Department of the
Environment
www.doeni.gov.uk

Air Pollution
in Northern Ireland 2011

RICARDO-AEA

1

Report Highlights

This brochure is the tenth in a series of annual reports on air quality in Northern Ireland. It is produced by Ricardo-AEA, on behalf of the Department of the Environment. This report 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 2011. Figure 1.1 shows the locations of all the automatic air quality monitoring sites in Northern Ireland that were in operation during part or all of 2011.

Section 2 of this report outlines the air quality legislation and policy applicable to Northern Ireland, including the Local Air Quality Management process by which district councils manage air quality at a local level. **Section 3** summarises the monitoring carried out in Northern Ireland, and presents an overview of the data from 2011, including exceedances of air quality objectives.

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 outcome of the Time Extension Notification (TEN) applications submitted for the Northern Ireland and Belfast Urban Area reporting zones. Finally, **Section 7** provides information on how each one of us can help protect the quality of the air in our region, and where to find more information.

Air quality in Northern Ireland has improved substantially in recent decades. In particular, concentrations of sulphur dioxide, a pollutant associated with coal and oil combustion, have declined significantly over the past twenty years (see Section 4). However some pollutants in some parts of Northern Ireland continue to exceed air quality objectives. A 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.

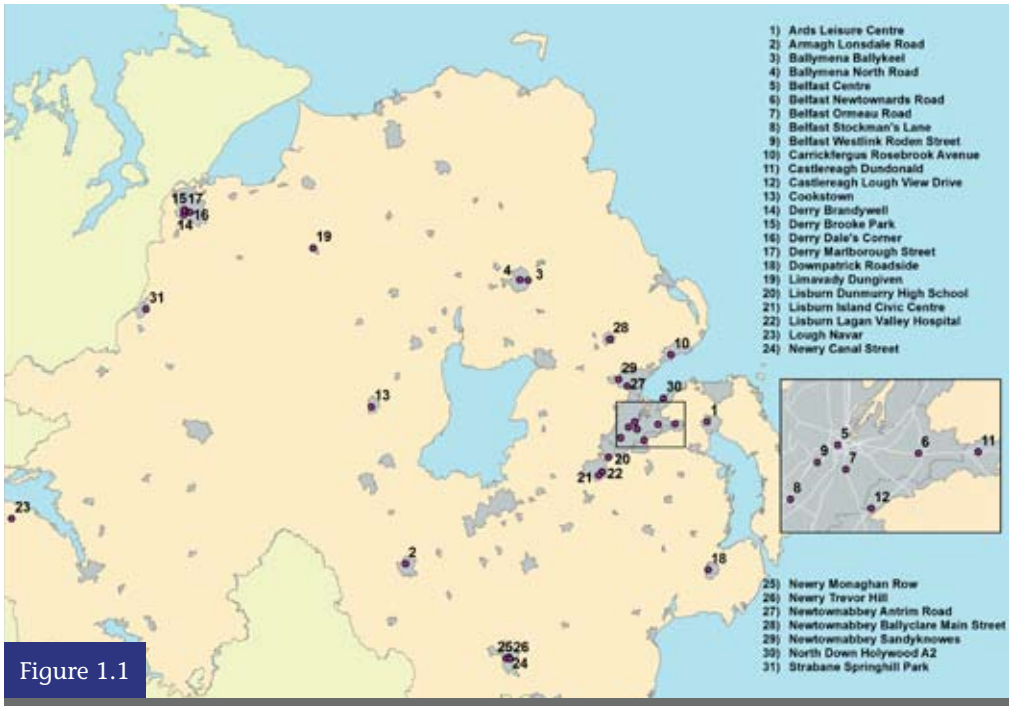


Figure 1.1

Locations of Air Quality Monitoring Sites in Northern Ireland, 2011.

2

Legislation and Policy

The management of air quality in Northern Ireland is based on the requirements of EU Air Quality Directives, and on the UK Air Quality Strategy. These requirements are transposed in Northern Ireland by legislation containing statutory measures, which form the basis of a strong framework for managing air quality.

2.1 The European Union

Much of Northern Ireland's air quality legislation has its roots within the Air Quality Directives which apply to all Member States of the European Union:

- Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe (the Air Quality Directive), which relates to sulphur dioxide, oxides of nitrogen, particulate matter, lead, carbon monoxide, benzene and ozone in ambient air.
- Directive 2004/107/EC (the Fourth Daughter Directive) relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons (PAH) in ambient air.

These are incorporated into Northern Ireland's national law by the Air Quality Standards Regulations (Northern Ireland), of which the most recent revision was in 2010.

2.2 The Air Quality Standards Regulations (Northern Ireland) 2010

These Regulations transpose the provisions of the above Directives into Northern Ireland's own legislation. As well as the EU limit values and non-mandatory target values for ambient concentrations of pollutants, the Regulations set out requirements for ambient air quality monitoring, including number of monitoring sites required, suitable locations and acceptable methodology. They also identify the duties of Northern Ireland's Departments in relation to achieving limit and target values. It is the responsibility of Departments to inform the public about air quality in the region, particularly with regard to warning the public when information and alert thresholds are exceeded.

2.3 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, first published in 1997 and updated in 2007, provides a comprehensive framework for tackling air pollution. It was established on the basis of strong scientific evidence and a science-based understanding of the effects of air pollutants on health and the environment.

The Strategy sets objectives for a series of pollutants to be met within the UK. The scientific basis, the objectives set and provisions contained within the Strategy are closely associated with the corresponding standards set within European Air Quality Directives, as described above. The Strategy's provisions for some pollutants differ from those in the Directives; these differences relate to scientific evidence and expert opinion that is specific to the UK situation. However, all the Air Quality Strategy objectives are at least as stringent as the corresponding limit values in the Air Quality Directive or 4th Daughter Directive.

The full Air Quality Strategy and its technical annexes are available online and can be downloaded from http://www.defra.gov.uk/environment/quality/air/air-quality/approach/.

Photo: The palm house, Belfast Botanic Gardens

2.4 Local Air Quality Management

Local Air Quality Management (LAQM) provides the framework under the Environment Order (NI) 2002 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, 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 to 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 the objectives, are also set out in the Air Quality Standards Regulations (NI) 2010.

At the time of writing, twelve of Northern Ireland's 26 district councils have Air Quality Management Areas in place (Table 2.1). Of these, one has declared AQMAs for PM_{10} alone, nine have declared AQMAs for NO_2 only, one has declared separate AQMAs for both NO_2 and PM_{10}, and one (Belfast City Council) has AQMAs for NO_2 and for NO_2 and PM_{10} together. Figure 2.1 shows the locations of these AQMAs, and which pollutants they address.

Table 2.1 Air Quality Management Areas in Northern Ireland (as of Oct 2012)

District Council	No. of AQMAs	Pollutants	Sources
Armagh	2	NO_2 (2)	Road traffic
Ballymena	3	PM_{10} (2), NO_2 (1)	Domestic emissions (PM_{10}), road traffic (NO_2)
Belfast City	4	NO_2 (3), NO_2 and PM_{10} (1)	Road traffic
Castlereagh	1	NO_2	Road traffic
Craigavon	2	NO_2 (2)	Road traffic
Derry City	3	NO_2 (3)	Road traffic
Dungannon	4	NO_2 (4)	Road traffic
Limavady	1	NO_2	Road traffic
Magherafelt	1	NO_2	Road traffic
Newry & Mourne	1	NO_2	Road traffic
Newtownabbey	3	NO_2 (3)	Road traffic
Strabane	3	PM_{10} (3)	Domestic emissions

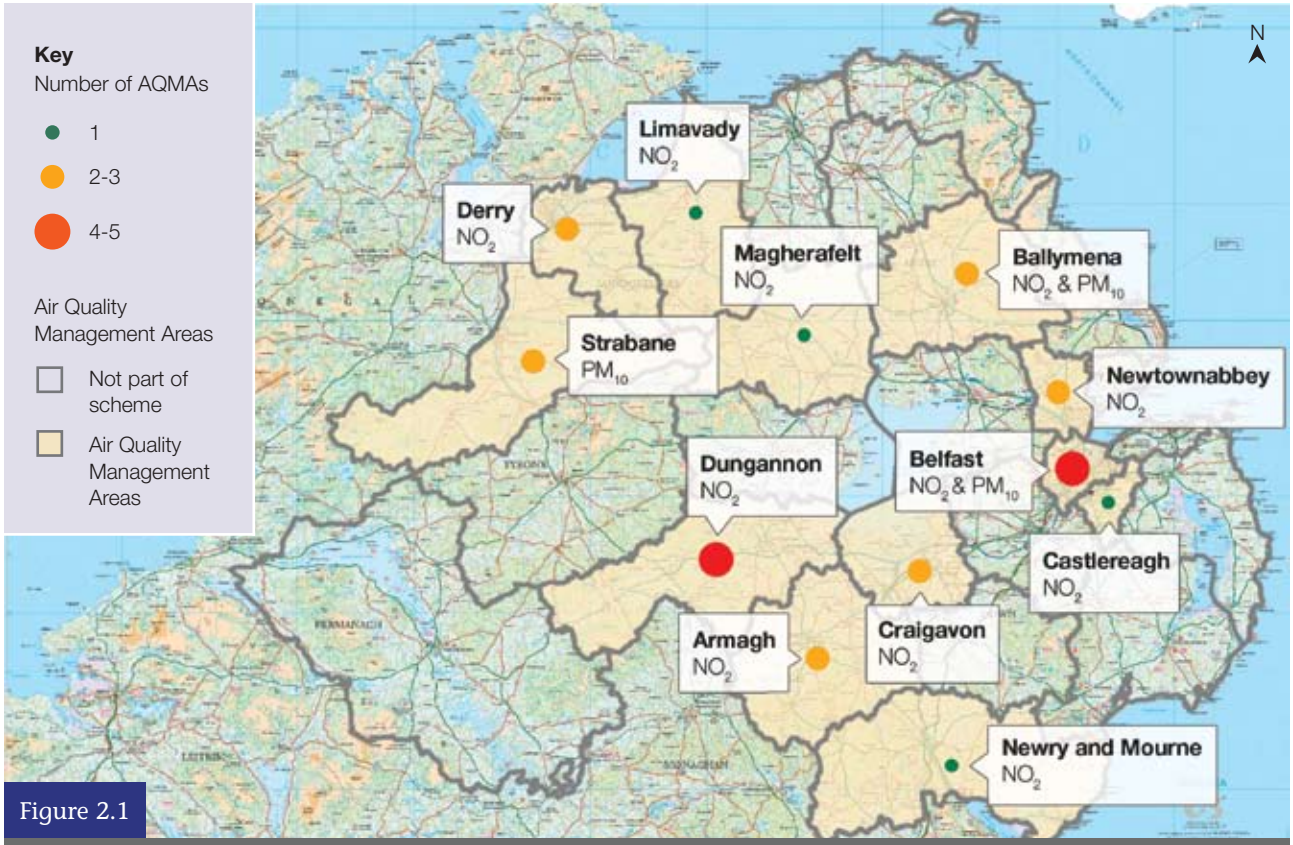


Figure 2.1

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

3

2011 Results from Monitoring Networks

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 Air Quality Directive sets out how many monitoring sites (or 'stations') are needed in each zone, based on size and population. Only sites which meet the stringent siting criteria of the Directive may be used for reporting to the European Commission. The Directive siting criteria are different from those used for LAQM: for example, sites located close to major road junctions are used in LAQM, but must not be used for Directive monitoring purposes.

The following pollutants were monitored in Northern Ireland during 2011:

- Carbon monoxide (CO)
- Oxides of nitrogen (NO_x), comprising nitric oxide (NO) and nitrogen dioxide (NO_2)
- Sulphur dioxide (SO_2)
- Particles (as PM_{10}, $PM_{2.5}$, and black carbon)
- Ozone
- Benzene
- Metallic pollutants
- Polycyclic Aromatic Hydrocarbons (PAH).

During 2011, there were 32 automatic air quality monitoring stations in Northern Ireland[1], each equipped with continuous monitoring equipment for some or all of the above pollutants. These sites (shown previously in Figure 1.1) provide high-resolution hourly information on a wide range of pollutants. Data from the continuous monitoring sites are communicated rapidly to the public, together with warnings when levels approach or reach the "high" pollution band.

Five sites (Belfast Centre, Derry Brooke Park, Armagh Lonsdale Road, Ballymena Ballykeel and Lough Navar) are part of the UK's national monitoring network, and are used to assess compliance with the Air Quality Directive.

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, many district councils use diffusion tubes for indicative monitoring of nitrogen dioxide. 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 a useful and economical supplement to automatic monitoring.

3.2 King's College London Volatile Correction Model

Eight of Northern Ireland's 20 PM_{10} monitoring sites use the Tapered Element Oscillating Microbalance (TEOM) to measure PM_{10}. The relatively high operating temperature of the TEOM (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 equivalent. To access the model and for more information, visit www.volatile-correction-model.info.
The TEOM PM_{10} data presented in this report have been corrected to gravimetric equivalent using the VCM. (There is at present no requirement to correct TEOM measurements of $PM_{2.5}$.)

[1] Note: North Down Bangor closed very early in 2011 and is therefore not shown in Figure 1.1.

3.3 Key Results for 2011

This section summarises key monitoring results from 2011, including compliance with EU limit values and the corresponding Air Quality Strategy (AQS) objectives. Further information is provided on the Northern Ireland Air website at www.airqualityni.co.uk/.

Carbon monoxide was monitored using an automatic instrument at one site – Belfast Centre. The results were well within the EU limit value and AQS objective for this pollutant, and have been for many years.

Benzene was monitored at one site: Belfast Centre – which met the annual mean EU limit value and AQS objective (for the running annual mean) in 2011, as it has for many years.

Metallic pollutants including lead, arsenic, cadmium and nickel were monitored using non-automatic techniques at Belfast Centre, as part of the Urban Metals Network. The results for 2011 were within the annual mean EU limit value and AQS objective for lead, and within the EU annual mean target values for arsenic, cadmium and nickel.

Sulphur dioxide was monitored at seven automatic sites. All sites met the EU limit values for SO_2 (1-hour and 24-hour mean), and the AQS objective for the 15-minute mean. 2011 was the eighth consecutive year in which all the SO_2 limit values and objectives have been met – this provides evidence of the progress made in reducing ambient levels of this pollutant in Northern Ireland.

Particulate matter – PM_{10} Particulate matter as PM_{10} was monitored at 20 locations in 2011. All sites met the limit value and objective of 40 µg m^{-3} for annual mean PM_{10}. Just one site (Newry Canal Street) exceeded the 24-hour mean limit value and objective of 50 µg m^{-3}, on more than the permitted 35 occasions during the year. As reported in previous years, there is concern about the location of Newry Canal Street. It is situated in a corner formed by two adjoining buildings, and it is feared that wind vortices can form in the corner, blowing dust into the sampling inlet and leading to artificially high PM_{10} measurements. (This site is not used for monitoring compliance with the Air Quality Directive.)

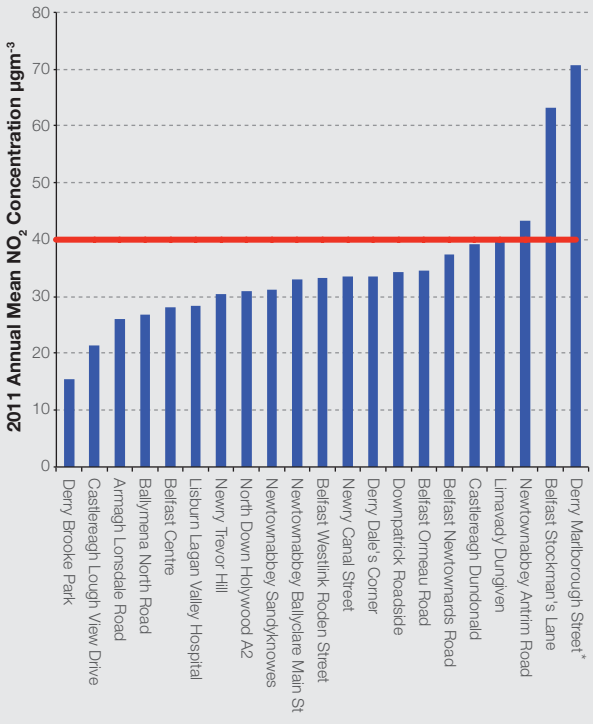
Particulate matter – $PM_{2.5}$ Fine particulate matter as $PM_{2.5}$ was monitored at Belfast Centre, Derry Brooke Park and Lisburn Dunmurry during 2011. All three sites measured annual mean $PM_{2.5}$ concentrations well within the EU annual mean target value of 25 µg m^{-3} (although not all these sites achieved 90% data capture for this pollutant).

Nitrogen dioxide was monitored using automatic analysers at 21 sites during 2011. Three roadside sites exceeded the limit value and objective for annual mean NO_2 concentration (40 µg m^{-3}). These sites were: Belfast Stockman's Lane, Derry Marlborough Street and Newtownabbey Antrim Road (Figure 3.1). (These sites are not used for monitoring compliance with the Air Quality Directive).

Derry Marlborough Street is a new site which was established in Nov 2011: therefore it had just 10% data capture for the year, which is insufficient for a valid annual mean. However, data for the six months January to June 2012 indicate that an exceedance is likely in 2012, the site's first full year of operation.

Of the three sites which exceeded the annual mean limit value, just one also recorded more than the permitted 18 exceedances of the hourly mean limit value and AQS objective (200 µg m^{-3}). This was Belfast Stockman's Lane.

The number of exceedances of both NO_2 limit values was lower than in 2010, which is considered to have been a relatively high year for this pollutant. (Modelling has also indicated that there are areas alongside the A12 Westlink/ M1 corridor which exceed the annual mean limit value).



(*Derry Marlborough Street included for information, despite low data capture of only 10% in 2011.)

Figure 3.1

Annual Mean NO_2 Concentrations

Ozone was monitored at Belfast Centre, Derry Brooke Park and the rural Lough Navar site. No sites exceeded the EU target value for human health of 120 µg m^{-3} (for the maximum daily 8-hour mean) on more than the permitted 25 days, but Lough Navar did exceed the more stringent AQS objective of 100 µg m^{-3} on more than the permitted 10 days in 2011, as it also did in 2010 (Figure 3.2).

Unlike some other pollutants, levels of ozone (O_3) in Northern Ireland do not appear to be decreasing, but remain variable from year to year. Ozone exceedances happen in some years but not others. The reasons for this relate to how ozone is formed: it is a "secondary" pollutant – that is, it is formed by reactions involving other pollutant gases, in the presence of sunlight, and over several hours. This means that the number of ozone exceedances in any given year depend substantially on weather conditions. It is also believed that the "hemispheric background" concentration of (largely natural) O_3 is not decreasing: O_3 exceedances therefore remain possible in future.

Ozone is also a "transboundary" pollutant: 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.

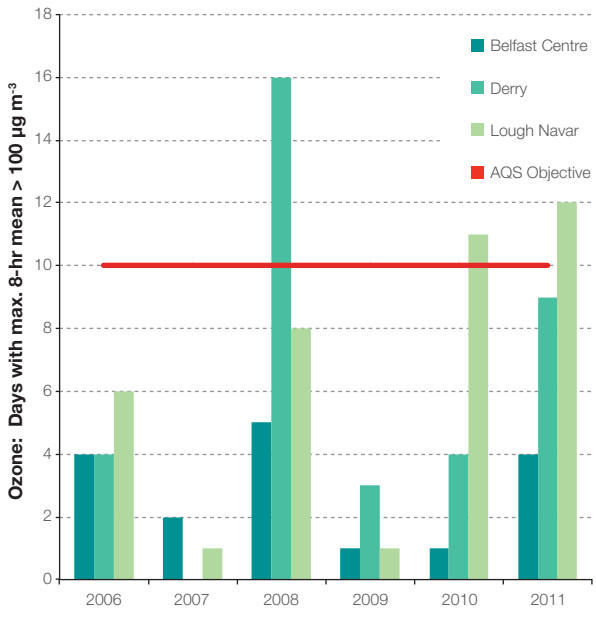


Figure 3.2

Ozone: Days with Maximum 8-hour mean > 100 µgm^{-3}

Polycyclic aromatic hydrocarbons (PAH) were monitored at three sites in 2011, which were all part of the PAH Network. The network measures a range of PAH compounds, but one species in particular, benzo[a]pyrene (B[a]P), is used as a "marker" for PAH compounds and is the subject of an AQS objective and EU target value. Annual mean concentrations of B[a]P at the three sites were as follows: 1.12 ng m^{-3} at Ballymena Ballykeel, 0.95 ng m^{-3} at Derry Brandywell and 0.86 ng m^{-3} at Lisburn Dunmurry (Figure 3.3). All three sites therefore exceeded the AQS annual mean objective of 0.25 ng m^{-3} for this PAH species, which was to have been achieved by 31st Dec 2010. Ballymena Ballykeel also exceeded the less stringent EU target value of 1 ng m^{-3} for annual mean B[a]P concentration, to be met by 31st Dec 2012.

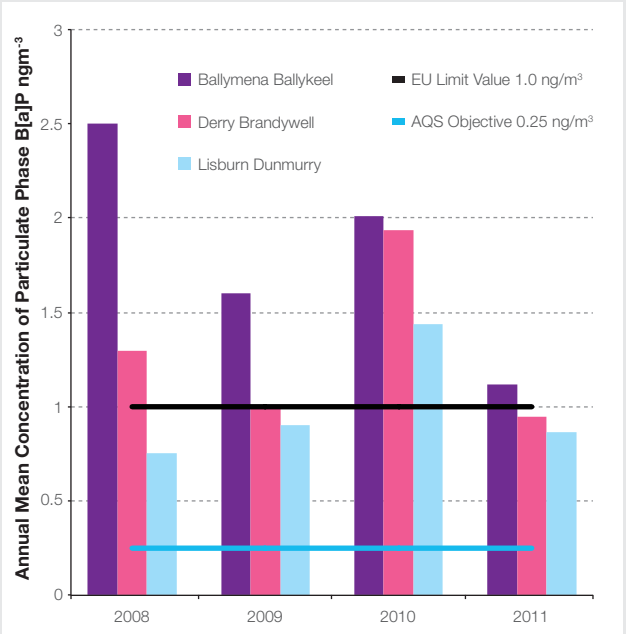


Figure 3.3

Annual mean concentrations of benzo[a]pyrene, 2011

A report on PAH in Northern Ireland, released in Feb 2012 by NPL[2] (the organisation responsible for operating the PAH Network) explores the reasons for the high PAH concentrations measured in Northern Ireland. These are believed to reflect the high usage of solid fuels in certain areas, particularly those with limited availability of natural gas. NPL's report makes five recommendations for policy in Northern Ireland, aimed at helping to reduce concentrations of these pollutants:

1. *"Conversion schemes for privately owned/let homes ought to be encouraged, perhaps through the provision of financial support to aid the rate of conversion* (of homes to natural gas) *across Northern Ireland. Further conversions will help to reduce B[a]P emissions and concentrations as well as PM_{10} concentrations.*
2. *Increase the availability of natural gas through extending current pipelines and encouraging uptake in areas already served.*
3. *Continue/improve promotion of current energy efficiency schemes to increase the uptake rate and hence reduce emissions and improve quality of life.*
4. *Smoke control areas ought to be effectively enforced and the areas covered by smoke control legislation should be examined.*
5. *Use spare aethalometers* to quickly and cheaply screen projected hotspot areas for elevated PAH concentration prior to making measurements using the filter based method".*

*Aethalometers are the instruments used in the Black Carbon Network to measure black carbon.

3.4 Summary

EU limit values, target values and corresponding AQS objectives, have been met by the due dates for the following pollutants –

- Carbon monoxide
- Benzene
- Sulphur dioxide
- Metallic pollutants: lead, arsenic, cadmium and nickel.

However, a small number of sites close to busy roads in urban areas do not meet the limit values and objectives for nitrogen dioxide. Using monitored values of NO_2 concentrations, modelling has been carried out; this has indicated NO_2 exceedances along the A12 Westlink/ M1 corridor, and so has shown a problem in achieving compliance with the EU limit value. Northern Ireland is not alone in this respect: many parts of the UK (and other Member States of Europe) have reported similar exceedances. The UK has applied for a time extension for compliance regarding NO_2 in a number of zones, including the Northern Ireland zone and the Belfast Urban Area zone.

One site in Newry did not meet the limit value and objective for 24-hour mean PM_{10}. There is concern that the relatively high PM_{10} levels measured at the site may not be genuinely representative of its surroundings, but affected by aspects of its "microscale" siting. Since it is not used for monitoring with respect to the EU Directive limit value, this does not affect Northern Ireland's compliance status.

Benzo[a]pyrene concentrations at Northern Ireland's three sites exceeded the AQS objective for 2010 and EU target value for 2012. The reasons for the high PAH concentrations in some parts of the country have been explored in the recent report by NPL, which also suggests policy measures to help tackle the problem.

Ozone concentrations are affected by long-range rather than local factors, and occasional O_3 exceedances (like those which occurred at Lough Navar in 2010 and in 2011) also remain a possibility in future.

[2] DM Butterfield, RJC Brown 2012 "Polycyclic Aromatic Hydrocarbons in Northern Ireland". NPL Report Number AS66. Available online at http://uk-air.defra.gov.uk/reports/cat05/1203080854_pah_in_ni_report_final_published_version_v2.pdf

4

Changes Over Time

Recent decades 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.

Recent years have seen a substantial increase in the number of automatic monitoring sites in Northern Ireland. This has improved our understanding of the region's pollution climate. However, it potentially complicates the investigation of trends in air quality: if such investigations are based on all available data, discontinuities may be introduced because of the changes in the number of sites (and their distribution). For example, in 2001 there was just one automatic roadside site monitoring NO_2 in Northern Ireland, but in 2010 there were 15 sites. Therefore, in recent reports in this series, investigation of changes over time has been based on subsets of long-running sites rather than on every site in the network. This should lead to a more robust assessment.

Also, it is usually considered that at least five consecutive years' data are required from a monitoring site, in order to assess long-term trends. Therefore in this section, assessment is based only on sites that have been in operation since at least 2007.

4.1 Sulphur Dioxide

Sulphur dioxide is formed when fuels containing small amounts of sulphur (such as coal and oil) are burned. In the past, such fuels have been widely used for domestic heating in Northern Ireland, leading to relatively high concentrations of sulphur dioxide. However, as natural gas has become more widely available, sulphur dioxide concentrations have declined significantly. This is illustrated by Figure 4.1, which shows a time series of annual mean SO_2 concentrations for two subsets of sites: firstly, Belfast East and Belfast Centre – the only two sites in operation since the early 1990s. The second subset refers to three urban sites all of which have been in operation since 2003.

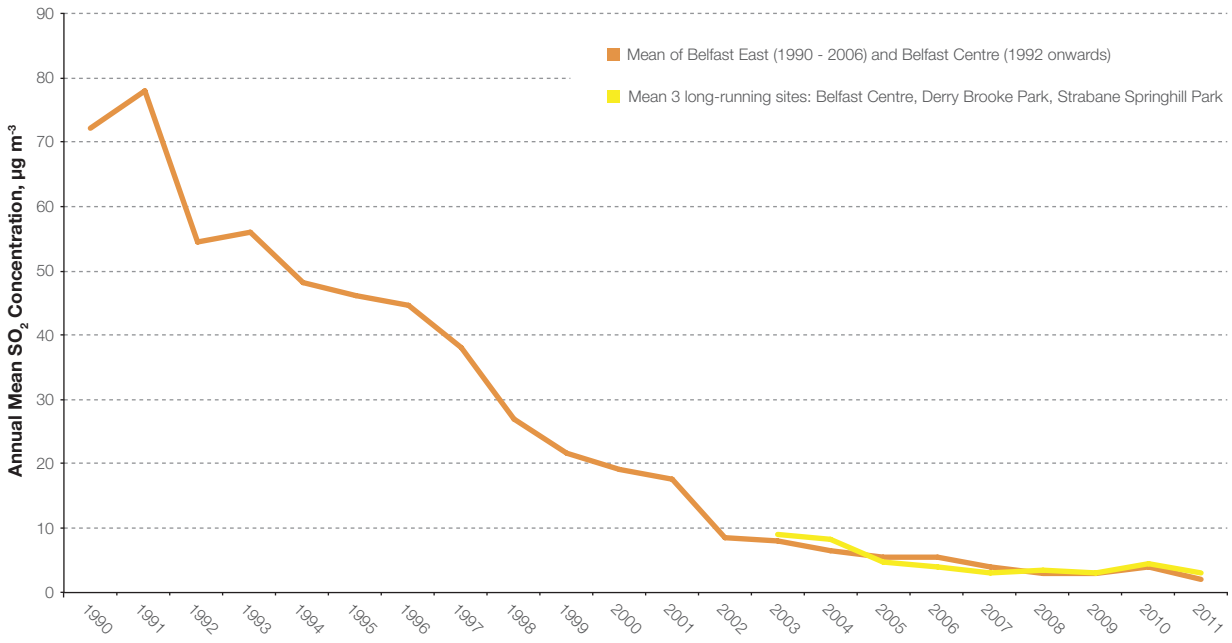


Figure 4.1

Time Series of Annual Mean Sulphur Dioxide Concentration at Long-Running Sites in Northern Ireland, 1990- 2011

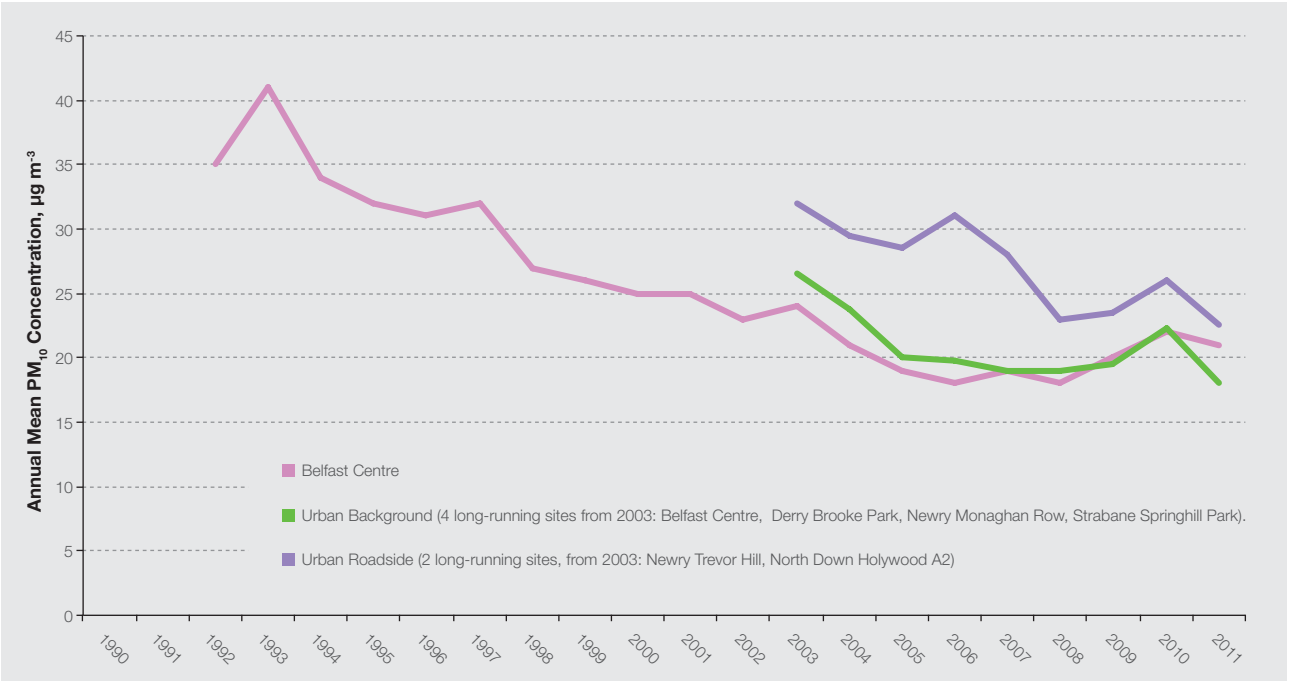


Figure 4.2

Time Series of Annual Mean PM_{10} at Long-Running Sites in Northern Ireland, 1990 - 2011.

4.2 Particulate Matter as PM_{10}

Figure 4.2 shows a time series of annual mean concentrations of PM_{10} since 1990. Roadside locations are represented by a subset of two long-running monitoring sites (Newry Trevor Hill and North Down Holywood A2). They have both been operating since 2003 or earlier, and have at least 70% data capture in all years (the exception being 2008 at Newry Trevor Hill, where only 56% data capture was obtained: this has been included to avoid a misleading discontinuity in the graph). Two other sites that were included in this subset in previous years have been excluded this year – Castlereagh Lough View Drive, which has now closed, and Lisburn Lagan Valley Hospital which no longer measures PM_{10}.

Urban background locations are represented by a subset of four long-running monitoring sites, all operational since 2003 or earlier; Belfast Centre, Derry Brooke Park, Newry Monaghan Row and Strabane Springhill Park. (The other four sites included in this subset in the 2010 report have either closed or no longer monitor PM_{10}). Belfast Centre, which has monitored PM_{10} since 1992, is also shown. Annual data capture is at least 50% in all cases.

Annual mean PM_{10} concentrations at Belfast Centre have generally decreased between 1992 and 2009: 2010 was a relatively high year. The urban background and roadside averages from 2003 onwards show a similar pattern: there is a noticeable peak for 2010. This is likely to have been due to periods of cold winter weather at the beginning and end of 2010; these caused periods of elevated PM_{10} concentration, as discussed in the 2010 report.

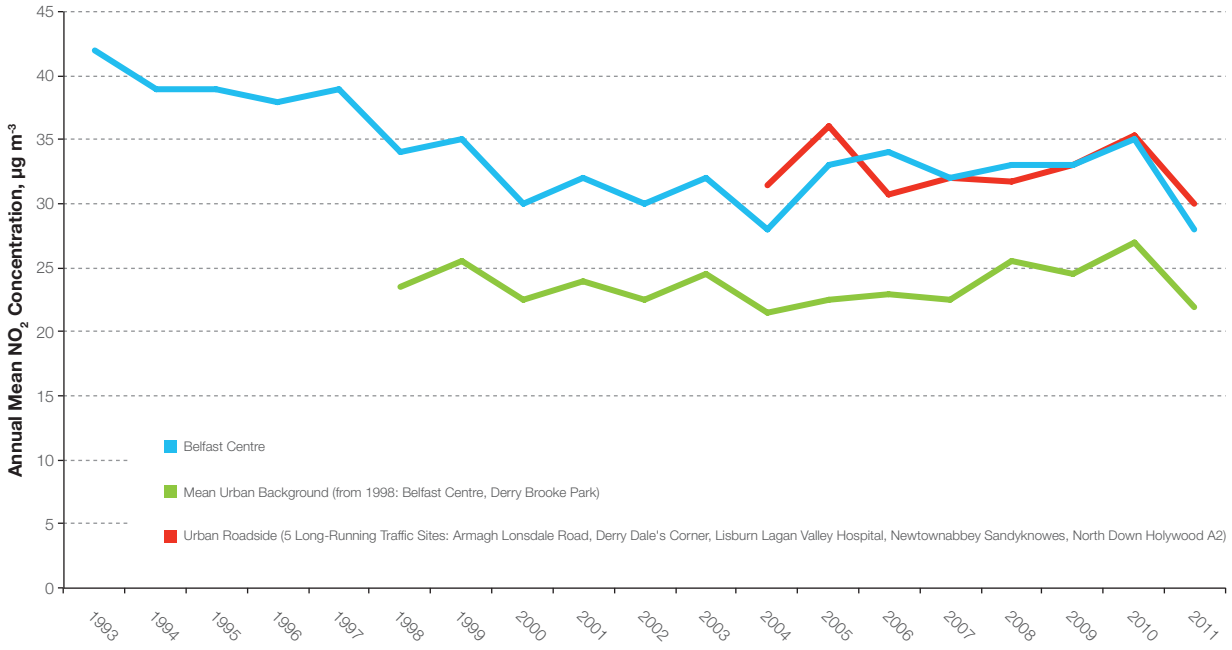


Figure 4.3

Time Series of Average Annual Mean NO_2 at Long-running Sites in Northern Ireland, 1993-2011

4.3 Oxides of Nitrogen

Within Northern Ireland (and throughout the UK) the most widely exceeded AQS objective and EU limit value applies to annual mean nitrogen dioxide (NO_2). It is therefore important to understand how ambient concentrations of this pollutant are changing over time.

Figure 4.3 shows a time series graph of the average annual mean NO_2 concentration for two sub-sets of long-running monitoring sites. Background urban (i.e. non-roadside) sites from 1998 onwards are represented by the mean of Belfast Centre and Derry Brooke Park, shown by the green line in Figure 4.3. Data capture for each site is at least 70%, except in 2005 at Belfast Centre, where it was only 50% - however, because NO_2 concentrations at this site are typically much higher than at Derry Brooke Park, this annual mean has been included, to avoid a misleading discontinuity in the graph. The annual mean NO_2 concentration at Belfast Centre, the longest running site, is also shown separately.

Traffic-related urban sites are represented from 2004 by a subset of five long-running sites; Armagh Lonsdale Road, Derry Dale's Corner, Lisburn Lagan Valley Hospital, Newtownabbey Sandyknowes and North Down Holywood A2. These are shown by the red line in Figure 4.3. Minimum annual data capture for inclusion in this graph is 70%: Armagh Lonsdale Road did not meet this minimum in 2004 or 2009, Derry Dale's Corner did not meet this minimum in 2006.

The annual mean NO_2 concentration at Belfast Centre (the longest-running site) decreased through the 1990s. This downward trend then appeared to reverse, as annual mean NO_2 concentrations at the site during 2008-2010 were slightly but consistently higher than those measured in 2000-2004. However, the annual mean of 28 µg m^{-3} measured at Belfast Centre in 2011 was the lowest since 2004. The mean of the two urban background sites (shown as a green line on Figure 4.3 from 1998 onwards) shows a similar pattern.

The average annual mean NO_2 concentration for urban traffic-related sites (based on the five sites listed above, from 2004 onwards) shows no clear upward or downward trend. Although the 2010 average was the highest since 2005, the 2011 average was the lowest since the series began in 2004.

The lack of a downward trend, for roadside sites in particular, is consistent with the findings of a 2007 report by the Air Quality Expert Group, which reported that roadside NO_2 concentrations in the UK (which had previously been falling) showed "little indication of a downward trend after 1997"[3]. AQEG attributed this to:

- An increase in the proportion of total NO_x emitted directly to the atmosphere as NO_2.This is due to the increased market penetration of diesel cars, and the retrofitting of pollution control devices, such as catalytically regenerative traps, to buses.
- Increasing hemispheric background concentrations of ozone, which promotes the oxidation of emitted NO to NO_2.

While 2010 appears to have been a relatively high year for NO_2 in Northern Ireland, possibly due to the cold winter weather experienced at the beginning and end of the year, by contrast 2011 appears to have been a low year for this pollutant.

4.4 Ozone

As highlighted in Section 3, the AQS objective for ozone was not met in Northern Ireland in 2011.

Figure 4.4 shows a time series graph of the average annual mean O_3 concentration for three long-running sites, all of which have at least 75% data capture since 1998 or earlier. These are: Belfast Centre, Derry Brooke Park and Lough Navar (the latter is a rural site, the other two are background urban).

There is no clear upward or downward trend in annual mean ozone concentrations over the period shown. As explained in Section 3, ozone is formed from other pollutants by chemical reactions in the presence of sunlight. Ozone concentrations (and the number of exceedances in any given year) therefore depend to a large extent on meteorological conditions.

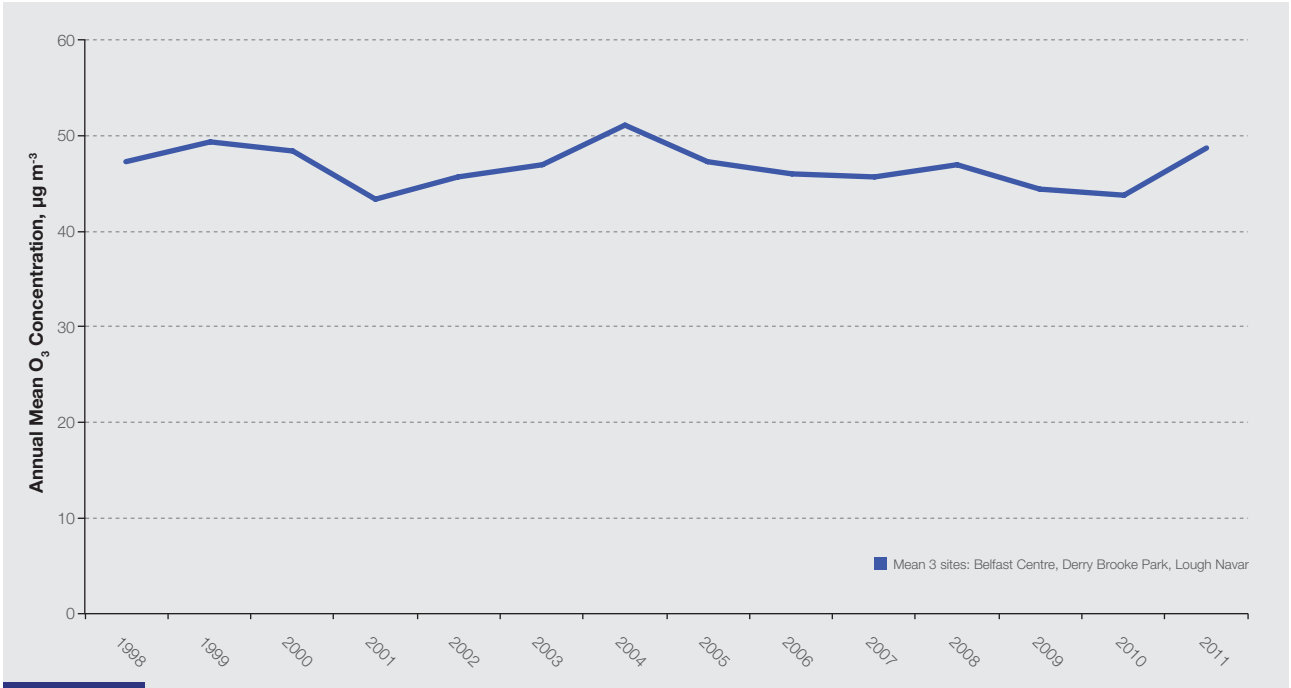


Figure 4.4

Time Series of Average Annual Mean O_3 at Long-running Sites in Northern Ireland, 1993-2011

[3] Air Quality Expert Group (2007) "Trends in primary nitrogen dioxide in the UK". [online]. Available at http://archive.defra.gov.uk/environment/quality/air/airquality/publications/primaryno2-trends/documents/primary-no-trends.pdf [accessed 5th Oct 2011].

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 modelled maps – at 1km resolution - of average or peak background pollutant concentrations across Northern Ireland for 2011.

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 modelled peak concentrations are below 50 µg m^{-3} over most of Northern Ireland, there are some small areas of higher peak SO_2 concentration (over 150 µg m^{-3}) in parts of the Belfast conurbation, as well as the Craigavon area and Newry - possibly areas of high domestic coal or oil use in these towns.

Figure 5.2 shows corresponding annual mean PM_{10} concentrations. 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 AQS objective.

Figure 5.3 shows modelled annual mean NO_2 concentrations at background locations (i.e. at least 10m away from major roads). These are all well below the AQS objective even in central Belfast. Although this map shows background concentrations, the contribution of vehicle emissions can still be seen – the network of major roads connecting Northern Ireland's cities is clearly visible in Figure 5.3. The roads are visible because the presence of a major road in a grid square raises the average NO_2 concentration in that grid square.

For traffic-related pollutants, roadside concentrations (4m from the kerb) are also modelled. Figure 5.4 shows modelled annual mean NO_2 concentrations alongside major roads in the Belfast area. Exceedances of the AQS objective are predicted along numerous road links, including some city centre streets, the A12 (Westlink) and part of the M1 corridor, the A2 towards Holywood and part of the A22 in the Castlereagh area. This is generally consistent with the monitoring results, which identified exceedances at several urban roadside sites: however, there is no modelled exceedance along Newtownabbey's Antrim Road, where a monitoring exceedance was measured in 2011.

SO_2

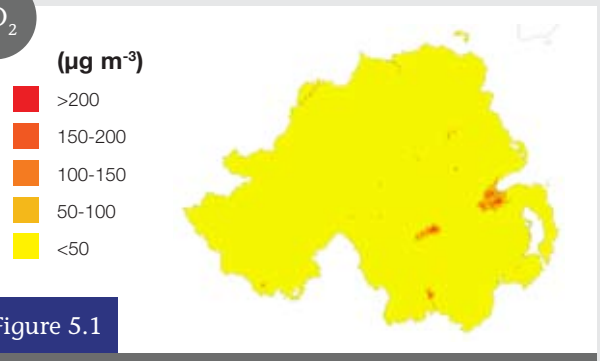


Figure 5.1

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

PM_{10}

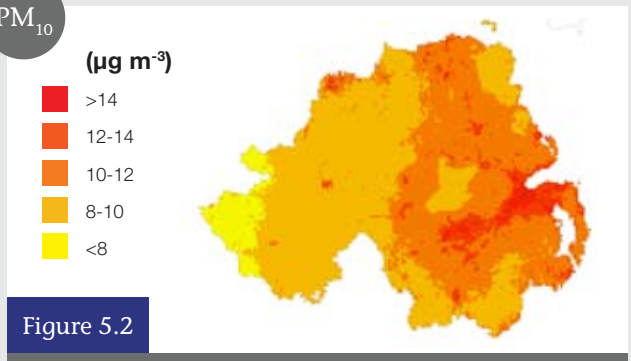


Figure 5.2

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

NO_2

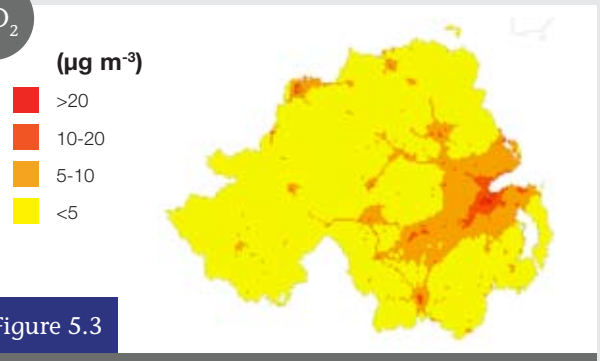


Figure 5.3

Estimated annual mean background NO_2, µg m^{-3}

NO_2

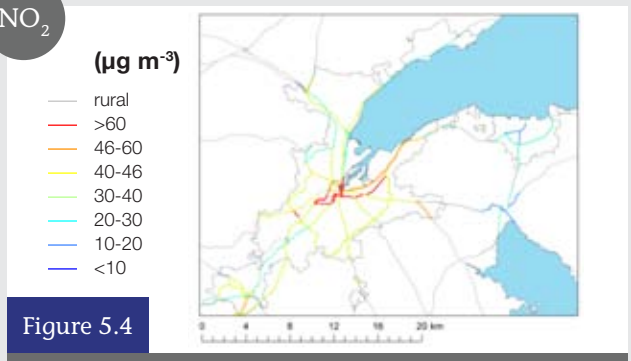


Figure 5.4

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

6

Achieving Compliance with the Air Quality Directive

The Air Quality Directive (2008/50/EC) contains mandatory limit values for the pollutants sulphur dioxide, oxides of nitrogen, particulate matter, lead, carbon monoxide and benzene, together with non-mandatory target values for ozone. Each Member State must demonstrate compliance with the limit values, by a specified date. Compliance is demonstrated using air quality monitoring data, with the option of supplementing this with modelling data. The UK uses both modelled and monitored data to assess compliance.

Each Member State is divided into "zones" for reporting purposes; the UK consists of 43 zones. Two zones make up Northern Ireland – Belfast Urban Area, and the Northern Ireland Zone (which comprises the remainder of the region, outside of Belfast).

The Air Quality Directive sets out criteria for the number of monitoring sites (or "stations") needed in each zone, based on size and population. It also specifies measurement methods, and how the apparatus must be sited. Five sites in Northern Ireland meet these criteria and are used to assess compliance with the Directive (see Section 3.1), while the rest of the monitoring sites are used to assess compliance with the UK Air Quality Strategy alone.

Directive limit values for sulphur dioxide, lead, carbon monoxide and benzene were achieved throughout the UK, by the due dates. The limit values for PM_{10} have been achieved in all UK zones although compliance risks remain in Greater London. However, the limit values for nitrogen dioxide have proven more difficult to achieve. Forty UK zones failed to meet the annual mean limit value for NO_2 (40 µg m^{-3}) by the deadline of 1st Jan 2010 – including Belfast Urban Area and Northern Ireland.

The Directive allows Member States to postpone this deadline until 2015 at the latest, if they can clearly demonstrate they are unable to comply by the specified date, and if they establish an Air Quality Action Plan, for each relevant reporting zone, capable of delivering compliance by the new deadline.

In September 2011, the UK Government applied to the European Commission for a Time Extension Notification (TEN) with respect to the above limit value in the affected zones. This was accompanied by Air Quality Action Plans for each affected zone, setting out how compliance with the annual mean NO_2 limit value would be achieved, by 2015 at the latest.

After considering the TEN applications, the Commission published its reply in June 2012. The conclusions were as follows:

- In the case of Belfast Urban Area, the Commission was not satisfied that the proposed and existing measures in the Action Plan could effectively address the compliance gap by 1st Jan 2015. Therefore, a TEN was not granted for this zone.
- For the Northern Ireland zone, the Commission considered that compliance could actually be achievable by 2014, and that the Air Quality Action Plans should be adjusted accordingly.

Belfast Urban Area and Northern Ireland were just two of 15 zones for which the Commission did not grant a TEN, in most cases for the reasons above or similar ones.

7

What Can I Do To Help?

It takes energy to produce food, treat our drinking water, manufacture the things we use, heat our homes and workplaces, and transport us to the places we need to go. Most of this energy comes from the burning of fuels – producing CO_2 (which contributes to climate change) and usually some air pollutants (such as NO_x and PM_{10}).

Therefore, the choices we make about how we travel, how we heat our homes, and the things we buy and use can all help to make a difference to air quality. If we can use less energy, and avoid wasting it, this will avoid releasing unnecessary pollution into the air. It will also save us money.

Here are some things we can do:

- Make sure your home is well insulated and the boiler well-maintained: in most UK homes, the central heating system accounts for the highest percentage of energy used[4]. Under the **Warm Homes Scheme** you may be able to receive the following help:
  - Cavity Wall Insulation
  - Loft Insulation
  - Hot water tank jacket
  - Benefit Entitlement Check
  - Energy Advice
  - Installation of central heating in homes that do not have it.
  - Conversion of an existing solid fuel, LPG or Economy 7 heating system to natural gas (in areas where it is available) or oil (where it is not).

Check out the Warm Homes website at http://www.warm-homes.com/ to see if you qualify.

- If you are a landlord, ensure that the homes you let are properly insulated, so that your tenants do not have to waste energy to keep warm.
- Stay warm but don't overheat your home: 21° C is comfortable for most people.
- Try to drive less. Walk or cycle if possible, or use public transport – especially for short journeys. The NIDirect **Travelwise Northern Ireland** website provides advice and information on more sustainable transport options, including walking, cycling, car sharing and public transport, for commuters, schools and employers. Travelwise Northern Ireland can be found at http://www.nidirect.gov.uk/index/information-and-services/travel-transport-and-roads/travelwiseni.htm.
- Avoid wasting food – it takes energy to produce. There is plenty of useful advice on the **Love Food Hate Waste** website, at http://ni.lovefoodhatewaste.com/.

Lots more energy saving advice can be found on the NI Direct "Environment and Greener Living" webpages at http://www.nidirect.gov.uk/index/information-and-services/environment-and-greener-living.htm.

Where to Find Out More on Air Quality:

The Northern Ireland Air Quality Website at http://www.airqualityni.co.uk/ provides information covering all aspects of air pollution in Northern Ireland.

The DoENI website at www.doeni.gov.uk provides information on a range of environmental issues including air quality, waste and climate change.

National and local air quality forecasts are available from:

- The Air Pollution Information Service on freephone 0800 556677
- The Defra UK Air Information Resource (UK-AIR) at http://uk-air.defra.gov.uk/

For information on air quality issues in your local area, please contact the Environmental Health Department of your district council.

[4] nidirect "Central Heating" [online]. Available at http://www.nidirect.gov.uk/index/information-and-services/environment-and-greener-living/energy-wise/central-heating.htm. (Accessed 19 Oct 2012)

Department of the Environment
www.doeni.gov.uk

RICARDO-AEA

This report has been produced by Ricardo-AEA on behalf of the Department of the Environment

Its main authors are Alison Loader, and Paul Willis. Maps by Justin Lingard and Shaun Brace.

ISBN: 978-1-907053-39-9

Front cover photo: Titanic Belfast building under construction. Back cover photo: detail of Titanic Belfast building. Courtesy of Titanic Belfast