2005, however the pollutants nitrogen dioxide, sulphur dioxide and particulate matter required further scrutiny at the second and third stage.

The second and third stage review and assessment report completed in June 2004, concluded that no exceedance of nitrogen dioxide, sulphur dioxide or particulate matter objectives were likely. Therefore

there was no need for any Air Quality Management Areas (AQMA) to be declared anywhere in Larne Borough.

The next round of air quality review and assessments will be carried out in two steps instead of the previous three-staged approach:

- An Updating and Screening Assessment for identifying those aspects that have changed since the last review and assessment which might lead to a risk of an air quality objective being exceeded
- A Detailed Assessment to provide an accurate assessment of the likelihood of an air quality objective being exceeded at locations with relevant exposure.

Air Quality Progress reports are required in years when District Council is not carrying out an Updating and Screening Assessment or a Detailed Assessment. The timetable for future air quality is shown below:

**Table 3 Timetable for Progress Reports within Review and Assessment System**

| LAQM Activity | Completion Date | Which Authorities? |
|---|---|---|
| Progress Report | April 2005 | All District Councils |
| Updating and Screening Assessment | April 2006 | All District Councils |
| Detailed Assessment | April 2007 | Those District Councils which have identified the need for one in their April 2006 updating and screening assessment. |
| Progress Report | April 2007 | Those District Councils which identified that there was **no** need for a detailed assessment in their April 2006 updating and screening assessment. |
| Progress Report | April 2008 | All District Councils |
| Updating and Screening Assessment | April 2009 | All District Councils |
| Detailed Assessment | April 2010 | Those District Councils which have identified the need for one in their April 2009 updating and screening assessment. |
| Progress Report | April 2010 | Those District Councils which identified that there was **no** need for a detailed assessment in their April 2009 updating and screening assessment. |

## 1.1 Purpose of the Progress Report

The purpose of a Progress Report is to ensure the continuity of the Local Air Quality Management (LAQM) process and to assist local authorities by:

- helping retain a profile for Local Air Quality Management within the council.
- providing a means for communicating air quality information to members and the public.
- maximising the usefulness and interpretation of the monitoring effort being carried out by the Council.
- maximising the value of the investment in monitoring equipment.

- making the next round of review and assessment easier, as there will be a readily available up to date source of information.
- helping Council respond to requests for up to date information on air quality.
- providing information to assist in other policy areas, such as transport and land use planning.
- providing a ready source of information on air quality for developers carrying out environmental assessments for new schemes.
- demonstrating progress with implementation of air quality Action Plans and/or air quality strategies.
- providing a timely indication of the need for further measures to improve air quality, rather than delaying until the next full round of review and assessment

This progress report covers the period from January 2004 to March 2005. To be most meaningful this report should be read in conjunction with Larne Borough Councils First Stage Review and Assessment of Air Quality (July 2001) and Second and Third Stage Review and Assessment of Air Quality (June 2004).

## 2. NEW MONITORING RESULTS

### 2.1 Air Quality Monitoring

The following pollutants are monitored within the Borough of Larne:

(i) nitrogen dioxide
(ii) sulphur dioxide
(iii) particulate matter

### 2.2 Monitoring of Nitrogen Dioxide

The air quality objective for Nitrogen Dioxide ($NO_2$) to be achieved by 31 December 2005 is a 1 hour mean of 200$\mu g/m^3$ not to be exceeded more than 18 times a year and an annual mean of not more than 40$\mu g/m^3$.

Larne Borough Council monitors monthly average concentrations of $NO_2$ using passive diffusion tubes located at 8 relevant sites including adjacent to Ballylumford Power Station as well as at roadsides. See Appendix 4 – Map 1 for location of diffusion tubes.

A passive diffusion tube is a clear plastic tube open at one end with the closed end containing an absorbent for the gas, in this case $NO_2$, to be monitored. See figure 1 below. Each tube is exposed for one month, resealed and then returned to the laboratory for analysis. Analysis was carried out by Lambeth Scientific Services, a UKAS accredited laboratory. Their trained staff operate rigorous quality control to UKAS standards ensuring the integrity of all results. The average ambient $NO_2$ concentration over the month is subsequently reported in $\mu g/m^3$ and ppb.

Diffusion tubes are subject to variance and bias (over read or under read) based on the methods of preparation and analysis by individual laboratories. A number of studies are carried out each year on $NO_2$ tubes prepared and analysed by Lambeth Scientific Services to determine, bias adjustment. The most studies (eight) were carried out in 2002 giving a bias of 1.15 compared to concentrations obtained from co-located automatic analysers. This was also the highest bias adjustment found since 2000 and therefore will give a worst-case scenario results. A bias factor of 1.15 has therefore been applied to the measured result to take account of the variance.

In accordance with GB Government Guidance LAQM TG(03) where measured data has been collected the concentrations will need to be adjusted for the relevant year. The projected annual average $NO_2$ concentration for 2005 has been derived using the correction factors detailed in the technical guidance.

Lambeth Scientific Services have advised that exceedance of the 105 ppb (200$ug/m^3$) 1 hour mean standard is likely if the annual mean concentration exceeds 21 ppb (40$ug/m^3$). This is applied only to the annual average concentration and not on month-by-month diffusion tube measurement. Defra guidance states that the 60 $ug/m^3$ annual mean can be used as an adequate proxy for the hourly mean objective (200$ug/m^3$). The annual average concentrations for 2004 from available data and projected concentrations for 2005 are shown in Table 4 over page. All available monthly results are summarised in Appendix 1.

**Figure 1 Nitrogen Dioxide Diffusion Tube**

**Results**

**Table 4 Annual Average $NO_2$ Concentrations Measured 2004**

| Location | Data Capture % | Average Measured 2004 $NO_2$ (ppb) | Annual Average 2004 $NO_2$ concentration (ppb) Corrected for bias | Annual Average 2004 $NO_2$ concentration ($\mu g/m^3$) Corrected for bias | Projection for 2005 Annual Average $NO_2$ concentration ($\mu g/m^3$) |
|---|---|---|---|---|---|
| Antiville Road/A8 junction | 83.3 | 11.7 | 13.46 | 25.71 | 25.06 |
| Riverdale | 83.3 | 8.7 | 10.01 | 19.12 | 18.64 |
| Main Street | 75 | 8.33 | 9.58 | 18.29 | 17.83 |
| Victoria Road / Agnew St junction | 83.3 | 12.4 | 14.26 | 27.24 | 26.56 |
| Upper Cairncastle Road | 91.2 | 9.45 | 10.87 | 20.76 | 20.24 |
| Larne Harbour Roundabout | 91.2 | 8.73 | 10.04 | 19.18 | 18.69 |
| Coastguard Road | 91.2 | 5.27 | 6.06 | 11.57 | 11.28 |
| Ballylumford Road, Islandmagee | 83.3 | 7 | 8.05 | 15.38 | 14.99 |

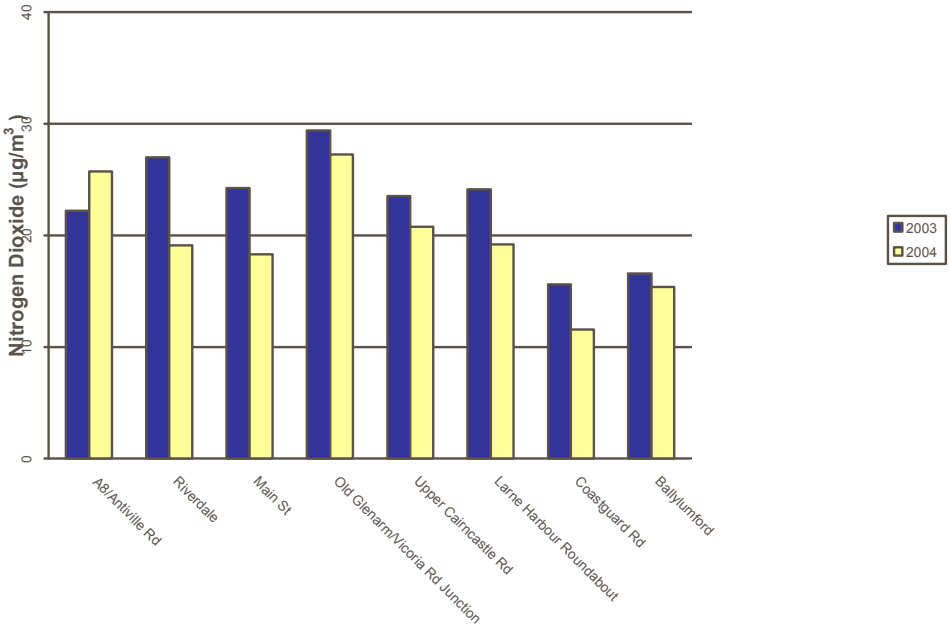
**Conclusion**

The levels measured by the diffusion tubes in 2004 did not exceed the objective for nitrogen dioxide of 21 ppb ($40\mu g/m^3$) and therefore the areas monitored are predicted to remain within the nitrogen dioxide objectives for 2005.

### 2.2.1 Comparison of Measured $NO_2$ Concentrations 2003-2004

The figure over page compares the annual average $NO_2$ concentrations obtained from the diffusion tubes during 2003 and 2004 at each monitoring site.

**Figure 2 Comparison of Measured $NO_2$ Concentrations 2003-2004**




The chart shows that in all locations with the exception of the A8/Antiville Road junction the average concentrations of $NO_2$ had fallen in 2004. The road layout at this junction changed at the end of 2003, which may account for the increase. Further detail on the road alterations are contained in section 3.3 of this report. Two years is too short a monitoring period to establish a meaningful trend. A trend would only be considered significant when supported with at least five years of monitoring data.

## 2.3 Monitoring Of Sulphur Dioxide

The air quality objective for sulphur dioxide ($SO_2$) to be achieved by 31 December 2004 is a 1 hour mean of 350$\mu g/m^3$ not to be exceeded more than 24 times per year and an 24 hour mean of 125 $\mu g/m^3$ not to be exceeded more that 3 times per year. A 15-minute mean of 266 $\mu g/m^3$ is not to be exceeded more than 35 times per year by 31 December 2005.

Larne Borough Council monitors levels of $SO_2$ in Larne using the following two methods:

(i) 8 Port Smoke & $SO_2$ Bubblers at two locations
(ii) Automatic Real Time $SO_2$ Analyser at one location

### 2.3.1 Monitoring Of Sulphur Dioxide Using 8 Port Bubblers

Smoke and $SO_2$ 8 Port Bubblers are installed in two areas of Larne with the highest densities of residential coal burning. The monitoring equipment was installed in the following locations:

1. Craigyhill – Lynn Community Centre, Linn Road, Larne (Grid Ref. 3873 0365)

**Figure 3 Sampler Inlet**

2. Townparks – McGarel Cemetery, Old Glenarm Road, Larne (Grid Ref. 4025 0335)

**Figure 4 Sampler Inlet**

Approval was given by AEA Technology Plc for both sites to be included in the UK Smoke and $SO_2$ monitoring network. The equipment is maintained weekly with the results of daily titration's and smoke forwarded to AEA Technology Plc on a monthly basis for input into the national database. Training of

officers responsible for the equipment has been conducted along with accompanied visits to ensure weekly maintenance. Validation checks together with auditing of chemical preparation and analysis are carried out as part of internal quality assurance procedures. Procedures with the 'UK Smoke and $SO_2$ Networks instruction manual' are followed as the QA/QC protocols.

Monitoring using the bubbler apparatus at Carnegie Library, Victoria Road, Larne, had been ongoing since 1995, however this location was not an area of concern. This equipment was therefore relocated to the McGarel Cemetery site where it would be more representative of the highest levels of smoke and $SO_2$ in Larne. See Appendix 4 – Map 1 for location of smoke & $SO_2$ Bubblers.

**Data Capture**

The bubblers determine concentrations of sulphur dioxide by use of net acidity measurements. Due to the general tendency for bubblers to under-read at high concentrations the maximum daily mean concentration is multiplied by 1.25. This factor is open to uncertainty and may overestimate concentrations but this is consistent with the precautionary approach used in Review and Assessments.

8-port bubbler apparatus has been used extensively throughout the UK in order to determine sulphur dioxide concentrations and whilst their use had declined in recent years, the data can still be of use in review and assessment.

The bubbler technique is used to measure daily mean sulphur dioxide concentration which can be directly compared to the 24-hour mean objective. For comparison with the 15-minute and 1-hour objectives, authorities may use correction factors based upon empirical relationships with the measured maximum daily mean. These relationships can be expressed by the following functions:

1. Calculation of 15-minute mean
   $99.9^{th}$ percentile of 15-minute mean = 1.8962 x maximum daily mean

2. Calculation of 1-hour mean
   $99.7^{th}$ percentile of 1-hour means = 1.3691 x maximum daily mean.

Following GB Government Guidance LAQM TG4 (00), to take account of uncertainty in the relationships, it may be assumed that the 15-minute mean objective is unlikely to be exceeded if the maximum daily mean concentration is less than 80 $\mu g/m^3$, and the 1-hour mean objective is unlikely to be exceeded if the maximum daily concentration is less than 200 $\mu g/m^3$.

**Results**

Available results from February 2004 are summarised in Table 5

**Table 5 $SO_2$ Maximum Daily Means (µg/m$^3$)**

| Month And Year | (A) $SO_2$ Measured Maximum Daily Mean (µg/m$^3$) | | $SO_2$ (Maximum Daily Mean (µg/m$^3$) ( A X1.25 Correction Factor) | |
|---|---|---|---|---|
| | Craigyhill | Townparks | Craigyhill | Townparks |
| January 2004 | 30 | 20 | 37.5 | 25 |
| February 2004 | 30 | 27 | 37.5 | 33.75 |
| March 2004 | 24 | 21 | 30 | 26.25 |
| April 2004 | 24 | 21 | 30 | 26.25 |
| May 2004 | 30 | 28 | 37.5 | 35 |
| June 2004 | 24 | 28 | 30 | 35 |
| July 2004 | 30 | 28 | 37.5 | 35 |
| August 2004 | 24 | 27 | 30 | 33.75 |
| September 2004 | 24 | 27 | 30 | 33.75 |
| **October 2004** | **36** | **48** | **45** | **60** |
| November 2004 | 24 | 28 | 30 | 35 |
| December 2004 | 24 | 28 | 30 | 35 |

The highest daily mean concentration measured at the Craigyhill site was 45 µg/m$^3$ and at the Townparks site the highest daily mean was 60 µg/m$^3$ during the period of measurement.

No co-location studies have been carried out using $SO_2$ diffusion tubes adjacent to the bubblers so no further correction factor has been applied.

The 24-hour mean objective of 125 µg/m$^3$ (47 ppb) was therefore not exceeded during the 12 months of measurement at either the Craigyhill or Townparks sites.

Comparison with the 15-minute and 1-hour objectives for each site is detailed in Table 6 below. The highest levels measured are worst-case scenarios at each monitoring location.

**Table 6 Comparison of Maximum Daily Mean, 15-minute and 1-Hour Standards**

| **Location** | **Maximum Daily Mean (µg/m$^3$)** | **> 80 µg/m$^3$** | **> 200 µg/m$^3$** |
|---|---|---|---|
| Craigyhill | 45 | No | No |
| Townparks | 60 | No | No |

As the maximum daily means did not exceed 80 µg/m$^3$ it is unlikely that the 15-minute mean objective will be exceeded in either area.

As the maximum daily means were less than 200 µg/m$^3$ it is unlikely that the 1-hour mean objective will be exceeded in either area.

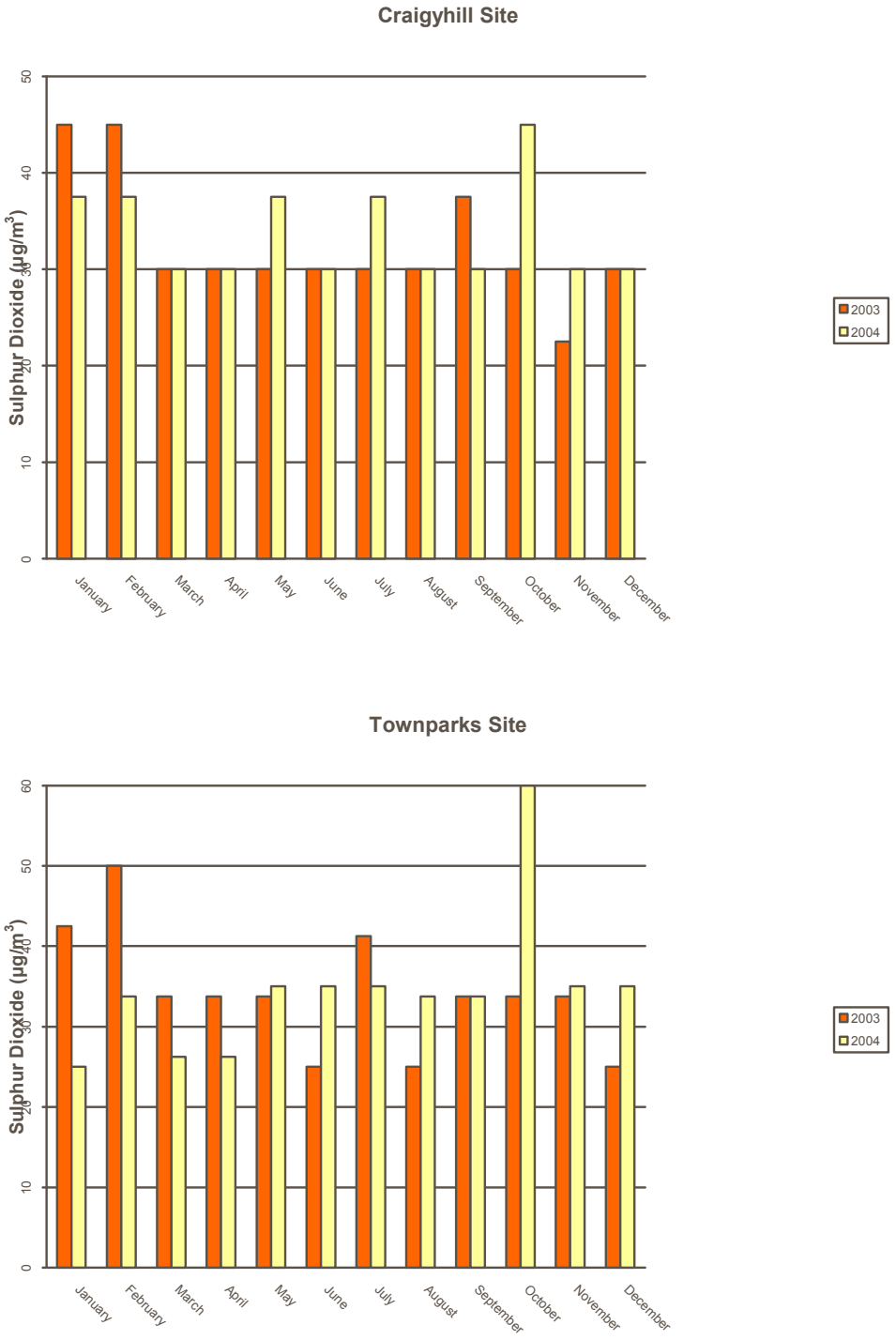
**Conclusion**

The monitoring data from the 8-port smoke and $SO_2$ bubblers indicate that the air quality standard of sulphur dioxide will continue to be met in relation to residential coal burning.

### 2.3.2 Comparison of $SO_2$ Concentrations 2003-2004

Figure 5 compares the maximum daily means (with correction factor) obtained from the bubbler equipment during 2003 and 2004 on a month-by-month basis at each monitoring site.

**Figure 5 Comparison of $SO_2$ Concentrations 2003-2004**




The maximum daily means of each month during 2003 and 2004 were well below the 24-hour mean objective of 125 µg/m$^3$. No obvious trend in the measurements obtained from either site is evident over this short monitoring period. A trend would only be considered significant when supported with at least five years of monitoring data. Changes in concentrations from year to year are to be expected due to weather conditions.

### 2.3.3 Monitoring of Sulphur Dioxide Using $SO_2$ Diffusion Tubes

Passive diffusion tube samplers have also been developed for sulphur dioxide ($SO_{2)}$, but their use is not recommended for review and assessment according to LAQM TG(03). These diffusive samplers are only able to measure concentrations over a relatively long average period, which cannot easily be compared with short-term objectives.

Eight $SO_2$ diffusion tubes were located in Larne Borough Council in areas of residential coal burning in Larne Town and in Glenarm since June 2002. See Appendix 4 – Map 1 for location of diffusion tubes. However in view of technical guidance this monitoring was discontinued in July 2004. All available monitoring results for the 5 months ending July 2004 are shown in Appendix 2.

### 2.3.4 Monitoring of Sulphur Dioxide Using Real Time Automatic Analyser

To determine whether emissions from Larne Harbour exceed the air quality objectives for $SO_2$, in accordance with LAQM TG4(00), monitoring of the pollutant was carried out in the vicinity of the port. A site was selected on the basis that it was representative of levels at the nearest sensitive receptors which were domestic dwellings on Coastguard Road. The equipment was located at a distance of approximately 25m from said domestic properties and 235 m from the closest mooring quay. An automatic UV fluorescent $SO_2$ analyser was installed which could provide real time data on short-term objectives. The analyser is housed in an air-conditioned enclosure within the confines of Larne Harbour to provide enhanced security. (Grid Ref 41320175). See Appendix 4 – Map 1 for location of air quality monitoring station.

The $SO_2$ analyser is calibrated manually every fortnight by trained Larne Borough Council staff. The calibration is performed with zero air from a zero air cylinder and span checks using a certified gas cylinder. NETCEN, a UKAS accredited laboratory, are appointed to provide QA/QC and data management services. Data is downloaded by NETCEN daily thus any faults or unusual results are detected early and brought to attention of Larne Borough Council. NETCEN carry out 6 monthly site audits and issue a UKAS certificate of calibration. Full ratification of data is provided which is comparable to that produced within the national network.

The equipment is US EPA approved and also approved in the DEFRA Automatic Urban Network. In addition, Envirotechnology Services plc, the supplier of the equipment, service and calibrate the equipment annually and provide emergency call out visits in the event of technical faults.

**Figure 6 - Air Quality Monitoring Station Larne Harbour**

## Results

Monitoring results from 1 April 2004 to 31 March 2005 are summarised in tables 7 and 8 overpage.

**Table 7 Sulphur Dioxide Concentrations at Larne Harbour**
**01 April 2004 – 31 March 2005**

| | |
|---|---|
| Number Very High | 0 |
| Number High | 0 |
| Number Moderate | 1 |
| Number Low | 31501 |
| Maximum 15-Minute Mean | 333 µg/m$^3$ |
| Maximum Hourly Mean | 162 µg/m$^3$ |
| Maximum running 8-Hour Mean | 68 µg/m$^3$ |
| Maximum running 24-Hour Mean | 35 µg/m$^3$ |
| Maximum Daily Mean | 30 µg/m$^3$ |
| Average | 2 µg/m$^3$ |
| Data Capture | 91.7% |

**Table 8 Sulphur Dioxide Exceedances at Larne Harbour**
**01 April 2004 – 31 March 2005**

| Pollutant | Air Quality Regulations (NI) 2003 | Exceedances | Days |
|---|---|---|---|
| Sulphur Dioxide | 15-minute mean > 266 µg/m$^3$ | 1 | 1 |
| Sulphur Dioxide | Hourly mean > 350 µg/m$^3$ | 0 | 0 |
| Sulphur Dioxide | Daily mean > 125 µg/m$^3$ | 0 | 0 |

Table 7 shows details on the concentration of $SO_2$ measured at Larne Harbour including information on the health based bandings into which the levels can be categorised. The Air Pollution Information Service uses these Air Pollution Bands and Indexes to provide more detail on air pollution levels in a simple way similar to the sun or pollen index. When air pollution is rated LOW, effects are unlikely to be noticed even by those who are sensitive to air pollution. When MODERATE, sensitive people may notice mild effects but these are unlikely to need action. When HIGH, sensitive people may notice significant effects and action may need to be taken and when VERY HIGH, effects on sensitive people may worsen. The Air Pollution Information Service provides such information via a freephone service, teletext and on website www.airquality.co.uk/archive/standards.

## Conclusion

As shown in Table 7 during the period of measurement there was one excursion into the MODERATE band with the remainder of the year in the LOW band.

Table 8 shows the concentrations measured did not exceed either the 1-hour mean or 24-hour mean standard for $SO_2$.

One 15-minute mean measurement was above 266 µg/m$^3$. The 15-minute mean standard for $SO_2$ is 266 µg/m$^3$ not to be exceeded more than 35 times in a year. Therefore the 15-minute mean objective has not been exceeded.

### 2.3.5 Comparison of $SO_2$ Concentrations at Larne Harbour

The table below compares the concentration of sulphur dioxide measured by the real time $SO_2$ automatic analyser over two years. The periods of measurement are from April to March.

**Table 9**

| Pollutant | Air Quality Regulations (Northern Ireland) 2003 | 2003/2004 Exceedances | 2004/2005 Exceedances |
|---|---|---|---|
| Sulphur Dioxide | 15-minute mean > 266 µg $m^{-3}$ | 1 | 1 |
| Sulphur Dioxide | Hourly mean > 350 µg $m^{-3}$ | 0 | 0 |
| Sulphur Dioxide | Daily mean > 125 µg $m^{-3}$ | 0 | 0 |

The number of exceedances in a 12 month period has remained the same for two years. A trend would only be considered significant when supported with at least five years of monitoring data. Changes in concentrations from year to year are to be expected due to weather conditions.

## 2.4 Monitoring of Particulate Matter

The air quality objective for particulate matter ($PM_{10}$) to be achieved by the end of 2004 is an annual mean of no more than 40 µg/$m^3$ and a 24 hour mean of 50 µg/$m^3$ not to be exceeded on more than 35 days per year. The EU has also set indicative limit value for $PM_{10,}$ which are to be achieved by 1 January 2010. Theses stage 2 limit values are a 24 hour mean of 50 µg/$m^3$ not to be exceeded more than 7 days per year and an annual of 20 µg/$m^3$ to be achieved by 2010. These new particle objectives are not currently included in Regulations for the purpose of Local Air Quality Management and there is no requirement for local authorities to achieve the 2010 standards. Reference to them at this stage may assist with longer term planning.

Larne Borough Councils monitors levels of $PM_{10}$ using the following methods:

(i) 8 port smoke and $SO_2$ bubblers at two locations
(ii) Automatic Air Quality Analyser at one location

### 2.4.1 Monitoring of Particulate Matter using Smoke & $SO_2$ 8-Port Bubblers

An assessment of the impact of domestic solid fuel use can be carried out from existing black smoke data, based upon the empirical relationship described in Appendix 3.

Black smoke data has been collected since June 2002 using Smoke and $SO_2$ 8-Port bubblers located in the Craigyhill and Townparks area. See Appendix 4 – Map 1 for location of bubblers. As detailed in section 2.3.1 the equipment was installed in the following secure locations:

1. Craigyhill – Lynn Community Centre, Linn Road, Larne
2. Townparks – McGarel Cemetery, Old Glenarm Road, Larne

Black smoke data is determined by measuring the staining to filters in conjunction with the 8-port bubbler apparatus. The equipment is maintained weekly with the results of filter reflectance forwarded to AEA Technology Plc on a monthly basis for input into the national database. Training of officers responsible for the equipment has been conducted along with accompanied visits to ensure weekly maintenance. Validation checks together with auditing of chemical preparation and analysis are carried out as part of internal quality assurance procedures. Procedures with the 'UK Smoke and $SO_2$ Networks instruction manual' are followed as the QA/QC protocols. The black smoke monthly average and annual average for 2004 are shown in Table 10.

**Table 10 Black Smoke Monthly Averages 2004 (µg/$m^3$)**

| Month | Craigyhill Site | Townparks Site |
|---|---|---|
| January | 7 | 10 |
| February | 10 | 12 |
| March | 6 | 11 |
| April | 9 | 10 |
| May | 5 | 6 |
| June | 4 | 4 |
| July | 10 | 4 |
| August | 7 | 6 |
| September | 4 | 4 |
| October | 5 | 7 |
| November | 4 | 5 |
| December | 5 | 10 |
| **ANNUAL AVERAGE** | **6.33** | **7.4** |

The 1996 annual mean background secondary $PM_{10}$ concentrations for the area using the internet maps (previously available on www.airquality.co.uk) for Larne was estimated as 7 - 8 µg/$m^3$. To determine the worst-case scenario a background of 8 µg/$m^3$ will be used for the purpose of this assessment.

Figure 9 (Appendix 3) from GB Government Guidance TG4(00) indicates that exceedances above an annual mean threshold of 18 µg/m$^3$ shows a need to progress to a detailed assessment.

**Results**

Applying the annual average black smoke data to figure 9 (Appendix 3) does not exceed the threshold and therefore a detailed assessment is not required.

**Conclusion**

Based on these results further investigation into $PM_{10}$ levels with respect to domestic solid fuel use is not necessary.

### 2.4.2 Comparison of Smoke Data

The charts below and over page compare the monthly average black smoke data obtained from the 8 - port bubbler equipment during 2003 and 2004 at each monitoring site.

**Figure 7**

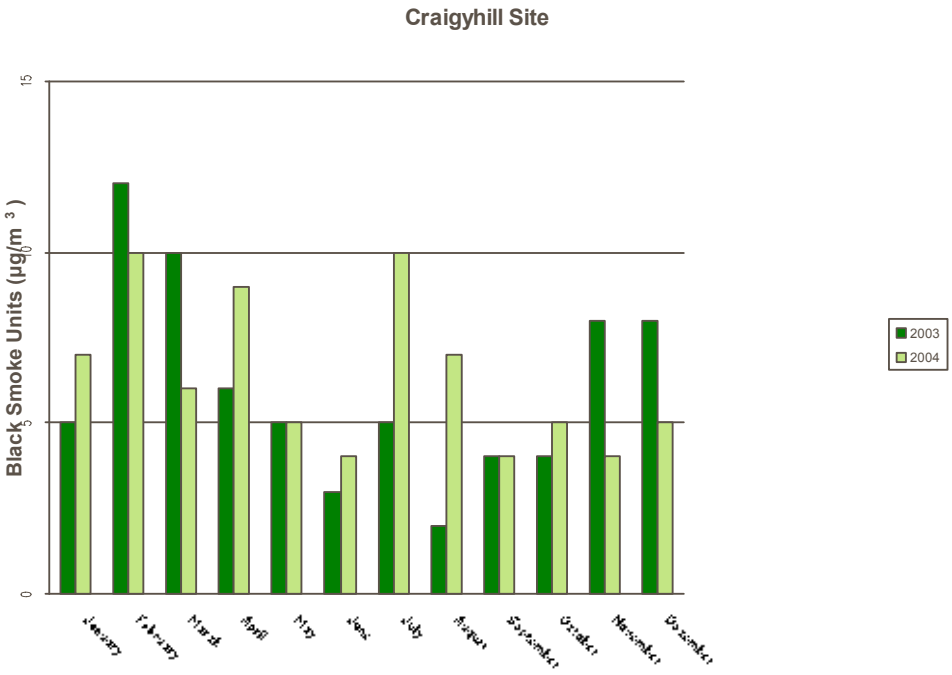
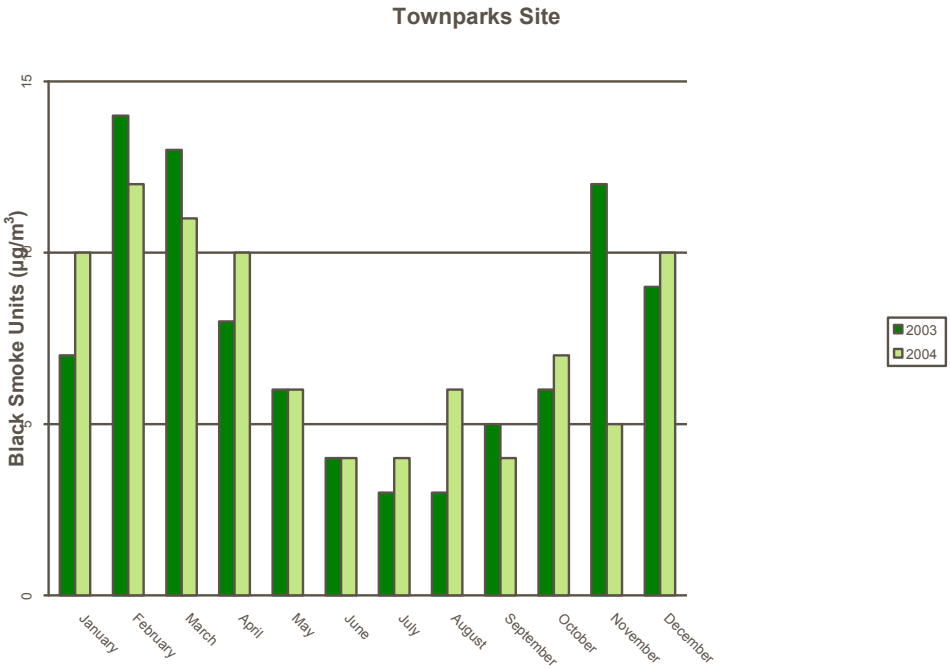


**Figure 8**




No obvious trend in the measurements obtained from either site is evident over this short monitoring period other than the characteristic higher concentrations in winter months associated with increased coal burning during cold weather. A trend would only be considered significant when supported with at least five years of monitoring data or longer. Changes in concentrations from year to year are to be expected due to weather conditions.

### 2.4.3 Monitoring of Particulate Matter Using Real Time Automatic Analyser

To determine whether emissions from Larne Harbour exceed the air quality objective for $PM_{10}$, in accordance with LAQM TG4(00), monitoring of the pollutant was carried out in the vicinity of the Port.

A site was selected on the basis that it was representative of levels at the nearest sensitive receptors which were domestic dwellings on Coastguard Road. The equipment was located at a distance of approximately 25m from said domestic properties and 235 m from the closest mooring quay. A Beta-attenuation sampler (BAM 1020) was installed which could provide real time data on $PM_{10}$ concentrations. The analyser is housed in an air-conditioned enclosure alongside the $SO_2$ analyser within the confines of Larne Harbour to provide enhanced security. (Grid Ref 4132 0175). See figure 6 for photograph and Appendix 4 – Map 1 for location map of monitoring station.

The BAM 1020 is operated in accordance with the operational manual. Sample flow rates are checked fortnightly by trained Larne Borough Council staff. The equipment also carries out it's own automatic calibration every hour and should the instrument fail to meet specification an error is logged in memory and data is flagged.

NETCEN, a UKAS accredited laboratory, are appointed to provide QA/QC and data management services. Data is downloaded by NETCEN daily thus any faults or unusual results are detected early and brought to attention of Larne Borough Council. NETCEN carry out 6 monthly site audits and issue a UKAS certificate of calibration. Full ratification of data is provided which is comparable to that produced within the national network.

The equipment is US EPA approved and also approved in the DEFRA Automatic Urban Network. In addition, Envirotechnology Services plc, the supplier of the equipment, service and calibrate the equipment annually and provide emergency call out visits in the event of technical faults.

**Results**

Monitoring results from 1 April 2004 to 31 March 2005 are summarised in Table 11 and 12 below.

**Table 11 $PM_{10}$ Concentrations at Larne Harbour**
**01 April 2004 – 31 March 2005**

| | |
|---|---|
| Number Very High | 0 |
| Number High | 13 |
| Number Moderate | 89 |
| Number Low | 7798 |
| Maximum Hourly Mean | 995 µg/m$^3$ |
| Maximum running 8-Hour Mean | 227 µg/m$^3$ |
| Maximum running 24-Hour Mean | 108 µg/m$^3$ |
| Maximum Daily Mean | 99 µg/m$^3$ |
| Average | 20 µg/m$^3$ |
| Data Capture | 90.5% |

**Table 12 Exceedances of $PM_{10}$ Objective at Larne Harbour**
**01 April 2004 – 31 March 2005**

| Pollutant | Air Quality Regulations (NI) 2003 | Exceedances | Days |
|---|---|---|---|
| $PM_{10}$ Particulate Matter | Daily mean > 50 µg/m$^3$ | 10 | 10 |
| $PM_{10}$ Particulate Matter | Annual mean > 40 µg/m$^3$ | 0 | 0 |

Table 11 shows details on the concentration of $PM_{10}$ measured at Larne Harbour including information on the health based bandings into which the levels can be categorised. The Air Pollution Information Service uses these Air Pollution Bands and Indexes to provide more detail on air pollution levels in a simple way similar to the sun or pollen index. When air pollution is rated LOW effects are unlikely to be noticed even by those who are sensitive to air pollution. When MODERATE sensitive people may notice mild effects but these are unlikely to need action. When HIGH, sensitive people may notice significant effects and action may need to be taken and when VERY HIGH, effects on sensitive people may worsen. The Air Pollution Information Service provides such information via a freephone service, teletext and on website www.airquality.co.uk/archive/standards.

**Conclusions**

Table 11 shows the number of excursions into the MODERATE, HIGH and VERY HIGH health based bandings. During the period of measurement there were 13 excursions into the HIGH band, 11 of which occurred between 01 October 2004 and 31 March 2005.

The concentrations measured did not exceed the annual mean of 40 µg/m$^3$. Ten daily mean measurements were above 50 µg/m$^3$. The daily mean standard for $PM_{10}$ is 50 µg/m$^3$ not to be exceeded more than 35 times in a year. Therefore the daily mean objective has not been exceeded.

### 2.4.4 Comparison of $PM_{10}$ Concentrations at Larne Harbour

Table 13 over page compares the concentration of particulate matter measured by the real time $PM_{10}$ automatic analyser over two years. The periods of measurement are from April to March.

**Table 13**

| Pollutant | Air Quality Regulations (Northern Ireland) 2003 | 2003/2004 Exceedances | 2004/2005 Exceedances |
|---|---|---|---|
| $PM_{10}$ Particulate Matter (Gravimetric) | Daily mean > 50 µg $m^{-3}$ | 20 | 10 |
| $PM_{10}$ Particulate Matter (Gravimetric) | Annual mean > 40 µg $m^{-3}$ | 0 | 0 |

The number of exceedances in a 12 month period has fallen during the second year of monitoring. It is understood that $PM_{10}$ levels were elevated regionally and UK wide during 2003/2004.See the Second and Third Stage Review and Assessment for further details. It is not possible therefore to draw any trends from the available data due to the short monitoring period and the elevated levels detected in the first year of the monitoring stations operation. A trend would only be considered significant when supported with at least five years worth of monitoring data or longer.

## 3.0 NEW LOCAL DEVELOPMENTS

3.1 No new industrial processes i.e. Part A, B or C processes commenced operation or changed significantly during the period July 2004 to April 2005.

3.2 New retail development has taken place in Larne town centre. Ten new shop units have been built with associated car park in Laharna Retail Park, Circular Road, Larne. This development is unlikely to impact upon air quality and does not significantly change traffic flows.

3.3 The road layout on the A8 altered at the end of 2003 with the construction of two new roundabouts located at the A8/Antiville Road junction and the A8/Drumahoe Road junction. The change is in layout only and the volume of traffic is unlikely to have increased significantly. Monitoring of nitrogen dioxide ($NO_2$) has continued at the A8/Antiville Road since construction of the new roundabout and has not shown any significant increase in $NO_2$ levels.

3.4 No new landfill sites, quarries etc have commenced operation in the borough of Larne.

## 4.0 ADDITIONAL INFORMATION

4.1 It has not been necessary for Larne Borough Council to declare any Air Quality Management Areas in the borough and therefore we cannot report progress on implementation of action plans.

4.2 The council does not intend to draw up a local air quality strategy at the present time, as designation of an Air Quality Management Area is not anticipated in the near future. This however is reviewed annually and will be reconsidered should pollutant levels begin to approach air quality objectives.

4.3 Proposed developments, which could have the potential to affect local air quality, include:

(i) Extension to an existing quarry operated by OMYA at Munie Road, Glenarm
(ii) Extension to Kilwaughter Quarry by Kilwaughter Chemical Company, Starbog Road, Larne
(iii) Landfill site at Loughside Quarries, Belfast Road, Larne
(iv) Development facilities at Larne Harbour comprising of a petrol filling station, lorry wash, car wash, tyre and exhaust centre, plant hire centre, import and export storage facility, offices, industrial units and scrap recycling area

All of the above proposed developments have yet to receive planning permission. Environmental Impact Assessments available for the two quarry extensions suggest that the implementation of planned mitigation measures will ensure the quarry developments will not have a significant detrimental effect on local air quality. In any case, the Environmental Health Department will be consulted by the Planning Service on all proposed developments. Consultation is an opportunity for any concerns regarding the impact on air quality either direct or indirect, e.g. increased levels of traffic, to be addressed prior to planning permission being granted.

4.4 Larne Borough Council does not monitor ozone, polycyclic aromatic hydrocarbons (PAHs). These pollutants are not currently covered by the regulations.

4.5 No complaints regarding odour and dust emission from regulated industrial sources have been received in recent years.

## 5.0 CONCLUSIONS AND DISCUSSION

Assessment of the available monitoring data for nitrogen dioxide, sulphur dioxide and particulate matter, indicates that air quality in Larne Borough currently meets the air quality objectives in relevant locations.

As air quality objectives are currently being met at Larne Harbour consideration is being given to relocating the air quality monitoring station to an area with high density domestic coal burning in order to verify modelling work carried out in 2004 by air quality consultants. See the Second and Third Stage Review and Assessment of Air Quality for further details and results of modelling work undertaken.

The next Updating and Screening Assessment will be completed in April 2006.

## 6.0 REFERENCES

DETR (2000) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Department of the Environment, Transport and the Regions. Cm 4548, SE 2000/3, NIA

Review and Assessment: Pollutant Specific Guidance LAQM (TG4 (00) ISBN 1 85112 387 3DETR May 2000

LAQM Technical Guidance TG(03) ISBN 0 85521 021 4

Larne Borough Council First Stage Review and Assessment of Air Quality 2001

Larne Borough Council Second & Third Stage Review and Assessment of Air Quality 2004

## 7.0 APPENDICES

**Appendix 1 – $NO_2$ Diffusion Tube Monitoring Results**

**Table 14**

| | Average Hourly $NO_2$ Concentration (ppb) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Location | | | | | | | |
| **Month and Year** | **Antiville Rd/A8 (Grid Ref 3864 0212)** | **Riverdale (Grid Ref 3968 0249)** | **Main Street (Grid Ref 4016 0260)** | **Victoria Rd/Agnew Street (Grid Ref 4033 0285)** | **Upper Cairncastle Road (Grid Ref 3920 0323)** | **Larne Harbour Roundabout (Grid Ref 4123 0196)** | **Coastguard Road (Grid Ref 4131 0171)** | **Ballylumford Road (Grid Ref 4206 0203)** |
| February 2004 | 7 | 4 | 7 | 5 | 5 | 13 | 6 | 8 |
| March 2004 | 12 | 11 | 10 | 9 | 13 | 12 | 3 | 7 |
| April 2004 | 13 | 8 | 9 | 13 | 10 | 6 | 6 | 6 |
| May 2004 | - | 5 | 11 | 9 | 6 | 2 | 5 | 5 |
| June 2004 | 10 | 8 | 12 | 9 | 9 | 7 | 4 | 3 |
| July 2004 | 11 | - | 6 | 11 | 9 | 11 | 5 | 3 |
| August 2004 | 10 | 7 | 3 | - | 14 | 8 | 5 | 8 |
| September 2004 | 10 | 6 | 11 | 18 | 8 | 8 | 4 | 9 |
| October 2004 | 14 | 17 | - | 13 | 11 | 10 | 7 | 7 |
| November 2004 | 14 | 11 | - | 19 | 9 | 10 | 6 | 11 |
| December 2004 | 16 | 10 | 6 | 18 | 10 | 9 | 7 | 10 |
| January 2005 | 9 | 8 | 9 | 12 | 9 | 10 | 8 | - |
| February 2005 | 12 | 10 | 10 | 15 | 9 | 7 | 7 | 7 |

**Appendix 2 - $SO_2$ Diffusion Tube Monitoring Results**

**Table 15**

| Average Hourly $SO_2$ Concentration ($\mu g/m^3$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Location | | | | | | | |
| **Month & Year** | **Coastguard Road, Larne (Grid Ref 4131 0171)** | **Dromaine Drive, Larne (Grid Ref 3839 0389)** | **Green Way, Larne (Grid Ref 3903 0353)** | **Loran Avenue, Larne (Grid Ref 3896 0272)** | **St. John's Place East, Larne (Grid Ref 3992 0281)** | **Recreation Road, Larne (Grid Ref 4053 0365)** | **Ballylumford Road, Larne (Grid Ref 4206 0203)** | **Channel Vista, Glenarm (Grid Ref 3066 1561)** |
| March 2004 | 5.43 | 13.95 | 15.76 | 15.76 | - | 53.98 | 12.5 | 7.61 |
| April 2004 | 5.36 | 7.69 | 6.96 | 8.55 | - | 38.40 | 12.61 | 5.07 |
| May 2004 | 5.83 | 9.21 | 6.95 | 7.89 | 10.33 | 16.53 | 11.60 | 5.07 |
| June 2004 | 7.46 | 3.08 | 4.17 | 5.26 | 11.78 | 5.26 | 22.19 | 6.35 |
| July 2004 | 31.16 | 7.09 | 5.21 | 8.40 | 6.09 | 22.55 | 8.38 | 3.48 |

**Appendix 3**

**Figure 9 Relationship between annual mean black smoke measurement and the annual mean secondary $PM_{10}$ concentration**