Department of the
Environment
www.doeni.gov.uk

Air Pollution
in Northern Ireland 2009

AEA

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Introduction

This brochure is the eighth in a series of annual reports on air quality in Northern Ireland. Produced by AEA, on behalf of the Department of the Environment, it aims to provide the citizens of Northern Ireland, and the wider air quality community, with user-friendly information on local air quality monitoring, and the results of that monitoring, throughout the region during 2009.

Section 2 of this report outlines the air quality legislation and policy applicable to Northern Ireland. This section includes information on the actions that district councils are taking to improve air quality at a local level. **Section 3** summarises the monitoring networks and presents an overview of the data from 2009, including exceedences of air quality objectives. Although this report is primarily concerned with 2009, Section 3 includes an analysis of the air quality issues and events surrounding the eruption of the Eyjafjallajökull volcano in Iceland in April 2010.

As in previous reports, **Section 4** deals with trends in air pollution in Northern Ireland, and **Section 5** covers spatial patterns of pollution. **Section 6** is used to report on topics of special interest; this year it looks at the Black Carbon Network, and the findings of its three Northern Ireland sites in 2009. Finally, for readers wanting to find out more, additional web-based and other published sources of information on air quality in Northern Ireland are summarised in **Section 7**.

Air quality in Northern Ireland has improved substantially in recent years. In particular, concentrations of sulphur dioxide, which is associated with coal and oil combustion, have declined significantly over the past two decades, as illustrated in Figure 1.1. However some pollutants in some parts of Northern Ireland continue to exceed air quality objectives. Continued effort to reduce air pollution is therefore important, together with monitoring to assess progress and to provide sound, science-based input to policy development.

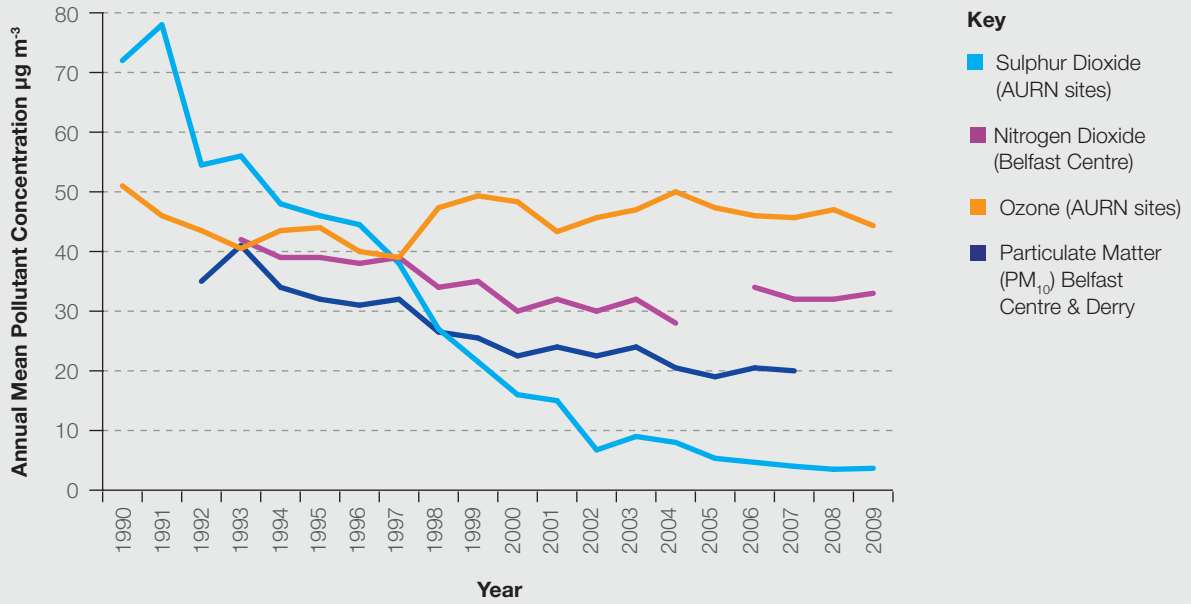

Figure 1.1

Annual mean concentrations of air pollutants at long-running automatic monitoring sites in Northern Ireland, 1990 onwards.

2

Legislation and Policy

2.1 Air Quality Standards Regulations (Northern Ireland) 2010

The Air Quality Standards Regulations (Northern Ireland) 2010 came into force on 11th June 2010. These regulations transpose the following European Union Directives into national law in Northern Ireland:

- Directive 2008/50/EC on Ambient Air Quality and Cleaner Air For Europe (the Air Quality Directive); and
- Directive 2004/107/EC (the Fourth Daughter Directive) relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

The Regulations set out requirements for ambient air quality monitoring, including the number of sampling points, suitable locations, and acceptable methodology. They identify the duties of Northern Ireland's Departments in relation to achieving limit and target values, and the responsibility of Departments to inform the public about air quality in Northern Ireland, particularly with regard to warning the public when information and alert thresholds are reached.

2.1.1 EU Limit and Target Values

EU Limit and Target Values are shown in Tables 2.1 and 2.2.

Table 2.2 Fourth Daughter Directive Target Values

Pollutant	Target value for the total content in the PM_{10} fraction averaged over a calendar year	Date by which target value should be met
Arsenic	6 ng m^{-3}	31st December 2012
Cadmium	5 ng m^{-3}	31st December 2012
Nickel	20 ng m^{-3}	31st December 2012
Benzo(a) pyrene	1 ng m^{-3}	31st December 2012

Table 2.1 EU Limit and Target Values

Pollutant	Averaging period	Limit Value (and Target Value for Ozone)
Sulphur dioxide	One hour	350 µg m^{-3}, not to be exceeded more than 24 times a calendar year
	One day	125 µg m^{-3}, not to be exceeded more than 3 times a calendar year
Nitrogen dioxide	One hour	200 µg m^{-3}, not to be exceeded more than 18 times a calendar year
	Calendar year	40 µg m^{-3}
Benzene	Calendar year	5 µg m^{-3}
Carbon monoxide	Maximum daily eight hour mean	10 mg m^{-3}
Lead	Calendar year	0.5 µg m^{-3}
PM_{10}	One day	50 µg m^{-3}, not to be exceeded more than 35 times a calendar year
	Calendar year	40 µg m^{-3}
$PM_{2.5}$	Calendar year	25 µg m^{-3}*
Ozone (Protection of human health)	Maximum daily eight hour mean	120 µg m^{-3}, not to be exceeded on more than 25 days per calendar year averaged over 3 years
Ozone (Protection of vegetation)	May to July	AOT 40 (calculated from 1h values) 18,000 µg m^{-3} · h averaged over five years

* The Limit Value for $PM_{2.5}$ has a Margin of Tolerance of 20% on 11th June 2008, decreasing on the 1st January 2009 and every 12 months thereafter by equal annual percentages to reach 0% by 1st January 2015.

2.1.2 National Exposure Reduction Target for $PM_{2.5}$

Northern Ireland's Departments must ensure that all necessary measures not entailing disproportionate costs are taken, with a view to

- attaining the national exposure reduction target by 2020
- ensuring the average population exposure indicator for 2015 does not exceed 20 µg m^{-3}.

2.2 Local Air Quality Management

Local Air Quality Management (LAQM) provides the strong framework within which air quality is managed by district councils in Northern Ireland. LAQM requires district councils to review and assess a range of air pollutants against the objectives set out within the Air Quality Strategy (which are at least as stringent as those set by the EU), using a range of monitoring, modelling, observations and corresponding analyses. For locations where objectives are not expected to be met by the relevant target date, district councils are required to declare an Air Quality Management Area (AQMA), and develop an Action Plan to address the problem. The requirements for Air Quality Action Planning, and the part that Action Plans should play in meeting target and limit values, are also set out in the Air Quality Standards Regulations (NI) 2010.

At the time of writing, eleven of Northern Ireland's 26 district councils have Air Quality Management Areas in place. Of these, two declared AQMAs for PM_{10} alone, two declared AQMAs for NO_2 and PM_{10} together, seven declared AQMAs for NO_2 only, and one for SO_2. Figure 2.1 shows the locations of these AQMAs, and what pollutants they address.

All district councils with AQMAs have submitted Air Quality Action Plans to the Department. Two of the most recent are

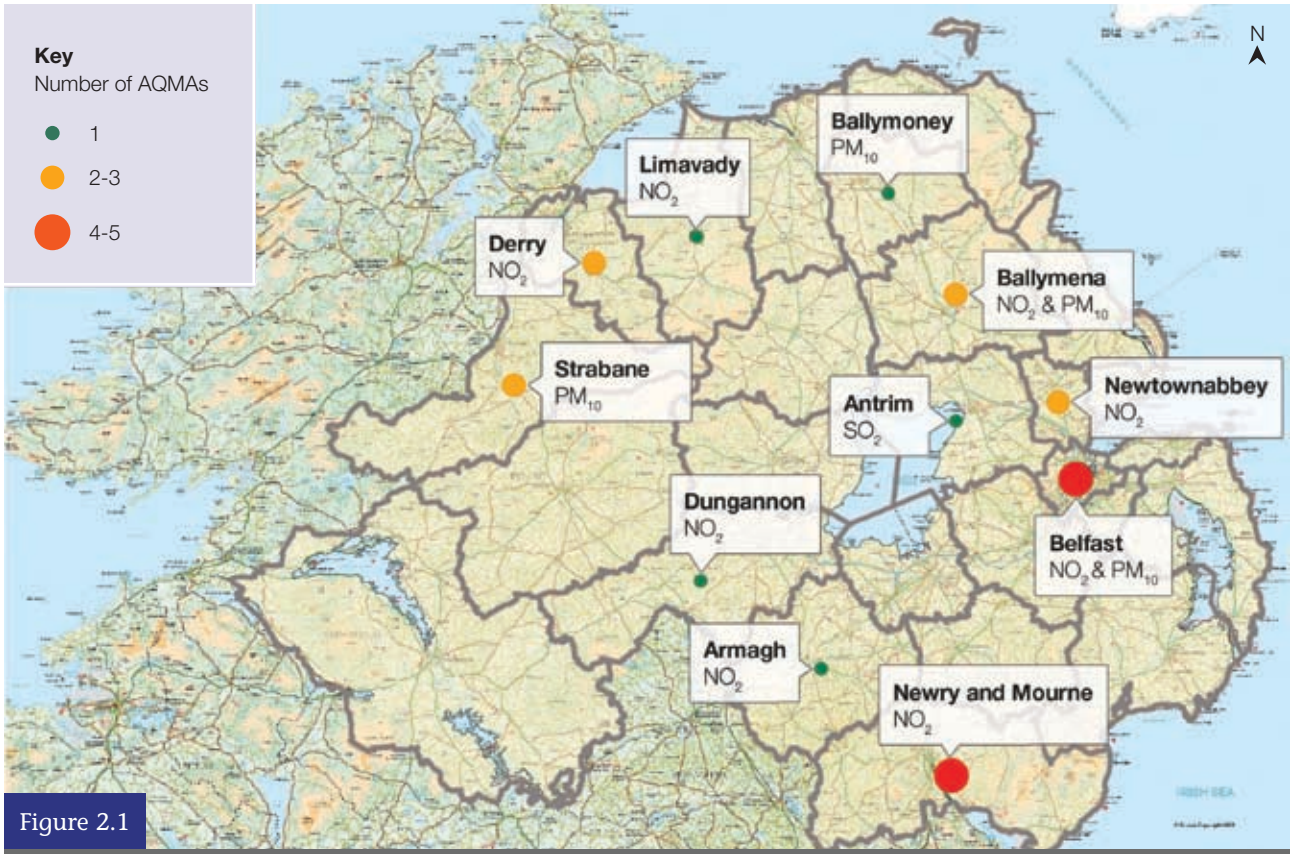

Figure 2.1

Air Quality Management Areas in Northern Ireland (source: DoENI)

Armagh City and District Council and Dungannon and South Tyrone (they are still at the draft stage at the time of writing).

Dungannon lies at the "hub" of several intersecting road routes and therefore experiences high levels of through traffic. Dungannon's AQMA (for NO_2) covers Church Street: a main road through the town centre. Church Street is used as access to the M1 towards Belfast and to the A29 (towards Armagh, Newry and then on to Dublin via the A1). It is also used as a short cut for school traffic, and by drivers avoiding Circular Road (the ring road) at busy times. Church Street is narrow, and on a steep hill: these factors cause congestion and increase vehicle emissions. A source apportionment study attributed up to 80% of the ambient NO_2 concentration in the AQMA to road traffic, particularly cars and light goods vehicles.

Dungannon's Action Plan sets out a range of options, and assesses each in terms of the cost of implementation, and the expected benefits. For each one, Dungannon DC gives details of how they would monitor its effectiveness. As the Action Plan has not yet been approved, the range of measures to be adopted has not yet been confirmed. However, the proposed measures include:

- investigating the efficiency of the traffic lights on nearby Circular Road, to improve traffic flow on that road and reduce the temptation for drivers to cut through the town centre via Church Street;
- investigating a Pay and Display parking scheme on Church Street, reducing congestion and encouraging use of larger off-street parking areas; and
- investigating the use of alternative fuels for Council vehicles, where possible.

Armagh's AQMA also covers a road section through the centre of the city. Like Dungannon, Armagh's source apportionment study also identified cars and light goods vehicles as the major contributor to ambient NO_2 (74% coming from this source). Similarly, Armagh's proposed measures are aimed at reducing vehicle numbers travelling through the AQMA, and encouraging more efficient traffic flow.

They include:

- investigating the efficiency of a roundabout within the AQMA, and assessing if other traffic control measures may be better suited to ease congestion;
- investigating the feasibility of introducing a 'Pay and Display' system, to reduce parking on the street and thus ease congestion; and
- sustainable development: raising awareness of sustainable development issues among policymakers and a variety of other stakeholders.

Both district councils recognise the importance of community engagement, and this is summed up in Armagh's Action Plan as follows:

> "To secure the necessary air quality improvements, there must be involvement by all local stakeholders, who should actively work to encourage community participation in the process."

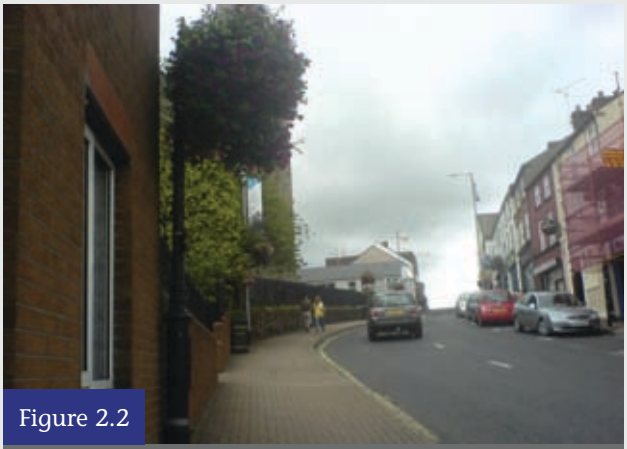

Figure 2.2

Church Street AQMA, Dungannon

3

Networks and Data

3.1 Monitoring in Northern Ireland

A wide range of air quality monitoring is carried out in Northern Ireland. Some monitoring sites are run as part of UK-wide monitoring networks; others are operated by district councils in order to meet local objectives. The following pollutants were monitored in Northern Ireland during 2009:

- Carbon Monoxide (CO)
- Oxides of Nitrogen (NO_x) and Nitrogen Dioxide (NO_2)
- Sulphur Dioxide (SO_2)
- Particles (as PM_{10} and $PM_{2.5}$, also using the Black Carbon technique)
- Ozone
- Benzene
- Polycyclic Aromatic Hydrocarbons (PAH).

During 2009, there were 35 air quality monitoring stations in Northern Ireland, each equipped with continuous monitoring equipment for some or all of the above pollutants. The locations of the automatic monitoring sites are shown in Figure 3.1.

These sites provide high-resolution hourly information on a wide range of pollutants. In the case of sites comprising the national network, this can be communicated rapidly to the public, together with warnings when levels approach or exceed the 'high' pollution band. A typical example is the Castlereagh Dundonald roadside automatic monitoring site shown in Figure 3.2

Northern Ireland's automatic monitoring is supplemented by non-automatic monitoring techniques, for example for hydrocarbons. These include the pumped tube samplers used to measure benzene, and the high-volume samplers used to measure PAH.

In addition, NO_2 diffusion tubes are widely used by the district councils for the purpose of Local Air Quality Management (LAQM). These low-cost, single-use samplers absorb the pollutant directly from the air and need no power supply. They measure average concentrations over a specified sampling period (typically one month), and provide invaluable data for screening purposes, 'hot-spot' identification, local impact assessment and mapping overall levels of pollution across the country as a whole.

Figure 3.1

Air Quality Monitoring Sites in Northern Ireland

Figure 3.2

Monitoring Site at Castlereagh (Dundonald)

3.2 King's College London Volatile Correction Model

Many monitoring sites use the Tapered Element Oscillating Microbalance (TEOM) to measure PM_{10}. The relatively high operating temperature of this instrument (necessary to prevent condensation on the filter) can result in the loss of volatile components of the particulate matter sampled, causing under-estimation of the PM_{10} concentration. However, it is possible to correct for this, using the Volatile Correction Model (VCM) developed by King's College, London. The VCM uses data from Filter Dynamic Measurement Systems (FDMS) PM_{10} analysers in the region (which measure both the volatile and non-volatile fractions) to calculate an appropriate correction based on the location of the instrument and the period of the measurements. The resulting corrected measurements have been demonstrated as equivalent to the gravimetric reference technique. In 2009 the TEOM air quality data submitted by the UK to the European Commission was corrected by the Volatile Correction Model. To access the model and for more information, visit www.volatile-correction-model.info

3.3 Key Results for 2009

This section summarises key monitoring results from 2009, including compliance with EU Limit Values and the corresponding Air Quality Strategy Objectives. Further information is provided on the Northern Ireland Air Quality website at www.airqualityni.co.uk/.

Carbon monoxide was monitored using automatic techniques at one site - Belfast Centre. This site met the Limit Value and AQS Objective for this pollutant.

Nitrogen dioxide was monitored using automatic techniques at 18 sites during 2009. Four roadside automatic sites failed to meet the Limit Value and Objective for annual mean NO_2 concentration (40 µg m^{-3}). These were Belfast Newtownards Road, Belfast Stockman's Lane, Newry Trevor Hill and Newtownabbey Antrim Road - all of which are close to busy roads. Of these four sites, one also recorded more than the 18 permitted exceedences of the Limit Value and AQS Objective for the hourly mean (200 µg m^{-3}). This site was Newtownabbey Antrim Road.

Sulphur dioxide was monitored at 13 automatic sites. EU Limit Values for SO_2 (1-hour and 24-hour mean), and the AQS Objective relating to the 15-minute mean, were met at all sites. 2009 was the sixth consecutive year in which all the SO_2 Limit Values and objectives have been met – evidence of the progress made in reducing ambient levels of this once highly problematical pollutant in Northern Ireland.

Particulate matter – PM_{10} Particulate matter as PM_{10} was monitored automatically at 26 locations in 2009. All sites met both the Limit Value and Objective of 40 µg m^{-3} for the annual mean PM_{10}, and the Limit Value and Objective of 50 µg m^{-3} for the 24-hour mean - which may be exceeded on up to 35 occasions per year. (Note: where TEOM analysers were used, data have been converted to gravimetric equivalent by applying the King's College London's Volatile Correction Model to correct for loss of volatile components, see section 3.2.)

Particulate matter – $PM_{2.5}$ Fine particulate matter as $PM_{2.5}$ was monitored at Belfast Centre, Derry and Lisburn Dunmurry throughout 2009, also at Belfast Clara Street from 23rd February 2009. All four sites measured annual mean $PM_{2.5}$ concentrations well within the limit of 25 µg m^{-3} to be achieved by 2020. The sites will also have to meet an exposure reduction target of 20%, between 2010 and 2020.

Ozone was monitored using automatic analysers at Belfast Centre, Derry and Lough Navar (rural). No sites exceeded the EU Limit Value of 120 µg m^{-3} (for the maximum daily 8-hour mean) on more than the permitted 25 days, or the more stringent AQS Objective of 100 µg m^{-3} on more than the permitted 10 days. Ozone (O_3) is a secondary pollutant that is formed by reactions involving other pollutant gases, in the presence of sunlight, and over several hours. Once formed, it may persist for several days and be transported over long distances. This means that district councils have little control over ozone levels in their area.

Unlike some other pollutants, levels of ozone in Northern Ireland do not appear to be decreasing, but remain variable from year to year, depending substantially on weather conditions. Ozone exceedences – such as the exceedence of the AQS Objective which occurred in 2008 at Derry - therefore remain possible in the future.

Benzene was monitored at one site: Belfast Centre – which met the Limit Value in 2009.

Polycyclic aromatic hydrocarbons (PAH) were monitored at three sites in 2009: Ballymena Ballykeel, Derry Brandywell and Lisburn Dunmurry. In 2009, all three sites exceeded the Air Quality Strategy Objective for the PAH species benzo[a]pyrene (which must be met by 2010).

3.4 Summary

Northern Ireland's air quality continues to improve. Results from Northern Ireland's network of air quality monitoring stations show that the EU Limit and Target Values, and corresponding AQS Objectives, for the following pollutants have been met by the due dates –

- Carbon monoxide
- PM_{10}
- Benzene
- Sulphur dioxide

Non-automatic monitoring in previous years also established that ambient concentrations of lead were well within the limit and objective values.

However, there remain a small number of sites close to busy roads in the Belfast conurbation and in Newry that do not meet the Limit Values and AQS Objectives for nitrogen dioxide. Benzo[a]pyrene concentrations at Lisburn Dunmurry, Derry Brandywell and Ballymena Ballykeel were also above the AQS Objective for 2010. Occasional ozone exceedences (such as that which occurred at Derry in 2008) also remain a possibility.

3.5 Eyjafjallajökull

On 20th March 2010, Iceland's Eyjafjallajökull volcano began erupting for the first time in 190 years. The main summit eruption of Eyjafjallajökull started on 14th April, sending a plume of ash and sulphur dioxide into the atmosphere. The size of the eruption itself was relatively weak, but the initial phase was extremely explosive due to meltwater from the glacier causing the magma to fragment into highly abrasive glass particles which were thrown upwards in a plume to 13 km.

Figure 3.3

Images of the ash plume taken during April 2010
Source: Icelandic Met Office, http://en.vedur.is/

Following advice from the UK Met Office (the north-west European Volcanic Ash Advisory Centre) UK airspace was closed for six days due to the risk of damage to aircraft flying through the plume. A significant reduction in NO_x was measured near some major airports during the period that air space was closed[1].

There was concern that Eyjafjallajökull's activity might trigger the eruption of a nearby and larger volcano, Katla - an occurrence last seen in 1821. However, this has not happened to date.

The Northern Ireland Air Quality Database and Website was a very valuable source of information to address public concern about possible air quality impacts, during this dramatic event.

[1] Barratt, B and Fuller, G "Preliminary analysis of the impact of airport closures due to the 2010 Eyjafjallajökull volcanic eruptions on local air quality" Available at http://www.londonair.org.uk/london/reports/volcano_airport_closures.pdf [Accessed 4th Nov 2010].

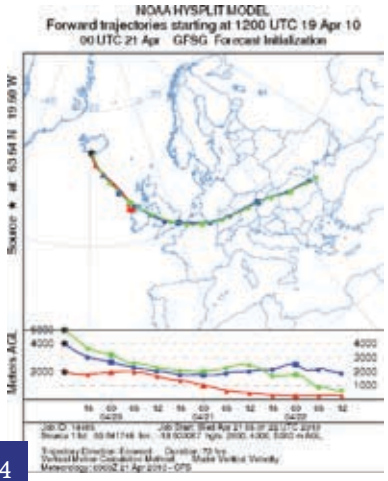

Figure 3.4

NOAA HYSPLIT output showing the forecast movement of air masses from Iceland to Northern Ireland, the UK and Eastern Europe (as provided by NOAA website, http://ready.arl.noaa.gov/HYSPLIT.php)

From April 14th the volcano continued to erupt intermittently for several weeks. Typically the dust plume from the volcano was between 4km and 6km above sea level. On April 19th the NOAA HYSPLIT model forecast that the ash plume might be driven over the UK. In certain meteorological conditions grounding of the plume could occur, increasing levels of air pollution (sulphur dioxide and particulate matter) at ground level. Air quality monitoring data from around the UK were examined for any evidence of this. In the case of Northern Ireland, PM_{10} data show two small peaks, the first around 11th April, the second around 21st - 24th April. A few sites exceeded the 24-hour Limit Value of 50 µg m^{-3}. Peaks in daily mean $PM_{2.5}$ concentration (data available from Belfast Centre and Lisburn Dunmurry only – Figure 3.5) occurred at the same times. The second of these coincided with a small increase in ambient sulphur dioxide (Figure 3.6), which is also found in volcanic emissions.

Air mass back trajectories were such that the volcano could have contributed to the second peak. However, the FDMS instruments used to monitor $PM_{2.5}$ allow the measurement to be split into volatile and non-volatile components. Both April peaks included some volatile material, which would not be expected in volcanic ash. Also, a small peak in oxides of nitrogen was observed: these arise from combustion sources, and their presence indicated that the particulate matter was from combustion sources, rather than the volcano.

So, there is no clear evidence that the volcano had an impact on ambient air pollution in Northern Ireland, although a small contribution cannot be ruled out. The actual levels of particulate matter and SO_2 during the relevant period were within the usual range, and were in fact lower than some daily means measured in early March before the eruption. There is still much to be learned from the vast amount of data collected, and many organisations continue to carry out research into the volcanic eruption and its effects.

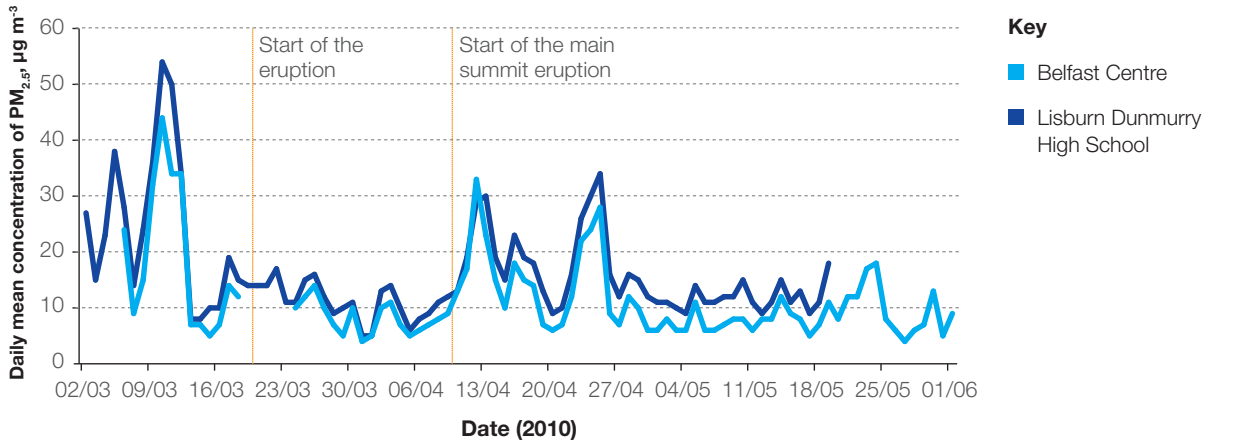

Figure 3.5

Daily mean $PM_{2.5}$ at automatic sites in Northern Ireland March – May 2010 (the volcanic activity began on 20th March).

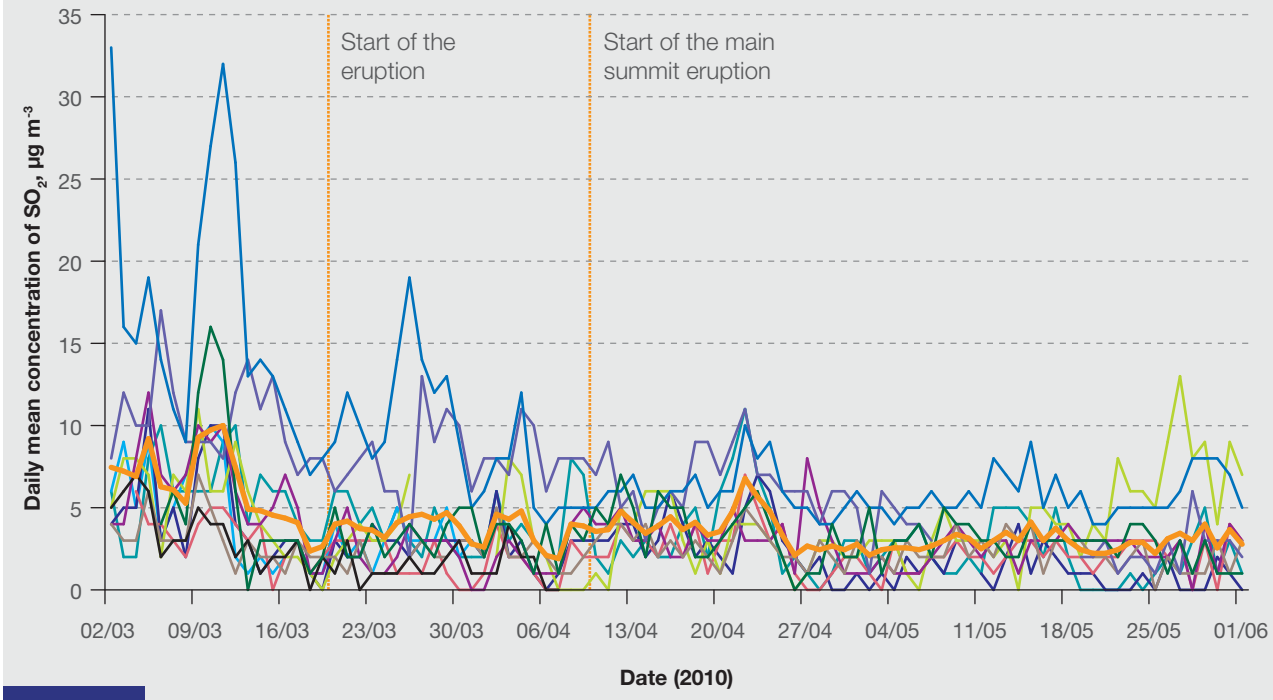

Figure 3.6

Daily mean SO_2 at automatic sites across Northern Ireland, March – May 2010 (the volcanic activity began on 20th March).

Key

- Antrim Greystone Estate
- Ballymena
- Carrickfergus Rosebrook Avenue
- Derry Brandywell
- Lisburn Dunmurry High School
- Strabane Springhill Park
- Derry
- Larne Craigyhill
- Ards Leisure Centre
- Belfast Centre
- North Down Bangor
- Mean

4

Air Quality Trends

Recent years have seen a marked improvement in Northern Ireland's overall air quality.

In particular, concentrations of pollutants such as SO_2, associated with coal and oil combustion, have declined significantly over the past decade. Here we examine how overall air pollution levels in Northern Ireland have changed over the last 20 years.

In 1999, a first air quality 'headline' indicator was introduced in support of the UK Sustainable Development Strategy. This original 'headline' indicator included the average number of days at which air pollution reached the 'moderate' level or higher. However, this indicator has proved to be of limited use when analysing trends in Northern Ireland, as it is affected by changes in the number and distribution of monitoring sites. Years 2001 – 2006 in particular saw substantial increases in the number of monitoring sites in Northern Ireland.

In 2005, a new indicator was introduced, as plotted in Figure 4.1: trends for annual exposure to particles and ozone. These trends are important, because there is considerable evidence suggesting long-term exposure to even low levels of particles may have a significant effect on public health.

Figure 4.1 shows annual mean concentrations of PM_{10} (for all roadside and urban background sites) and ozone (for all sites, rural and urban locations) in Northern Ireland during the period 1990 to 2009. This figure demonstrates that there has been a general reduction in urban background PM_{10} concentrations since 1990. For roadside sites, this parameter can only be calculated from 2002 onwards, due to the lack of roadside PM_{10} sites with sufficient data before that year. This indicator appears to show an overall decreasing trend from 2002 to 2009. By contrast, mean ozone concentrations in Northern Ireland do not appear to show any clear overall trend over the same period, although there is distinct year-to-year fluctuation. This is consistent with UK–wide observations, together with our understanding that this metric is strongly dependent on summer temperatures and weather conditions.

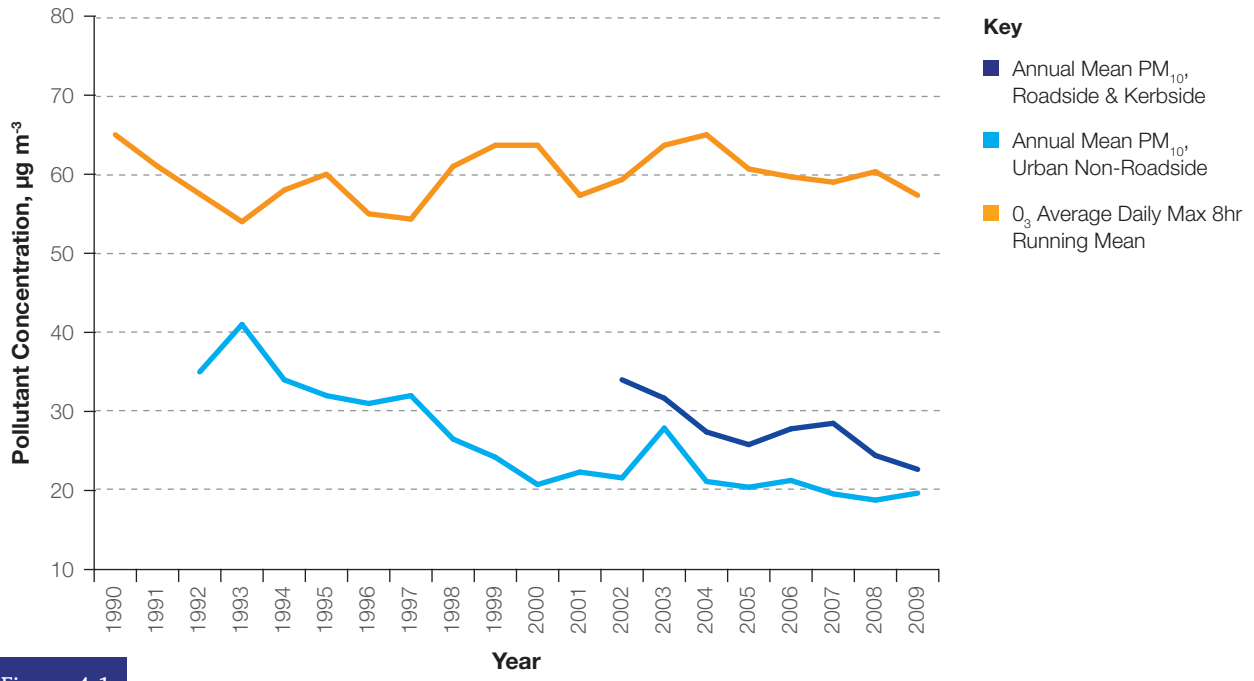

Figure 4.1

Air Quality Indicator: PM_{10} annual means at urban background and roadside sites, plus ozone mean daily maximum 8-hr running means at all sites: 1990-2009.

Figure 4.2 shows annual mean concentrations of nitrogen dioxide (NO_2) concentrations at urban background and kerbside/roadside sites. To avoid discontinuities due to changes in the number (and distribution) of sites, each average is based on a subset of long-running sites: the urban background average is based on Belfast Centre and Derry, and shown from 1998 (when the latter began operation). The kerbside/roadside average is based on six long-running sites, and is shown from 2004 only, when the number of such sites almost doubled. There are no clear trends in nitrogen dioxide concentration for these sets of long-running sites.

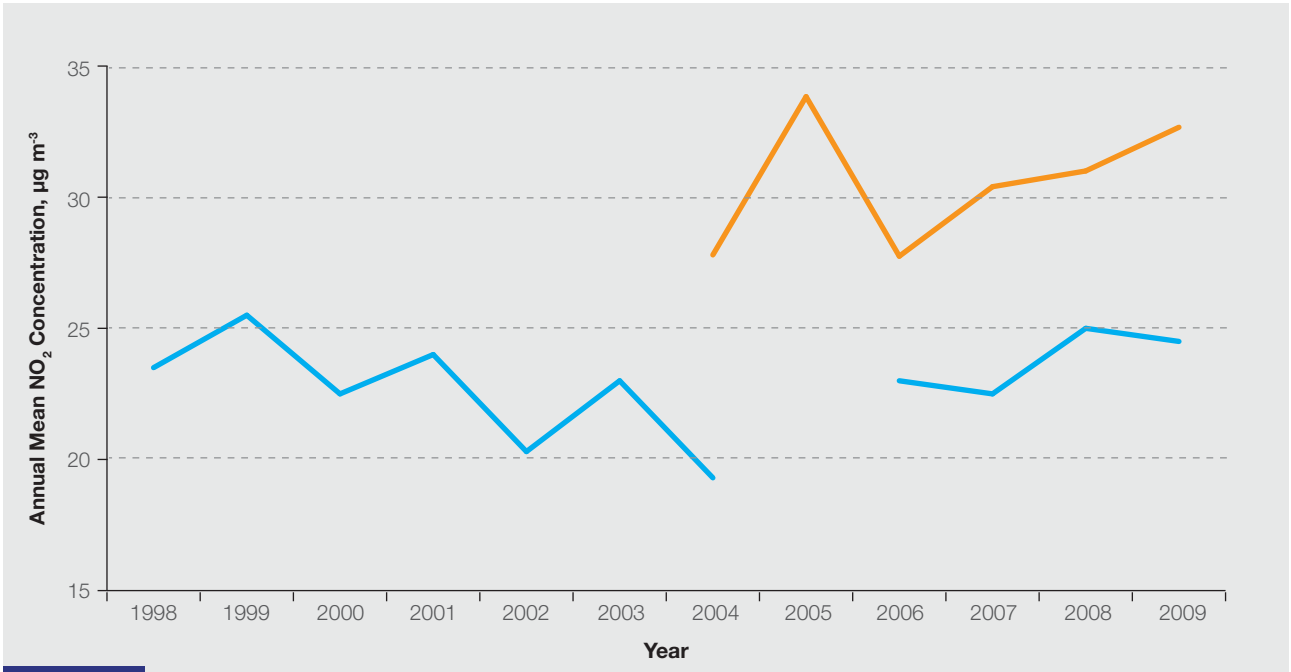

Figure 4.2

Annual mean NO_2 concentrations at long-running urban background and roadside sites in Northern Ireland, 1998-2009.

Key

- Roadside and Kerbside (Long-running sites, from 2004 only: Castlereagh Lough View Drive, Derry Dale's Corner, Lisburn LVH, Newry Trevor Hill, Newtownabbey Sandyknowes, North Down Holywood A2)
- Urban Background - Belfast Centre and Derry

5

Maps of Air Quality

Measurements from air quality monitoring sites in Northern Ireland have been combined with pollutant emissions data from the UK's National Atmospheric Emissions Inventory (NAEI) to produce detailed maps - at 1km resolution - of average or peak background pollutant concentrations across the country for 2009.

Figure 5.1 shows peak (99.9th percentile) 15-minute average concentrations of sulphur dioxide (SO_2). The main sources of this pollutant are industrial and domestic fuel burning - particularly coal and oil. While peak concentrations are very low over most of Northern Ireland, there are still some small areas of higher peak SO_2 concentration around Derry and parts of the Belfast conurbation. There are also isolated "hot spots" of higher concentration throughout the rest of the region, such as around Ballymena - possibly due to small pockets of high domestic coal or oil use in small towns.

Figure 5.2 shows corresponding annual mean PM_{10} concentration. Highest concentrations occur in the Lagan Valley, in the area around Belfast and Dunmurry. However, annual mean background concentrations throughout the region are well below the Air Quality Strategy Objective.

Like the other pollutants represented in these maps, estimated background NO_2 concentrations modelled for Northern Ireland in 2009 (Figure 5.3) are low. The highest concentrations occurred in the centres of Belfast and Derry. Also visible are the major roads connecting Northern Ireland's cities. Figure 5.4 examines in greater spatial resolution NO_2 concentrations in and around Belfast: this clearly shows the impacts of road vehicle emissions on modelled NO_2 concentrations.

SO_2

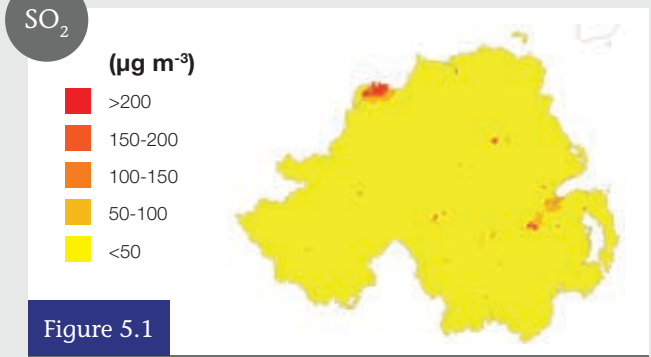

Figure 5.1

Estimated 99.9th percentile of 15-minute mean SO_2 µg m^{-3}

PM_{10}

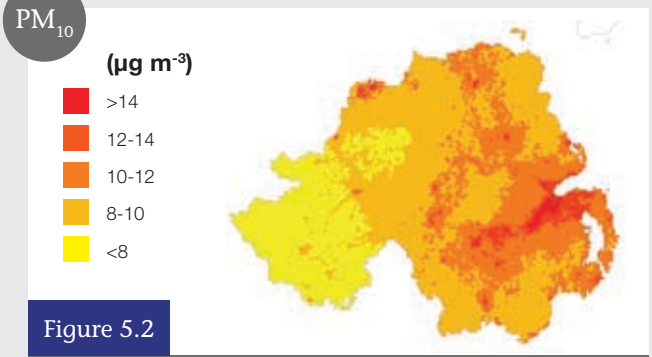

Figure 5.2

Estimated annual mean PM_{10} µg m^{-3}

NO_2

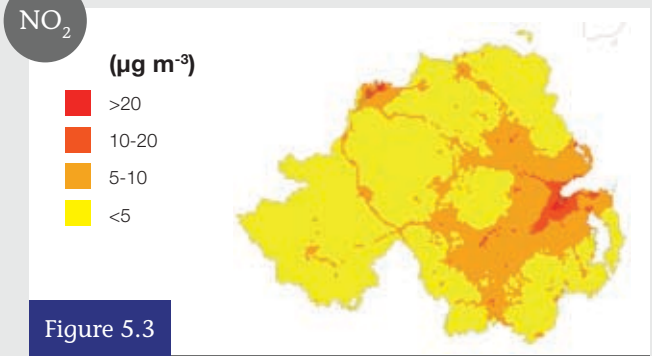

Figure 5.3

Estimated annual mean NO_2 µg m^{-3}

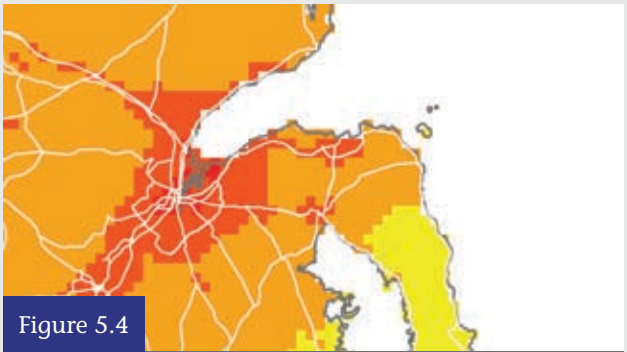

Figure 5.4

Estimated annual mean NO_2 µg m^{-3} in the Belfast area

6

Black Carbon

Black carbon is a measurement of airborne soot-like particulate matter, based on an optical absorption technique. Black carbon is typically formed in combustion processes.

In the years before automatic PM_{10} monitoring became widespread, particulate pollution was often measured as "black smoke", and a large UK network of monitoring sites existed until 2005. This has been replaced by a smaller network of monitoring sites (currently operated by the National Physical Laboratory, NPL). The old-style "black smoke" samplers were replaced with new automatic black carbon analysers during 2008, allowing hourly monitoring and analysis of diurnal patterns.

The fourth annual report[2] for this network, now renamed the Black Carbon Network, covering 2009, is available on the UK Air Quality Archive at: http://www.airquality.co.uk/reports/cat05/1009031405_2009_BC_Annual_Report_Final.pdf

The Black Carbon Network includes three sites in Northern Ireland – at Belfast Centre, Lisburn Dunmurry, and Strabane. The annual mean black carbon concentrations measured in 2009 were 2.1 µg m^{-3} at Belfast Centre (an urban centre site), 1.3 µg m^{-3} at Lisburn Dunmurry and 1.6 µg m^{-3} at Strabane (the latter two sites are in residential areas where domestic use of oil and solid fuels are widespread). The annual mean for Belfast is similar to that measured at sites in other urban centres such as Glasgow, Manchester, Stoke-on-Trent and Nottingham. (Note: data capture at Belfast was reduced to 59% due to equipment problems, and data rejection because of dust from nearby building work). NPL's 2009 report investigated diurnal variation (variation with time of day) in black carbon concentration at all sites. Belfast Centre showed a pattern typical of urban centre sites in the Network: there was a pronounced peak coinciding with morning rush hour traffic, and a broader evening rush hour peak extending into the evening. However, the diurnal patterns at Lisburn Dunmurry and Strabane were dominated by the evening peak. NPL attribute this to the domestic use of oil and solid fuels for household heating. The differences in diurnal variation between the three sites are illustrated in Figure 6.1.

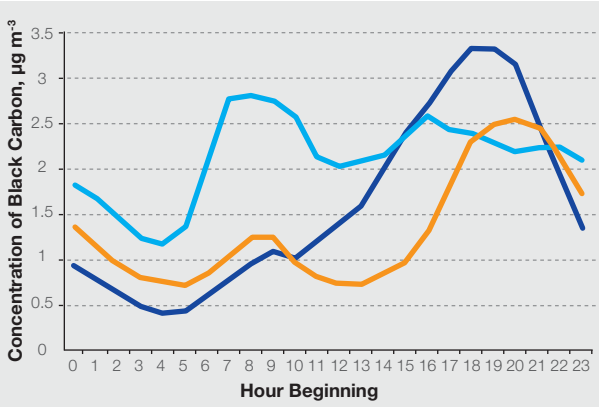

Figure 6.1 Diurnal Variation in Black Carbon at Belfast Centre, Lisburn Dunmurry and Strabane, 2009.

As would be expected if this was the case, the evening peak is much more pronounced in winter, when fuel usage is greater. As an example, Figure 6.2 shows the diurnal variation in black carbon concentration at Strabane, in summer (represented by the period April 1st to September 30th 2009), winter (represented by the mean of 1st January to 31st March and 1st October to 31st December 2009), and the full year.

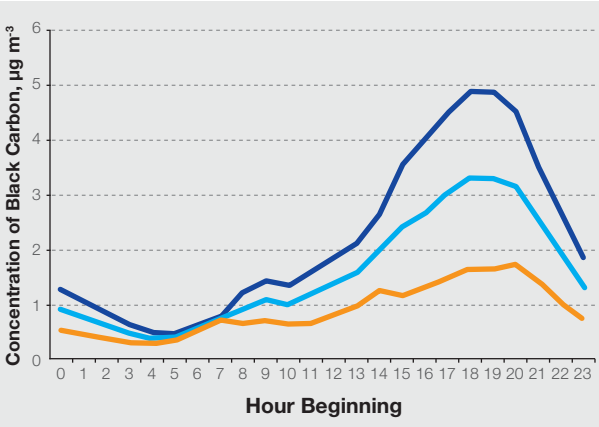

Figure 6.2 Diurnal Variation in Black Carbon at Strabane: summer, winter and full year.

[2] D Butterfield, S Beccaceci, B Sweeney, D Green, J Alexander, A Grieve (2010) "2009 Annual Report for the UK Black Carbon Network" NPL Report AS 52, National Physical Laboratory Queens Road, Teddington, Middlesex TW11 0LW, ISBN 1754-2928. Available on the Air Quality Archive at http://www.airquality.co.uk/reports/cat05/1009031405_2009_BC_Annual_Report_Final.pdf [Accessed 20th Sep 2010].

7

More information

Figure 7.1

The Air Quality Website

1) The Northern Ireland Air Quality Website

The Northern Ireland Air Quality website, available at www.airqualityni.co.uk provides information covering all aspects of air pollution in Northern Ireland. The site, funded by the Department of Environment in Northern Ireland, provides information on;

- latest up-to-date air quality levels across Northern Ireland;
- reports and analysis of trends and historical data;
- information on both national air quality policy and the work of Northern Ireland's district councils;
- descriptions of what causes air pollution, how it is measured, and relevant health, amenity and ecosystem impacts.

The website includes an interactive map showing where Northern Ireland's automatic monitoring stations are located. By clicking on the map, users can view details of each monitoring site and current levels of the pollutants monitored. An 'Air Pollution Index' is used to provide a simple indication of current pollution levels. The website also incorporates an advanced Google Earth™ mapping feature, which allows users to "zoom in" on a site location, using both satellite photos or maps.

2) Current and forecast air quality (national and local)

This information is also readily available from:

- the Air Pollution Information Service on freephone 0800 556677;
- the UK Air Quality Archive on www.airquality.co.uk

3) General information on Air Quality

General air quality information can be found at:

- the DoENI website at www.doeni.gov.uk
- The Northern Ireland Environment Agency website at www.ni-environment.gov.uk
- The UK Air Quality Information Archive on www.airquality.co.uk
- The National Atmospheric Emissions Inventory on www.naei.org.uk
- The Defra air quality information web resource on ww2.defra.gov.uk/environment/quality/air/air-quality/

4) Local Air Quality Issues

For further information on air quality issues in your area, please contact the Environmental Health Department at your local district council office. Further information on Local Air Quality Management may also be found at ww2.defra.gov.uk/environment/

Department of the
Environment
www.doeni.gov.uk

AEA

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ISBN: 978-1-907053-16-0