Air Pollution

Summary points

- 4.7% of "all-cause adult mortality" in Bristol was considered attributable to "particulate air pollution" (measured as fine particulate matter, $PM_{2.5}$) in 2023, lower than the England average of 5.2%.
- After the introduction of the Clean Air Zone in November 2022, on average, across 193 monitoring locations, nitrogen dioxide pollution levels fell by 13.2% in 2023 when compared to 2022.

Health Impact

Air pollution generated from human sources such as the combustion of fuels for heat, electricity and transport is having an adverse effect on the health of Bristol's communities. In 2023, 4.7% of "all-cause adult mortality" in Bristol was considered attributable to "particulate air pollution"[1], which is 0.5% lower than the national proportion (5.2%) (fig 1) and is mid-ranking for English Core Cities.

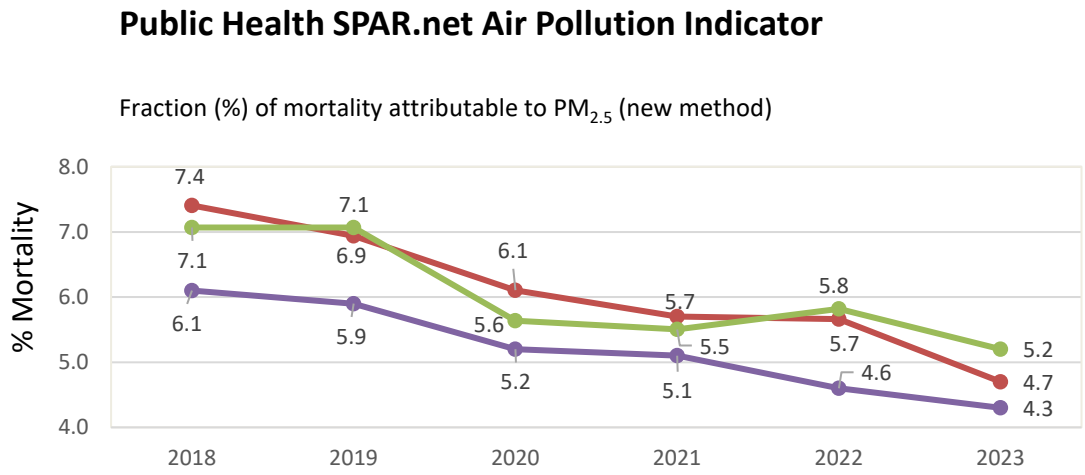

Figure 1: Fraction (%) of mortality attributable to $PM_{2.5}$ pollution

Caution is needed when considering apparent trends over time. Trend data should not be overinterpreted for a number of reasons:

- Concentrations of $PM_{2.5}$ vary from year to year due to the weather. This variation due to weather is generally greater than the year to year variation from changes in emissions.
- The methods and data inputs for the pollution modelling are continually updated and improved.

There is increasing evidence showing health effects of exposure to lower levels of pollutants, and no obvious thresholds have been detected for the effects for air pollution at a population level.

[1] Public health profiles - OHID (phe.org.uk)

This evidence has been reflected by the updated World Health Organisations (WHO) Global Air Quality Guidelines published in 2021. WHO's annual average air quality guidelines were reduced from 10 to 5 µg/m^3 for fine particulate matter ($PM_{2.5}$) and 40 to 10 µg/m^3 for NO_2. The absence of thresholds of effect for common air pollutants is likely to be partly due to variability between individuals' sensitivity to the pollutants studied[2].

Long-term exposure to air pollution contributes to the development of cardiovascular disease, lung cancer and respiratory disease[3]. Those at particular risk include children aged 14 and under, older people aged 65 and over, pregnant women and not unexpectedly people with pre-existing respiratory or heart conditions[4].

There is evidence that short-term exposure to PM is associated with hospital admissions for respiratory conditions. The US Environmental Protection Agency (US EPA) has an Integrated Science assessment for PM which concluded that short-term exposures to $PM_{2.5}$ are likely to be causally associated with respiratory effects, particularly exacerbations of asthma and chronic obstructive pulmonary disease (COPD) and respiratory-related diseases. Short-term exposure to $PM_{2.5}$ causes cardiovascular effects, with the strongest evidence from epidemiological studies for ischaemic heart disease, stroke and heart failure emergency department and hospital admissions, along with cardiovascular-related mortality[5].

Areas of high deprivation frequently have higher levels of traffic or industrial activities, and these more heavily polluted areas may be more affordable to live in. People in lower socio-economic groups are more likely to have pre-existing health conditions earlier in life, and the higher exposures to air pollution may add to the greater burden of poor health. Studies of hospital admissions and mortality show increased health risks associated with exposure to air pollution among those living in areas of higher socio-economic deprivation[5].

A Clean Air Zone was introduced in Bristol in November 2022 to reduce traffic generated NO_2 concentrations, to achieve compliance with legal limits for this pollutant as soon as possible. Monitoring data in 2023 demonstrated that average NO_2 concentrations, across 193 locations, fell by 13.2% when compared to 2022.

Air Quality Management

Road transport is a major source of particulate matter and nitrogen oxides (NOx) accounting for 34% of nitrogen oxides and 12% of primary particulate matter ($PM_{2.5}$) emissions in the UK[5]. At busy roadside locations the contribution of traffic to nitrogen oxides can be greater than 80%.

Through monitoring of the city's air quality, a geographical area has been identified where health based air quality standards (known as objectives) are not achieved, and an Air Quality

[2] Chief Medical Officer's annual report (2022): Air Pollution. Chief Medical Officer's Annual Report 2022 (publishing.service.gov.uk)
[3] World Health Organization (2016). Ambient (outdoor) air quality and health factsheet (accessed 23.11.16)
[4] National Institute for Health and Care Excellence (2015). Air pollution – outdoor air quality and health. Final scope. London: NICE
[5] Chief Medical Officer's annual report (2022): Air Pollution. Chief Medical Officer's Annual Report 2022 (publishing.service.gov.uk)

Management Area (AQMA) has been established in line with DEFRA (Department for Environment and Rural Affairs) recommendations.

Fig 2 indicates the boundary of the Air Quality Management Area (AQMA) for Bristol, inside which air quality is at risk of exceeding government objectives.

The AQMA is based around busy road junctions and arterial roads where nitrogen dioxide from the exhausts of vehicles does not get readily dispersed because of the surrounding buildings.

Domestic solid fuel (wood) burning is a re-emerging area of concern. Recent evidence shows that this source accounts for 20% of all $PM_{2.5}$ emissions nationally[6]. BCC has published research to identify possible policies for mitigating emissions of $PM_{2.5}$. Air quality (bristol.gov.uk)

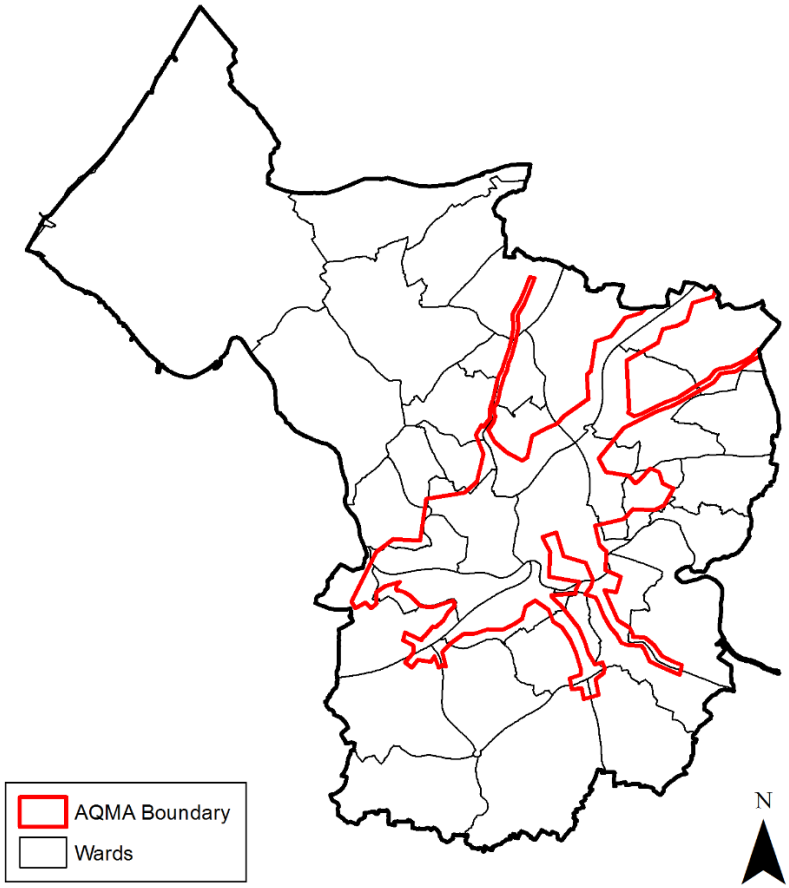

Figure 2: Air Quality Management Area (AQMA) boundary

Trends in Nitrogen Dioxide

The chart overleaf (Fig 3) shows trends for NO_2 at a selection of city centre monitoring sites. 2023 was the first year in which all, with the exception of the Co-located Colston Avenue site, achieved compliance with legal limits. Three locations have seen a slight worsening of NO_2 concentrations in 2024 compared to 2023, the rest have continued to fall. The red line at 40µgm^{-3} represents the annual EU and UK objective for nitrogen dioxide.

[6] Emissions of air pollutants in the UK – Particulate matter (PM10 and PM2.5) - GOV.UK (www.gov.uk)

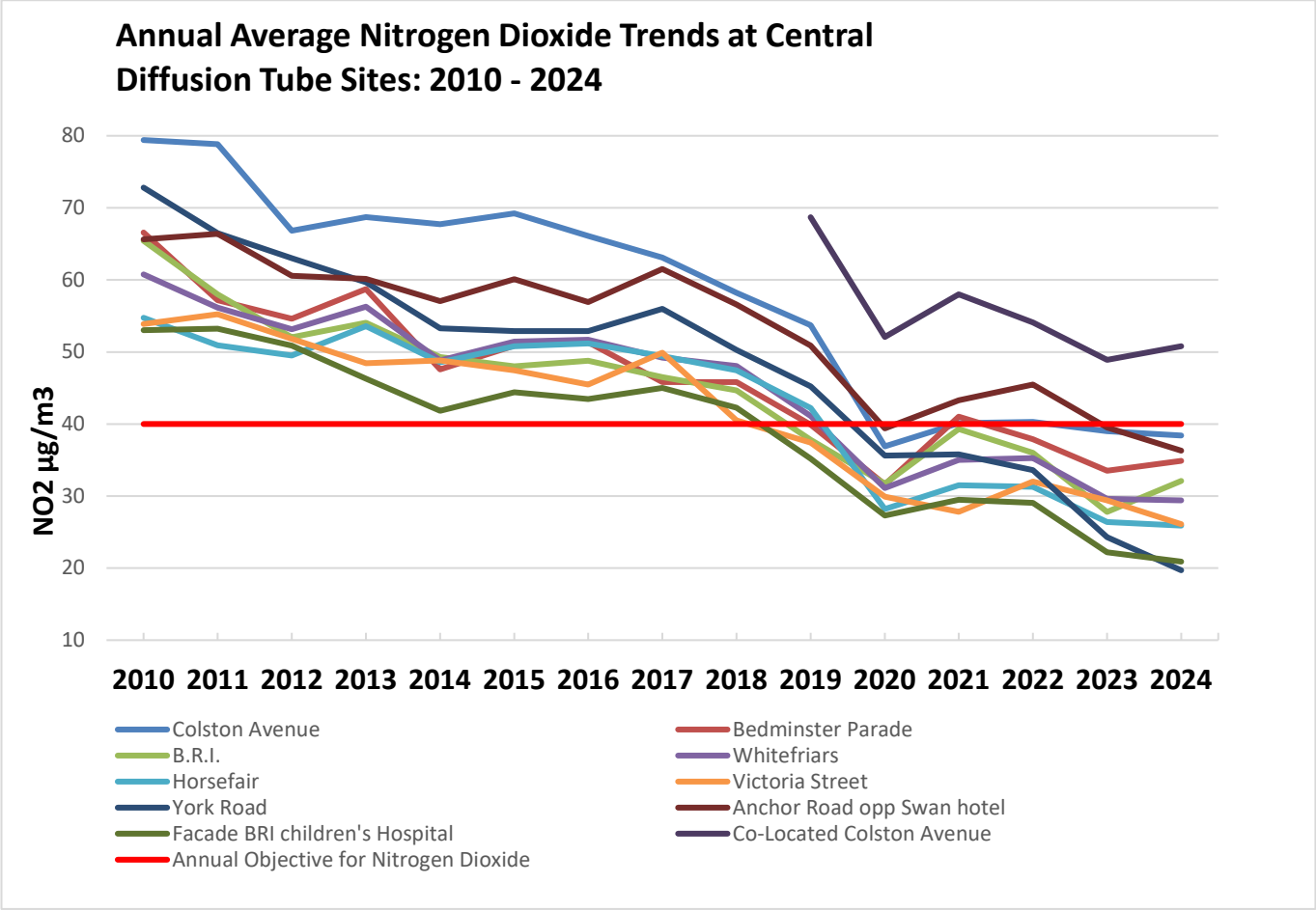

Fig 3 Trends in Nitrogen Dioxide at city centre monitoring sites

Equalities: Black, Asian and Minority Ethnic (BAME) people make up a larger proportion of the population living in the more polluted areas – the AQMA - than the city as a whole and therefore it is reasonable to assume that they experience greater exposure to air pollution. Successful interventions to improve air quality should contribute to improving the citywide health of Black, Asian and minority ethnic people. An equalities impact assessment in the final business case for the scheme summarised the equalities impact for the Clean Air Zone.

Clean Air Zone:

The Clean Air Zone is designed to accelerate progress towards compliance across the city. The introduction of the Clean Air Zone in November 2022 has helped to reduce NO_2 as noted in the report above. Full impacts of the CAZ on NO_2 concentrations in the first year of operation are contained in this January 2024 Clean Air Zone Report. Whilst NO_2 concentrations have fallen, a small number of locations continue to exceed current legal limits.

Further data / links / consultations:

- Bristol: Air Quality open data
- Bristol: Air Quality Dashboard
- WECA: Air quality measurements — Open Data Portal

Date updated: May 2025 **Date of next update**: April 2026