Department of the
Environment
www.doeni.gov.uk

Air Pollution
in Northern Ireland 2013

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Report Highlights

This is the twelfth 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. The report contains the key results of that monitoring from throughout the region during 2013. 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 2013.

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 2013, including exceedances of air quality objectives.

As in previous reports, **Section 4** deals with how air pollution in Northern Ireland has changed over time, and **Section 5** covers spatial patterns in pollution. **Section 6** is used to report on topics of special interest; this year it covers the Northern Ireland 'ecar' project, in which a comprehensive network of 174 public charging points for electric vehicles has been installed, in towns and cities throughout Northern Ireland. Finally, **Section 7** provides information on how each one of us can help protect and improve 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. 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.

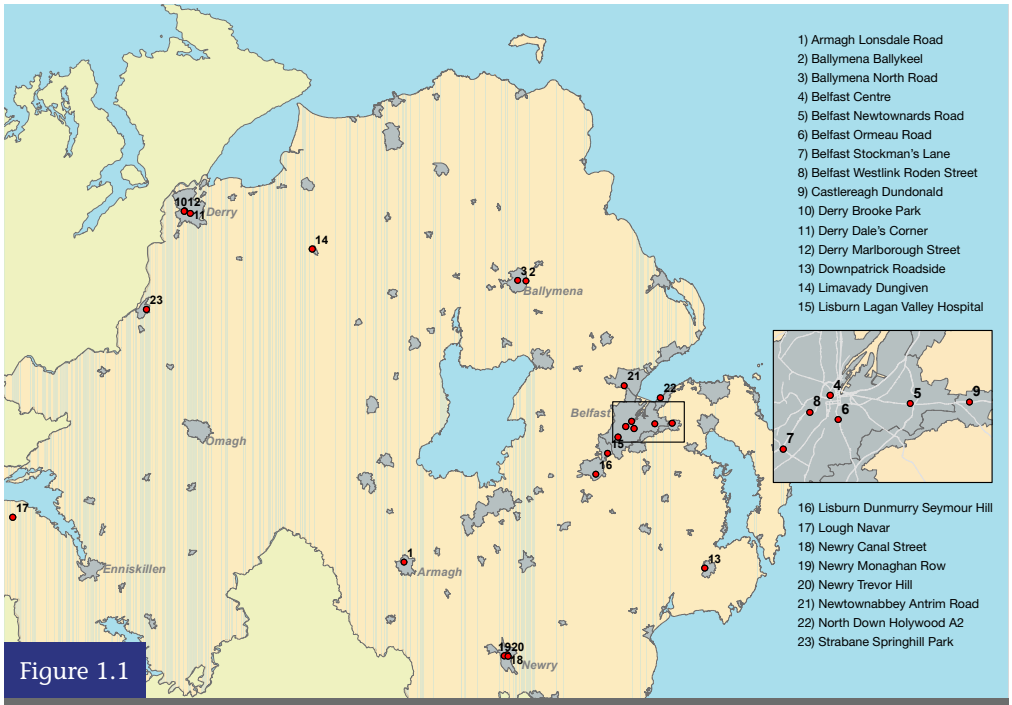

Figure 1.1

Locations of Automatic Air Quality Monitoring Sites in Northern Ireland, 2013

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Legislation and Policy

The management of air quality in Northern Ireland is based on the requirements of European Union (EU) Air Quality Directives, and on the UK Air Quality Strategy. These requirements are incorporated (or "transposed") into Northern Ireland's own legislation by statutory measures, forming 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 the number of monitoring sites required, siting criteria and acceptable methodology. They also identify the duties of Northern Ireland's Government Departments in relation to achieving limit and target values. It is the responsibility of Department of the Environment 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 www.defra.gov.uk/environment/quality/air/air-quality/approach.

Photo: Dunluce Castle

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 by 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.

At the time of writing, there are a total of 28 AQMA's in Northern Ireland which have been declared by twelve of Northern Ireland's 26 district councils (Table 2.1). Of these, eleven have declared AQMAs for NO_2 (either on its own or together with PM_{10}), and four have AQMAs for PM_{10} (on its own or with another pollutant). Ballymena has an AQMA in place for SO_2 (together with PM_{10}) though this is expected to be revoked in the near future. Table 2.1 and Figure 2.1 show the locations of these AQMAs, and which pollutants they address.

Table 2.1 Air Quality Management Areas in Northern Ireland (as of Sep 2014)

District Council	No. of AQMAs	Pollutants	Sources
Armagh	2	NO_2 (2)	Road traffic
Ballymena	3	PM_{10} (1), NO_2 (1), PM_{10} and SO_2 (1),	Domestic emissions (PM_{10},SO_2) 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	4	NO_2 (4)	Road traffic
Dungannon	4	NO_2	Road traffic
Limavady	1	NO_2	Road traffic
Magherafelt	1	NO_2	Road traffic
Newry & Mourne	2	NO_2 (1), PM_{10} (1)	Road traffic, domestic emissions
Newtownabbey	1	NO_2	Road traffic
Strabane	3	PM_{10} (3)	Domestic emissions

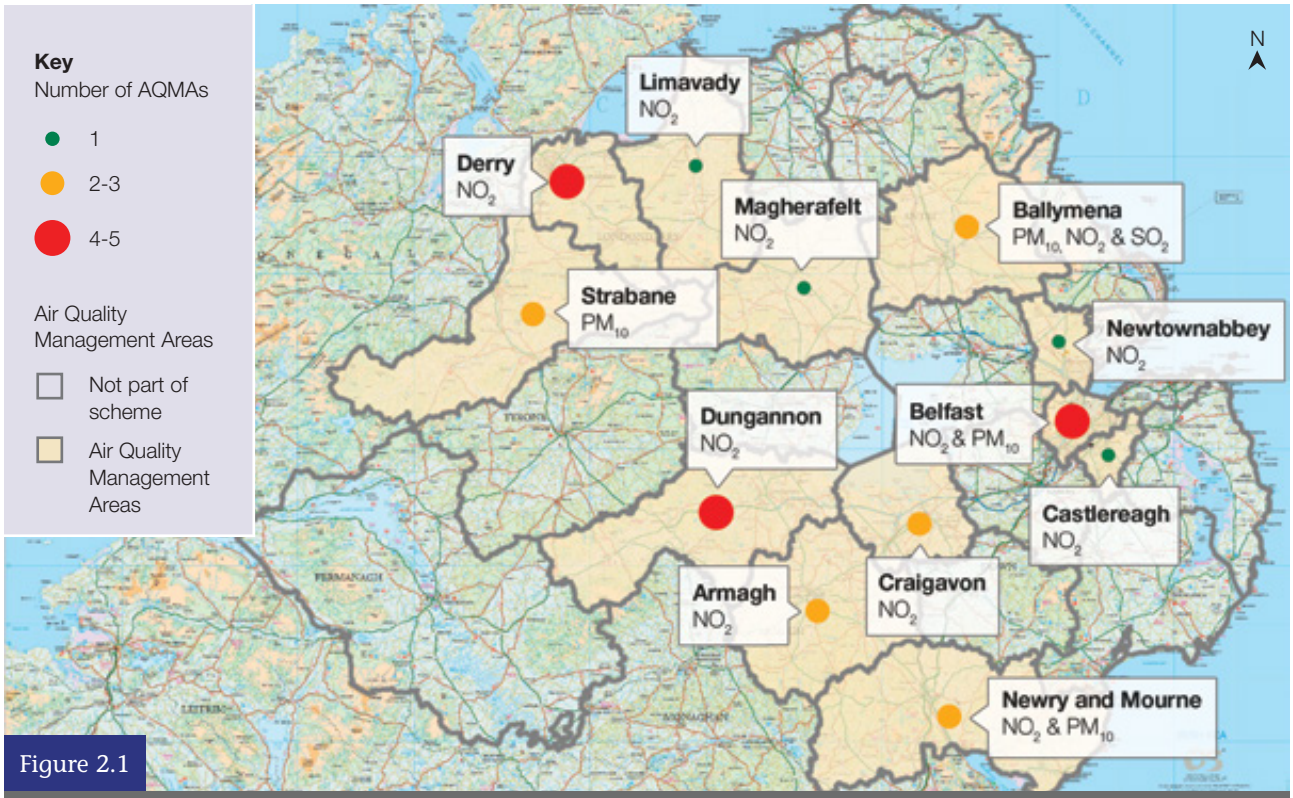


Figure 2.1

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

3

Monitoring Results for 2013

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 requires Member States to be divided into 'zones' for reporting purposes. Northern Ireland comprises two reporting zones – the 'Belfast Metropolitan Urban Area' agglomeration (the conurbation of Belfast), and the 'Northern Ireland' zone (the rest of the region). The Directive then specifies how many monitoring sites (or 'stations') are needed in each zone (based on its 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 compliance monitoring purposes. There are also different criteria regarding relevant public exposure.

The following pollutants were monitored in Northern Ireland during 2013:

- 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 (O_3)
- Benzene
- Metallic pollutants – including lead, arsenic, cadmium, nickel and mercury
- Polycyclic Aromatic Hydrocarbons (PAH).

During 2013, there were 23 automatic air quality monitoring stations in Northern Ireland, each equipped with continuous monitoring equipment for one or more of the pollutants for which automatic methods are used: CO, NOx, SO_2, PM_{10}, $PM_{2.5}$ and O_3. 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 via the website www.airqualityni.gov.uk. Public warnings are issued when levels approach or reach 'high' levels as defined by the Daily Air Quality Index.

Six of the automatic monitoring sites (Belfast Centre, Belfast Stockman's Lane, 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. Belfast Stockman's Lane is the latest addition, having been 'affiliated' into the national network in 2014.

Non-automatic monitoring techniques are used for benzene, metallic pollutants, black carbon, and PAH: some of these measurements are used to assess compliance with the Air Quality Directive and Fourth Daughter Directive.

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

Two of Northern Ireland's 13 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 method. 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. (This issue only arises for PM_{10}: there is at present no requirement to correct TEOM measurements of $PM_{2.5}$, and in any case, all three of Northern Ireland's $PM_{2.5}$ monitoring sites use the FDMS analyser.)

3.3 Key Results for 2013

This section summarises key monitoring results from 2013, 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 2013, 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 2013 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 five 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. The year 2013 marked a full decade since the last exceedance of any SO_2 limit value or objective in Northern Ireland.

Particulate matter – PM_{10}. Particulate matter as PM_{10} was monitored at 13 locations in 2013. Two of these sites (Newry Canal Street and North Down Holywood A2) used the TEOM instrument: data from these sites have been corrected to gravimetric equivalent using the King's College Volatile Correction Model as explained in Section 3.2. All sites met the limit value and objective of 40 µg m^{-3} for annual mean PM_{10}. However, one site (Newry Canal Street) exceeded the daily mean limit value and objective of 50 µg m^{-3}, on more than the maximum permitted 35 occasions during the year (based on VCM-corrected data). Newry Canal Street, which began operation in 2009, has recorded similar exceedances in 2010 and 2011. There is concern about the location of the monitoring site; 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.)

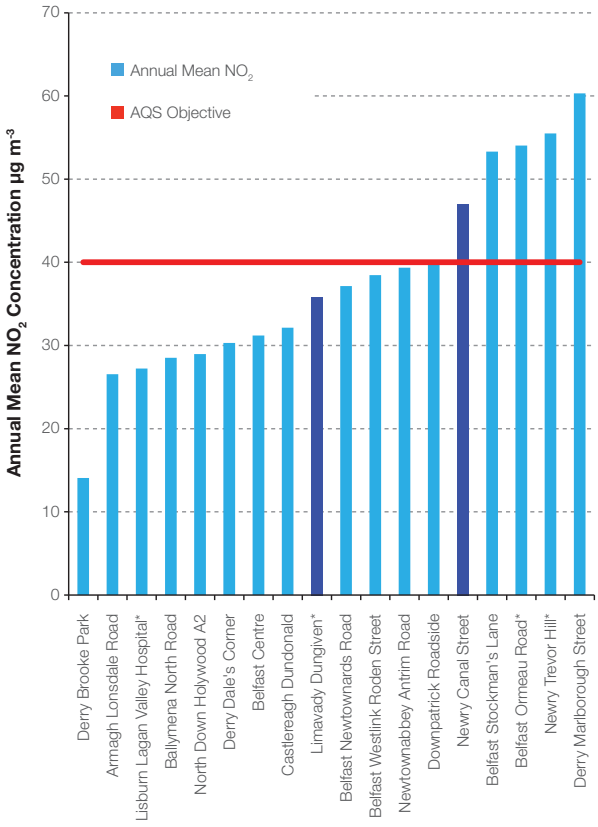
Particulate matter – $PM_{2.5}$. Fine particulate matter as $PM_{2.5}$ was monitored (using the FDMS analyser) at Belfast Centre, Derry Brooke Park and Lisburn Dunmurry Seymour Hill during 2013. Belfast Centre and Derry Brooke Park measured annual mean $PM_{2.5}$ concentrations well below the EU target value for 2010 of 25 µg m^{-3}. These two sites have therefore also already achieved the Stage 1 limit value, which is also 25 µg m^{-3}, and must be met by 1st Jan 2015. Levels were also below the Stage 2 limit value (20 µg m^{-3} to be achieved by 1st Jan 2020). Lisburn Dunmurry Seymour Hill achieved marginally less than the 75% data capture required for a representative annual mean; however, the available data indicate that this site will have no difficulty in meeting the limit values for $PM_{2.5}$.

Nitrogen dioxide was monitored using automatic analysers at 18 sites during 2013. Five urban traffic-related sites exceeded the AQS objective for annual mean NO_2 concentration (40 µg m^{-3}). These sites were: Newry Canal Street, Belfast Stockman's Lane, Belfast Ormeau Road, Newry Trevor Hill and Derry Marlborough Street (Figure 3.1).

However, two of these (Belfast Ormeau Road and Newry Trevor Hill) had less than the 75% annual data capture considered necessary for a valid annual mean.

None of the above five sites were used for monitoring compliance with the Air Quality Directive in 2013, though Belfast Stockman's Lane has since been affiliated into the national network in 2014. This site falls within the Belfast Metropolitan Urban Area reporting zone, which in previous years has been identified as not compliant with the EU Directive limit value for annual mean NO_2 (also 40 µg m^{-3}), on the basis of modelled data.

Two sites also recorded more than the permitted 18 exceedances of the hourly mean AQS objective for NO_2 (200 µg m^{-3}); the first of these was Newry Canal Street (which also exceeded the annual mean objective). The second was Limavady Dungiven, despite having less than 75% data capture for the full year.



Sites which exceeded the AQS objective for hourly mean NO_2 on > 18 occasions, (or for which data capture was < 90% and the 99.8th %ile of hourly means was > 200 µg m^{-3}), are shaded dark blue. *Asterisk indicates sites with less than 75% data capture in 2013 (Belfast Ormeau Road, Lisburn Lagan Valley Hospital, Limavady Dungiven and Newry Trevor Hill)

Figure 3.1

Annual Mean NO_2 Concentrations 2013

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, or the more stringent AQS objective of 100 µg m^{-3} on more than the permitted 10 days in 2013 (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 depends substantially on weather conditions. There is also evidence that the "hemispheric background" concentration of O_3 has increased since the 1950s due to the contribution from human activities[1]. 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.

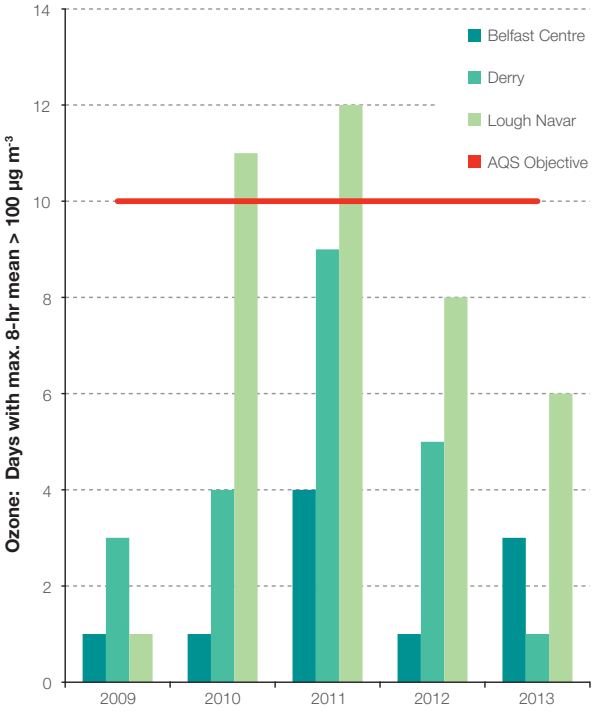


Figure 3.2

Ozone: Days with Maximum 8-hour mean > 100 µg m^{-3}, for Five Years 2009-2013

[1] See the APIS webpage "Ozone" at www.apis.ac.uk/overview/pollutants/overview_O3.htm

Polycyclic aromatic hydrocarbons (PAH) were monitored at three sites in 2013; Ballymena Ballykeel, Derry Brandywell and Kilmakee Leisure Centre in Dunmurry. All are part of the UK 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. Fig 3.3 shows the annual mean concentrations at these three sites over the past five years. (This graph also shows data from the old Dunmurry High School site which closed in 2012). All three sites 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. However, none exceeded the EU target value of 1 ng m^{-3} for annual mean B[a]P concentration, to be met by 31st Dec 2012. 2013 was the first year in which the Ballymena Ballykeel site did not exceed the EU target value. (Unlike EU limit values, EU target values are non-mandatory; however, Member States must show that they are taking all necessary and reasonable measures towards achieving target values).

The reasons for the high PAH concentrations in some areas were explored in a 2012 report by NPL[2] (the organisation responsible for operating the UK PAH Network); they are believed to arise primarily from household combustion of solid fuel, in particular "smoky" coal. Particularly high levels of PAH were seen in 2010 due to very cold winter weather. The cold weather is believed to have led to an increase in domestic solid fuel burning, coupled with meteorological conditions which did not allow air pollutants to disperse effectively.

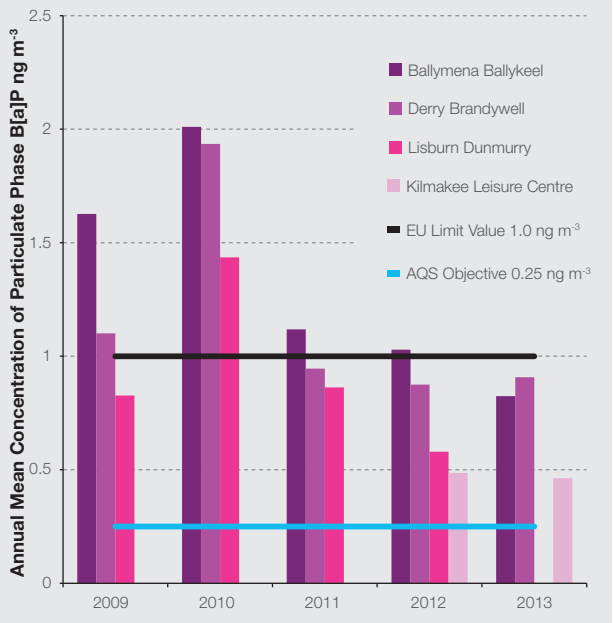


Figure 3.3

Annual mean concentrations of benzo[a]pyrene, for Five Years 2009 - 2013

3.4 Summary

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

- Particulate matter as PM_{10} and $PM_{2.5}$
- 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 did not meet the limit values and objectives for nitrogen dioxide in 2013. Although none of these sites were used for assessment of compliance with the Air Quality Directive in 2013, modelling carried out for compliance assessment purposes indicated that there were locations within the Belfast Urban Area which did not achieve compliance with the EU limit value for annual mean NO_2. Belfast Urban Area is not alone in this respect: many parts of the UK (and other Member States of Europe) have reported similar exceedances.

Ozone concentrations are affected by both long-range and local factors. Although no sites exceeded the AQS objective in 2013, O_3 exceedances (like those which occurred in 2008, 2010 and in 2011) remain a possibility in future.

Benzo[a]pyrene concentrations at all three of Northern Ireland's PAH Network sites met the non-mandatory EU target value in 2013. This is the first year in which Ballymena Ballykeel has been compliant with this target value, since monitoring began at the site in late 2007. However, all three sites continue to exceed the AQS objective for 2010, as they have in previous years.

[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

This section looks at how air quality in Northern Ireland has changed over the years since routine automatic monitoring began in the region. Previous reports in this series have used long-term datasets from sub-sets of long-running monitoring sites, to investigate trends over the region as a whole, for urban background and urban traffic locations.

These reports have placed particular emphasis on nitrogen dioxide (NO_2), as this pollutant is responsible for most of the exceedances of AQS objectives that occur in Northern Ireland. The report for 2012 highlighted that there is no overall trend in ambient NO_2 concentrations common to all urban traffic sites in Northern Ireland, and that instead, trends at individual sites appear to be site-dependent. It is possible that these trends reflect changes in traffic emissions on the nearby roads.

Therefore, rather than investigating trends in air quality over Northern Ireland as a whole, this year the report focuses on specific sites: those at which there has been an exceedance of an Air Quality Strategy Objective for NO_2 in 2013 or in recent years. The sites selected are:

- Newtownabbey Antrim Road
- Belfast Stockman's Lane
- Belfast Newtownards Road
- Belfast Ormeau Road
- Newry Trevor Hill

Derry Marlborough Street, Limavady Dungiven and Downpatrick Roadside have not been included despite having reported exceedances in recent years. This is because they have been in operation for less than the five years usually considered necessary for investigation of long-term trends in air quality.

Trend analysis has been carried out using Openair: a free, open-source software package of tools for analysis of air pollution data. Openair was developed by King's College London with the University of Leeds: for more information on this package please see www.openair-project.org. Here, the Openair "TheilSen" tool (based on the Theil-Sen statistical method) has been used to determine trends in pollutant concentrations over several years. The trend analysis is based on monthly mean pollutant concentrations, calculated here from daily mean data.

Openair includes an option to "de-seasonalise" the data (i.e. statistically modify the plotted data to remove the influence of seasonal cycles, thus providing a clearer indication of the overall trend over the relevant time). The "de-seasonalise" option has been used here, where appropriate. When the "de-seasonalise" option is used, Openair also fills any gaps in the dataset by a linear interpolation method.

The Openair Theil-Sen trend graphs show the trend as a solid red line, with its 95% confidence intervals as dotted red lines. The trend is given at the top of the graph in green, with confidence intervals shown in square brackets. The trend is given as units (i.e. $\mu g\ m^{-3}$) per year, over the period shown. This may be followed by a symbol, with + indicating that the trend is statistically significant at the 0.1 level,* indicating significance at the 0.05 level, ** indicating significance at the 0.01 level and *** indicating significance at the 0.001 level.

Trend plots have also been prepared for other pollutants: sulphur dioxide, particulate matter, ozone and total oxides of nitrogen. These are presented and discussed on the "Trend" pages of the Northern Ireland Air website, at www.airqualityni.co.uk/reports.php?n_action=trend as there is not sufficient space to include them in this short report.

4.1 Newtownabbey Antrim Road

Newtownabbey Antrim Road lies on a busy road within the Borough Council's Elmfield AQMA, declared in 2010. An Air Quality Action Plan has been in place since that time, containing a large number of measures including developing a Green Travel Plan, a programme of vehicle testing, and the provision of information on the Council website to encourage change in travel behaviour.

Figure 4.1 shows a de-seasonalised trend plot for NO_2 at Newtownabbey Antrim Road. This site has been in operation since 2008 and until 2013 had consistently exceeded the AQS Objective for annual mean NO_2 concentration.

There is a downward trend in NO_2 concentration at this site, statistically significant at the 0.001 level. It should be noted that in January 2010 the monitoring station was moved back from the road, such that the distance from the inlet to the kerb increased from 1m to 3m. Although the Borough Council reported a decrease following this change, it does not account

for the long-term decrease in NO_2 concentration apparent from early 2009. In 2013, for the first time, Newtownabbey Antrim Road met the AQS Objective, with an annual mean NO_2 concentration of 39 µg m^{-3}. It therefore appears that the measures contained within the Action Plan have in this case successfully achieved a reduction in air pollution.

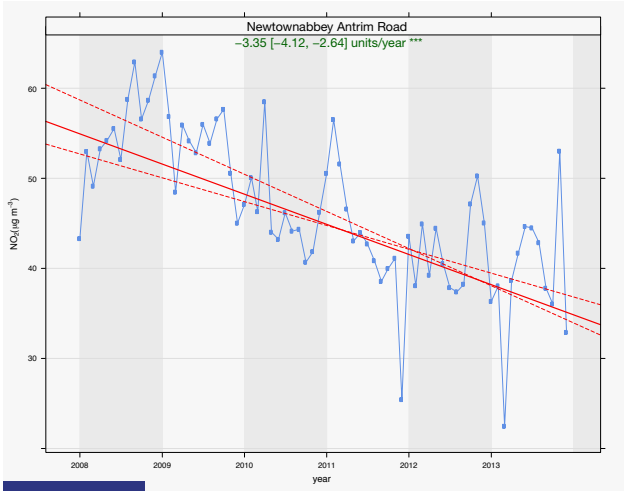


Figure 4.1

De-seasonalised Trend Plot for NO_2 at Newtownabbey Antrim Road, 2008 - 2013

4.2 Belfast Stockman's Lane

This monitoring site is located in an AQMA extending along a long stretch of the M1/Westlink corridor. Belfast City Council's Action Plan contains a wide range of measures, many aimed at improving public transport and encouraging its use. These will have required significant investment and time to implement.

Figure 4.2 shows a de-seasonalised trend plot for NO_2 at Belfast Stockman's Lane, which has operated since 2006. Throughout this time, it has consistently measured annual mean NO_2 concentrations well above 40 µg m^{-3}.

There is a downward trend in NO_2 concentration at this site, statistically significant at the 0.001 level. However, it appears that most of the reduction in NO_2 concentration has occurred in the past three to four years. This was confirmed using the same TheilSen method (plots not shown here), which quantified the downward trend as -4.4 µg m^{-3} per year over the period 2011 - 2013, but in contrast, identified no significant trend in the years 2006 to 2010 inclusive. If the apparent downward trend of the past three years continues, the AQS Objective could be met at this site after a further three to four years. However, meteorological and other factors will inevitably influence whether this proves to be the case.

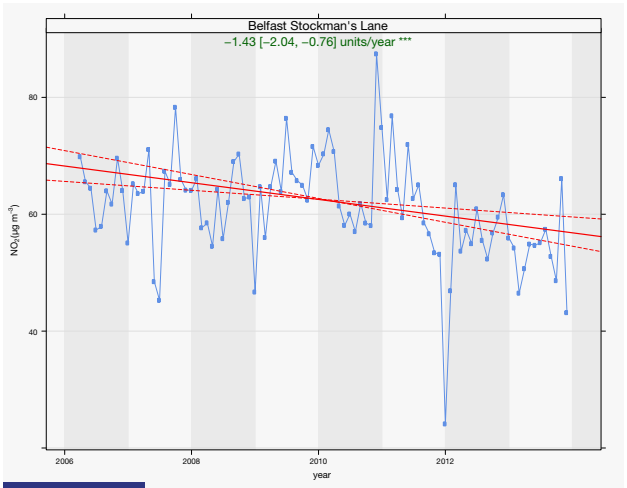


Figure 4.2

De-seasonalised Trend Plot for NO_2 at Belfast Stockman's Lane, 2006 - 2013

4.3 Belfast Newtownards Road

This monitoring site is located beside the busy Upper Newtownards Road, and is in one of Belfast City Council's AQMAs. Figure 4.3 shows a de-seasonalised trend plot for NO_2 measured at this site. Although there is an overall (highly significant) downward trend, most of the decrease appears to have happened after 2010. In this respect the pattern is similar to that observed for Belfast Stockman's Lane. Statistics from the Northern Ireland Air website confirm that annual mean concentrations were consistently in the mid forties of µg m^{-3}. In 2011 however, there appears to have been a substantial decrease. From that year onwards, the AQS Objective has been met at this site.

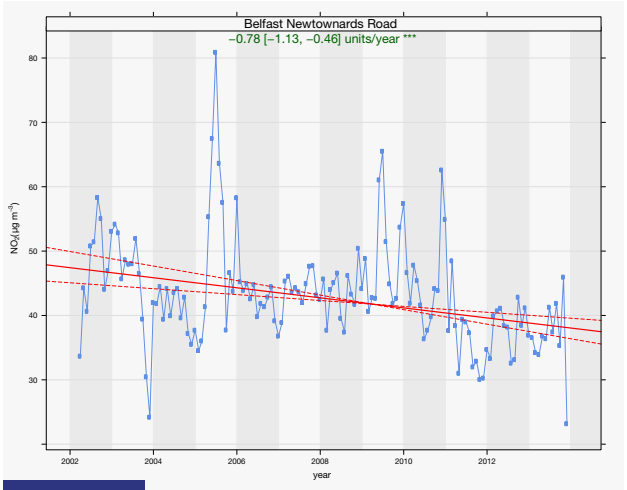


Figure 4.3

De-seasonalised Trend Plot for NO_2 at Belfast Newtownards Road, 2002 - 2013

4.4 Belfast Ormeau Road

This monitoring site is also beside a busy road and within one of Belfast City Council's AQMAs. Figure 4.4 shows a de-seasonalised trend plot for NO_2 measured at this site. There is a highly significant upward trend in NO_2 concentration over the period from 2006 (when the site was started up) to 2012 (there is very little data in 2013). While there is apparently an upward trend in this pollutant for years 2006 to 2011, this is followed by a large increase at the beginning of 2012. Belfast City Council's 2013 Progress Report (available for download from the Northern Ireland Air District Council Reports page at www.airqualityni.co.uk/reports.php?n_action=dc_report) highlights this increase, and explains that *"It is considered that this sharp increase may be attributed to more congestion in the area resulting from the introduction of bus corridors and changes in traffic signalling to facilitate the introduction of Belfast on the Move. It is anticipated that this congestion will be short term until Belfast on the Move and the Rapid Transit System are fully operational"*. The Council will continue to monitor at the site. However, data for 2014 so far indicate that NO_2 concentrations have returned to their pre-2012 levels.

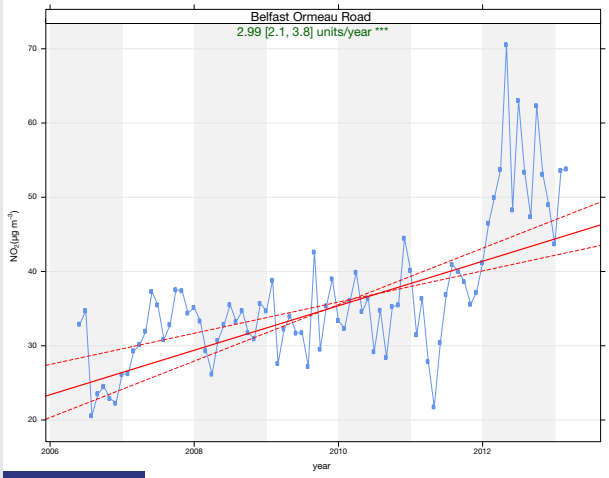


Figure 4.4

De-seasonalised Trend Plot for NO_2 at Belfast Ormeau Road, 2006 - 2013

4.5 Newry Trevor Hill

Figure 4.5 shows a de-seasonalised trend plot for NO_2 as measured at Newry Trevor Hill, a site on a junction of two major roads in Newry. Concentrations of NO_2 at this site are very variable, and there is no significant increasing or decreasing trend. Therefore, further exceedances of the AQS Objective remain likely in future years.

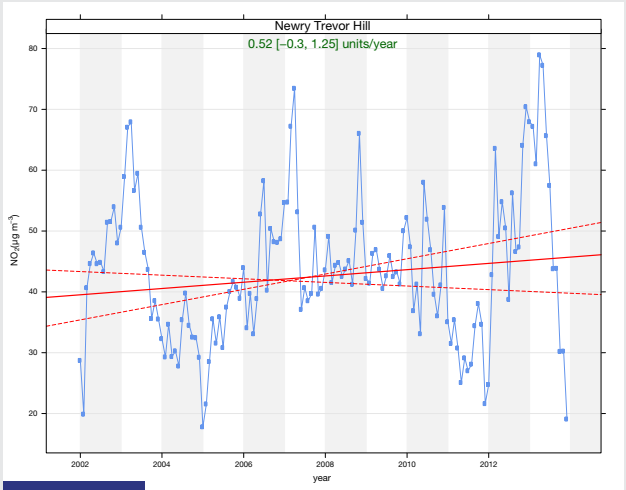


Figure 4.5

De-seasonalised Trend Plot for NO_2 at Newry Trevor Hill, 2002 - 2013

4.6 Summary

The five monitoring sites discussed in this section (all of which have been in operation for at least five years and have measured an exceedance of the AQS Objective for annual mean NO_2 concentration during this time) show different long-term trends in NO_2 concentration.

Both Newtownabbey Antrim Road and Belfast Newtownards Road datasets show downward trends in NO_2 concentration, and recent annual mean concentrations are now less than 40 µg m^{-3}. Belfast Stockman's Lane, too, has recorded a decrease in NO_2 concentration, although levels here are higher and it is likely to be several years before the AQS Objective is met.

The recent increase in NO_2 at Belfast Ormeau Road is expected to be temporary, and data for 2014 so far indicate that concentrations of this pollutant have now returned to their pre-2012 levels.

Overall the graphs from the Belfast sites show that the long term roadside NO_2 concentrations in the city are mostly decreasing, although at different rates in the monitored areas.

However, the Newry Trevor Hill site, which has measured annual mean NO_2 concentrations above 40 µg m^{-3} in several recent years, is at present not showing a clear trend either upward or downward. It is therefore difficult to predict when compliance with the AQS Objective might be achieved.

5

Maps of Air Quality

Measurements from air quality monitoring sites in Northern Ireland have been combined with pollutant emissions estimates from the UK's National Atmospheric Emissions Inventory (NAEI) to produce detailed modelled maps – at 1 km resolution – of average or peak background pollutant concentrations across Northern Ireland for 2013.

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. Modelled peak concentrations are below 50 µg m^{-3} over almost all the region. Areas of higher peak SO_2 concentration (over 100 µg m^{-3}) are now very small and confined to Belfast and Craigavon. There are no areas with peak SO_2 concentration over 150 µg m^{-3}.

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 10 m 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 (4 m 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 stretches of the A2 towards Holywood. This is generally consistent with the monitoring results. However, North Down Holywood A2 did not record an exceedance in 2013 – possibly because of its coastal location.

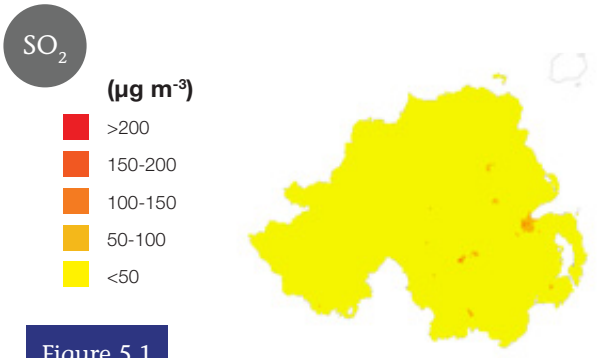


Figure 5.1

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

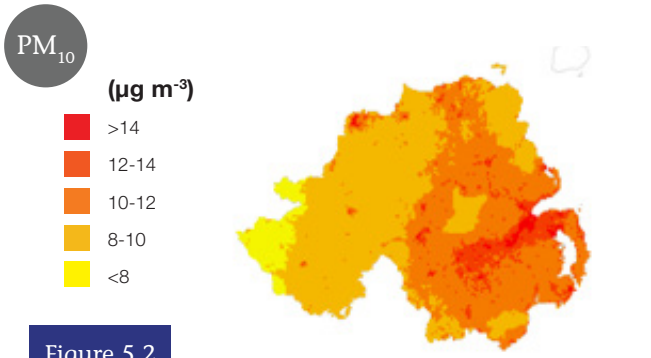


Figure 5.2

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

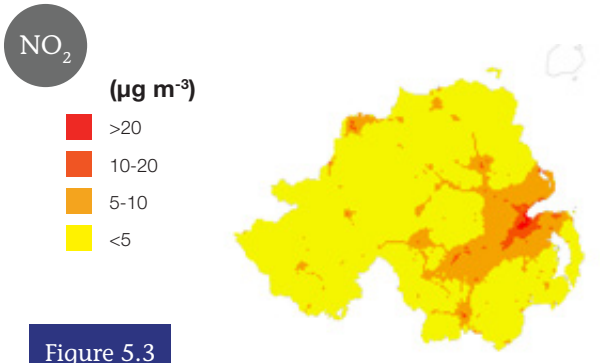


Figure 5.3

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

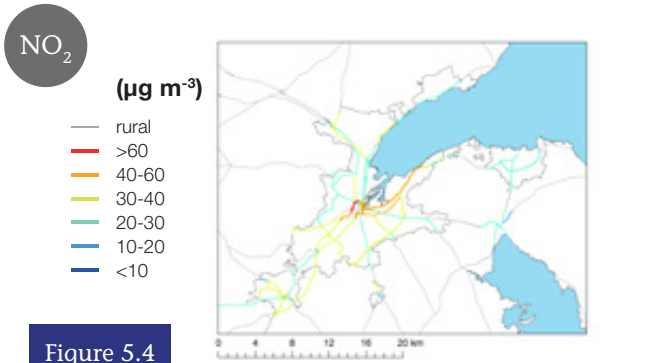


Figure 5.4

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

6

Electric Vehicles and Northern Ireland's Electric Vehicle Charging Infrastructure

Northern Ireland, in common with other regions in the UK, has identified certain areas, principally in towns and cities, where there are air pollution issues as a result of emissions from traffic. An increase in electric vehicle usage is one approach with the potential to help address this problem by cutting emissions, particularly of nitrogen dioxide and PM_{10} and thereby reducing the impact of transport on human health[3].

The benefits of electric vehicles can be further increased if the electricity used to charge the vehicles is generated from renewable sources. This aligns well with the target set by the Department of Enterprise, Trade and Investment to have 40% of electricity consumption in Northern Ireland generated from renewable sources by 2020[4].

In order to help promote the uptake in use of electric vehicles a comprehensive charging infrastructure has been installed in Northern Ireland.

The Northern Ireland 'ecar' project (www.ecarni.com) was successful in bidding for funding from the UK-wide 'Plugged in Places' (PIPS) scheme. This scheme provided government money to consortia to part fund the installation of public charging points in their area.

The 'ecar' project has delivered one of the most comprehensive networks of public charge points of any region. No household in Northern Ireland is now further than 10 miles from a public charge point, or 30 miles from a rapid charge point (Figure 6.1).

Photo: Provided by Department of Environment

Figure 6.1

New ecar Public Charging Point

[3] www.ncl.ac.uk/.../electric-vehicles-deliver-double-the-environmental-benefit

[4] www.detini.gov.uk/03may.pdf?rev=0

Most of the charging points are capable of charging two vehicles at the same time, which means electric vehicle users in Northern Ireland have an effective network of 334 public charge points. Electric vehicles can be also charged at owners' homes or workplaces.

Figure 6.2 below illustrates the geographic spread of the 174 charge posts in towns and cities throughout Northern Ireland. Further details about the charging infrastructure, electric vehicles, their benefits and incentives can found on the 'ecar' website at www.ecarni.com.

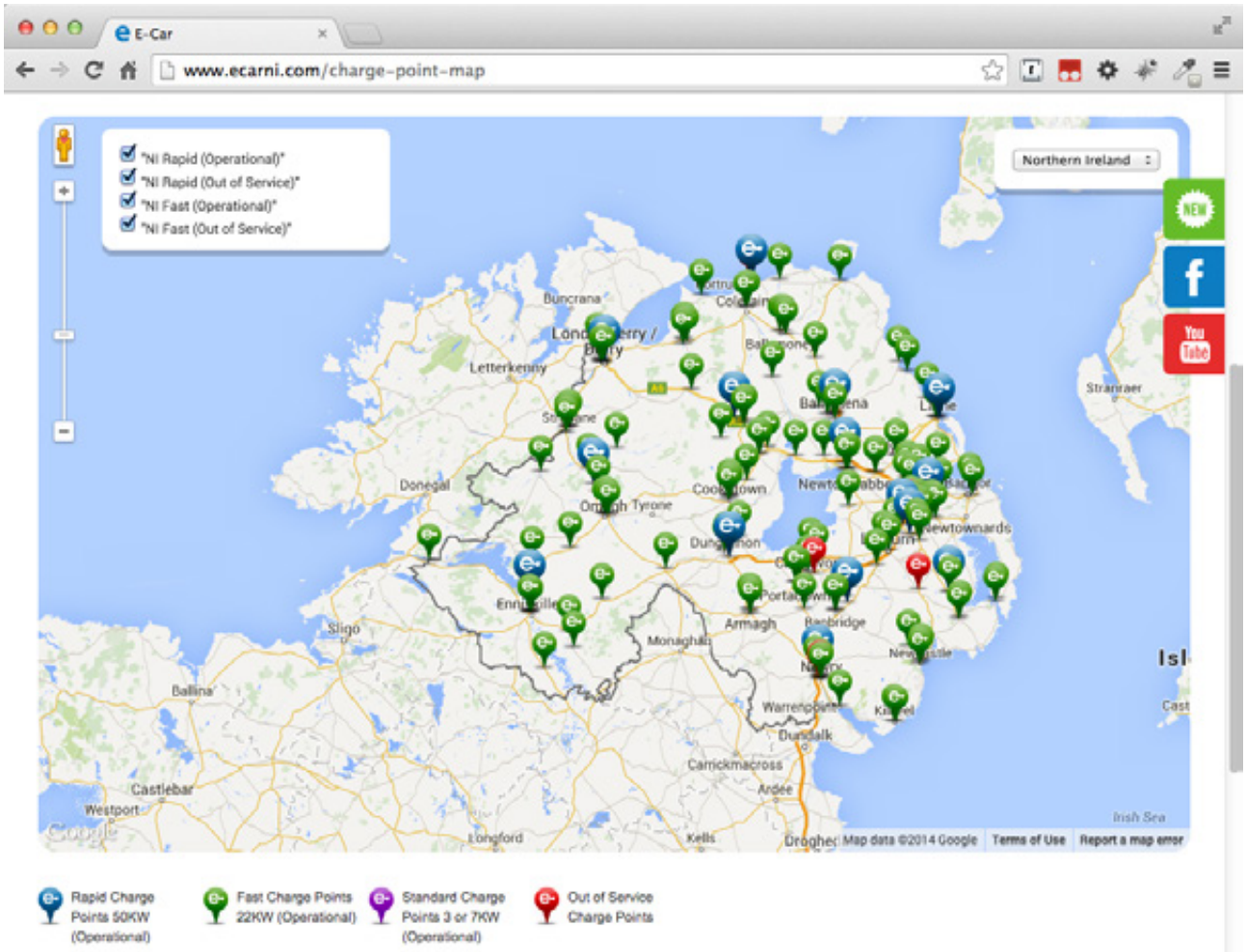


Figure 6.2

Northern Ireland electric car charging infrastructure

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[5]. Under the **Warm Homes Scheme** you may be able to receive energy advice and help to make sure your home is well insulated. Check out the Warm Homes website at www.warm-homes.com to see if you qualify.
- Stay warm but don't overheat your home: 21 °C is comfortable for most people.
- 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.
- 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.
- 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 will help you to understand the health and environmental benefits and cost savings of cycling. For example, by visiting the website at www.nidirect.gov.uk/index/information-and-services/travel-transport-and-roads/travelwiseni.htm, you can:
  - Compare the costs of cycling with those of using a car
  - Estimate the calories you can burn
  - Learn about important safety skills for cyclists
  - Plan your bike journey using interactive route maps
  - Find out about the Cycle to Work scheme, a financial initiative that allows employees to take out a tax exempt loan to purchase a bicycle.

Lots more energy saving advice can be found on the **NI Direct "Environment and Greener Living"** webpages at 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 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:

- Air Pollution Recorded Helpline 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.

[5] 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 13 Oct 2014)

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