



Nitrogen Dioxide

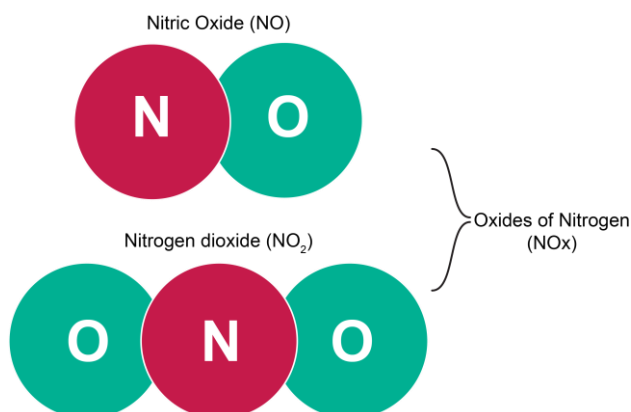
At a glance

- **80%:** percentage of NO_x emissions in areas where the UK is exceeding NO₂ limits are due to transport, with the largest source being emissions from diesel light duty vehicles (cars and vans) (Defra)
- **Nearly 600:** number of AQMAs across England, most of which are declared for NO₂ (Defra)
- **No threshold:** currently there is no clear evidence of a threshold concentration of NO₂ in ambient air below which there are no harmful effects for human health. Therefore, further reduction of NO₂ concentrations below the air quality standards is likely to bring additional health benefits.

Nitrogen dioxide (NO₂)

Nitrogen dioxide is a gas with the chemical formula NO₂; it is produced with nitric oxide (NO) by combustion processes. Together they are often referred to as oxides of nitrogen (NO_x).

Local road traffic contributes substantially to outdoor air pollution, particularly in busy towns and cities. Defra estimates that 80% of NO_x emissions in areas where the UK is exceeding NO₂ limits are due to transport, with the largest source being emissions from diesel light duty vehicles (cars and vans).



These continue to be the largest sources of emissions due to significant growth in the use of diesel vehicles and the failure of the Euro standard to deliver the expected emission standards under real world driving conditions. Emissions from industry, agriculture and commercial and domestic sources are also significant contributors.

A number of studies have reported associations with long-term exposure to NO₂ and adverse effects on health, including reduced life expectancy. It has been unclear whether these effects are caused by NO₂ itself or by other pollutants emitted by the same sources (such as road traffic). Evidence associating NO₂ with health effects has strengthened substantially in recent years and it is now thought that, on the balance of probability, NO₂ itself is responsible for some of the health impact found to be associated with it in epidemiological studies.

Air quality management

Local authorities are responsible for assessing and reviewing air quality in their areas to establish whether they are meeting the national air quality objectives. If these are not being met they must declare an Air Quality Management Area (AQMA) and produce an action plan to show how they are going to meet the objectives.

UK Air Quality Objectives for NO₂

200 µg/m³
One hour mean not to be exceeded more than 18 times a year

40 µg/m³
Annual mean

There are currently nearly 600 AQMAs across England, most of which are declared for NO₂. Local authorities are also expected to report on NO₂, particulate matter (with a diameter of 10 µm or less – PM₁₀) and sulphur dioxide in annual status reports (ASRs), which as well as results of monitoring and modelling should report on progress with reducing air pollution and identify new sources of pollution.

In February 2014, the European Commission commenced legal proceeding against the UK, following a Supreme Court finding that the UK was in breach of its obligations for failing to meet air NO₂ quality limit values.

In December 2015 Defra published a plan to reduce NO₂ emissions in the UK; this introduced a new programme of Clean Air Zones (CAZ) for five UK cities: Birmingham, Leeds, Southampton, Nottingham and Derby, to discourage buses, coaches, taxis and lorries from entering their city centre zones. A revised air quality plan for NO₂ in UK was published in July 2017, which notes a number of other local authority areas and locations which are required to take action. London will see the introduction of an Ultra Low Emission Zone by 2020, whereby cars, motorcycles, vans, minibuses, buses, coaches and lorries will need to meet exhaust emission standards (ULEZ standards), or pay a daily charge, when travelling in central London.

Defra encourages all local authorities to consider drawing up an Air Quality Strategy and encourages linking national work on NO₂ with the Public Health Outcome Framework (PHOF) indicator on particulate matter. It also encourages local authority public health to be involved in action planning and ASRs and to include population impacts from air pollution in Joint Strategic Needs Assessments (JSNA).

Measuring NO₂

Local authorities operate a range of air quality monitoring equipment and networks. Typically NO_x, NO and NO₂ are measured using on-line real-time automatic monitors and passive diffusion tubes, which are widely used to assess spatial variation in NO₂ concentration on a monthly basis. In addition to local authority monitoring, Defra maintains the Automatic Urban and Rural Network (AURN), which is the main network used for national compliance monitoring and includes monitoring for NO_x. The Defra UK-AIR (Air Information Resource) webpages include information on latest pollution levels, forecasts, monitoring data archives and details of the Defra AURN monitoring network.

Health effects

It is well established that NO₂, particularly at high concentrations, is a respiratory irritant that can cause inflammation of the airways (for example, cough, production of mucous and shortness of breath). Studies have shown associations of NO₂ in outdoor air with reduced lung development (lung function growth) and respiratory infections in early childhood and effects on lung function in adulthood. There are a number of studies associating NO₂ with negative health effects, including death. However, attributing health outcomes from exposure to individual constituent

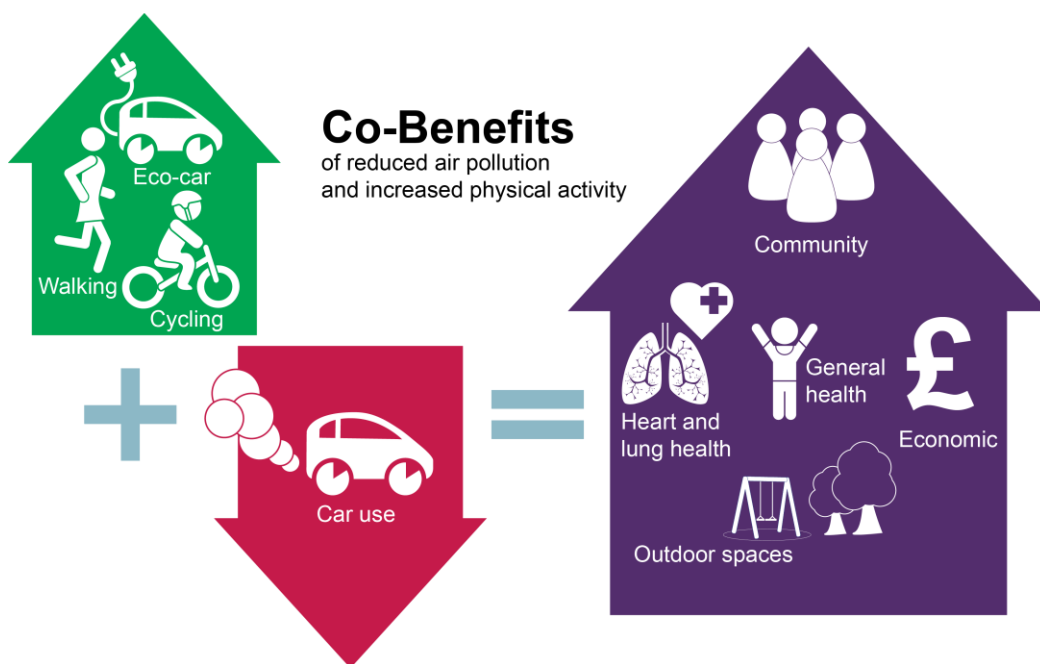
pollutants in emissions is not simple. This supports the need to tackle emissions in general and not necessarily to focus on individual pollutants.

Currently there is no clear evidence of a threshold concentration of NO₂ in ambient air below which there are no harmful effects for human health. Therefore, further reduction of NO₂ concentrations below the air quality standards is likely to bring additional health benefits.

The Committee on the Medical Effects of Air Pollutants (COMEAP) are investigating whether it is possible to quantify the association between long-term exposure to NO₂ and mortality. In its interim statement COMEAP indicates that care needs to be taken to avoid double-counting and overestimation of the combined mortality effect of PM_{2.5} and NO₂ when considering the effects from exposure to each pollutant separately and are currently considering whether and how mortality estimates should be combined.

Co-benefits

Air pollution is not an issue in isolation. It is often a reflector of and contributor to wider environmental inequalities. It is clear that actions to improve air quality will benefit other public health outcomes. As well as targeting defined areas where exceedances of NO₂ have been observed, PHE supports actions that improve air quality as a whole.



Attention to improving air quality over the wider area also acknowledges that the negative effects of air pollution may occur at locations other than where the emissions occur.

Taking action

The Action Toolbox in Annex A of the Defra [Local Air Quality Management Technical Guidance \(TG16\)](#) and the Action Matrix referred to in the [London Local Air Quality Management \(PG 16\)](#) provide information on action that can be taken to reduce air pollution and thereby improve the health of the public. The toolkit recognises that the suitability and effectiveness of different actions will vary by location and highlights activities that local authorities have taken, such as low emission strategies and promoting active travel.

The [Defra Air quality: a briefing for directors of public health](#) is intended to help local authorities and public health professionals to communicate to decision makers and the public on air pollution.

Further information

[Committee on the Medical Effects of Air Pollutants \(COMEAP\)](#)

[Defra UK-AIR Air Information Resource](#)

[Defra Air Pollution in UK](#)

[Defra Tackling nitrogen dioxide in our towns and cities, December 2015](#)

[Defra UK plan for tackling roadside nitrogen dioxide concentrations, July 2017](#)

[Defra Local Air Quality Management Support](#)

[Royal College of Physicians \(RCP\) Every breath we take: the lifelong impact of air pollution](#)

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