

Air quality monitoring in Oxfordshire

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Ambient air pollution is a major global environmental health concern which exerts economic costs for public and private sector organisations [1]. In urban areas, air pollution has been identified as one of the top five causes of death, ahead of road traffic accidents and excess winter deaths [2]. It is estimated that between 26,000 and 38,000 people die prematurely each year in the United Kingdom (UK) due to air pollutant exposure, with an average reduction in life expectancy of up to 6 months [3]. In the UK pollutants of major health concern include nitrogen dioxide (NO₂) (the main nitrogen-containing atmospheric pollutant gas) which can cause airway inflammation, and fine particulate matter pollution – particles with diameter < 2.5 µm (PM_{2.5}), which can enter the circulation and affect multiple organs. Long term exposure to both pollutants is linked to increased risk of cardio-respiratory disease.

Overview

- Air quality monitoring allows us to better understand air pollutant concentrations and to ensure regulatory compliance.
- Regulatory air quality monitoring stations in Oxfordshire are currently only located in Oxford City.
- There is very limited information on particulate pollution in market towns and rural areas of Oxfordshire.

Transport related road emissions are often considered the main contributor to local air pollution, however domestic heating, industry, and agriculture are also important emissions sources in the UK (*Figure 1*). Both petrol and diesel vehicle emissions are an important source of nitrogen oxides (NO_x) and PM pollution. In the UK, it is estimated that around 34% of NO_x emissions arise from road transport, with further contributions from industry and domestic combustion [4].

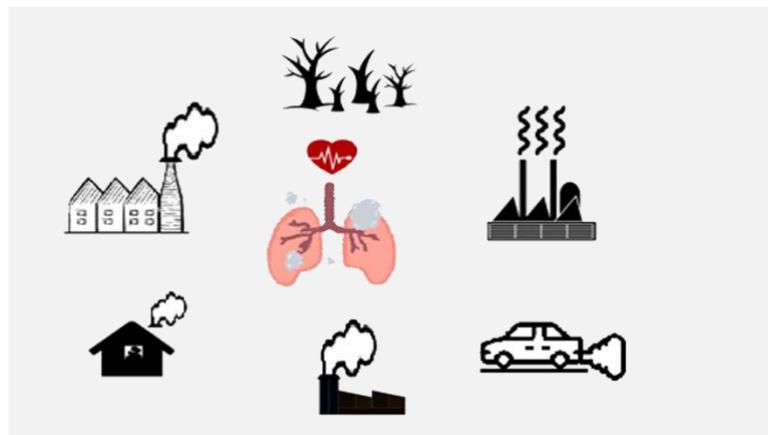


Figure 1 Key sources of air pollution

Air Quality Monitoring

Air quality monitoring is an essential tool for understanding local air quality through the identification of pollutant concentrations and how these change over time. Air quality is monitored with a combination of automatic (continuous) and non-automatic (passive) monitoring methods. NO₂ is mostly measured manually using diffusion tubes to collect data, which are checked and changed at regular intervals. **Automatic monitoring** provides continuous real-time data at high resolution for a range of air pollutants. The combination of these monitoring approaches provides large-scale datasets which can be used to develop air quality models that predict how pollution levels will change over time and in response to targeted measures to reduce emissions from specific sources.

In Oxfordshire, the lower-tier authorities (Oxford City Council, Vale of White Horse District Council, South Oxfordshire District

Council, West Oxfordshire District Council and Cherwell District Council) have statutory responsibility for air quality monitoring. However, Oxfordshire County Council (upper tier) has launched a county-wide **air quality strategy (2023-2030)** and has a key role in delivering related interventions. The authorities have a strong track record of working in partnership with academic institutions (i.e., University of Oxford, University of Birmingham, Cranfield University and Oxford Brookes University) for air quality research and innovation projects, primarily in Oxford City.

Air quality monitoring locations in Oxfordshire

In total, 380* known air quality monitoring sites were identified in Oxfordshire (at April 2023), most of which measure NO₂ (*Figure 2*). Very few sites measure PM (49* sites) or other pollutants (*Table 1*).

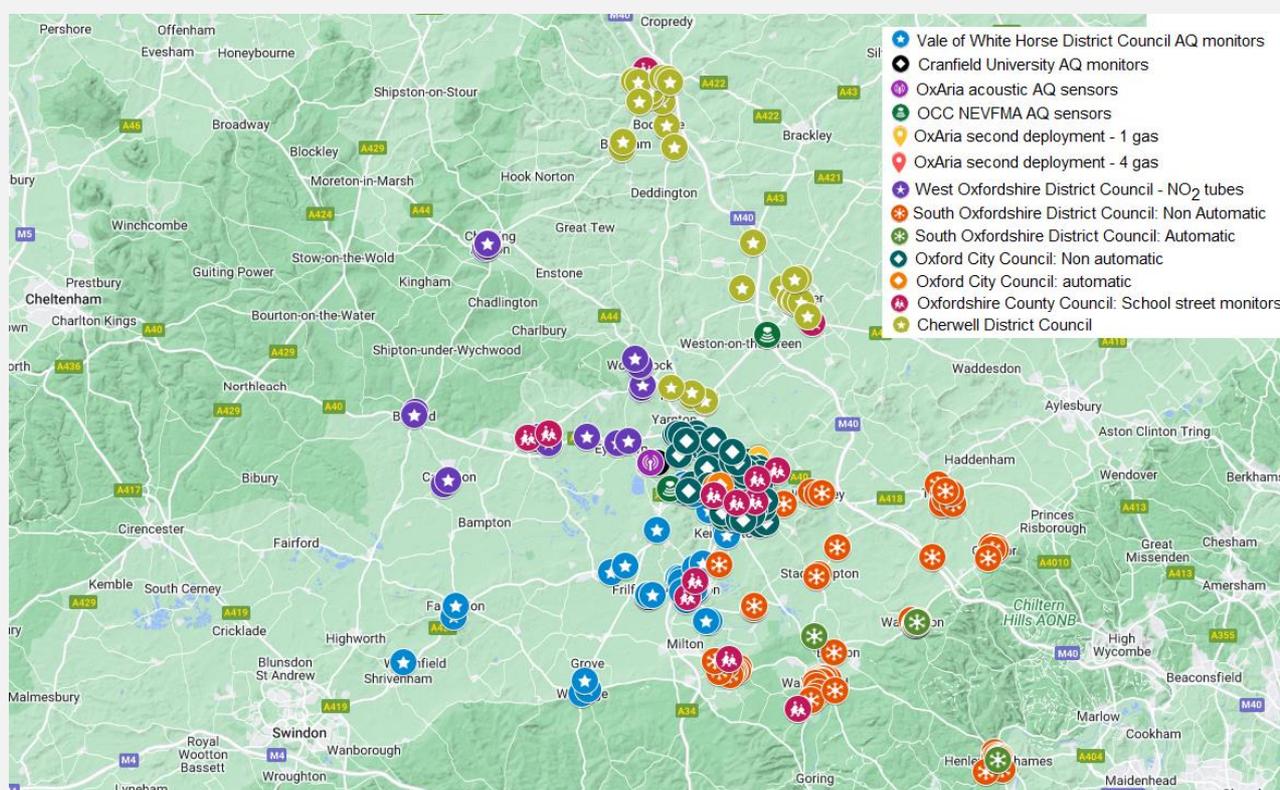


Figure 2 Air quality monitoring sites across Oxfordshire (April 2023). [▶ Click here for online map](#)

The online version of *Figure 2* shows all known [measuring sites across the Oxfordshire](#). These air quality monitoring sites mostly cover the city area, with major scope to expand the network to the district council areas. There are also 110* locations in Oxfordshire (mostly in Oxford city) where [Vivacity](#) traffic sensors have been deployed by Oxfordshire County Council to measure traffic and active travel data. Oxfordshire County Council also maintain 439* Automatic Traffic Counters (ATC) to measure traffic flow, speed, and classification. These traffic sensors can contribute significantly to our knowledge of transport focussed measures in Oxfordshire (*Figure 3*).



Figure 3 Location of traffic sensors in Oxfordshire. [▶ Click here for online map](#)

What is the role of local authorities with regard to air quality?

Lower tier local authorities - district and city councils - are required to monitor air quality, review the present and future air quality in their respective areas to achieve compliance with UK Air Quality Objectives [5]. When air quality objectives/targets are not being met, they must identify and declare Air Quality Management Areas (AQMAs) and develop Air

Quality Action Plans (AQAPs). However, many actions to improve air quality are the responsibility of the upper tier local authority – Oxfordshire County Council. Therefore, a collaborative approach is most effective to aligning monitoring, interventions, and evaluation. Local authorities may adopt measures through advancing monitoring networks, using data to inform strategic planning, undertaking campaigns to promote behaviour change and adopting new technologies in a range of sectors. Oxfordshire is one of the first local authority administrations to start working more collaboratively between district/city and county council authorities, as well as with businesses, civil society organizations and universities to develop coordinated air quality strategies. The Environment Act 2021 (UK) recognises the necessity of collaboration in achieving environmental objectives.

Air quality information

Oxfordshire's air quality information can be accessed from dedicated Oxfordshire air quality [website](#), however there are many more sources that provide data information in various formats (i.e. cloud-based and on request) – See *Appendix Table 1*. Oxfordshire AQ website also provides Local Air Quality Management (LAQM) information along with latest air quality report generated by different councils across the Oxfordshire. A more advanced Oxfordshire Air Quality website is under development, supported by Defra Air Quality Grant funding.

Scope

Oxfordshire authorities are committed to improving air quality. Whilst air quality in Oxfordshire (and across the UK) has improved in recent decades [6], and will continue to improve due to national and local policies, there are some areas where additional local

action is needed to improve air quality further.

It is crucial to identify those areas where air quality monitoring is currently inadequate to inform further actions and strategies which ensure sustained improvement.

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Citation

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Appendix

Table 1 Air quality monitoring in Oxfordshire (as known in June 2023) Colours denote commissioning organisation.

Operating agency	Monitoring Type	Number of sites	Pollutants measured	Monitors
Oxford City Council on behalf of DEFRA and the Environment Agency	Automatic***	1	NO ₂	
Oxford City Council	Automatic***	1	NO ₂ ;PM ₁₀	
Oxford City Council on behalf of DEFRA and the Env Agency	Automatic***	1	NO ₂ ;PM ₁₀ ; PM _{2.5} ;O ₃	
Oxford City Council	Non-Automatic	125	NO ₂	Diffusion Tube
Oxford County Council (School streets monitoring)	Air Quality Sensor	13	Both Particle and gases	Earth Sense Zephyr air quality sensor
Vale of White Horse District Council	Non-Automatic	50	NO ₂	Diffusion Tube
Vale of White Horse District Council	Automatic***	1	NO _x /NO ₂	
West Oxfordshire District Council	Non-Automatic	27	NO ₂	Diffusion Tube
Cranfield University	Air Quality Sensor	1	NO; NO ₂ ; SO ₂ ; O ₃ ; PM ₁ ; PM _{2.5} ; PM ₁₀ ; T;P;H	Earth Sense Zephyr air quality sensor
Oxfordshire County Council – Network Emissions/Vehicle Flow Management Adjustment (NEVFMA) initiative	Air Quality Sensor	15	NO; NO ₂ ; SO ₂ ; O ₃ ; PM ₁ ; PM _{2.5} ; PM ₁₀ ; T;P;H	Earth Sense Zephyr air quality sensor
OxAria (University of Birmingham/University of Oxford)		11	NO; NO ₂ ; CO; O ₃ ; PM ₁ ; PM _{2.5} ; PM ₁₀	South Coast Science Praxis/Urban air quality monitors
OxAria (University of Birmingham/University of Oxford)		7	NO ₂ ; PM ₁ ; PM _{2.5} ; PM ₁₀	South Coast Science Praxis/Urban air quality monitors
South Oxfordshire District Council	Non-Automatic	77*	NO ₂	Diffusion Tube
South Oxfordshire District Council	Automatic***	3*	NO ₂	-
Cherwell District Council	Non-automatic	47**	NO ₂	Diffusion Tube

* Information obtained from 2021 Air Quality Annual Status [Report](#).

** Information obtained from 2022 Air Quality Annual Status [Report](#).

*** Two types of automated monitoring sites, i) Automatic Urban and Rural Network (AURN), ii) Locally-managed automatic monitoring sites. All information presented is to the best of our knowledge at 30 June 2023.