

Air quality and public health

Research Briefing

July 2026



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Research Briefing

July 2026

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Senedd Research acknowledges the parliamentary fellowship provided to Charlotte Morgan by the Engineering and Physical Sciences Research Council (EPSRC) which enabled this briefing to be completed.

This research briefing provides an overview of air quality and public health in Wales. It explains the main sources of air pollution, including transport, domestic burning, industry, electricity production and agriculture, and outlines how pollutants are monitored and regulated. It also summarises the development of air quality law and policy in Wales, including the Environment (Air Quality and Soundscapes) (Wales) Act 2024 and the introduction of new targets for fine particulate matter.

The briefing also examines the health effects of air pollution, highlighting evidence that the burden of poor air quality is equivalent to around 1,000 to 1,400 deaths each year in Wales, and is linked to respiratory, cardiovascular and other long-term conditions. It reviews recent trends in major pollutants, showing that many emissions have fallen over time, while noting continuing challenges such as ozone, inequalities in exposure, and the need to balance environmental improvement with wider economic and social considerations.





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Introduction

Poor air quality significantly impacts public health. Air pollution originates from a variety of everyday activities, including industrial processes, domestic burning of wood and coal, combustion engine vehicles, and agricultural practices.

Public Health Wales estimates the burden of poor air quality is equivalent to between 1000 and 1400 deaths per year in Wales. Air pollution can contribute to diseases that place pressure on the Welsh NHS, particularly cardiovascular, respiratory and neurological conditions.

Legislative and policy action across the UK has aimed to lower the production of pollution, and people's exposure to pollution on multiple timescales. Wales now has full legislative competence for air quality. Most recently, the Senedd passed the **Environment (Air Quality and Soundscapes) (Wales) Act 2024**, which provides a framework for setting national targets for overall air quality improvement.

This research brief addresses the causes and health impacts of air pollution. It reflects on legislative and policy action to improve air quality over the past three decades, investigates the health impacts and broader societal consequences of air pollution, and explores long-term changes in a variety of major pollutants.

Background

What is air pollution?

Air pollution refers to a change in an indoor or outdoor environment caused by a pollutant. Pollutants can be chemical, biological, or physical in nature. Air pollution can impact human health in a variety of ways, and also **impacts the health of natural ecosystems**.

The **World Health Organisation (WHO)** says over 99% of the global population breathe air contaminated by pollutants exceeding **its guideline thresholds**, which offer an international standard for governments to consider when setting domestic air quality targets.

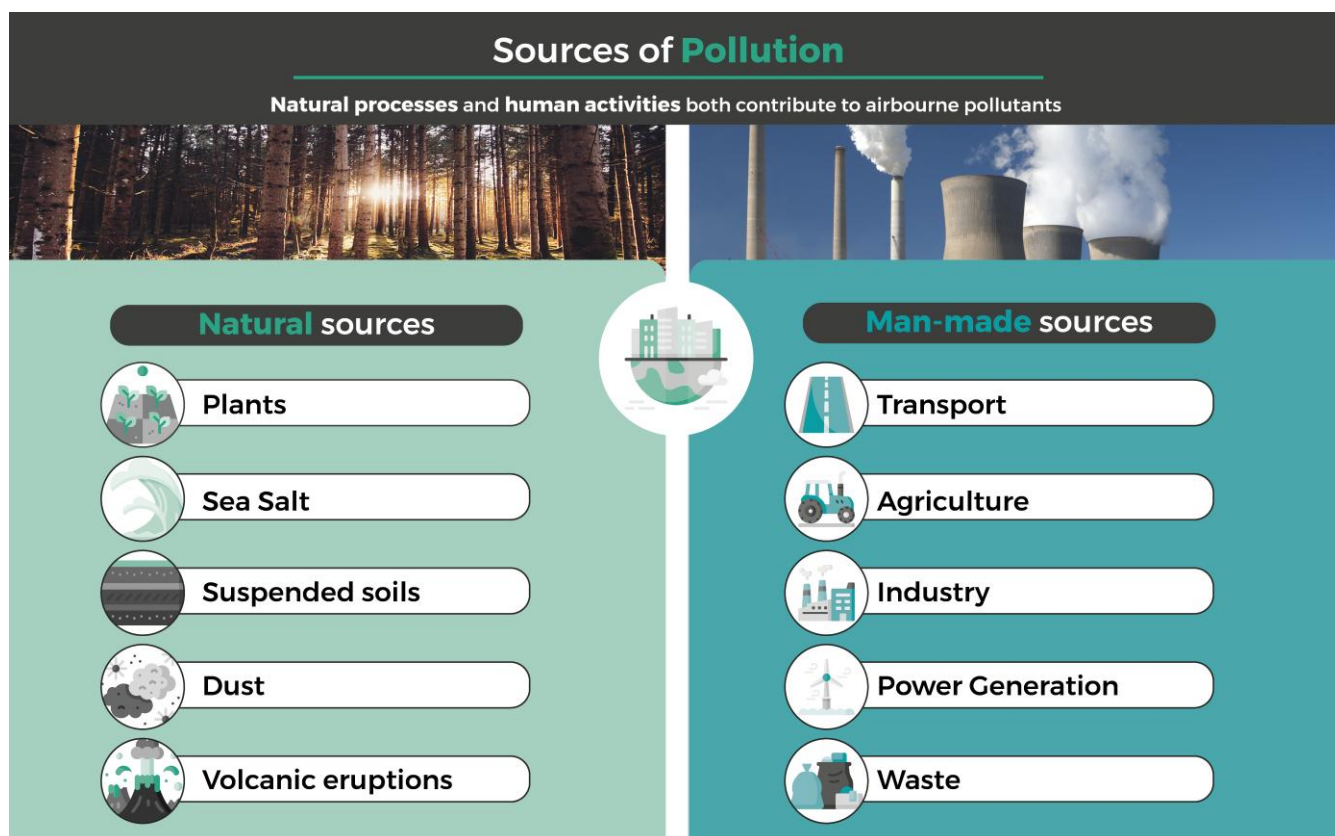
A range of Welsh Government actions have aimed to reduce air pollution, including **setting statutory limits for certain pollutants** known to cause harm, and setting **long-term targets** for the reduction of certain pollutants.

Many processes that produce air pollution also release greenhouse gases, meaning policies that aim to reduce the air pollution may also help to **mitigate climate change**, and vice versa.

How is air pollution formed?

Pollution can arise from both human activities and natural processes.

While natural events such as volcanic eruptions, wildfires, and dust storms release significant amounts of particulate matter into the atmosphere, human pollution sources are often more sustained and concentrated. Major pollution sources include transport, industrial processes, and energy production.

Figure 1: Natural and man-made sources of pollution:

Source: Senedd Research

Natural

Some sources of pollution occur naturally, and are not significantly impacted by human activity.

Wildfires release large amounts of **smoke and fine particulate matter** into the atmosphere, impacting air quality on regional scales. Wildfires are more likely to occur during prolonged dry periods. Although wildfires do occur naturally, their **severity and frequency may increase** due to human-induced climate change.

Volcanic eruptions emit sulphur dioxide, ash, and gases that can temporarily **alter air quality** across large regions. Although the UK has no active volcanoes, its air quality **can be affected by eruptions** in volcanically active areas such as Iceland.

Natural dust storms and biological processes, such as pollen release, also play a seasonally-important role in shaping local air quality.

Natural events are typically episodic, but their intensity and unpredictability can make them significant contributors during specific periods.

Human-induced air pollution

Human activity has had a significant effect on pollution and has had negative implications for **both health and climate change**. Sources of man-made air pollution are extensive, and have been present throughout human history but have **increased dramatically after the industrial revolution**.

Many pollutants originate by burning solid or liquid materials, such as the burning of methane gas for electricity, burning **oil for transport**, burning **wood for heating**, and **combustion processes in industry**, such as steel production. Some air pollutants can also be produced without burning, such as ammonia, which is mainly **released from manure and fertiliser** on farmland.

Monitoring air quality

Active air quality monitoring has taken place in the UK since 1961, following the first **Clean Air Act in 1956**.

There are **39 automated air quality monitoring sites** across Wales. Monitoring sites often measure different types of pollutants, depending on why the site was initially established. For example, some roadside monitoring stations only measure nitrogen oxides to **check legal compliance**, whereas urban monitoring sites measure a broader range of pollutants, including particulate matter, ozone, and sulphur dioxide. **48 Welsh automatic monitoring sites have closed** at various stages since monitoring first began. Continuous air quality monitoring data, and pollution forecasts, are **published online by the Welsh Government**.

Local authorities also undertake manual air quality monitoring, for example to assess specific nuisance complaints. They are **legally required** to conduct annual air quality reviews assessing current and future local air quality.

What pollutants are monitored?

The main monitored air pollutants are:

- Nitrogen oxides (NO_x), including **Nitrogen Dioxide** (NO₂) and Nitric oxide (NO)

- **Ammonia** (NH₃) and Ammonium (NH₄)
- **Coarse particulate matter** (PM₁₀)
- **Fine particulate matter** (PM_{2.5})
- **Ozone** (O₃)
- **Sulphur dioxide** (SO₂)
- **Carbon compounds**; including carbon monoxide (CO), carbon dioxide (CO₂) and **black carbon**
- **Benzene**
- **Polycyclic Aromatic Hydrocarbons (PAH)**
- **Heavy metals**; including Arsenic (As), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Manganese (Mn), Nickel (Ni), Lead (Pb), Selenium (Se), Vanadium (V), Zinc (Zn), Aluminium (Al), Barium (Ba), Beryllium (Be), Caesium (Cs), Mercury (Hg), Lithium (Li), Molybdenum (Mo), Rubidium (Rb), Antimony (Sb), Tin (Sn), Strontium (Sr), Titanium (Ti), Uranium (U), and Tungsten (W).
- **Eutrophying & Acidifying Compounds**

Although these pollutants are now monitored, some currently have no legal limit in UK or Welsh law – this is discussed in greater detail in the next chapter. Other pollutants, such as ultrafine particulate matter (PM_{0.1}), are not widely monitored, but still **pose significant risks to public health**.

Health effects of air pollution

Public Health Wales says outdoor air pollution is the largest environmental risk to health, with the burden of poor air quality equivalent to approximately 1,000 to 1,400 deaths in Wales each year.

Pollutants such as fine particulate matter (PM_{2.5}), nitrogen dioxide (NO₂), and ozone are linked to short and long term health effects. Impacts can be substantial, ranging from respiratory and cardiovascular diseases to adverse pregnancy outcomes. Pollution adversely affects people with pre-existing conditions, and in some instances can cause death.

While illness related to air pollution is substantial, it is also unevenly distributed, often **reflecting underlying patterns of deprivation and environmental inequality**. This chapter explores the latest evidence on exposure and risk to human health, and highlights the populations most affected, health outcomes, and wider societal costs.

What pollutants impact public health?

Atmospheric particles that impact human health can be described as pollutants. Health effects vary based on the pollutant. The table below lists pollutants, major sources, and potential risks to human health.

Table 1: Pollutants affecting human health and their sources

Pollutant		Main emission sources	Health risks
Particulate matter	Coarse (PM ₁₀)	Industrial processes, road transport, domestic combustion, industrial combustion	Respiratory conditions; cardiovascular diseases; cancer.
	Fine (PM _{2.5})	Road transport, domestic combustion, industrial processes,	Respiratory and cardiovascular diseases; neurological disorders; cancer.

		industrial combustion	
	Ultrafine (PM_{0.1})	Domestic combustion; road transport; industrial combustion; industrial processes.	Metal fume fever; cardiovascular disease; diabetes; cancer; neurological disorders; low birthweight.
Heavy metals		Industrial combustion and manufacturing, mining, transport.	Cardiovascular diseases, neurological disorders, renal disease; lung disease; dermal diseases; cancers.
Nitrogen dioxide (NO₂)		Industrial combustion; road transport; power stations.	Respiratory infections; lung function; asthma; lung & heart conditions.
Ozone (O₃)		Reactions between other pollutants in sunlight, such as nitrogen oxides and volatile organic compounds.	Respiratory and cardiovascular conditions.
Sulphur dioxide (SO₂)		Energy industries; manufacturing industries; domestic combustion.	Irritation, respiratory conditions; reduced lung function.
Ammonia (NH₃)		Agriculture	Minimal direct risks, but ammonia reacts to produce particulate matter.
Carbon monoxide (CO)		Heating systems (e.g. gas boilers);	Headaches; nausea; neuropsychological

	transport; domestic combustion.	issues; cardiovascular issues.
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Different air pollutants affect various regions of the body in multiple ways. When inhaled, pollution can impact the lungs. Some pollutants can penetrate deeper into biological barriers and affect organs throughout the body, resulting in wider health effects.

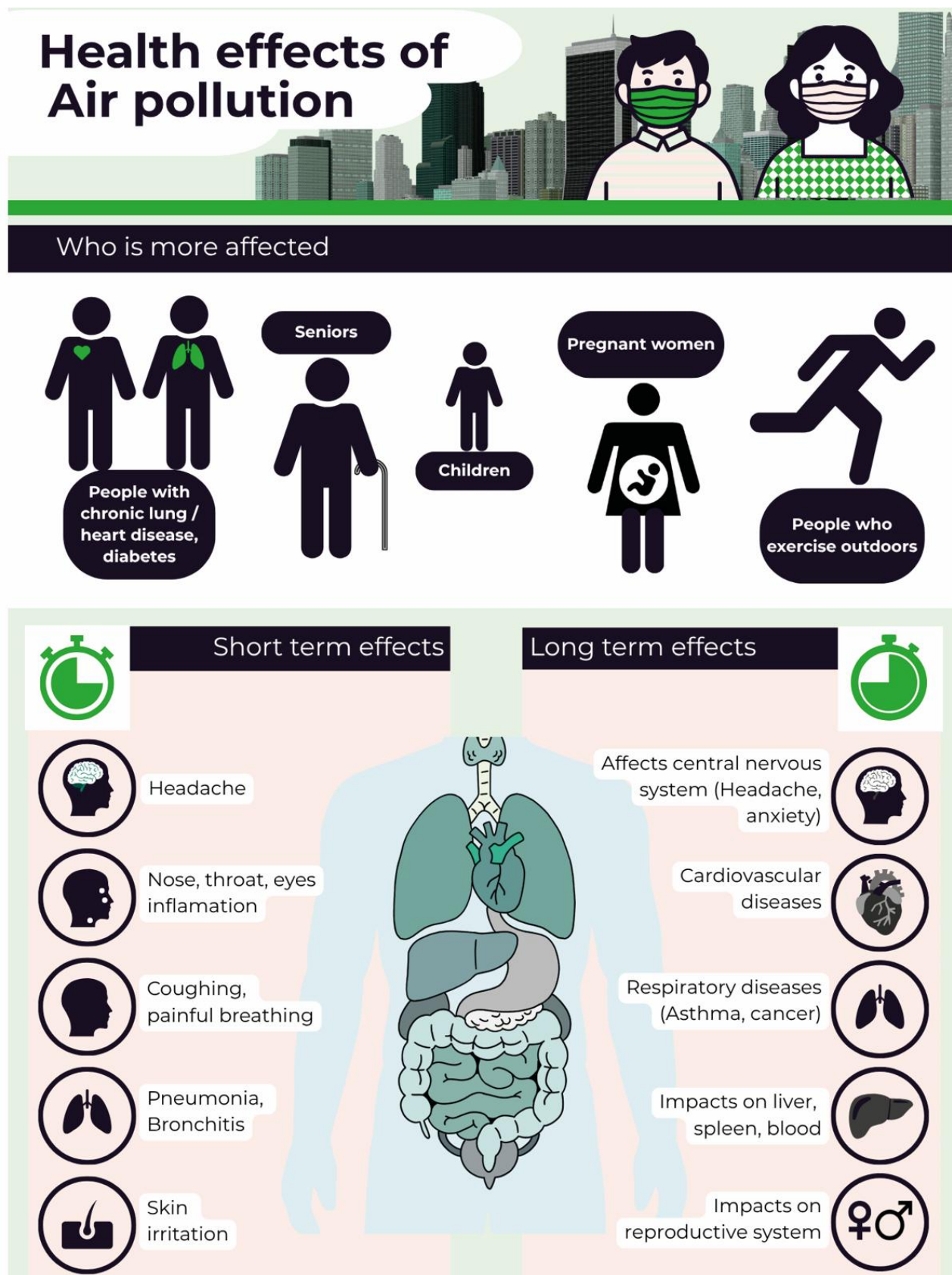
Our understanding of the health impacts of pollutants is variable. The health effects of some pollutants, **such as ozone and nitrogen dioxide**, are relatively well understood, thanks to decades of research effort and long-term data collection. Over the past few decades, there has been a **focus on fine particulate matter** (PM_{2.5}) due to growing awareness of its health effects, resulting in **legislative action**. In contrast, the health effects of other pollutants are not as well studied, often due to technical challenges in measuring them accurately. Recent research has focussed on the **health risks associated with ultrafine particles** (PM_{0.1}), which are not currently well understood. In general, finer air pollutants can **penetrate deeper into the body** and travel through the blood stream, affecting all organs of the body.

Health outcomes of air pollution exposure

The health outcomes related to air pollution can be minimal or extremely severe depending on the duration of exposure and pollutant itself.

What are the long and short term health impacts?

The graphic shows the areas of the body impacted by pollution in the short and long term, it also shows which people are at the highest risk.

Figure 2: Health effects of air pollution and groups at higher risk

Air pollution can have negative effects on health throughout the body. Some effects are short term and wear off once a person moves away from the pollution. The short term effects include **irritation, headaches and coughing**. The long term impacts can be more severe and serious, and have the potential to cause conditions that lead to mortality or life-altering conditions.

Air pollution can affect the entire body, from **the brain** to the **reproductive organs**, as well as multiple systems in between. **Long-term exposure** can cause lasting and life-altering health effects. For example, damage to the lungs **can lead to chronic obstructive pulmonary disease** (COPD), a progressive condition that can severely impair breathing and may eventually require long-term oxygen therapy. Air pollution exposure can also **increase the risk of lung cancer** and, in severe cases, **premature death**.

Who is most affected?

Although the burden of air pollution has decreased over time in Wales, those living in the **most deprived areas are most like to be exposed to greater pollution** than those in the least deprived areas.

Air pollution can have more severe impacts on vulnerable people, including the **elderly, people suffering from chronic conditions, people with diabetes, pregnant women, and children**. Air pollution can also exacerbate respiratory conditions **related to airborne allergens**, such as pollen. Airborne pollutants can bind to natural particles, increasing their potency and lowering the threshold for allergic reactions.

Societal impacts of pollution-related morbidity

Air pollution impacts beyond the level of individual health. There are economic and practical **impacts for the Welsh NHS**. Preventative measures to reduce pollution may lower the cost of responding to air pollution by reducing the number of people affected and the severity of effects.

NHS burden of air pollution

The Royal College of Physicians estimates the direct cost of air pollution on health in the **UK is more than £27 billion annually**. **Public Health Wales estimates** that the cost of healthcare expenses and lost workdays due to air pollution in Wales is approximately £1 billion per year, equivalent to **more than 1% of total economic output**.

Table 2: Conditions associated with air pollution or increasing vulnerability to its effects

Condition related to or impacted by air pollution	Number of people in Wales (year of assessment)
Heart Conditions	>400,000 (2026)
Asthma	237,400 (2023/24)
COPD	75,600 (2023/24)
Dementia	44,000 (2025)
Pregnancy	24,600 (2024)
Lung Cancer	2,600 (2019)

Not all instances of a disease can be directly attributed to air pollution. However, understanding the prevalence of a condition can help to estimate the number of people who may be impacted. Many long-term health conditions associated with pollution also **increase individuals' vulnerability to its impacts**, meaning those most affected by pollution often face multiple, compounding risks.

For some conditions, statistics exist to quantify the number of deaths associated with air pollution. These are addressed below.

Public Health Wales estimates the burden associated with long-term **air pollution as the equivalent of between 1000 and 1400** deaths a year. The British Heart Foundation says that **700 deaths due to heart conditions or heart failure in Wales can be attributed to air pollution** annually.

In the UK, **1 in 10 cases of lung cancer** are caused by outdoor air pollution. Air pollutants can build up in the lungs and cause damage to the DNA, causing cancer. According to the Global Initiative for Chronic Obstructive Lung Disease, **air pollution is a major risk factor and threat** to individuals suffering from COPD, and “acutely increases their risk of morbidity and mortality”. Globally, **50% of the risk factor for COPD is at least part-attributable to air pollution**, and air pollution is the leading cause in non-smokers.

The brain is another organ that is negatively affected, with exposure to air pollution **resulting in poorer outcomes** for memory, thinking and motor skills. In 2025, **44,000 people in Wales had dementia**. The independent **Committee on the Medical Effects of Air Pollutants** found that there was a

link between **air pollution exposure and negative cognitive ability**. Some cases of vascular dementia **may be caused** by a lack of blood reaching the brain due to damage to the heart and circulatory system from air pollution. A **2017 study** found that people living closer to major roads in Canada had an increased risk of developing dementia – the risk was 7% higher for people living within 50 meters of the road, and decreased the further away someone lived.

Pregnant women can be affected by air pollution in the same way as other people, but risks may be compounded due to the strain pregnancy has on the body. Air pollutants can affect fertility, and may also **impact a foetus during gestation in the womb**. Pollutant exposure can lead to adverse developmental issues. Research has found **that the first 1000 days of life from conception to 2 years old** are particularly significant for development and health outcomes, and exposure to PM_{2.5} during this time can be harmful. A 2023 study in North America found a connection between **air pollution and spontaneous abortion** (pregnancy loss before 20 weeks of gestation). The **UK Health Security Agency says** there is a lack of high-quality studies, and further research is needed to better understand the impact of air pollution on pregnancy.

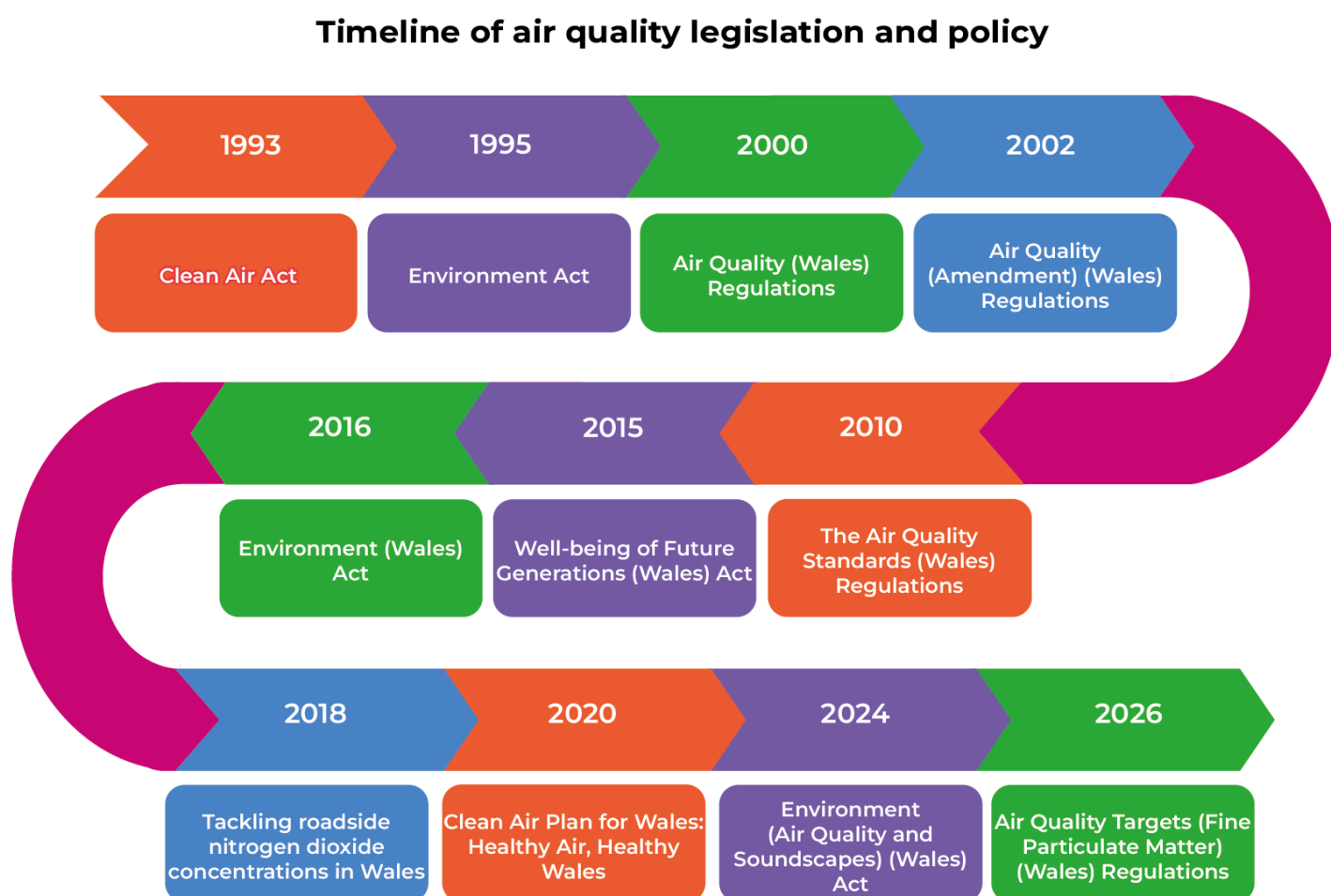
Given the documented developmental impacts on unborn babies and young children, and the almost **27,000 live births recorded in Wales in 2024**, this represents a substantial population potentially at risk of adverse effects. UNICEF says **15% of global deaths in children under 5 years**, and 34% of pre-term births in 2021 were attributable to air pollution. A Harvard University report found that air pollutants can **negatively impact all aspects of a child's development** both physically and neurologically.

Legal framework

Wales's air quality framework has evolved through legislation and policy at European, UK, and devolved levels. The **Wales Act 2017** provides a '**reserved powers model**' for Wales, giving the Senedd and the Welsh Ministers the ability to legislate across any area except those explicitly reserved to the UK. As air quality is not a reserved area, the Senedd now has full legislative competence for its management.

A timeline of major developments in Welsh air quality legislation and policy is shown below. Policy approaches to improving air quality are discussed in the next chapter of this briefing.

Figure 3: Major developments on air quality policy and legislation:



Source: Senedd Research

Environment Act 1995

Prior to the Senedd's establishment, **Part IV of the Environment Act 1995** ('the 1995 Act') established a UK-wide air quality management framework. It **requires local authorities to monitor, assess, and improve air quality** and to designate **Air Quality Management Areas** (AQMAs) where national air quality objectives are not being met. Local authorities must develop action plans for any designated AQMAs. As of June 2026, half (11 out of 22) Welsh local authorities have **at least one AQMA in place**.

Clean Air Act 1993

The **Clean Air Act 1993** ('the 1993 Act') also introduced some restrictions on air pollution emissions that remain relevant in Wales today. Notably **Part III of the 1993 Act** grants local authorities the ability to establish **smoke control areas**, where emitting smoke from building chimneys and the buying and selling of **unauthorised fuels** is prohibited. Smoke control areas **currently exist** in parts of Flintshire, Newport, Swansea, and Wrexham.

Wales Air Quality Regulations 2000 and 2002

The Senedd passed the **Air Quality (Wales) Regulations 2000** and the **Air Quality (Amendment) (Wales) Regulations 2002**, which set time-dependent **air quality objectives** for a range of pollutants in Wales. The Welsh Ministers later introduced **The Air Quality Standards (Wales) Regulations 2010**, which implemented the **EU directive** on ambient air quality and cleaner air for Europe.

Well-being of Future Generations (Wales) Act 2015

The **Well-being of Future Generations (Wales) Act 2015** ('the WFG Act') introduced **requirements for public bodies to act in accordance with the sustainable development** principle, which may indirectly relate to air quality. Sustainable development means ensuring actions to meet the needs of the present do not compromise the ability of future generations to meet their own needs. The WFG Act's outcomes are measured using **national well-being indicators**, one of which relates directly to air quality, specifically the average level of nitrogen dioxide (NO₂) in ambient air. This indicator relates to four of the WFG Act's well-being goals: a prosperous Wales; a resilient Wales; a healthier Wales, and; a globally responsible Wales. Following the passing of the WFG Act,

the Welsh Government updated its **statutory guidance for local authorities** in 2017 to ensure their air quality management was aligned with WFG requirements. This guidance was further updated following the **Environment (Air Quality and Soundscapes) (Wales) Act 2024** (discussed below).

Environment (Wales) Act 2016

A broad 'sustainability of natural resources' framework was introduced by the **Environment (Wales) Act 2016**. This Act places a range of requirements on public authorities to manage natural resources (including air) in accordance with sustainable principles. In 2019, the Welsh Government produced **guidance for sustainable management of natural resources**.

Environment (Air Quality and Soundscapes) (Wales) Act 2024

Welsh primary legislation directly related to air quality was introduced for the first time during the Sixth Senedd. The **Environment (Air Quality and Soundscapes) (Wales) Act 2024** ('the 2024 Act') gave the Welsh Ministers various powers including to set new national targets through regulations, and enhanced public-health duties related to air quality, such as:

- a duty to introduce **air quality targets for fine particulate matter (PM_{2.5}) by 2026**;
- a duty to engage and inform the public of the danger of air pollution; and
- powers to set long-term targets relating to a range of other pollutants.

The 2024 Act further requires that **active travel** (walking, wheeling, and cycling) must be promoted as a way to reduce air pollution, and that a national target is set for at least **one of the following pollutants by 2030**: ammonia, PM₁₀, ground level ozone, nitrogen dioxide, carbon monoxide, or sulphur dioxide.

Using powers in the 2024 Act, the last Welsh Government introduced the **Air Quality Targets (Fine Particulate Matter) (Wales) Regulations 2026**, which set targets for reducing PM_{2.5} levels and population exposure.

Current legal limits for pollutants

The table below details the Welsh Government's national air quality objectives, as set by the **Air Quality (Wales) Regulations 2000**, amended by the **Air Quality (Wales) (Amendment) Regulations 2002**.

Table 3: Current guidelines for pollutants

Pollutant	Limit	Period
Benzene	16.25 µg/m ³	Running annual mean
	5 µg/m ³	Annual mean
1,3-butadiene	2.25 µg/m ³	Annual mean
Carbon monoxide	10 mg/m ³	Maximum daily running 8-hour mean
Lead	0.25 µg/m ³	Annual mean
Nitrogen dioxide	200 µg/m ³ no more than 18 times a year	1-hour mean
	40 µg/m ³	Annual mean
Coarse particulate matter (PM ₁₀)	50 µg/m ³ no more than 35 times a year	24-hour mean
	40 µg/m ³	Annual mean
Fine particulate matter (PM_{2.5})*	25 µg/m ³	Annual mean
Sulphur dioxide	266 µg/m ³ no more than 35 times a year	15-minute mean
	350 µg/m ³ no more than 24 times a year	1-hour mean
	125 µg/m ³ no more than 3 times a year	24-hour mean

****The Air Quality Targets (Fine Particulate Matter) (Wales) Regulations 2026** have set an additional target for annual mean PM_{2.5} to be no greater than 10 µg/m³ by 31 December 2035*

Source: **Welsh Government**

Alignment and divergence of air quality matters

A variety of bodies are involved in developing and implementing legal air quality limits in Wales.

The World Health Organisation (WHO) is a United Nations agency that produces global **air quality guidelines** for a range of pollutants that it recommends governments to adopt. The guidelines are based on the latest available scientific data and are updated every few years. The **most recent guidelines** were published in 2021.

The Senedd now has full legislative competence for air quality issues, although some UK legislation pre-dating devolution remains relevant (particularly the **Environment Act 1995**). The **European Union also sets legal limits** for certain air pollutants. When the UK was a member of the EU, these limits were enforceable in Wales. Following the **UK's exit from the EU**, new EU air quality measures no longer apply to Wales.

There is therefore potential for divergence between Welsh, UK, European, and WHO air quality targets. Fine particulate matter (PM_{2.5}) provides an illustration of this divergence. The **most recent WHO guidelines** recommend a level of 5 µg/m³. The last Welsh Government **set a legal target** to reduce average PM_{2.5} concentrations to 10 µg/m³ by 2035. Responding to the Welsh Government's consultation, the independent **Committee on the Medical Effects of Air Pollutants said** it "would strongly support a reduction of PM_{2.5} concentrations, ideally to (or below) the WHO guideline value", whilst acknowledging a need to balance health benefits and cost. A **report commissioned by the last Welsh Government** found there was no plausible scenario where the stricter WHO guideline could be met everywhere in Wales, due to road traffic, cross-border pollution, and small-scale emissions sources. The UK Government has also **set a PM_{2.5} target** of 10 µg/m³ for England, but aims to achieve this five years slower, by 2040.

Policy approaches

Although policy action to address air quality dates back **as far as the 13th century**, modern approaches to monitoring UK air pollution began in the 1950s, following a series of smog events that led to the **deaths of 4,000 people**. In **1961 the 'National Survey' was established** to monitor black smoke and sulphur dioxide – this was the world's first coordinated national air pollution network, with 1200 sites across the UK.

This chapter discusses devolved policy developments that impact the management of air pollution in Wales.

Clean Air Plan for Wales 2020

The **Clean Air Plan for Wales: Healthy Air, Healthy Wales**, published in 2020, was the then-Welsh Government's overarching plan to address air pollution through regulatory, financial and behavioural interventions across multiple sectors. The Welsh Government committed to 56 short, medium, and long-term actions across the four themes of 'People', 'Environment', 'Prosperity' and 'Place'. In September 2024, it provided an **update on these actions**, in which it described 41 actions (71%) as 'complete' or 'on track', 13 actions (23%) as 'delayed', and 2 actions (4%) as 'policy change'.

Domestic burning

According to **UK Government-commissioned research** published in 2020, around 12% of Welsh households sometimes burn solid fuels such as wood and coal for heating. 9% of Welsh respondents said indoor burning was used for all or home of their home heating needs, while 85% said they used it some 'some' of their heating. Domestic burning is one of the most significant contributors to harmful particulate pollution, accounting for **approximately 20% of all PM_{2.5} emissions in the UK**.

PM_{2.5} inhalation from domestic burners has been linked to **health conditions like diabetes; and respiratory, neurological, and cardiovascular conditions**. A North American study found that prolonged exposure to open fires for greater than 30 days a year was associated **with a 68% higher incidence of lung cancer** in non-smoking women.

In the **2020 Clean Air Plan**, the then-Welsh Government said it would take a range of actions to reduce air pollution from domestic burning, including:

- prohibiting the sale of wet wood and traditional/bituminous house coal from 2023, subject to consultation;
- ensuring that only the 'most efficient appliances' could be purchased from 2022;
- requiring annual maintenance of burning appliances, subject to review; and
- working with industry and other governments to develop test standards for solid fuels entering the market by 2024.

In its 2024 **Clean Air Plan update**, the last Welsh Government said that, following **a 2021 consultation**, it no longer planned to require annual maintenance of burners and that the other three commitments had been delayed. In the update, it committed 'to restrict the most polluting forms of domestic solid fuels throughout Wales and these regulations are expected to be in force by autumn 2025'. However, in February 2026 the then-Cabinet Secretary for Climate Change and Rural Affairs **told a Senedd Committee** these regulations would no longer be introduced because of the risk of increased costs to consumers, and a need for stronger evidence.

In a **2025 update on air quality actions**, the last Welsh Government committed to raising awareness of how domestic burning impacts health, saying:

*As part of the **Delivery Plan** we intend to develop a communications campaign to inform the public about the impacts of domestic burning on health, the environment and the wider community. Our focus will be on sharing clear, evidence-based information to help people make informed choices.*

Electricity production and 'net zero'

Wales and the UK are **legally committed** to achieve 'net zero' greenhouse gas emissions by 2050, and to incrementally lower emissions up to that point, in order to limit the **negative impacts of climate change**. Although the most common greenhouse gases, such as carbon dioxide, have limited direct impact on human health through inhalation, reducing greenhouse gas emissions can have a co-benefit of reducing air pollution.

Fossil fuel power stations are among the largest single sources of air pollutants in Wales. Coal-fired power stations in particular were **major sources of particulate matter, nitrogen oxides, and sulphur dioxide** (SO₂). Wales' last coal power station, at **Aberthaw, closed in 2019**. As a result, there has been a **99% reduction in SO₂ emissions from power stations** since 2005. Gas-fired power stations (such as those at **Pembroke** and **Connah's Quay**) are **much less polluting per unit of electricity generated** than coal-fired power stations, but remain a **significant source of nitrogen oxides and particulate matter**. In contrast, renewable electricity generation, including wind and solar energy, has no direct impact on air quality.

Agriculture

Agriculture **contributes 85% of Welsh ammonia emissions**, mainly from cattle farming. Ammonia (NH₃) is a highly reactive nitrogen compound that **can cause irritation to the eyes and lungs**. It is primarily released from **animal waste and synthetic nitrogen fertilisers**.

The last Welsh Government aimed to incentivise environmental improvement, including reduced air pollution from agriculture, through its **Sustainable Farming Scheme** (SFS). The SFS pays land managers for the production of food as well as actions to mitigate pollution and improve environmental outcomes.

The initial SFS (launched in 2026) includes actions which are part-targeted at improving air quality, including:

- a **mandatory 'universal action'** to test soil health so that natural and artificial inputs, such as fertiliser, can be limited, reducing ammonia emissions; and
- an **'optional actions' theme** of 'improved air quality and lowering ammonia emissions', **which includes** Welsh Government funding of small infrastructure and precision management equipment for soils and manures.

Transport

Transport remains one of the most significant sources of harmful air pollutants, with the sector responsible for **49% of the UK's nitrogen oxides (NO₂ and NO) emissions** and **26% of PM_{2.5} emissions** in 2023.

In Wales, the transport sector is largest single **source of NO₂ emissions**, although total emissions fell by 62% between 2005 and 2023.

Road vehicles

In November 2018, the Welsh Government published its plans for **Tackling Roadside Nitrogen Dioxide Concentrations in Wales**, as a supplement to the **UK Government's plan**. Both governments had been **successfully litigated** by an environmental group for failing to bring nitrogen dioxide (NO₂) levels on major roads within European legal limits. The Welsh Government's plan resulted in the introduction of **five sections of 50 mph speed limits** on the trunk road network. A June 2026 **Senedd Research article** evaluates the efficacy of these measures in improving roadside air quality.

Road vehicles produce most of the total air pollution released by the transport sector. However, pollution-per-vehicle has improved over time, partly due to the **European Union's emissions standards** ('Euro standards'). Since 1992, these have required all new cars sold in the EU to meet increasingly strict per-kilometre emissions limits for a range of pollutants, including nitrogen oxides, particular matter, and carbon monoxide. **New (Euro 7) standards** are due to be introduced from November 2026, which will also apply to emissions from braking (tyre and road surface wear) for the first time. Although the UK is no longer a member of the EU, it adopted previous EU standards into domestic law, and the UK Government is **proposing to adopt** the Euro 7 standards.

The adoption of electric vehicles (EVs) is expected to reduce air pollution from transport. Uptake of electric vehicles has accelerated in recent years. EVs and hybrids have risen from only 7% of all new car registrations in 2018, to almost **half of new UK registrations in 2025**. There are now **over 2 million** fully electric cars on UK roads. Under existing UK Government plans, all new cars sold in the UK **will need to be fully electric by 2035**, although older petrol and diesel vehicles will remain in use for some time due to long vehicle lifespans.

Public transport

Improving public transport has the potential to help reduce air pollution because the 'modal shift' of journeys from private cars to buses and trains can **cut overall vehicle emissions**.

The last Welsh Government **set a target** for 45% of journeys to be made by sustainable modes (public transport, walking, wheeling or cycling) by 2040. However, public transport use remains similar to pre-pandemic levels. Total bus

journeys were **22% lower in 2024-2025 compared to 2019-20** while rail use rose only slightly, from **31 million trips in 2018** to **31.7 million in 2025**.

The Welsh Government and local authorities have a range of roles and responsibilities related to public transport. Senedd Research has produced further background briefing on the **Welsh rail system** and the new **Bus Services (Wales) Act**.

Active Travel

Active travel refers to everyday journeys made by walking, wheeling, or cycling. The last Welsh Government encouraged active travel, **investing £218 million between 2013 and 2024**.

Section 11 of the Environment (Air Quality and Soundscapes) (Wales) Act 2024 requires Welsh Ministers and local authorities to take steps to promote active travel as a way of reducing or limiting air pollution, using guidance produced by the Welsh Government.

Changes in travel behaviour have the potential to influence pollution levels. In 2021, the **previous Welsh Government set a target** for 30% of the workforce to work remotely 'on a regular basis'. Across the UK, **42% of employees** worked either fully or partly from home in early 2025.

Air pollution trends in Wales

This chapter provides an overview of trends over time for major air pollutants in Wales, as well as some localised case studies.

National trends in major pollutants

PM_{2.5} and PM₁₀

Annual mean PM_{2.5} levels at long-running Welsh sites **fell by 28% between 2009 and 2023**. At urban background sites, PM_{2.5} levels did **not change significantly** between 2020 and 2024.

There has been a steady fall in concentrations of PM₁₀, with the urban background **falling by 51%** between 1997 and 2023.

Nitrogen dioxide (NO₂)

Nitrogen dioxide (NO₂) concentrations have been decreasing over the past three decades. At **long-running urban background sites**, average annual NO₂ fell by 39% between 1997 and 2024, from 30 µg/m³ to 11.6 µg/m³ (the legal threshold is 40 µg/m³).

Urban traffic sites have **witnessed a similar trend**, going from an average annual mean of 33.8 µg/m³ in 2008 to a record low of 19.4 µg/m³ in 2024, with sharp declines after the mid-2010s.

Changes in roadside NO₂ are discussed further in the case study on 50 mph speed limits below, and in a **separate Senedd Research article**.

Ozone (O₃)

Ozone is a colourless and odourless gas. As a secondary pollutant, it is formed at ground level by chemical reaction between primary pollutants (nitrogen oxides and volatile organic compounds). The chemical reaction that forms ozone is temperature and sunlight dependent, so ozone concentrations **tend to be higher in summer**. Human-induced climate change is **making heatwaves longer and more frequent**, which **may increase ground-level ozone pollution**.

Ozone is a relatively stable pollutant that can **travel significant distances** from its original source, presenting challenges for local policies alone to impact ozone concentrations.

Ozone concentrations tend to be **higher in rural areas than urban areas**. UK ozone concentrations have generally **increased since the 1980s**, particularly in urban areas, with some fluctuations.

There has been **little change in ozone concentrations** at long-running Welsh rural sites since the late 1980s. In central Cardiff, average ozone concentrations almost doubled between 1993 and 2023. The **Welsh Government attributes this** to a fall in the concentrations of nitrogen oxides over the same period, because of **complex chemical relationships** that mean high nitrogen oxide levels can reduce ozone formation.

In 2023, there were **six Welsh sites** where ozone exceeded the target average of no more than **120 µg/m³ during an 8-hour period more than 10 times**. These exceedances coincided with summer heatwaves.

Sulphur dioxide (SO₂)

Sulphur dioxide concentrations have decreased, especially after the **closure of Wales's last coal power station** at Aberthaw in 2019. SO₂ emissions from power stations have **fallen by 99% since 2005**.

Case studies of air quality changes

Port Talbot steelworks

Port Talbot's coal-fired blast furnaces **closed in 2024**, with significant impacts not only **for the local economy and community**, but also for the **environmental conditions of the town**.

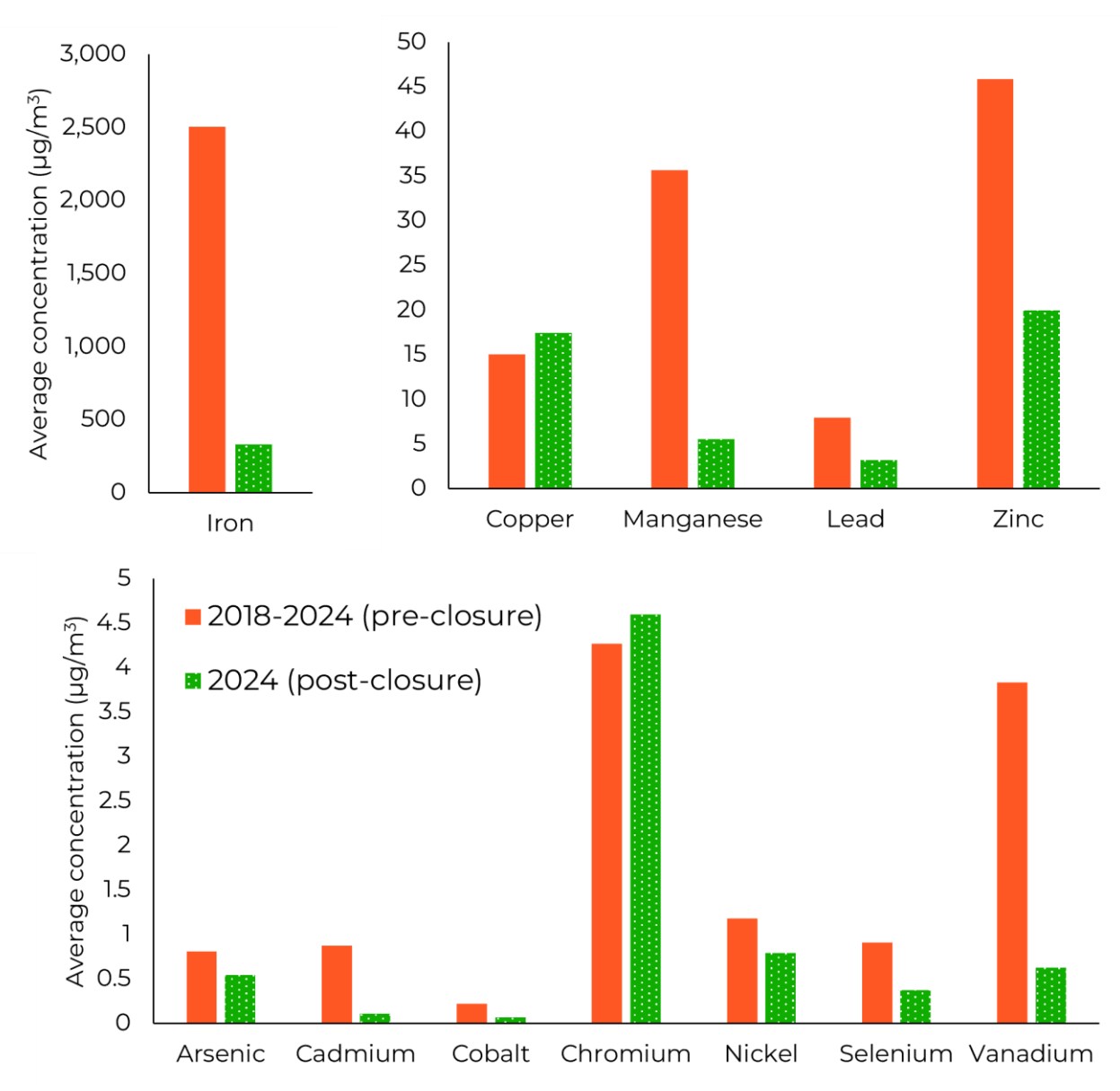
Since the closure, there have been reductions in some of the most significant pollutants associated with steel manufacturing. A December 2025 **analysis by the BBC** found that levels of SO₂ and PM₁₀ had both fallen. Between October 2024 and September 2025, SO₂ levels had fallen by 71% compared to the previous five-year average. In the same period, PM₁₀ had fallen by a third and only exceeded **WHO guideline levels** on one day, compared to an average exceedance of 31 days per year in the previous five years.

Long-term air quality data for the period after the blast furnace closure is not yet available. However, 2024 data for heavy metal pollution suggests short-term declines for many major pollutants. The graphs below show average concentrations of 12 heavy metals at **a Port Talbot site** before the blast furnaces closed (January 2018 – August 2024) and immediately afterwards (October – December 2024).

In the months immediately following the closure, the average airborne concentrations of all pollutants was 53% lower than the previous six-year average. Concentrations of cadmium, iron, manganese, vanadium all declined by more than 80%. Concentrations of copper and chromium were higher than the previous multi-year average, indicating major sources other than the blast furnaces for these two metals (e.g. **other industrial sources, vehicles, and other combustion processes**).

The comparisons presented here must be interpreted cautiously, as post-closure data only spans three months and may therefore not be representative of future trends.

Figure 4: Average air concentrations of heavy metals in Port Talbot before and after the blast furnace closure in September 2024.



Source: Senedd Research analysis of UK Government data

Chronic exposure to certain airborne heavy metals is associated with health risks, including **neurological effects (lead)**, increased **cancer risk (arsenic)**, and **kidney and bone damage (cadmium)**.

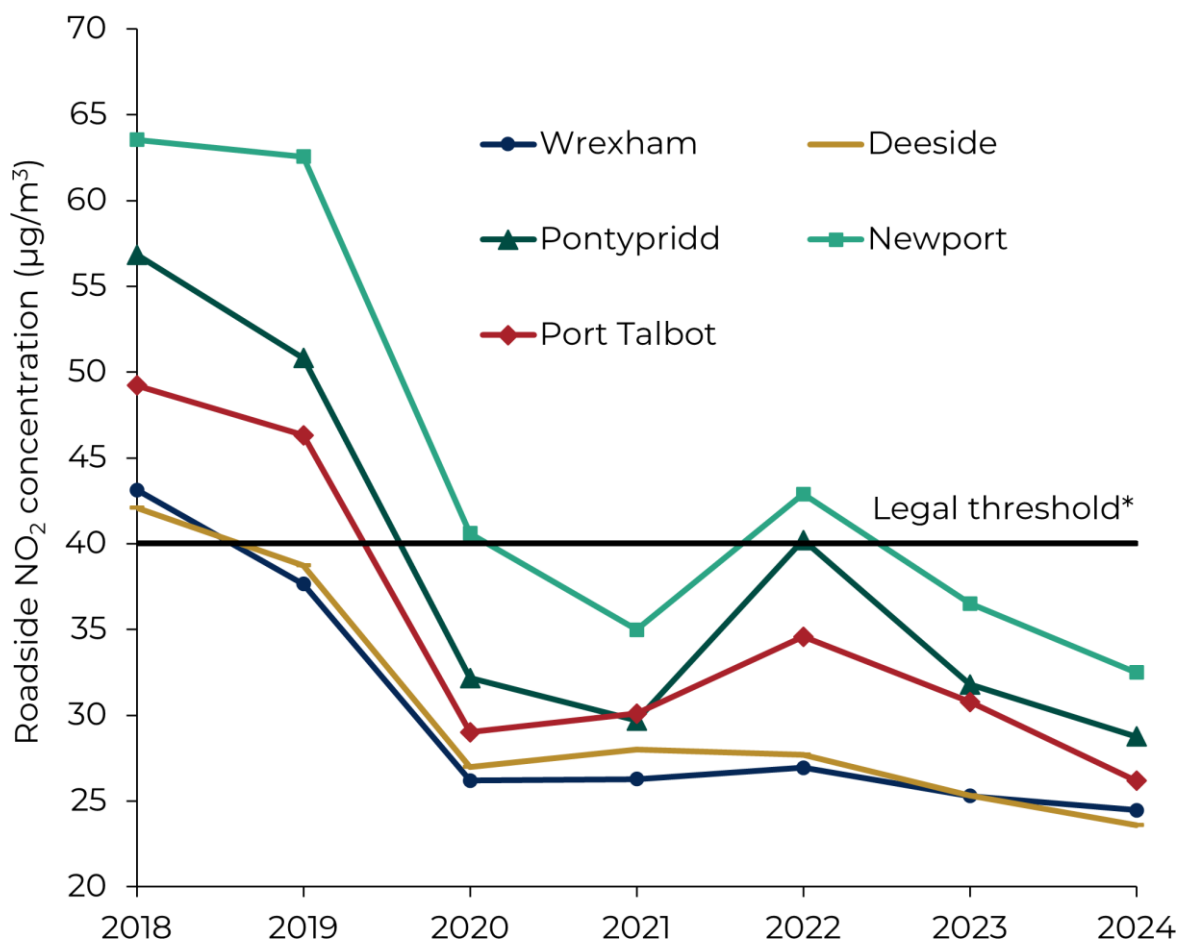
An electric arc furnace (EAF) is **expected to replace Port Talbot's closed blast furnaces**. **Analysis by the environmental organisation Green Alliance** suggests existing EAFs are generally far less polluting than blast furnaces, producing far less particulate matter, nitrogen oxides, sulphur dioxide, and

carbon monoxide per tonne of steel produced. However, existing EAFs emit more chromium and zinc per tonne of steel produced than blast furnaces.

50mph limits on trunk roads

In 2018 the then-Welsh Government reduced speed limits on five sections of major Welsh roads from 70 to 50 mph, **with the aim of bringing roadside NO₂ within legal limits**. Roadside NO₂ has **fallen below legal thresholds** since the speed limits were introduced, but it is challenging to disentangle the specific contribution of speed limits to this improvement, given other contributing factors such as improved car efficiency and changing working patterns. These issues are discussed in detail in [a Senedd Research article](#).

Figure 5: Average annual roadside NO₂ trends at five 50 mph sites since 2018



Source: Senedd Research analysis of **Welsh Government data**

*Threshold is indicative only, see **The Air Quality Standards Regulations 2010** for precise legal definitions

Key sources and further reading

Legislation and policy

- The [Environment \(Air Quality and Soundscapes\) \(Wales\) Act 2024](#).
- [Fine particulate matter air quality targets](#), Welsh Government, 2026.
- [Promoting awareness of air pollution in Wales: delivery plan 2025 to 2028](#), Welsh Government, 2026.
- [Clean Air Plan for Wales: Healthy Air, Healthy Wales](#), Welsh Government, 2020.
- [50mph speed limits to reduce pollution](#), Welsh Government, 2024.
- [Smoke control areas](#), Welsh Government, 2026.
- [The Air Quality Standards \(Wales\) Regulations 2010](#)
- [The Air Quality \(Wales\) Regulations 2000](#), as amended by [The Air Quality \(Amendment\) \(Wales\) Regulations 2002](#)
- [Part IV of the Environment Act 1995](#).
- [Clean Air Act 1993](#)

Health

- [Air quality](#), Public Health Wales.
- [Air quality](#), Public Health Network Cymru.
- [Health matters: air pollution](#), Public Health England, 2018.
- [Asthma and Lung UK Cymru](#).

Pollution trends and data

- [Air Quality in Wales](#), Welsh Government.
- [Air pollutant emissions](#), National Atmospheric Emissions Inventory.

- **State of Natural Resources Report 2025: Air**, Natural Resources Wales.
- **UK AIR Local Air Quality Dashboard**, UK Government Department for Environment Food & Rural Affairs.
- **Air Quality Management Areas (AQMAs)**, UK Government Department for Environment Food & Rural Affairs.