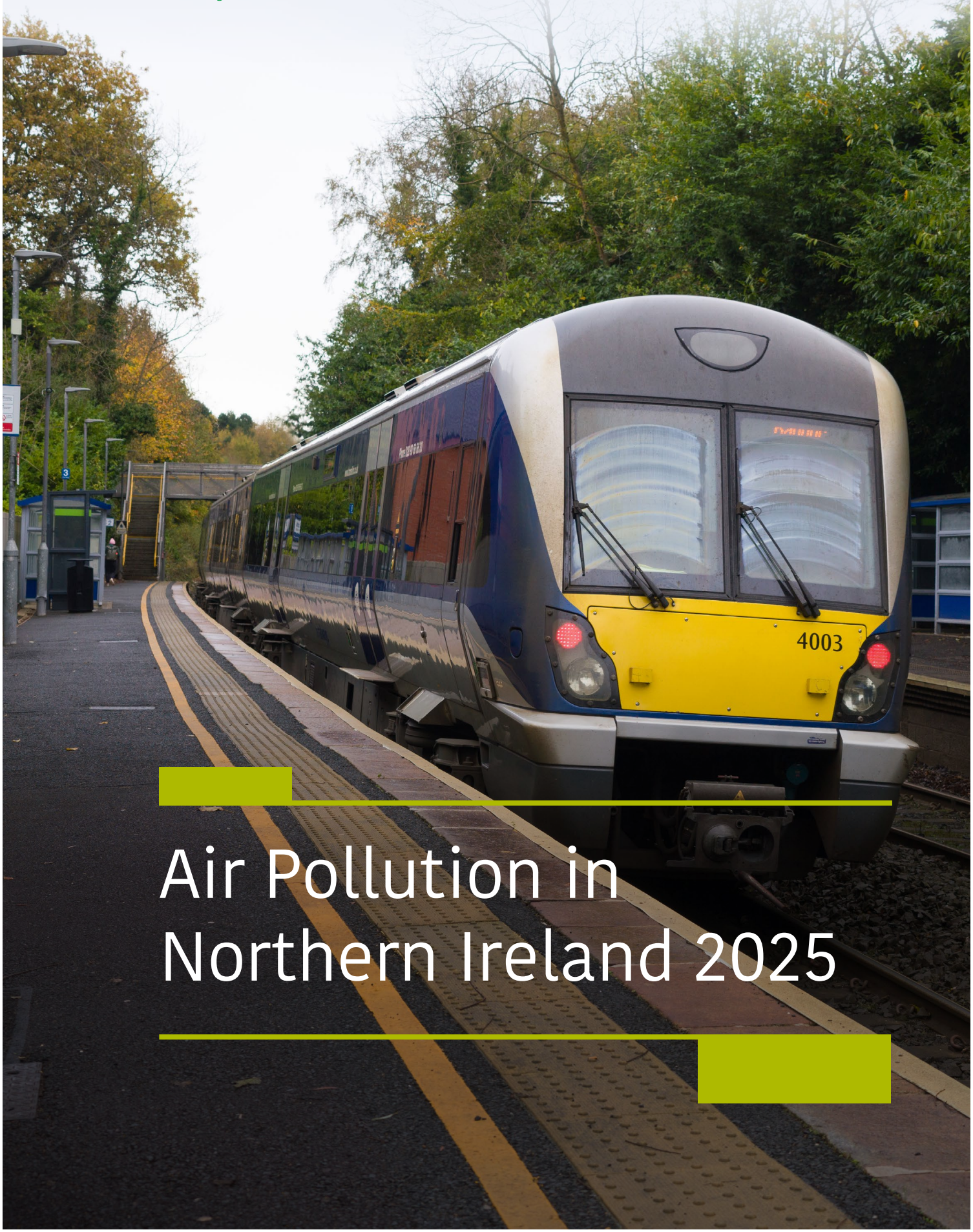
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An Roinn Talmhaíochta, Comhshaoil agus Gnóthaí Tuaithe

Depairtment o' Fairmin, Environment an' Kintra Matthers



Air Pollution in Northern Ireland 2025

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1. Report Highlights

This is the twenty-fourth in a series of annual reports on air quality in Northern Ireland. It has been written and produced by WSP, on behalf of the Department of Agriculture, Environment and Rural Affairs (DAERA).

The key purpose of this report is to summarise air quality monitoring results for Northern Ireland in 2025, to inform the public, government and wider air quality community in Northern Ireland. This report also contains useful information on air quality policy and legislation as well as on the sources of pollution. Figure 1.1 shows the locations of automatic, black carbon and Polycyclic Aromatic Hydrocarbons (PAH) network air quality monitoring sites in Northern Ireland that were in operation during part or all of 2025.

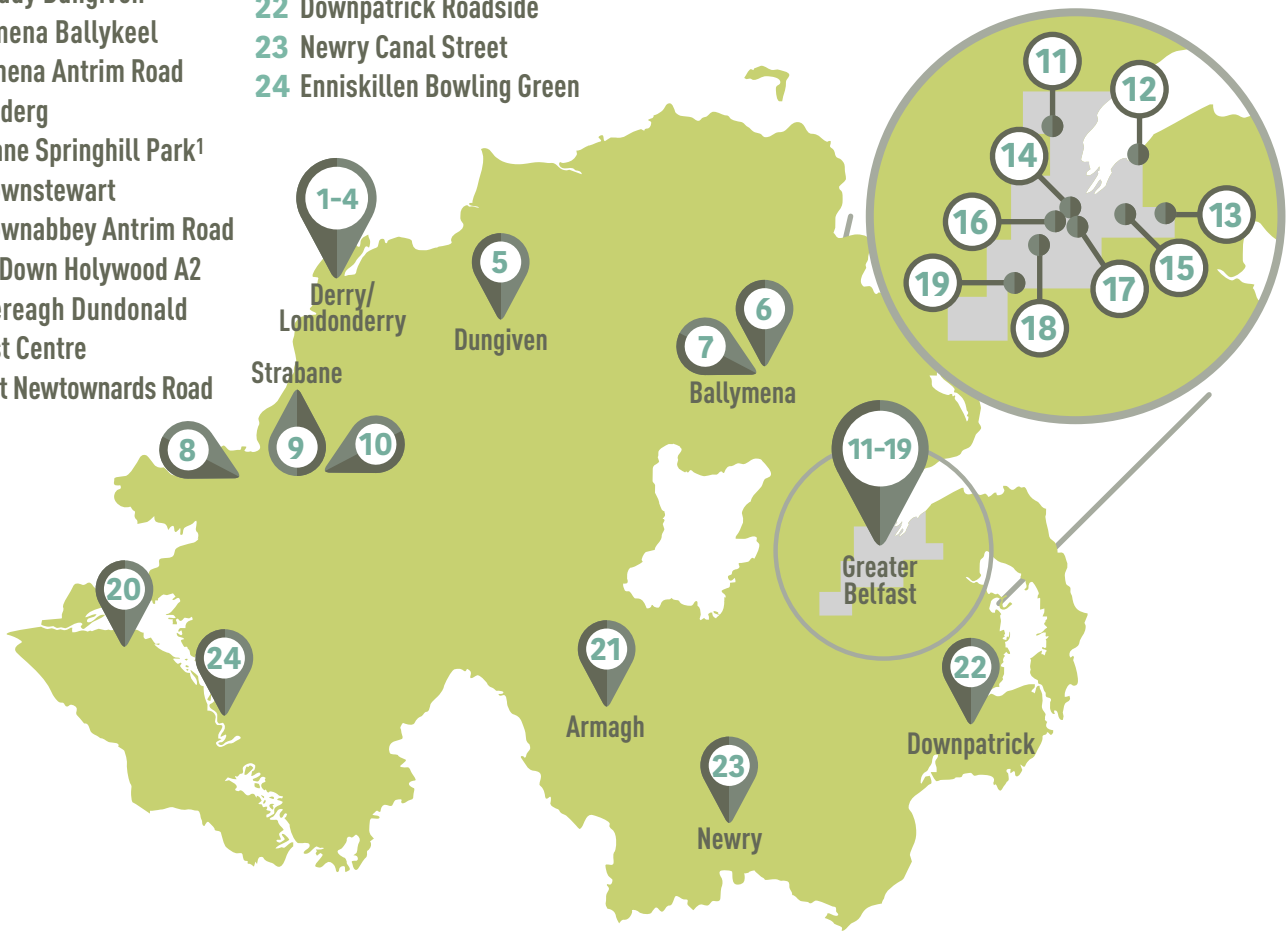
Figure 1.1: Monitoring Sites in Northern Ireland in Operation During Part or All of 2025

1 Derry/Londonderry Rosemount
2 Derry/Londonderry Dale's Corner
3 Strathfoyle Bawnmore Place
4 Derry/Londonderry Brandywell
5 Limavady Dungiven
6 Ballymena Ballykeel
7 Ballymena Antrim Road
8 Castlederg
9 Strabane Springhill Park[1]
10 Newtownstewart
11 Newtownabbey Antrim Road
12 North Down Holywood A2
13 Castlereagh Dundonald
14 Belfast Centre
15 Belfast Newtownards Road
16 Belfast Westlink Roden Street
17 Belfast Ormeau Road
18 Belfast Stockman's Lane
19 Lisburn Dunmurry Seymour Hill[2]
20 Lough Navar
21 Armagh Lonsdale Road
22 Downpatrick Roadside
23 Newry Canal Street
24 Enniskillen Bowling Green

24 sites in operation in 2025. This map also shows the location of sites in the UK Black Carbon and PAH Networks

[1] Black Carbon is measured at Strabane 2 which is at the same location as Strabane Springhill Park

[2] Black Carbon and PAHs are measured at Kilmakee Leisure Centre which is at the same location as Lisburn Dunmurry Seymour Hill





Newry City Bypass, County Down, Northern Ireland

This report is based on data from Northern Ireland's network of air quality monitoring stations. Some of these (e.g. the Automatic Urban and Rural Network - AURN), are operated on behalf of the Department of Environment, Food and Rural Affairs (Defra) and the Devolved Governments, while others are managed by district councils, via the Local Air Quality Management framework, for which DAERA provides funding support. An interactive map of the automatic monitoring stations shown in Figure 1.1 can be found on the Northern Ireland Air Quality website at www.airqualityni.co.uk. Information on the sites in Northern Ireland within the Black Carbon, Polycyclic Aromatic Hydrocarbons (PAH), Hydrocarbon, Toxic Organic Micro Pollutants (TOMPs) and Heavy Metals Networks, can be found on the UK-AIR website at https://uk-air.defra.gov.uk/interactive-map. These networks are operated by (or on behalf of) Defra and the Devolved Governments.

This report reviews the pollutants monitored, and highlights compliance as well as exceedances of air quality objectives.

In 2025, Northern Ireland's monitoring sites remained compliant with applicable Air Quality Standards Regulations (Northern Ireland) 2010 (AQSRNI) limit values and target values for all measured pollutants except nitrogen dioxide: one roadside site exceeded the annual mean limit value of 40 µg m^{-3} for nitrogen dioxide, the first such exceedance since 2019.

All monitoring sites in Northern Ireland were compliant with the corresponding Air Quality Strategy Objectives for all measured pollutants except annual mean nitrogen dioxide, which was exceeded at one roadside site as mentioned above, and the PAH compound benzo[a]pyrene, which was exceeded at three sites.

Particulate matter (measured as PM_{10} and $PM_{2.5}$) and nitrogen dioxide were also above the more stringent (but non-mandatory) World Health Organization (WHO) guidelines. There is also growing concern worldwide regarding particulate pollution and its impact on health: many countries are actively investigating ways to reduce particulate pollution. A continued effort to reduce air pollution from all known sources is therefore important, together with monitoring to assess progress and to provide sound, science-based input into policy development.

2. Sources of Air Pollution in Northern Ireland

Table 2.1 below illustrates the most significant air pollutants for our region and provides information on their sources.

Table 2.1: Key Pollutants, their Sources and Effects

Pollutant	Major Sources	Effects
Nitrogen oxides (NO_x includes NO, NO_2)	• Domestic and industrial combustion • Energy production • Transport	• Respiratory irritant (i.e. irritates airways and lungs) • Contributes to formation of secondary particulate matter
Sulphur Dioxide (SO_2)	• Combustion of fuels containing sulphur • Industry • Household heating	• Respiratory irritant • Contributes to formation of acid rain • Contributes to formation of secondary particulate matter
Particulate Matter (PM_{10} and $PM_{2.5}$)	• Industrial combustion • Domestic combustion • Road transport • Formation from reactions involving other pollutants e.g. ammonia, SO_2, NO_X	• Inflammation (PM_{10}) • Respiratory irritant • Irritates eyes • Travels into the airways (PM_{10}) or deep into lungs and bloodstream ($PM_{2.5}$)
Ground-level ozone (O_3)	• Secondary pollutant formed by chemical reactions in presence of sunlight	• Respiratory irritant • Irritates eyes
Ammonia (NH_3)	• Agricultural activities • Waste	• Forms fine particles of ammonium sulphate and nitrate
Polycyclic Aromatic Hydrocarbons (PAHs)	• Domestic combustion	• Toxic • Carcinogenic

Transboundary Air Pollution

When taking action to improve air quality, it is important to consider both locally emitted pollutants (for example, emissions from road traffic and nearby industrial processes), and transboundary air pollution. 'Transboundary' air pollution, as the name implies, means pollutants emitted in one country (or in some cases, from ships in international waters) that can affect air quality in other countries or sometimes even continents, hundreds or thousands of kilometres away. This happens because of the natural movement of air masses.

Some types of transboundary pollution arise from natural sources – for example, during 2024, volcanic eruptions in Iceland resulted in detectable increases in SO_2 in the UK. Smoke from wildfires may also affect air quality long distances away. However, others result from human activity, such as so-called 'acid rain' which can lead to the acidification of lakes, rivers and other ecosystems due to emissions of SO_2 and other acidic gases.

As well as being transported long distances, pollutants can also undergo reactions in the atmosphere, forming 'secondary' pollutants. Some examples of transboundary secondary pollution include:

- Formation of ground-level ozone, from chemical reactions between oxides of nitrogen (NO_X) and volatile organic compounds (VOCs), in the presence of sunlight and particularly at higher temperatures, i.e. summer.
- Formation of particulate matter (especially $PM_{2.5}$) when emissions of ammonia react with NO_X and SO_2 to form ammonium sulphate and nitrate.

Much of the ground-level ozone affecting the UK has a transboundary source. Most summers, the UK will experience some 'episodes' of ozone pollution, especially during hot weather. The south and east of the UK tend to be worst affected: Northern Ireland (along with Scotland and Wales) typically experiences fewer ozone episodes. This is due to slightly lower average temperatures, and its location, which is further away from continental Europe and more likely to receive cleaner air masses coming from the west, over the Atlantic Ocean. However, ozone episodes can and do regularly affect Northern Ireland.

Transboundary pollution is also estimated to account for a significant proportion of the particulate pollution affecting the UK. It has been estimated by the Air Quality Expert Group (AQEG) that only 50-55% of the measured annual mean $PM_{2.5}$ in the UK comes from emission sources within the UK[1]. The rest is transboundary: either 'primary' $PM_{2.5}$ directly emitted from sources outside the UK, or 'secondary' $PM_{2.5}$, formed from other pollutants also emitted outside the UK.

Transboundary pollution therefore makes a significant contribution to the UK's pollution climate. Continued international co-operation is necessary, both to reduce the impacts of transboundary pollution on our air quality, and conversely, to reduce the impacts of our pollutant emissions on air quality in neighbouring countries.

The UK's National Emission Ceilings Regulations (NECR) set emission reduction commitments for NO_X, oxides of sulphur, non-methane volatile organic compounds (NMVOC), ammonia and $PM_{2.5}$, to be met between 2020 to 2029 and from 2030 onwards.

The UK is also party to the Gothenburg Protocol, part of the Convention on Long-Range Transboundary Air Pollution (CLRTAP) of the United Nations Economic Commission for Europe. This also sets emission reduction commitments for 2020 and beyond, for the same range of pollutants as the NECR.

[1] Air Quality Expert Group, 2013 "Mitigation of United Kingdom $PM_{2.5}$ Concentrations". Available online at: 1508060903_DEF-PB14161_Mitigation_of_UK_PM25.pdf

3. Legislation and Policy

During 2025 the management of air quality in Northern Ireland was based on the requirements of the Air Quality Standards Regulations (Northern Ireland) 2010, the 2007 UK Air Quality Strategy (AQS), the Environment Order (NI) 2002, and the Air Quality Regulations (Northern Ireland) 2003.

The Environment (Northern Ireland) Order 2002

Under this legislation, DAERA has a duty to prepare and publish a statement or Air Quality Strategy, containing policies with respect to the assessment or management of the quality of air. DAERA is finalising Northern Ireland's first Clean Air Strategy, driven by the need to protect public health. On 1 September 2026, DAERA issued the draft Clean Air Strategy for Northern Ireland, covering the period up to 2032, for open public consultation for a period of eight weeks. The draft Strategy *"sets out an ambition to improve air quality by 2032 through five strategic objectives and a comprehensive programme of actions, including upgraded monitoring, annual awareness campaigns, transport planning and tighter fuel and appliance standards. Together, the proposed measures will support a healthier population, more resilient natural environments, and cleaner communities. The strategy aims to ensure that by 2032, Northern Ireland has stronger air quality protections, greater public understanding of air pollution, and the foundations for continued long term improvement*[2]*."*

District councils have a duty to review and assess air quality within their districts, under Part III of the Environment (NI) Order 2002. These Regulations also make provision for DAERA to provide financial support to the district councils in carrying out an air quality assessment, reviewing, preparing and implementing an action plan, or management of the quality of air. DAERA supports the district councils financially through the Local Air Quality Management Grant.

The Air Quality Regulations (Northern Ireland) 2003

These Regulations set out the air quality objectives to be achieved. The Regulations require district councils to review the quality of air within their area. The reviews have to consider the current and likely future air quality and assess whether the air quality objectives are being met or are likely to be achieved within the relevant period. These Regulations also list a number of other Relevant Authorities in Northern Ireland, with important air quality responsibilities.

The Air Quality Standards Regulations (Northern Ireland) 2010 (AQSRNI)

Ambient air quality in Northern Ireland is regulated by the Air Quality Standards Regulations (Northern Ireland) 2010 and their subsequent 2016 amendment[3]. As well as 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

[2] https://www.daera-ni.gov.uk/news/muir-launches-consultation-draft-northern-ireland-clean-air-strategy
[3] Available at: https://www.legislation.gov.uk/nisr/2010/188/contents/made

Departments in relation to achieving limit and target values. It is the responsibility of DAERA to inform the public about air quality in the region, particularly with regard to warning the public when air quality is poor.

The Air Quality Provisional Common Framework

The UK Government published the Air Quality Provisional Common Framework[4] in February 2022. This is a policy paper which explains how the UK Government and the Devolved Administrations propose to work together to develop air quality policy, following the UK's exit from the European Union.

World Health Organization (WHO) Guidelines

The World Health Organization (WHO) publishes Air Quality Guidelines for key pollutants based on scientific evidence available at the time on the health effects of these pollutants. These guidelines are not legally binding but are valuable for providing guidance for future legislation. The WHO also provides interim targets to guide reduction efforts towards the ultimate and timely achievement of its Air Quality Guideline levels. The latest updated guidelines were issued in 2021[5]. Table 3.1 shows the 2021 WHO Air Quality Guideline levels and interim targets for $PM_{2.5}$ and PM_{10} particulate matter, ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO).

Table 3.1: WHO 2021 Air Quality Guidelines

Pollutant	Averaging Period	2021 WHO Interim Targets				2021 WHO Air Quality Guideline Level
		1	2	3	4	
$PM_{2.5}$ (µg m^{-3})	Annual	35	25	15	10	5
	24-hour*	75	50	37.5	25	15
PM_{10} (µg m^{-3})	Annual	70	50	30	20	15
	24-hour*	150	100	75	50	45
O_3 (µg m^{-3})	Peak season**	100	70	-	-	60
	8-hour*	160	120	-	-	100
NO_2 (µg m^{-3})	Annual	40	30	20	-	10
	24-hour*	120	50	-	-	25
SO_2 (µg m^{-3})	24-hour*	125	50	-	-	40
CO (mg m^{-3})	24-hour*	7	-	-	-	4

* measured as the 99th percentile of 24-hour means in a year (equivalent to 3-4 exceedances)
** Average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running-average O_3 concentration

[4] The Air Quality Common Framework is available online at https://www.gov.uk/government/publications/air-quality-provisional-common-framework

[5] World Health Organization (2021). WHO global air quality guidelines: particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide. World Health Organization. https://www.who.int/publications/i/item/9789240034228/. License: CC BY-NC-SA 3.0 IGO

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 the 11 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 Regulations (Northern Ireland) 2003, using a range of monitoring, modelling, observations and corresponding analyses. For locations where Air Quality Objectives (discussed in section 4) are not met or maintained, district councils are required to declare an Air Quality Management Area (AQMA), and (along with relevant authorities), to develop an Action Plan to address the problem. In 2025 there were 18 AQMAs in Northern Ireland, as shown in Table 3.2. Nine councils have AQMAs: of these, seven councils have AQMAs for NO_2 only, and two councils have AQMAs for PM_{10} and NO_2. There are no AQMAs in place for any other pollutants in Northern Ireland.

District council reports on air quality can be accessed through the following webpage: https://www.airqualityni.co.uk/laqm/district-council-reports.

Table 3.2: Air Quality Management Areas in Northern Ireland

District Council	Number of AQMAs	Pollutant which triggered designation	Sources
Antrim and Newtownabbey Borough Council	1	Nitrogen dioxide	Road traffic
Ards and North Down Borough Council	0	-	-
Armagh City, Banbridge and Craigavon Borough Council	1	Nitrogen dioxide	Road traffic
Belfast City Council	4	Nitrogen dioxide	Road traffic
Causeway Coast and Glens	1	Nitrogen dioxide	Road traffic
Derry City and Strabane District Council	4	Nitrogen dioxide	Road traffic
Fermanagh and Omagh	0	-	-
Lisburn City and Castlereagh District Council	1	Nitrogen dioxide	Road traffic
Mid and East Antrim Borough Council	2	Nitrogen dioxide (1) and PM_{10} (1)	NO_2: Road traffic. PM_{10}: domestic heating
Mid Ulster District Council	2	Nitrogen dioxide	Road traffic
Newry, Mourne and Down District Council	2	Nitrogen dioxide (1) and PM_{10} (1)	Road traffic

4. Air Quality Monitoring Results for 2025

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 2025:

- Particulate matter (as PM_{10}, $PM_{2.5}$, and black carbon);
- Oxides of nitrogen (NO_x), comprising nitric oxide (NO) and nitrogen dioxide (NO_2);
- Ozone (O_3);
- Sulphur dioxide (SO_2);
- Carbon monoxide (CO);
- Benzene;
- Polluting elements – including lead (Pb), arsenic (As), cadmium (Cd) and nickel (Ni);
- Polycyclic Aromatic Hydrocarbons (PAH) including benzo[a]pyrene; and
- Toxic Organic Micro Pollutants (TOMPs).

There were 24 air quality monitoring stations operating in Northern Ireland during part or all of 2025. This included one new site, Castlederg, which started operation in February 2025 (monitoring particulate matter as PM_{10} and $PM_{2.5}$ at an urban background location) and one site which closed in May 2025: Belfast Ormeau Road. The Ormeau Road site has been relocated to the other side of the road and will be operational in the near future.

Each automatic monitoring site is equipped with continuous monitoring equipment for one or more of the pollutants for which automatic methods are used (PM_{10}, $PM_{2.5}$, black carbon, NO_x, O_3, SO_2 and CO), and/or a non-automatic sampler for PAH.

These sites (shown previously in Figure 1.1) provide information on a wide range of pollutants.

Data from the continuous monitoring sites are communicated rapidly to the public via the website www.airqualityni.co.uk and the Northern Ireland Air phone app, which can be downloaded free of charge from https://www.airqualityni.co.uk/stay-informed. The app issues notifications when measured or forecast air pollutant concentrations reach Daily Air Quality Index band 'Moderate' or above. (For more information on the Daily Air Quality Index, please see https://www.airqualityni.co.uk/air-quality/daily-air-quality-index). Public health alerts are also separately issued via the DAERA/Department of Health 'Air Aware' SMS service. Further information and how to sign up can be found on the final page of this report.

Seven of the automatic monitoring sites (Armagh Lonsdale Road, Ballymena Antrim Road, Ballymena Ballykeel, Belfast Centre, Belfast Stockman's Lane, Derry/Londonderry Rosemount and Lough Navar) are part of the UK's national monitoring network and were used in 2025 to assess compliance with the Air Quality Standards Regulations (Northern Ireland). Non-automatic monitoring techniques are used for benzene, metallic pollutants, and PAHs. Some of these measurements are used to assess compliance with the AQSRNI and the UK Air Quality Strategy (2007).

The Air Quality Standards Regulations (Northern Ireland) 2010 divide the region into two 'zones' for reporting purposes – the 'Belfast Metropolitan Urban Area' agglomeration (the conurbation of Greater Belfast), and the 'Northern Ireland' zone (the rest of the region). The Regulations then specify 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 Regulations may be used for reporting compliance.

The Regulations' 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 compliance monitoring purposes. There are also different criteria regarding relevant public exposure.

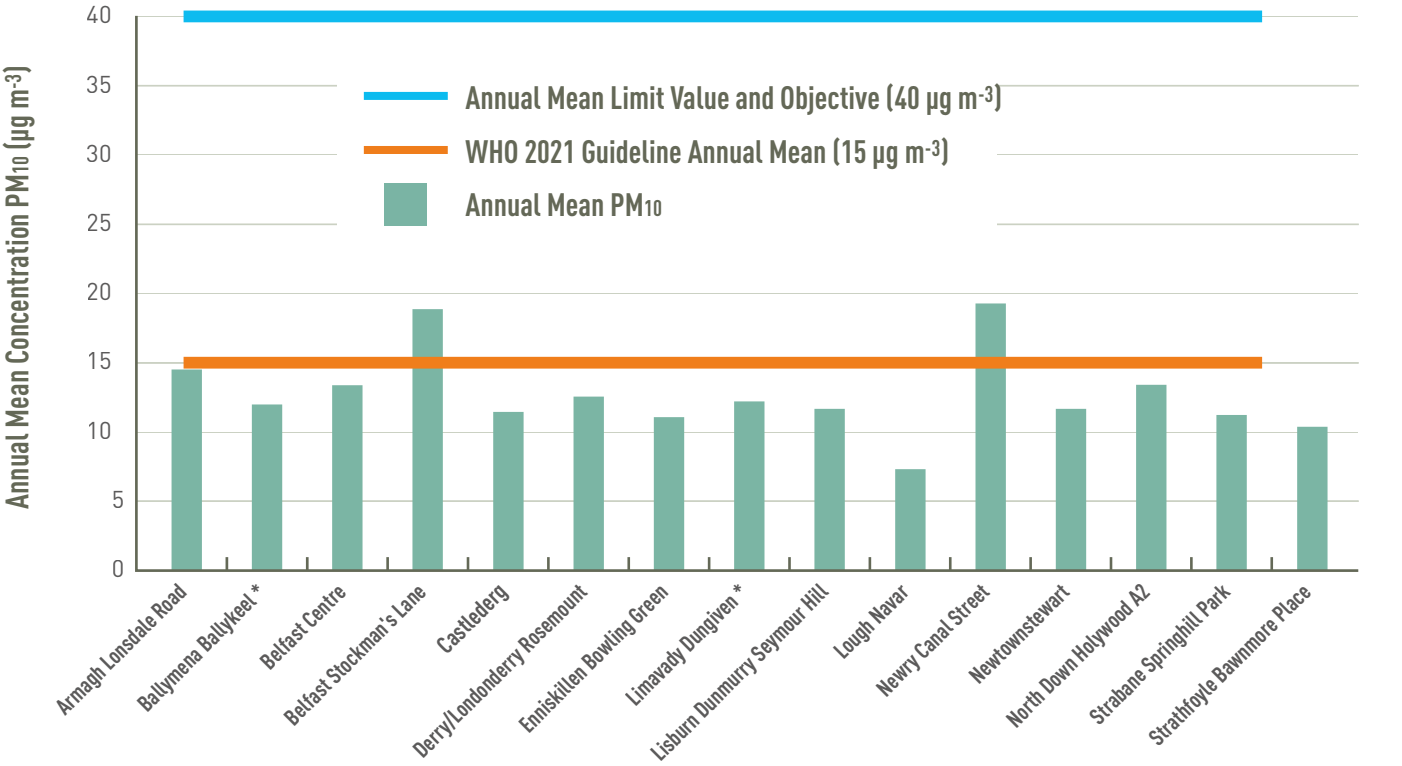
The AQSRNI set limit values, target values and long-term objectives for a range of air pollutants. There are no limit or target values for nitric oxide (NO) but it is measured along with NO_2 and total oxides of nitrogen (NO_X). Measurements of black carbon and TOMPs are carried out for research purposes, to increase our scientific understanding of these pollutants.

Key Results for 2025

This section summarises key monitoring results from 2025, including compliance with Air Quality Standards Regulations limit and target values and the corresponding Air Quality Strategy (AQS) objectives. Further information is provided on the Northern Ireland Air website.

Particulate Matter as PM_{10} was monitored at 15 locations in 2025, including Castlederg which started up during the year. Figure 4.1 shows the annual mean PM_{10} concentrations (as vertical bars), compared with the Air Quality Objective and AQSRNI Annual Mean Limit Value (both 40 µg m^{-3}) and WHO annual mean guideline (as horizontal lines). Two sites (Ballymena Ballykeel and Limavady Dungiven) had less than 75% data capture in 2025: therefore annualisation has been undertaken to estimate the annual mean, using the procedure set out in the LAQM Technical Guidance, LAQM.TG(22) (Box 7.9)[6]. To perform annualisation, data from two to four nearby continuous background monitors (urban or rural) with data capture greater than 85% should be used to calculate an annualisation factor. In this case, data from Derry/Londonderry Rosemount, Lisburn Dunmurry, Lough Navar and Newtownstewart were used for this purpose.

Figure 4.1: Annual Mean PM_{10} Concentrations, 2025



*** Asterisk indicates data capture less than 75% and annual mean has been annualised using the method set out in the 2022 LAQM Technical Guidance.**

[6] Local Air Quality Management - Technical Guidance TG(22): Available at https://laqm.defra.gov.uk/air-quality/featured/uk-regions-exc-london-technical-guidance/

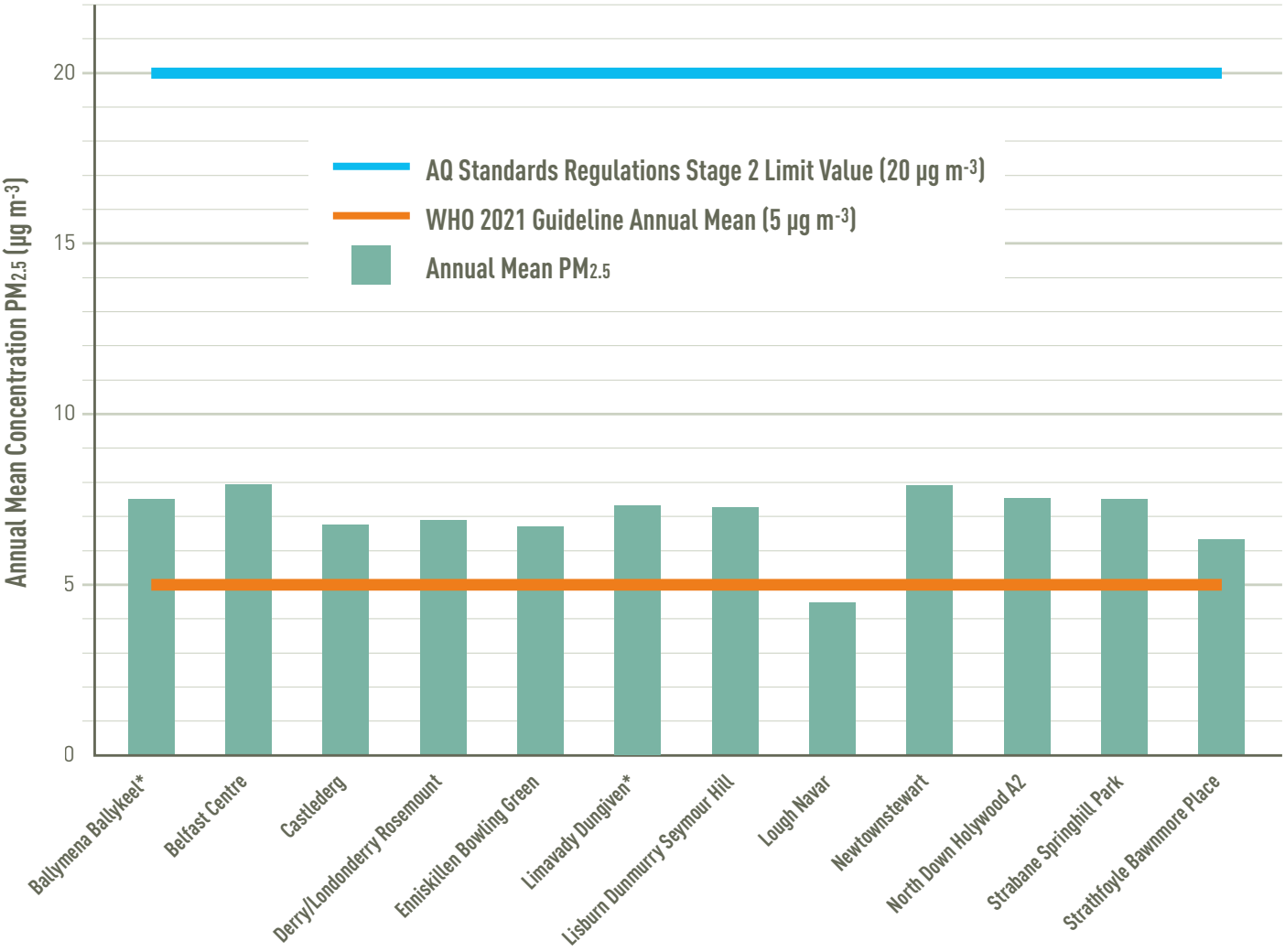
All sites met the limit value and objective of 40 µg m^{-3} for annual mean PM_{10}, although two sites (Belfast Stockman's Lane and Newry Canal Street) exceeded the more stringent WHO 2021 guideline of 15 µg m^{-3} for annual mean PM_{10} concentrations, in 2025.

The AQSRNI and AQS Objective also include a daily mean limit value/objective of 50 µg m^{-3}, not to be exceeded on more than 35 occasions during the year. All sites were compliant with this limit value and objective: Belfast Stockman's Lane recorded three daily means above 50 µg m^{-3}, Newry Canal Street recorded two such daily means, and Belfast Centre and North Down Holywood A2 each recorded one (the latter believed to be due to a localised source). All other sites recorded no daily means above 50 µg m^{-3}.

All sites were compliant with the WHO 2021 guideline of 45 µg m^{-3} for annual 99th percentile of 24-hour mean PM_{10} concentrations, except Belfast Stockman's Lane and Newry Canal Street.

Particulate matter as $PM_{2.5}$. Fine particulate matter as $PM_{2.5}$ was continuously monitored at 12 sites in 2025, including Castlederg which started up during the year. Figure 4.2 shows the annual mean $PM_{2.5}$ concentrations for 2025, compared with the Air Quality Standards Regulations Stage 2 limit value and the WHO 2021 guideline.

Figure 4.2: Annual Mean $PM_{2.5}$ Concentrations, 2025



*** Asterisk indicates data capture less than 75% and annual mean has been annualised using the method set out in the 2022 LAQM Technical Guidance.**



Port of Larne, Antrim, Northern Ireland

All sites reported annual mean $PM_{2.5}$ concentrations well below the Air Quality Regulations Stage 2 limit value of 20 µg m^{-3}. However, all sites except the rural site at Lough Navar exceeded the 2021 WHO guideline for annual mean $PM_{2.5}$ concentrations (5 µg m^{-3}), in 2025.

Two sites (Ballymena Ballykeel and Limavady Dungiven) had less than 75% data capture in 2025: therefore annualisation has been undertaken to estimate the annual mean, using the procedure set out in the LAQM Technical Guidance, LAQM. TG(22) (Box 7.9)[7]. To perform annualisation, data from two to four nearby continuous background monitors with capture greater than 85% should be used to calculate an annualisation factor. In this case, data from Derry/Londonderry Rosemount, Lisburn Dunmurry, Lough Navar and Newtownstewart were used for this purpose.

There is also a WHO 2021 guideline of 15 µg m^{-3} for annual 99th percentile of 24-hour mean $PM_{2.5}$ concentrations: all monitoring sites in Northern Ireland (including Lough Navar) exceeded this guideline in 2025.

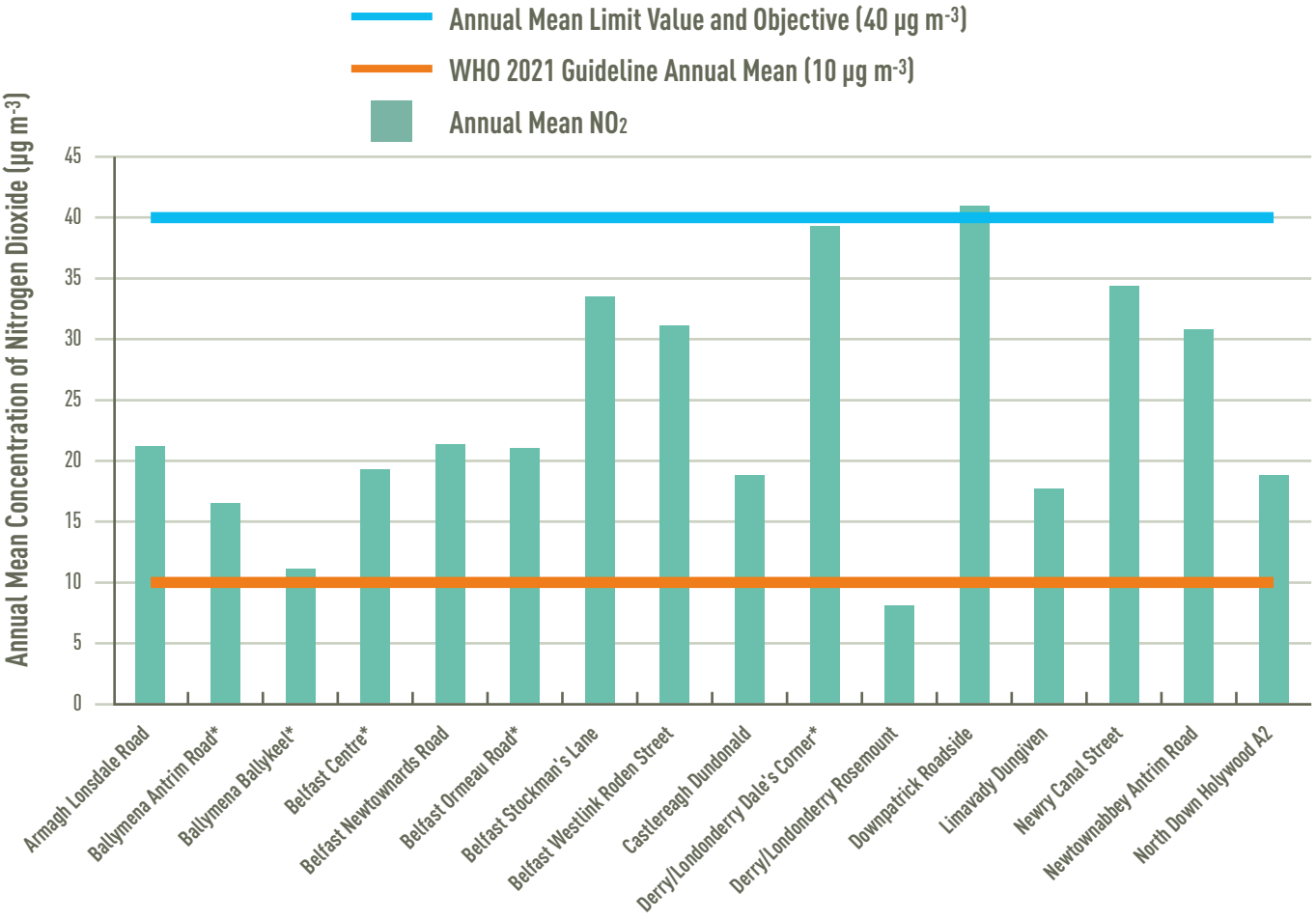
Nitrogen Dioxide was monitored using automatic analysers at 16 sites during 2025 (including Belfast Ormeau Road which closed down in May 2025). Figure 4.3 shows the annual mean NO_2 concentrations for all sites.

Five sites (Ballymena Antrim Road, Ballymena Ballykeel, Belfast Centre, Belfast Ormeau Road and Derry/Londonderry Dales Corner) had less than 75% data capture in 2025. If possible, the annual mean NO_2 concentrations for these sites should be 'annualised' using the procedure in Box 7.9 of LAQM. TG(22). However, the annualisation process needs between two and four urban or rural background sites, with greater than 85% data capture. There are only two non-roadside sites in Northern Ireland that monitor NO_2; Belfast Centre and Derry/Londonderry Rosemount. Of these, one (Belfast Centre) had only 70% data capture for NO_2 and so could not be used for this purpose. There was therefore insufficient data to reliably carry out annualisation for NO_2. It was agreed with DAERA that the annual means for these sites should be presented here without annualisation. The annual means for the five sites with less than 75% annual data capture should be treated with caution. Two sites in particular - Belfast Ormeau Road (which closed during the year) and Derry/Londonderry Dale's Corner - had very low data capture for NO_2 (36% and 39% respectively), so their annual means should be treated as indicative only.

Figure 4.3 shows the annual mean NO_2 concentrations at each monitoring site. For comparison, it also shows the Air Quality Objective and AQSRNI Annual Mean Limit Value (40 µg m^{-3}), and the WHO 2021 guideline for annual mean NO_2 (10 µg m^{-3}) as horizontal lines.

[7] Local Air Quality Management - Technical Guidance TG(22): Available at https://laqm.defra.gov.uk/air-quality/featured/uk-regions-exc-london-technical-guidance/

Figure 4.3: Annual Mean NO_2 Concentrations, 2025



*** Asterisk indicates data capture less than 75%. Not annualised – insufficient data from other suitable sites to annualise using the method set out in the 2022 LAQM Technical Guidance.**

One site, Downpatrick Roadside, exceeded the AQS objective for annual mean NO_2 concentration (its annual mean was 41 µg m^{-3}) – the first such exceedance in Northern Ireland since 2019.

Annual mean NO_2 concentrations were above the WHO 2021 guideline (10 µg m^{-3}) at 15 out of 16 sites in 2025: the only site that did not exceed the WHO annual mean guideline was Derry/ Londonderry Rosemount.

The Air Quality Strategy and AQSRNI also contain an Objective and Limit Value respectively of 200 µg m^{-3} for the hourly mean NO_2 concentration, not to be exceeded more than 18 times per calendar year. No sites in Northern Ireland recorded any hourly means above 200 µg m^{-3} in 2025, therefore all were compliant with this Objective and Limit Value, regardless of their data capture.

There is also a WHO 2021 guideline of 25 µg m^{-3} for annual 99th percentile of 24-hour mean NO_2 concentrations: all sites exceeded this guideline in 2025.

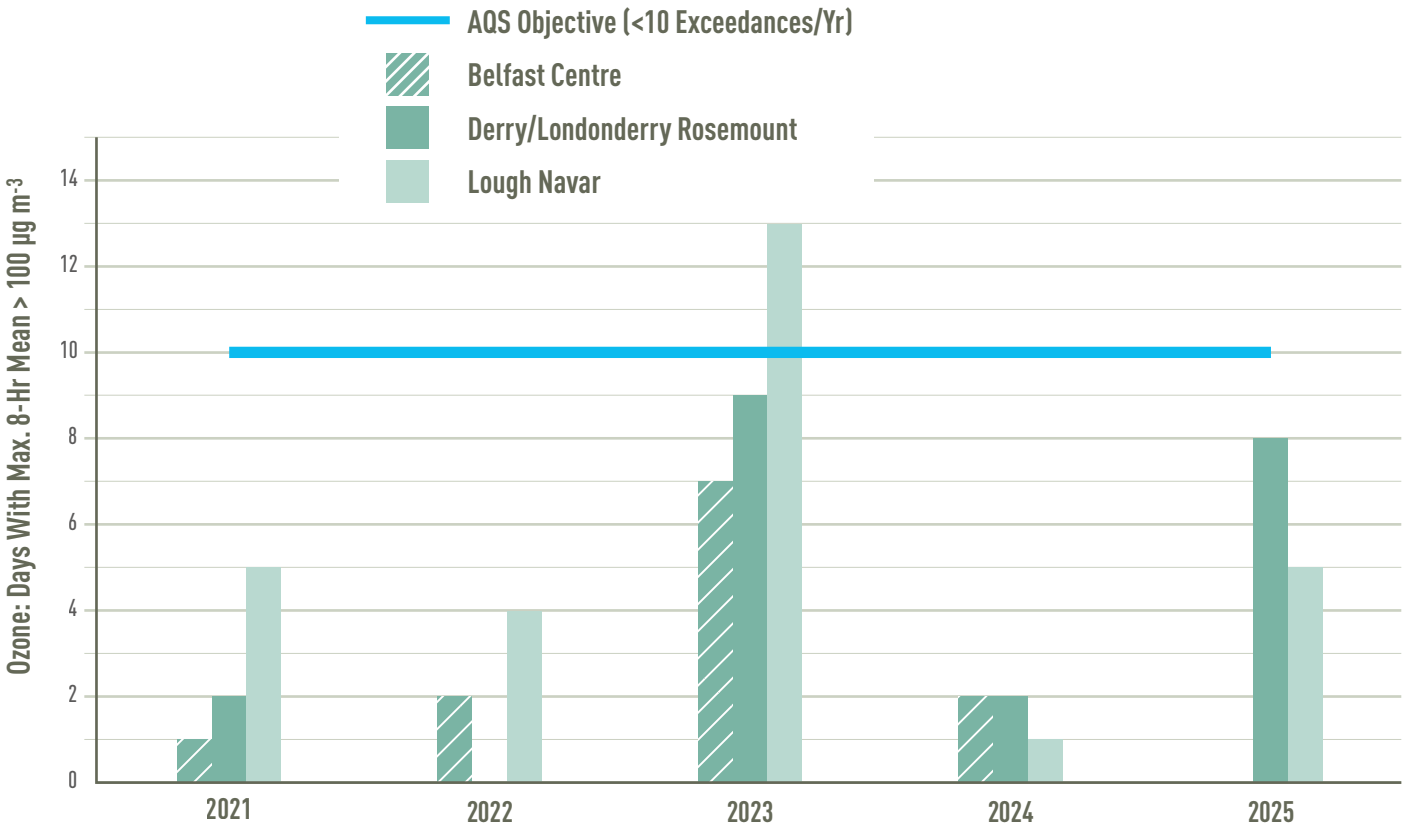
Ozone was monitored at Belfast Centre, Derry/Londonderry Rosemount, and the rural Lough Navar site. The results are shown in Figure 4.4, and compared with the Air Quality Strategy objective, which is for the maximum daily 8-hour mean not to exceed 100 µg m^{-3} on more than 10 days per year. In 2025, the maximum daily 8-hour mean exceeded 100 µg m^{-3} on eight days at Derry/ Londonderry Rosemount, five days at Lough Navar

and no days at Belfast Centre. Therefore, all three sites met the AQS Objective in 2025, as well as the less stringent AQSRNI target value, which requires the daily maximum 8-hour running mean not to be more than 120 µg m^{-3} on more than 25 days. However, it should be noted that Belfast Centre had low data capture (33%) for ozone in 2025, and in particular this site had no data for February to July 2025, which for the other two sites were the months with the highest average maximum daily 8-hour running means. (The data for this period were rejected as suspect, due to an analyser fault). Therefore, the dataset for Belfast Centre cannot be considered representative of the full year, as there are no data for the period in spring and early summer when ozone concentrations were likely to have been at their highest.

In 2025 neither Derry/Londonderry Rosemount nor Lough Navar were compliant with the WHO Guideline of 100 µg m^{-3} for the maximum daily 8-hour mean, or with the WHO 'peak season' guideline of 60 µg m^{-3} (for the average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running-average O_3 concentration, which for these two sites were February to July and January to June). Belfast Centre did not have sufficient data capture for the peak ozone period to reliably assess compliance with these WHO guidelines.

However, concentrations of O_3 in Northern Ireland vary considerably from year to year, with O_3 exceedances in some years but not others. Ozone is formed by reactions involving other pollutants, in the presence of sunlight and heat, and over several hours. Therefore, the number of ozone exceedances in any given year depends substantially on weather conditions, with hot, sunny weather favouring ozone formation. To illustrate this, Figure 4.4 shows ozone exceedances for the most recent five years.

Figure 4.4: Days with Maximum 8-Hour Mean Ozone Concentrations > 100 µg m^{-3} for Five Years 2021 – 2025





Residential housing in Derry/Londonderry, Northern Ireland

Sulphur Dioxide was monitored at five automatic sites during 2025 (Belfast Centre, Derry/ Londonderry Rosemount, Lisburn Dunmurry Seymour Hill, Ballymena Ballykeel and Strabane Springhill Park). All sites met the Regulations limit values for SO_2 (1-hour and 24-hour mean), and the AQS objective for the 15-minute mean.

All sites were also compliant with the WHO 2021 guideline of 40 µg m^{-3} for annual 99th percentile of 24-hour mean SO_2 concentrations.

Concentrations of sulphur dioxide in Northern Ireland have decreased substantially in recent decades, due to a decrease in reliance on oil and solid fuels for domestic heating. There has also been a notable reduction in power station emissions due to the introduction of Combined Cycle Gas Turbine (CCGT) plants, which are more efficient than conventional coal and oil power stations and have negligible SO_2 emissions. Section 6 of this year's report looks in more detail at sulphur dioxide and how concentrations have changed in Northern Ireland over many years.

Carbon Monoxide was monitored using an automatic instrument at one site – Belfast Centre. The results were well within the Regulations limit value and AQS objective for this pollutant, as they have been for many years. Belfast Centre was also compliant with the WHO 2021 guideline of 4 mg m^{-3} for annual 99th percentile of 24-hour mean CO concentrations.

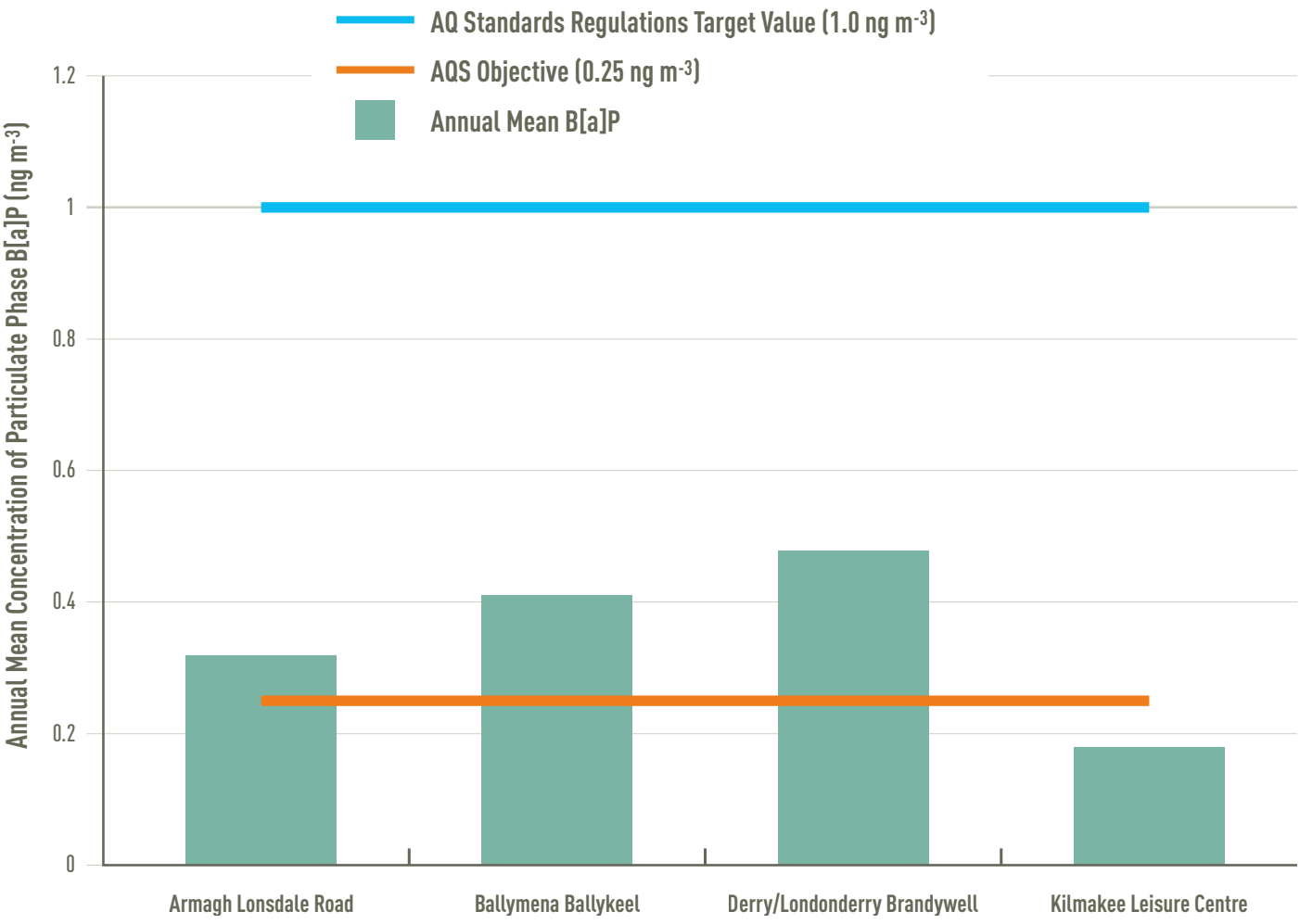
Benzene was monitored at one site, Belfast Centre, which met the Regulations annual mean limit value and AQS objective (5 µg m^{-3} for the annual mean and 3.25 µg m^{-3} for the running annual mean respectively) in 2025, as it has done for many years.

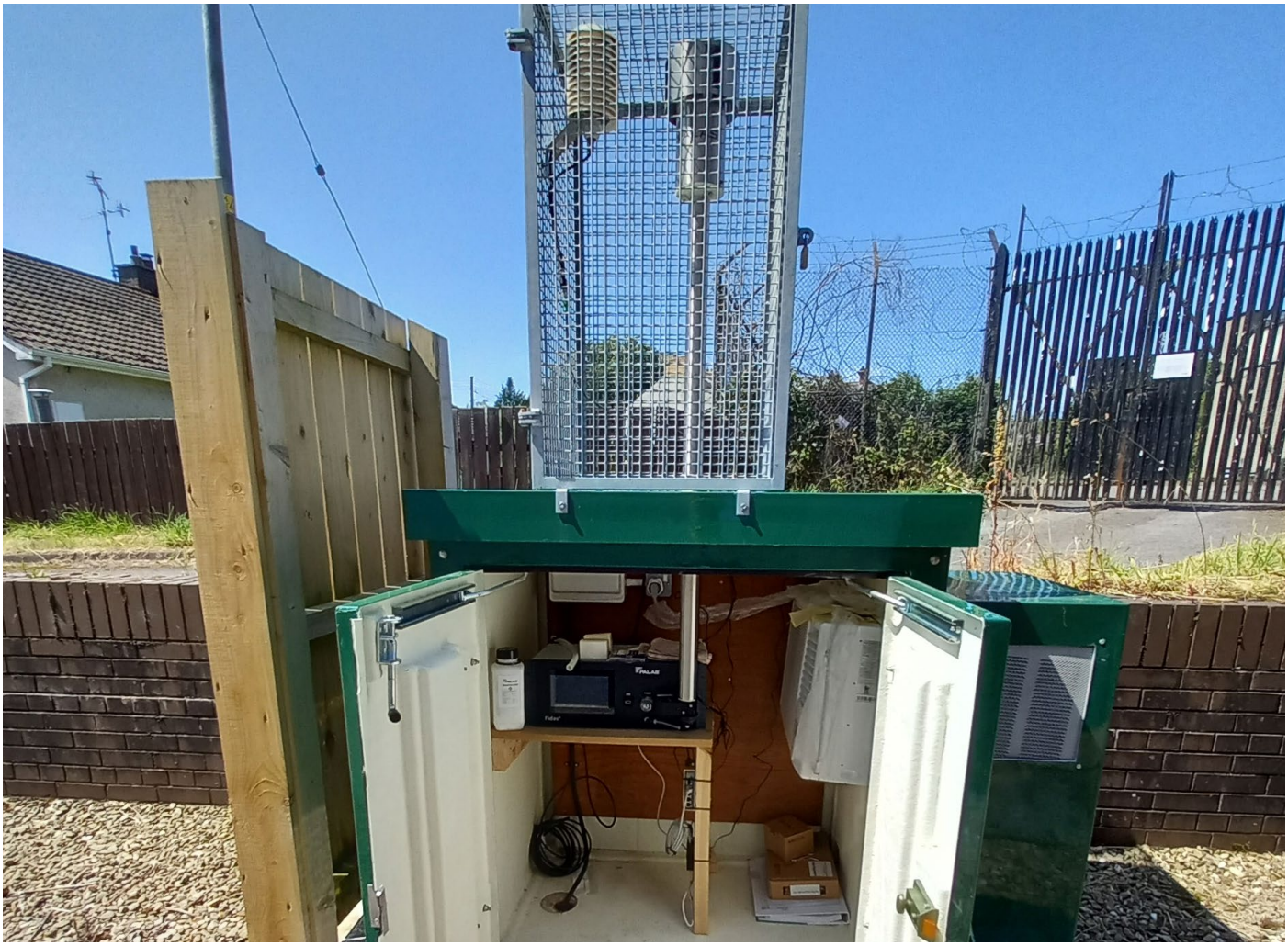
Metallic Elements including lead, arsenic, cadmium and nickel – were monitored using non-automatic techniques at Belfast Centre, as part of the Heavy Metals Network. The results for 2025 were within the Regulations annual mean limit value and AQS objective for lead, and within the Regulations annual mean target values for arsenic, cadmium and nickel.

Polycyclic Aromatic Hydrocarbons (PAHs) were monitored at four sites in 2025: Ballymena Ballykeel, Derry/Londonderry Brandywell, Kilmakee Leisure Centre (in Dunmurry), and Armagh Roadside. All four are part of the UK PAH Monitoring Network. This 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 Regulations target value.

Figure 4.5 shows the annual mean concentrations for 2025. No site exceeded the Regulations target value of 1 ng m^{-3} for annual mean B[a]P concentration during 2025 (which was to be met by 31 December 2012). Three sites exceeded the more stringent AQS annual mean objective of 0.25 ng m^{-3} for this PAH species, which was to have been achieved by 31 December 2012: only Kilmakee Leisure Centre achieved this more stringent objective in 2025.

Figure 4.5: Annual Mean Concentrations of Benzo[a]pyrene, 2025





Castlederg monitoring station

Summary

Air Quality Standards Regulations (Northern Ireland) limit values, target values and corresponding AQS objectives have been met for the following pollutants in Northern Ireland:

- Particulate matter as PM_{10}
- Particulate matter as $PM_{2.5}$
- Ozone
- Sulphur dioxide
- Carbon monoxide
- Benzene
- The elements lead, arsenic, cadmium and nickel.

One site (Downpatrick Roadside) exceeded the annual mean objective of 40 µg m^{-3} for nitrogen dioxide, the first exceedance since 2019.

Three of the four sites where benzo[a]pyrene was monitored in 2025 exceeded the AQS annual mean objective of 0.25 ng m^{-3}.

Although no sites exceeded the AQS objective for ozone of 100 µg m^{-3} on more than the permitted 10 days in 2025, it is noted that ozone concentrations depend greatly on weather conditions and therefore the number of ozone exceedances varies considerably from year to year.

A summary of compliance status for the pollutants measured in Northern Ireland with the Limit Values and Target Values of the AQSRNI, the UK Air Quality Strategy Objectives and the WHO Air Quality Guidelines 2021, is shown in Table 4.1.

Table 4.1: Summary of Compliance Status for Pollutants Measured in Northern Ireland in 2025

Pollutant and units	Monitoring sites	Averaging time	Air Quality Standards Regulations (Northern Ireland) Limits/ Targets	AQSRNI Compliance	UK Air Quality Strategy Objective	AQS Objective Compliance	WHO Air Quality Guidelines 2021	WHO AQ Guideline Compliance
PM_{10} µg m^{-3}	Armagh Lonsdale Road, Ballymena Ballykeel, Belfast Centre, Belfast Stockman's Lane, Castlederg, Derry/Londonderry Rosemount, Enniskillen Bowling Green, Limavady Dungiven, Lisburn Dunmurry Seymour Hill, Lough Navar, Newry Canal Street, Newtownstewart, North Down Holywood A2, Strabane Springhill Park, Strathfoyle Bawnmore Place	Annual Mean	40	Compliant	40	Compliant	15	Non-compliant at the following sites: Belfast Stockman's Lane and Newry Canal Street
		24-hour	50 (not to be exceeded more than 35 times a year)	Compliant	50 (not to be exceeded more than 35 times a year)	Compliant	45 (99th percentile of 24-hour means i.e. 3-4 exceedance days/year)	Non-compliant at the following sites: Belfast Stockman's Lane and Newry Canal Street
$PM_{2.5}$ µg m^{-3}	Ballymena Ballykeel, Belfast Centre, Castlederg, Derry/Londonderry Rosemount, Enniskillen Bowling Green, Limavady Dungiven, Lisburn Dunmurry Seymour Hill, Lough Navar, Newtownstewart, North Down Holywood A2, Strabane Springhill Park, Strathfoyle Bawnmore Place	Annual Mean	25	Compliant	20	Compliant	5	Non-compliant at all sites except Lough Navar
		24-hour	-	-	-	-	15 (99th percentile of 24-hour means i.e. 3-4 exceedance days/year)	Non-compliant at all sites
NO_2 µg m^{-3}	Armagh Lonsdale Road, Ballymena Antrim Road, Ballymena Ballykeel, Belfast Centre, Belfast Newtownards Road, Belfast Ormeau Road, Belfast Stockman's Lane, Belfast Westlink Roden Street, Castlereagh Dundonald, Derry/Londonderry Dale's Corner, Derry/Londonderry Rosemount, Downpatrick Roadside, Limavady Dungiven, Newry Canal Street, Newtownabbey Antrim Road, North Down Holywood A2	Annual Mean	40	Compliant except Downpatrick Roadside	40	Compliant except Downpatrick Roadside	10	Non-compliant at all sites except Derry/ Londonderry Rosemount
		24-hour	-	-	-	-	25 (99th percentile of 24-hour means i.e. 3-4 exceedance days/year)	Non-compliant at all sites.
		1-hour	200 (not to be exceeded more than 18 times a calendar year)	Compliant	200 (not to be exceeded more than 18 times a calendar year)	Compliant	200 (from previous 2005 guidelines, still valid)	Compliant
O_3 µg m^{-3}	Belfast Centre, Derry/ Londonderry Rosemount, Lough Navar	Peak season mean	-	-	-	-	60 (Avg. of daily max. 8-hour means in the 6 consecutive months with highest 6 month running average concentration)	Non-compliant at Derry/ Londonderry Rosemount and Lough Navar: insufficient data at Belfast Centre
		Daily maximum 8-hour running mean	120 (not to be exceeded more than 25 times a year, averaged over 3 years)	Compliant	100 (not to be exceeded more than 10 times a year)	Compliant	100 (99th percentile of 8-hour means)	Compliant

Table 4.1: Summary of Compliance Status for Pollutants Measured in Northern Ireland in 2025 – Continued

Pollutant and units	Monitoring sites	Averaging time	Air Quality Standards Regulations (Northern Ireland) Limits/ Targets	AQSRNI Compliance	UK Air Quality Strategy Objective	AQS Objective Compliance	WHO Air Quality Guidelines 2021	WHO AQ Guideline Compliance
SO_2 µg m^{-3}	Ballymena Ballykeel, Belfast Centre, Derry/Londonderry Rosemount, Strabane Springhill Park	24-hour	125 (not to be exceeded more than 3 times a year)	Compliant	125 (not to be exceeded more than 3 times a year)	Compliant	40 (99th percentile of 24-hour means)	Compliant
		1-hour	350 (not to be exceeded more than 24 times a year)	Compliant	350 (not to be exceeded more than 24 times a year)	Compliant	-	-
		15-min	-	-	266 (not to be exceeded more than 35 times a year)	Compliant	-	-
CO mg m^{-3}	Belfast Centre	24-hour	-	-	-	-	4	Compliant
		Daily maximum 8-hour running mean	10	Compliant	10	Compliant	10	Compliant
		1-hour	-	-	-	-	35	Compliant
		15-minute	-	-	-	-	100	Compliant
Benzene µg m^{-3}	Belfast Centre	Annual Mean	5	Compliant	3.25 as max. running annual mean	Compliant	-	-
Pb µg m^{-3}	Belfast Centre	Annual Mean limit value	0.5	Compliant	0.5, 0.25	Compliant	-	-
As ng m^{-3}	Belfast Centre	Annual Mean target value	6	Compliant	-	-	-	-
Cd ng m^{-3}	Belfast Centre	Annual Mean target value	5	Compliant	-	-	-	-
Ni ng m^{-3}	Belfast Centre	Annual Mean target value	20	Compliant	-	-	-	-
Benzo[a] pyrene ng m^{-3}	Armagh Lonsdale Road, Ballymena Ballykeel, Derry/Londonderry Brandywell, Kilmakee Leisure Centre	Annual Mean target value	1	Compliant	0.25	Non-compliant at all sites except Kilmakee Leisure Centre	-	-

5. Sulphur Dioxide: Changes over Time

In this section, we look at one pollutant - sulphur dioxide (SO_2) – and how sources and concentrations have changed over time in Northern Ireland.

Sulphur dioxide is harmful to human health as it can irritate the respiratory system and is dangerously toxic at high concentrations. It can also damage ecosystems, for example by acidifying rain.

As summarised in Table 2.1, SO_2 is formed when fuels containing sulphur (which include some fossil fuels such as coal and oil) are burned. In Northern Ireland, domestic solid fuel and oil burning was historically a major source of SO_2, but this has decreased substantially in recent decades and is no longer the case in most parts of the region.

Historic Smoke and Sulphur Dioxide Measurements

Local authorities and other organisations have been carrying out measurements of air pollution since the early 20th century. However, the first nationally coordinated network of air pollution monitoring was the National Survey of Air Pollution (later known as the Smoke and Sulphur Dioxide Network), which started operation in October 1961 and operated until the end of 2005. At its largest, in the late 1970s, this network consisted of over 1200 monitoring sites throughout the UK, of which 38 were in Northern Ireland.

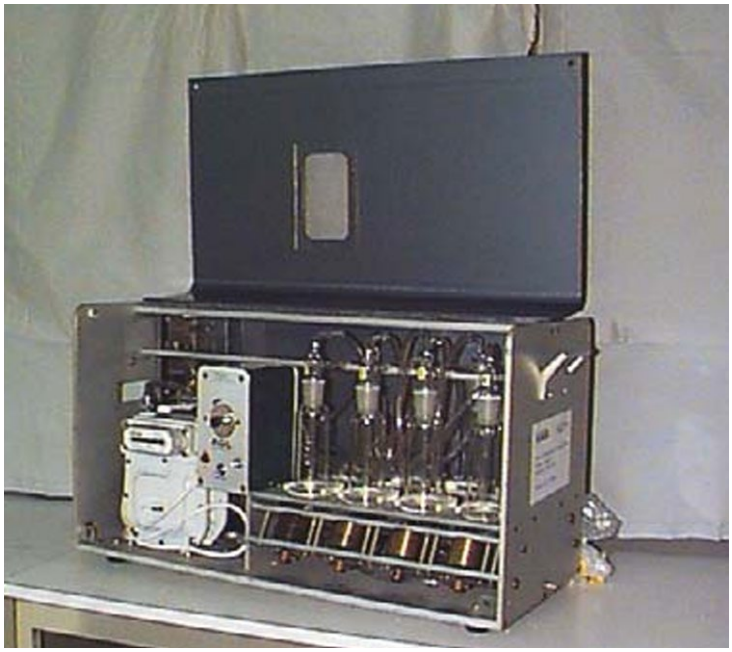
Each site measured 'black smoke' – a measure of dark particulate matter – and sulphur dioxide. Both pollutants were associated with coal and oil burning, which were major pollution sources at the time.

Black smoke was measured by passing a measured volume of sampled outdoor air through a filter paper: the darkness of the stain formed was measured using reflectometry, from which the concentration of smoke could be calculated.

Sulphur dioxide was measured using the net acidity method, where the same sample of air was bubbled through a reagent solution: this solution was then titrated in a laboratory to determine the total concentration of strongly acidic gases in the air. This method was not specific to SO_2: other acidic gases such as NO_2 also contributed. However, at that time, SO_2 concentrations were sufficiently high that the contribution from other pollutants was relatively small, and net acidity measurements were considered representative of SO_2 concentrations.

Monitoring was carried out using an instrument called an 'eight-port sampler', shown in Figure 5.1. It contained eight bubbler bottles, eight filter holders, a pump to draw outdoor air in through a length of tubing, and a meter to measure the volume of sampled air. A timed eight-port valve directed the sampled air through a different filter and bubbler each day, so it could sample unattended for up to eight days, providing eight midnight-to-midnight daily samples. The operator would visit the site on a weekly basis: they would change the filters and bubbler solutions, taking the exposed ones back to the laboratory for processing.

Figure 5.1: Typical Eight-Port Sampler Used in the Smoke and SO_2 Network



For over four decades, the Smoke and SO_2 Network was the main constituent of the UK's air pollution monitoring. It played a key role in monitoring the impact of the Clean Air Acts of the 1950s, and later, of monitoring compliance with the EC Directive 80/779/EEC on sulphur dioxide and suspended particulates.

Figure 5.2 shows the annual mean concentration of black smoke and net acidity (as SO_2), averaged over all sites in Northern Ireland, measured by the Smoke and SO_2 Network and its predecessor the National Survey. (Minimum annual data capture for inclusion is 75%.)

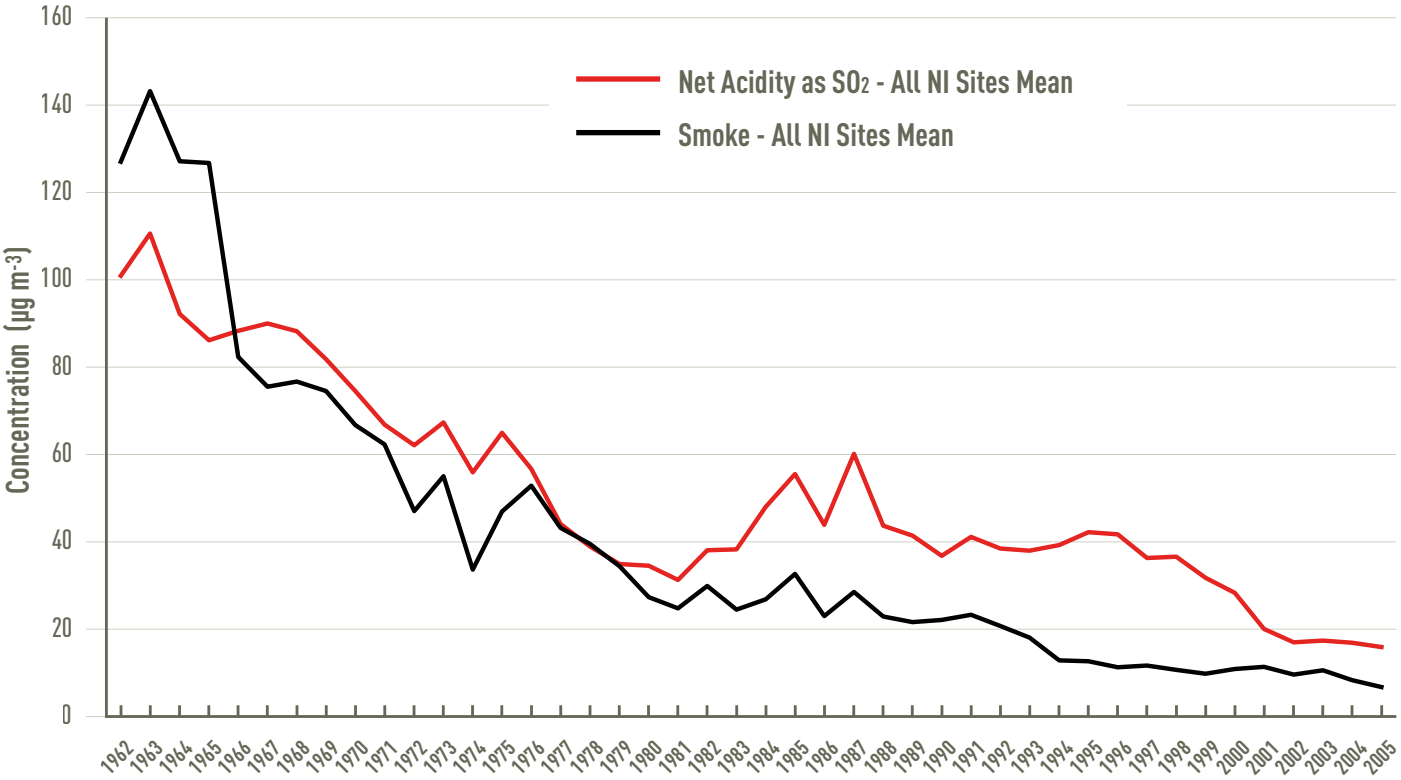
The average annual mean concentration of SO_2 (as measured by this network) decreased from over 80 µg m^{-3} throughout the 1960s, to just over 30 µg m^{-3} in 1981. From 1980 – 1987, average concentrations rose in most years, before the downward trend resumed in the late 1980s.

This rise in the 1980s was not seen elsewhere in the UK, and a possible explanation is that it may have resulted from a rise in coal and oil burning, as the use of 'town gas' was phased out[8]. 'Town gas' was a gas produced from coal, consisting largely of carbon monoxide and hydrogen, widely used as a domestic fuel in the early and mid 20th century. It was phased out in the 1960s and 1970s throughout most of the UK, being superseded by natural gas (methane) in most parts of England, Wales and Scotland – though not at this stage Northern Ireland. 'Town gas' production decreased through the late 1970s and early 1980s: the eventual shut-down of the supply began in 1984 and was completed in Northern Ireland in 1988. However, in Northern Ireland, natural gas did not start to become widely available until well into the 1990s, therefore solid fuels and oil remained important domestic fuels.

[8] 'Air Quality Monitoring in Northern Ireland 2004', https://www.airqualityni.co.uk/uploads/reports/16060221-air-quality-monitoring-in-northern-ireland-2004-complete2-6723a392f385d221912605.pdf

As a result, concentrations of SO_2 (as net acidity) remained relatively high in Northern Ireland (particularly Belfast) compared to the rest of the UK. However as natural gas became more widely available, SO_2 concentrations declined through the late 1990s and early 2000. By 2024, the difference between annual mean net acidity concentrations in Northern Ireland and those for the Network as a whole, had been reduced to 3 µg m^{-3}.[9]

Figure 5.2: Annual Mean Concentration of Smoke and SO_2 at Sites in Northern Ireland, as Measured by the Smoke and SO_2 Network, 1962 – 2005





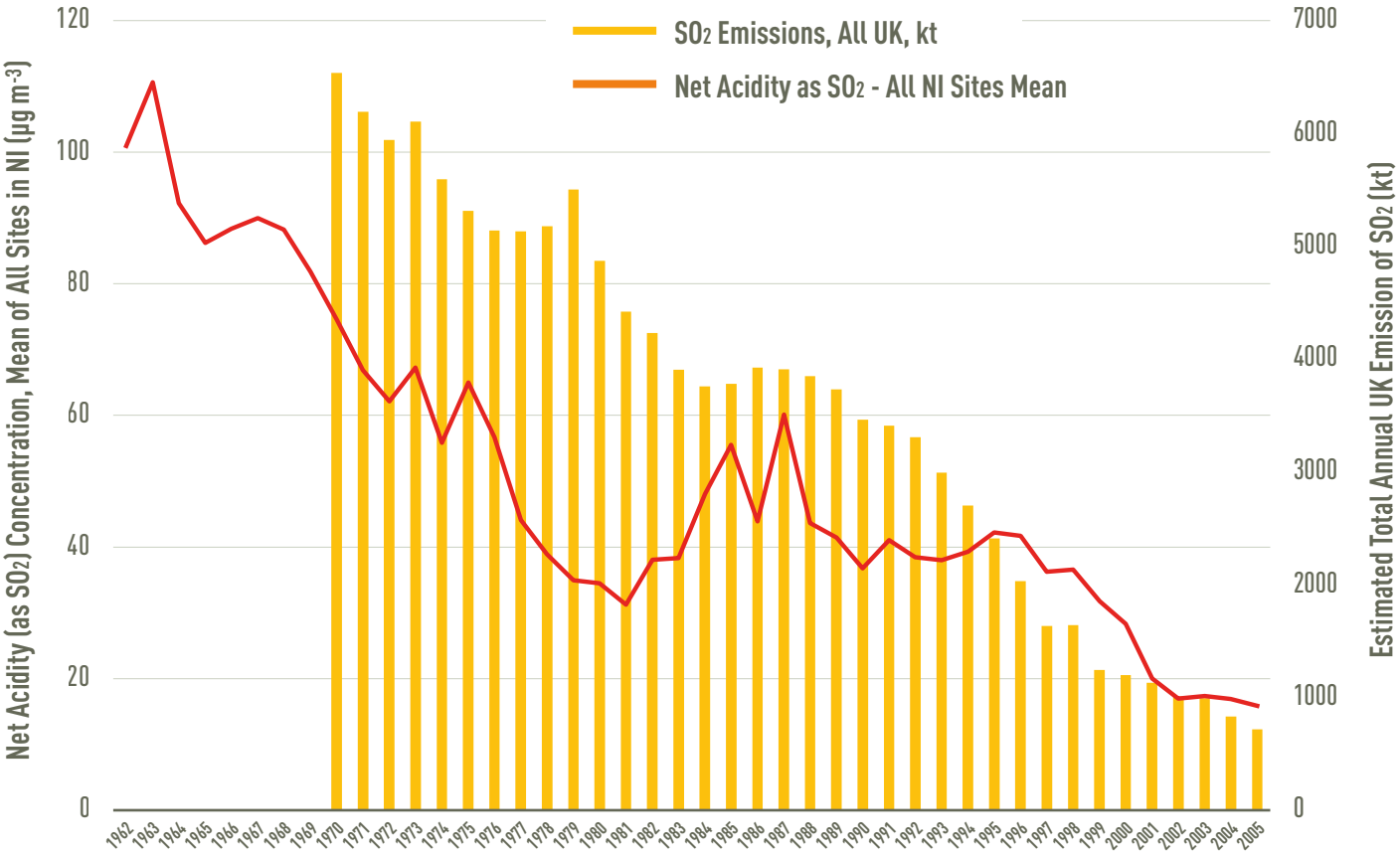
Belfast Cityscape in Northern Ireland

[9] 'UK Smoke and Sulphur Dioxide Network 2004', https://uk-air.defra.gov.uk/assets/documents/reports/cat13/0602211414_SmkSO2_report_2004_Issue_1.pdf

The National Atmospheric Emissions Inventory (NAEI) contains estimates of total UK emissions of a range of pollutants, for years 1970 onwards. Figure 5.3 compares the annual mean concentration of net acidity (as SO_2), averaged over all sites in Northern Ireland (as shown previously in Figure 5.2) with the estimated total UK annual emission of SO_2.

This comparison should be treated with caution, as Northern Ireland's annual SO_2 emissions are likely to have followed a slightly different trend to those of the UK as a whole[10]. However, the graph illustrates the overall substantial decline in both total UK SO_2 emissions and average concentrations in Northern Ireland, as measured by the Smoke and SO_2 Network.

Figure 5.3: Comparison of Annual Mean Net Acidity in Northern Ireland and Total UK Annual Mean SO_2 Emissions (kt), 1970 – 2005



As smoke and SO_2 concentrations fell, EC Directive 80/779/EEC was repealed and replaced with more stringent legislation (the forerunner of today's regulations), so the Smoke and SO_2 Network no longer had a compliance monitoring role. SO_2 concentrations in particular decreased to the point where the net acidity method was no longer able to provide representative measurements. Also, less labour-intensive automatic monitoring methods became more widely available. The Smoke and SO_2 Network came to the end of its useful life and ceased operating at the end of 2005.

However, the dataset from this long-running historic network remains of interest to the scientific community and is available from the Northern Ireland Air Quality website at www.airqualityni.co.uk.

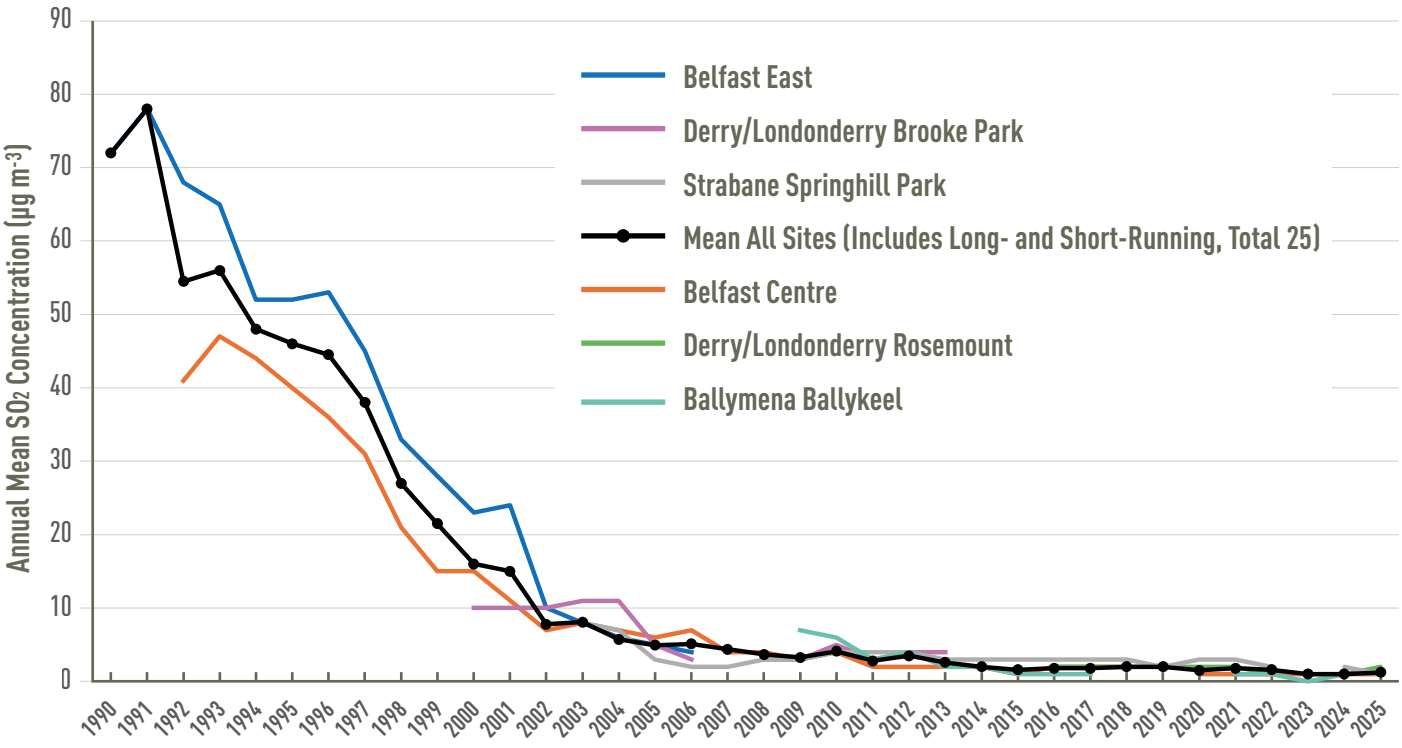
[10] 'Air Quality Monitoring in Northern Ireland, 2000-2001': https://www.airqualityni.co.uk/uploads/reports/1060221-aqmnireport-web-6723a41601a9e133711618.pdf

Automatic SO_2 Measurements

The first automatic SO_2 monitoring in Northern Ireland was Belfast East, which started up in 1990, followed by Belfast Centre in 1992. These two remained the only automatic SO_2 monitoring sites in Northern Ireland until 2000, when a number of other SO_2 monitoring sites started up between 2000 and 2005. A total of 25 automatic monitoring sites have operated in Northern Ireland from 1990 onwards, but most of these operated for a relatively short period of time (less than 10 years) before closing down.

This complicates the process of investigating changes over time: if using a long-term dataset based on the average of several sites, there can be apparent step changes and discontinuities if any sites start up or close down during the period being considered. Therefore, the time series chart in Figure 5.4 shows not only the annual mean SO_2 concentration averaged over all 25 automatic sites that have operated in Northern Ireland, but also separately, time series for the most long-running SO_2 sites (Belfast East, Belfast Centre, Derry/Londonderry Brooke Park, Derry/Londonderry Rosemount, Strabane Springhill Park and Ballymena Ballykeel). The two Belfast sites show a sharp decline in SO_2 concentrations throughout the 1990s and into the early 2000s: this subsequently levelled off to some extent.

Figure 5.4: Annual Mean SO_2 Concentration as Measured at Automatic Monitoring Sites in Northern Ireland: Average of All Sites, and Individual Long-Running Sites

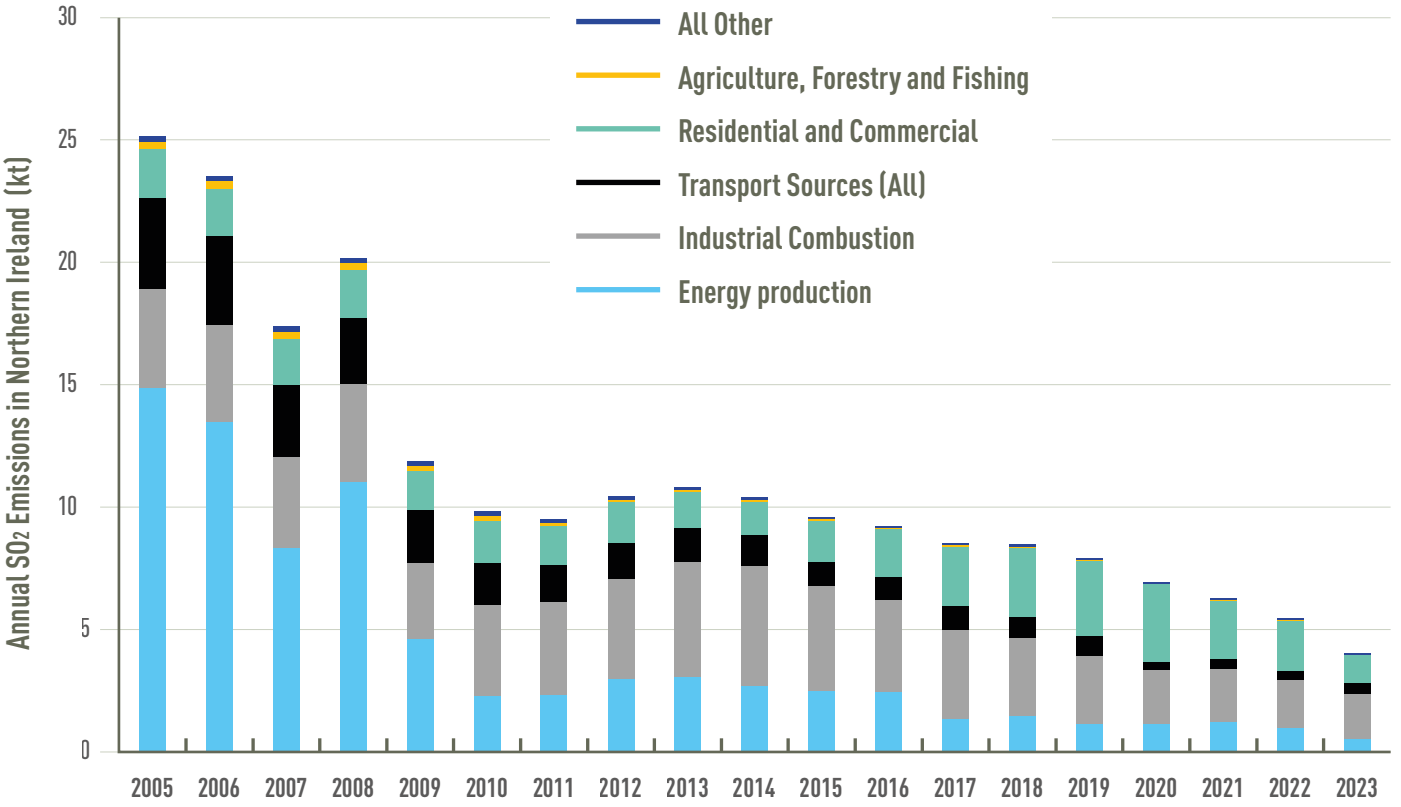


The NAEI contains emission estimates for the individual regions of Scotland, Wales and Northern Ireland from 2005 onwards. Figure 5.5 shows estimated total annual SO_2 emissions for Northern Ireland, from 2005 to 2023 (the most recent year for which emission estimates are available). This bar chart, based on one in the NAEI report for 2005 - 2023[11] shows which source categories have made the largest contributions to the total, and how these have changed over the years.

Overall, total 2023 emissions of SO_2 in Northern Ireland were estimated as 4kt, which constitutes just 4% of the total estimated UK emissions. The largest sources are currently industrial combustion, and residential and commercial combustion.

Total estimated SO_2 emissions for Northern Ireland have fallen by 84% since 2005, with much of this decrease resulting from reductions in emissions from the energy generation sector. Some of the reasons for this include the introduction of OCGT (Open Cycle Gas Turbines) and CCGT (Combined Cycle Gas Turbine) plant, which are more efficient than conventional coal and oil power stations and (because they burn gas) have negligible SO_2 emissions[11]. The continued expansion of the natural gas supply throughout Northern Ireland has allowed other sectors to reduce use of sulphur-containing fuels such as coal and oil.

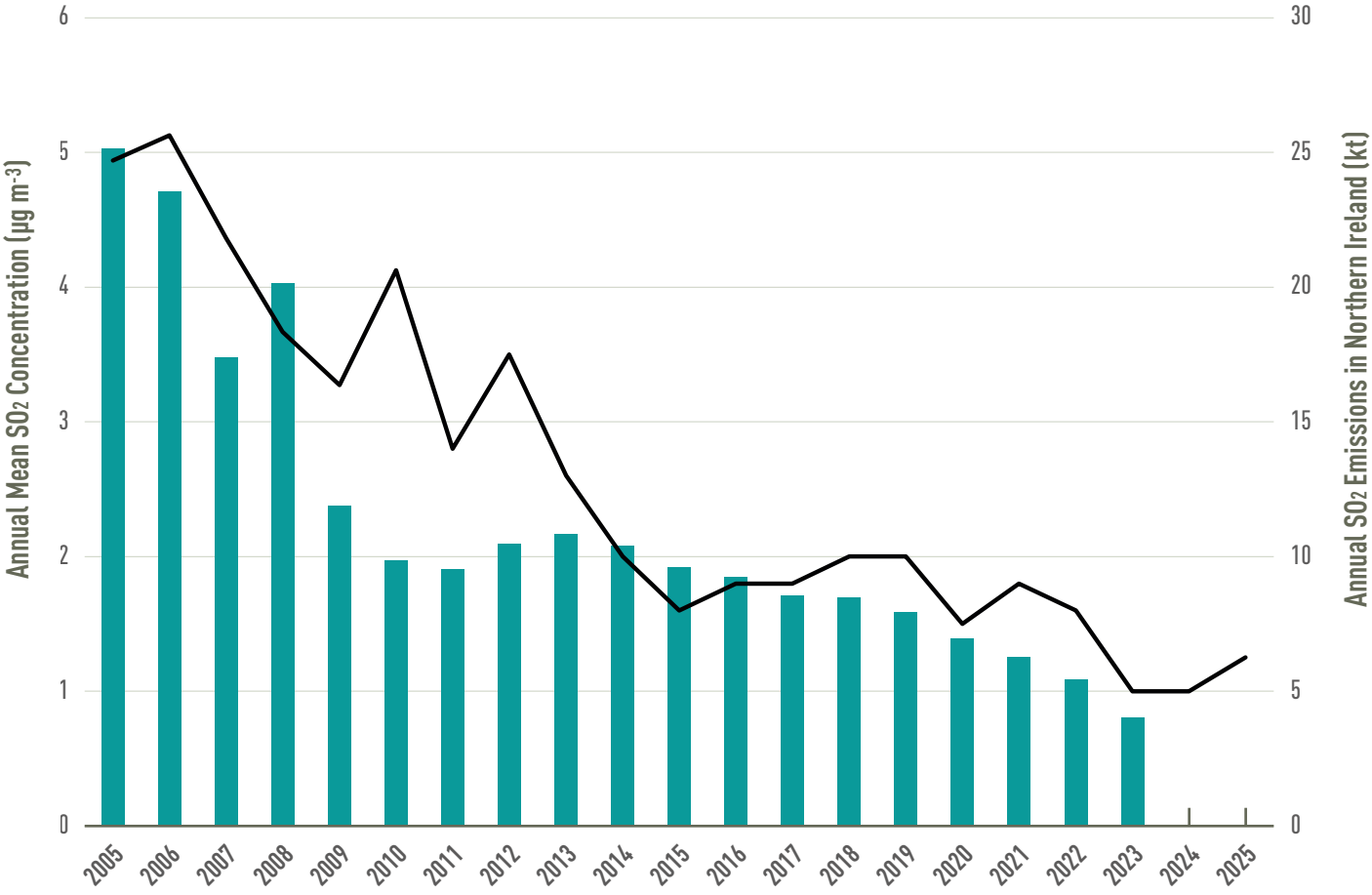
Figure 5.5: Estimated Total Annual SO_2 Emissions for Northern Ireland, From 2005 – 2023



[11] 'Air Pollutant Inventories for England, Scotland, Wales and Northern Ireland: 2005-2023' at https://naei.energysecurity.gov.uk/sites/default/files/2025-09/DG_AP_Inventory_2005-2023_Report_FINAL_for_publication.pdf

Figure 5.6 compares the mean measured annual mean SO_2 concentrations (averaged over all automatic monitoring sites) for years 2005 onwards, with the NAEI's estimated total annual SO_2 emissions for Northern Ireland, in years 2005 – 2023. Apart from a period around 2009 – 2013 when estimated emissions appeared to decrease more sharply than measured concentrations, the two parameters show a similar pattern. This illustrates the value of Northern Ireland's monitoring network in quantifying the effects of changes in emissions.

Figure 5.6: Comparison of Measured Annual Mean Concentrations and Estimated Annual Emissions for SO_2 in Northern Ireland, 2005 – 2023



Measured annual mean SO_2 concentration is represented by the line and estimated annual SO_2 emissions by the bars.



Belfast, Northern Ireland

6. Air Pollution and Noise in Northern Ireland

In this section, we look at the health impacts of exposure to environmental noise, the links between noise (that is, unwanted or harmful sound) and air pollution, and some actions that can be taken to address both issues.

Effects of Noise on Health

It is well known that exposure to high noise levels – such as working in a noisy factory or listening to very loud music - can cause hearing impairment. It has also been known for a long time that exposure to high levels of noise can affect quality of life. Noise emitted from premises so as to be prejudicial to health or a nuisance is one of a range of 'statutory nuisances' against which local authorities can take action under the Clean Neighbourhoods and Environment Act (Northern Ireland) 2011[12].

However, it is less well-known that exposure to high levels of noise for long periods can be directly harmful to health. A 2011 study carried out for the WHO Regional Office for Europe[13] examined evidence linking environmental noise exposure with the following:

- Cardiovascular disease
- Tinnitus (a hearing condition causing ringing or other sounds in the ears)
- Sleep disturbance
- Cognitive impairment in children.

The study found that at least one million healthy life years are lost every year from traffic related noise alone, in western Europe.

A British Medical Journal (BMJ) article[14] linked environmental noise exposure to a range of health problems including:

- Hearing loss and tinnitus (due to the direct effects of exposure to noise)
- Sleep disturbance
- Impacts on children's ability to learn
- Mental health conditions caused or exacerbated by the annoyance of noise exposure, such as depression and anxiety
- Physiological stress responses (that is, the body's responses to stress)
- Conditions relating to the cardiovascular and metabolic system, including high blood pressure, atherosclerosis (hardening of the arteries), insulin resistance (which can lead to type 2 diabetes), heart disease and stroke.

This study explains that environmental noise causes these adverse outcomes in two ways: directly, via sleep disturbance, and indirectly, via disturbance of activities and cognitive and emotional responses to this. Both cause stress responses within the body, and these stress responses increase a range of risk factors for cardiovascular disease (that is, disease related to the heart and circulation system).

[12] The Clean Neighbourhoods and Environment Act (Northern Ireland) 2011: https://www.legislation.gov.uk/nia/2011/23/contents
[13] Burden of disease from environmental noise: Quantification of healthy life years lost in Europe. Copenhagen: WHO Regional Office for Europe; 2011. Overview at https://www.who.int/europe/publications/i/item/9789289002295
[14] The impact of noise pollution on health: BMJ 2025; 391 doi: https://doi.org/10.1136/bmj-2024-081193 (Published 03 November 2025)

Air pollution is also associated with cardiovascular disease and frequently comes from the same sources as noise (particularly traffic). Research has investigated the impacts of (mostly road, railway and air traffic) noise exposure in the context of air pollution and concluded that – when the health effects of air pollution are adjusted for - noise exposure "*has a separate and substantial role in ill-health separate to that of air pollution*"[15]. This same study concludes that while air pollution is the primary environmental cause of disability adjusted life years lost in Europe, environmental noise is ranked second. It recommends that both air pollution and environmental noise exposure should be taken into account when assessing environmental impacts.

Quantifying Exposure to Environmental Noise

Noise is measured in units of decibels (dB). This is a logarithmic scale, able to quantify sounds from barely audible to as loud as a jet engine nearby. Some points on the decibel scale[16]:

- 0 dB: threshold of hearing
- 35 dB: a quiet bedroom
- 60 dB: an office environment
- 95 dB: a pneumatic drill 7m away
- 120 dB: threshold of pain.

When assessing people's exposure to environmental noise, A-weighted decibels (dB(A)) are often used: the 'A-weighting' is an adjustment applied to adjust for the variation in the sensitivity of human hearing to different frequencies of sound.

In addition, assessment of environmental noise takes into account the time of day when the noise is occurring: for example, noise at night when people are trying to sleep may be more disruptive than the same level of noise occurring during the day. The Environmental Noise Regulations (Northern Ireland) 2006[17] define standardised noise exposure metrics for the daytime (07:00 – 19:00), evening (19:00 – 23:00), night (23:00 – 07:00) and full day.

In terms of what constitutes an unhealthy level of environmental noise, according to the WHO's Factsheet on noise[18], WHO guidelines recommend less than 30 A-weighted decibels (dB(A)) in bedrooms during the night to allow good quality sleep. Outside of bedrooms, the WHO guidelines recommend annual average night-time noise should be less than 40 dB(A), to prevent adverse health effects. During daytime, noise levels in classrooms should be less than 35 dB(A) to facilitate good teaching and learning. (These guidelines do not cover workplace occupational noise, which is covered by separate legislation).

Who is Affected?

Air pollution and environmental noise frequently come from the same sources. While there are sources of environmental noise which do not emit air pollution – for example wind turbines – and sources of air pollution which are generally quiet – for example domestic fuel burning – there some important sources of both, which include:

- Road traffic
- Trains
- Aircraft and airports
- Industrial premises and activities
- Construction and demolition activities.

[15] Stansfield S.A., "Noise Effects on Health in the Context of Air Pollution Exposure". Int J Environ Res Public Health. 2015 Oct 14;12(10):12735–12760. doi: 10.3390/ijerph121012735 . Online: https://pmc.ncbi.nlm.nih.gov/articles/PMC4626997/#sec5-ijerph-12-12735

[16] DAERA Noise Mapping User Guide and Glossary: https://gis.daera-ni.gov.uk/arcgis/apps/storymaps/collections/4965ad9d9ec042049fd206001ee63b02?item=2

[17] The Environmental Noise Regulations (Northern Ireland) 2006: https://www.legislation.gov.uk/nisr/2006/387/regulation/2/made

[18] WHO Factsheet 'Noise': https://www.who.int/europe/news-room/fact-sheets/item/noise

According to a European Union (EU) publication cited by the WHO:

- about 40% of the population in EU countries is exposed to road traffic noise at levels exceeding 55 db(A)
- 20% of the population is exposed to levels exceeding 65 dB(A) during the daytime
- more than 30% is exposed to levels exceeding 55 dB(A) at night.

The BMJ publication referenced above[14] stated that people living in urban areas, or near busy transport routes, are likely to have greater exposure to noise. This is also the case for some types of air pollution. Disadvantaged people or groups are also likely to be more impacted: they may live in noisier areas and be unable to afford to move somewhere quieter. They may live in poorer quality housing without, for example, double glazing to insulate their homes from noise. Again, this is similar to the situation with air pollution, which tends to disproportionately affect the less well-off (who may have no choice but to live in areas with poor air quality). And the elderly, very young and those with existing health conditions are also likely to suffer more from the effects of noise: again, these groups are also known to be more vulnerable to the effects of air pollution.

Environmental Noise Legislation in Northern Ireland

Within the European Union, the assessment and management of environmental noise is regulated by Directive 2002/49/EC relating to assessment and management of environmental noise. This Directive aims to define a common approach to avoid, prevent or reduce the harmful effects of environmental noise. This Directive was transposed into Northern Ireland's own legislation before the UK left the EU, by the Environmental Noise Regulations (Northern Ireland) 2006[19].

These regulations require the relevant Competent Authority in Northern Ireland to carry out the following:

- determine the population's exposure to environmental noise, through noise mapping,
- ensure that information on environmental noise and its effects is made available to the public
- establish Action Plans based on the mapping results (a similar principle to those prepared for air quality).

The Environmental Noise Regulations (Northern Ireland) 2006 apply to environmental noise in built-up areas, public parks or other quiet areas in agglomerations (large urban areas) and other noise sensitive buildings and areas. There are some exclusions – for example they do not apply to noise that a person is exposed to because they cause it themselves, or occupational noise, or noise nuisance from neighbours – some of which are covered by separate legislation.

The specific noise sources covered are as follows:

- road noise
- railway noise
- industrial noise
- airport noise from Belfast International Airport
- airport noise from Belfast City Airport.

Each of these sources has a designated Competent Authority responsible for compiling the noise maps, identifying noise priorities, and preparing an Action Plan to reduce noise or prevent it increasing. Action Plans must be reviewed at least every five years (or before that if a major development occurs). In a further similarity to LAQM, DAERA has produced Technical Guidance to assist the Competent Authorities in producing their noise maps and Action Plans, ensuring a consistent approach.

[19] The Environmental Noise Regulations (Northern Ireland) 2006: https://www.legislation.gov.uk/nisr/2006/387/regulation/2/made



Northern Ireland's Noise Maps

Noise mapping in Northern Ireland is done using computer modelling. The noise maps must be updated every five years, in a timetable of 'rounds' similar to that used for Local Air Quality Management. The latest of these is Round 4, based on 2021 data. The Round 4 strategic Noise Maps are available online at https://gis.daera-ni.gov.uk/arcgis/apps/storymaps/collections/4965ad9d9ec042049fd206001ee63b02?item=1.

There are separate modelled maps for noise associated with:

- Major Roads, Railways and Airports
- Roads, Railways, Industry and Airports within the Belfast Agglomeration
- Agglomeration noise consolidated.

For each noise source, a range of time periods can be selected, for example day, evening and night.

Some examples are shown in Figure 6.1 to Figure 6.4:

Figure 6.1: Example - Noise Map for Major Roads in Northern Ireland

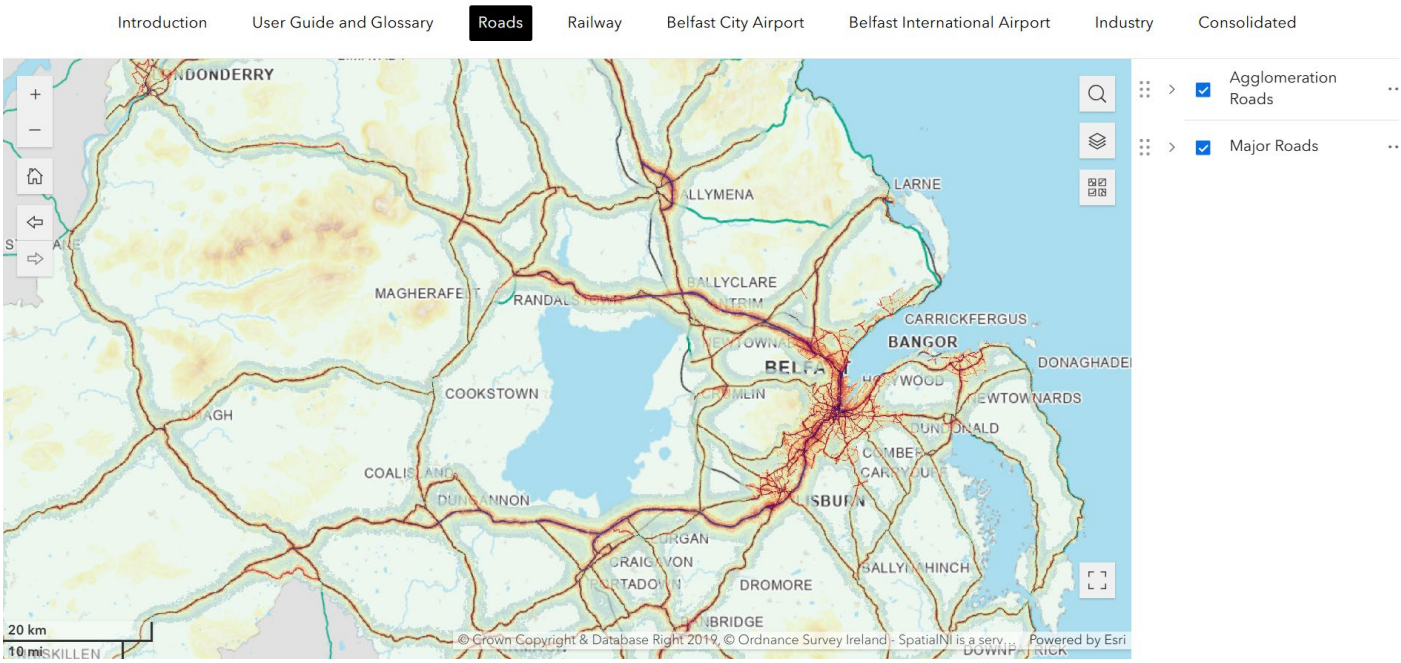


Figure 6.2: Example - Railway Noise Map, Belfast Area

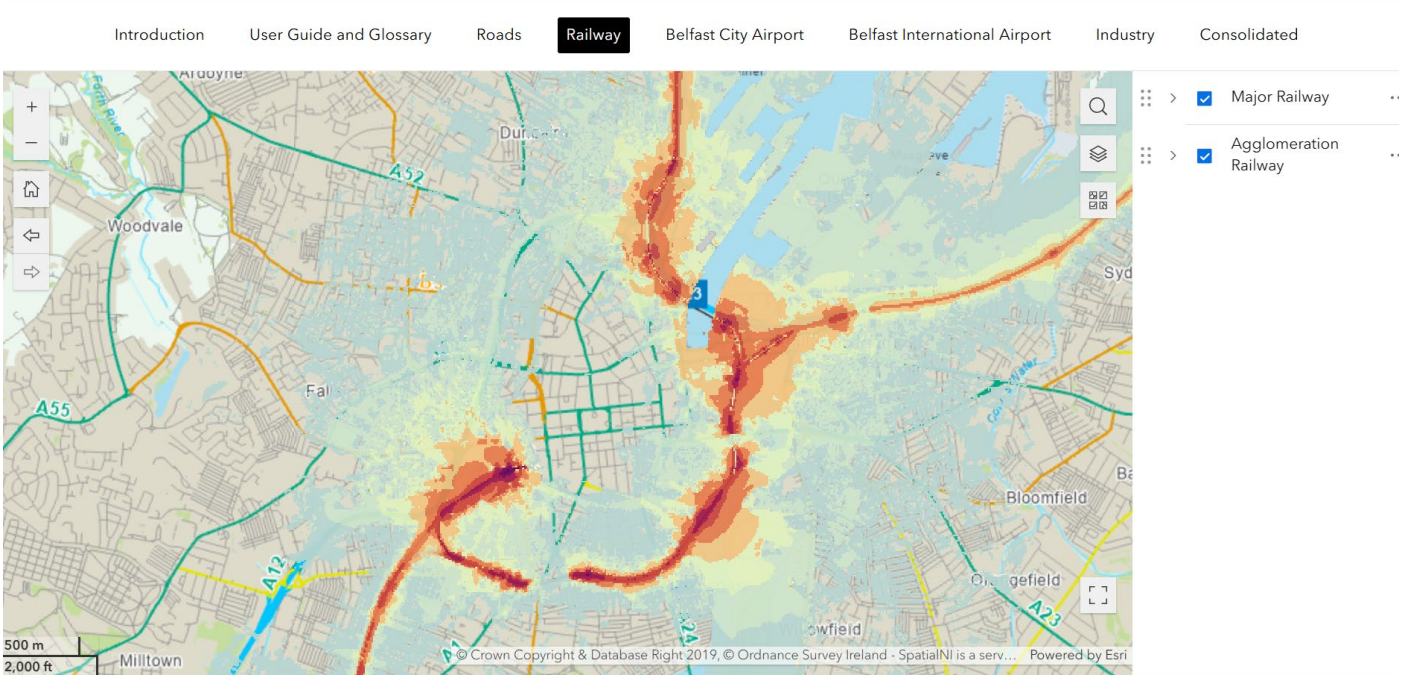


Figure 6.3: Example – Daytime Noise Map, Belfast City Airport

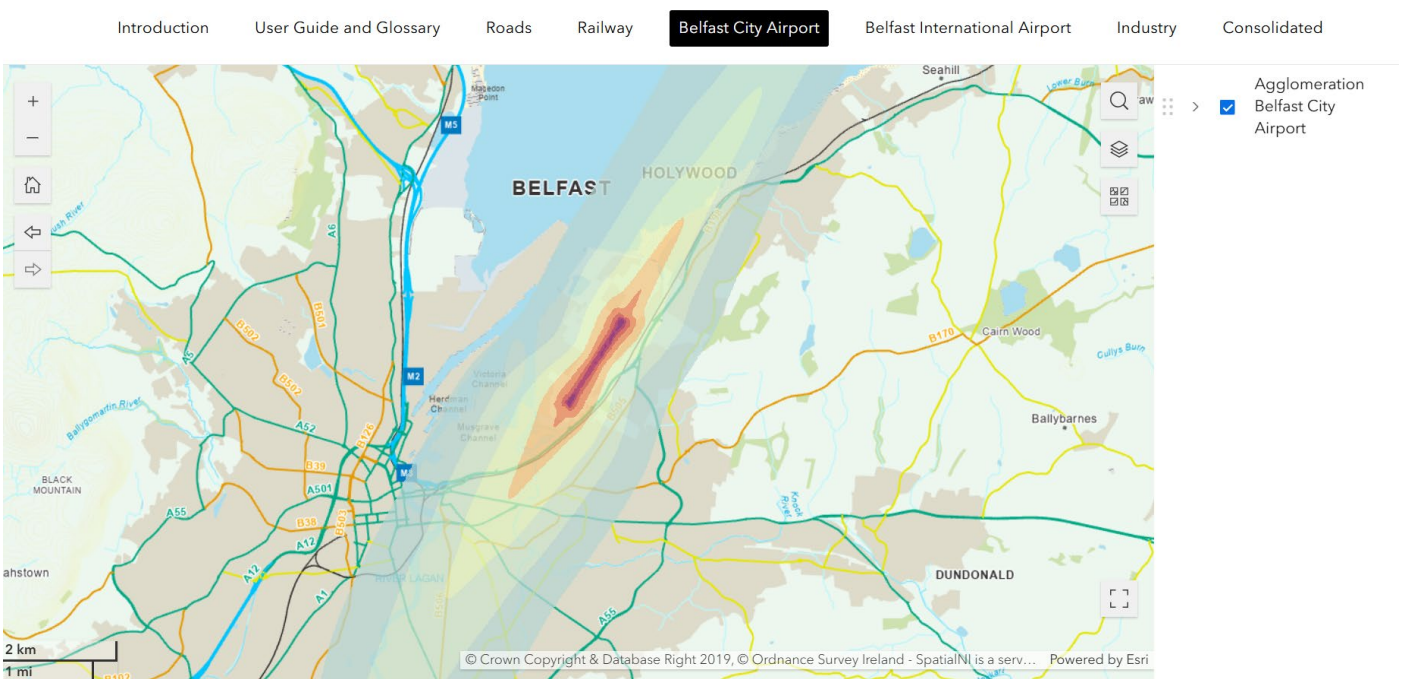


Figure 6.4: Example - Night-time Noise Map, Belfast City Airport



Summary – Air Pollution and Noise in Northern Ireland

- Air pollution and environmental noise share many of the same sources – for example road traffic, trains, industrial activities and airport activities. Therefore, many areas with poor air quality may also have higher than average levels of environmental noise.
- Both air pollution and environmental noise are associated with serious health impacts: although the mechanisms by which they harm the body are different, both can contribute to serious illness such as cardiovascular disease.
- Both air pollution and environmental noise are likely to disproportionately affect the most vulnerable in society: the elderly, children, the less well-off, and those with existing health problems.
- Northern Ireland's legislation requires the relevant Competent Authorities associated with noise sources to carry out noise mapping, make the information available to the public, and establish Action Plans based on the results of the mapping. The process has some similarities to the LAQM regime used for air quality.
- Northern Ireland's noise maps are available online at https://gis.daera-ni.gov.uk/arcgis/apps/storymaps/collections/4965ad9d9ec042049fd206001ee63b02?item=1.

Where to Find Out More About Air Quality

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

DAERA's website at https://www.daera-ni.gov.uk provides links to information on a range of environmental issues including biodiversity, waste and pollution.

DAERA's 'Protect the Environment' web page at https://www.daera-ni.gov.uk/topics/protect-environment covers air quality, climate change and local environmental issues including noise.

National and local air quality forecasts are available from:

- The Defra UK Air Information Resource (UK-AIR) - http://uk-air.defra.gov.uk
- The Northern Ireland Air Quality website - https://www.airqualityni.co.uk
- The Environmental Protection Agency (Ireland) Air Quality website - https://www.airquality.ie

Download the Northern Ireland Air app for iPhone and Android, keeping you updated about air pollution in Northern Ireland - https://www.airqualityni.co.uk/stay-informed

The app provides:

- Easy access to the latest pollution levels from the monitoring sites
- A colour-coded map showing the pollution forecasts
- Approved health advice based on the pollution levels
- Opportunity to subscribe to free alerts when moderate, high and very high pollution is forecast.

DAERA, in conjunction with Department of Health, provides the "Air Aware" SMS subscription service. This service allows members of the public to receive SMS text alerts when periods of high air pollution are forecast or occurring in Northern Ireland. The service is targeted at those with chronic health conditions such as heart disease and lung disease, who may be affected by air quality. The service can be initiated by texting '**AIR**' to **07984405722**.

For information on air quality issues in your local area please contact the Environmental Health Department of your district council: https://www.nidirect.gov.uk/contacts/local-councils-in-northern-ireland

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www.daera-ni.gov.uk



This report has been produced by WSP on behalf of the Department of Agriculture, Environment and Rural Affairs



Air Aware

Do you suffer from a chronic illness that affects your breathing?

You can receive alerts FREE to your mobile phone to let you know when air pollution levels are high.

Just text Air to 079 8440 5722 or download the Northern Ireland Air App

If you use regular treatment for respiratory problems and think your breathing may be affected by air pollution levels, consider adjusting your treatment as you would do for a normal increase in symptoms. If this is not effective, consult your doctor.

You may wish to consider avoiding busy, congested streets and not participating in strenuous outdoor activity on days when air pollution levels are high.

If you suffer from a heart condition and notice a change in your symptoms, you should seek medical advice as you normally would.

Northern Ireland Air
Air Quality in Northern Ireland

ANDROID APP ON Google play

Download on the App Store

For more information visit: www.airqualityni.co.uk

Text messages to the service will be charged at your normal standard rate. Alerts are received free of charge. To opt out, text STOPAIR to 079 8440 5722

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