



**South
Cambridgeshire
District Council**

Short term air quality in Comberton

September 2025





Executive Summary

Air quality was monitored at Comberton Village College using mobile Zephyr monitoring technology during the period November 2024 to July 2025 as part of a study into the impact of idling buses on air quality. Comberton Village College was selected as a monitoring site due to concerns raised by the school, that buses were idling outside the school entrance during pick-up and drop-off periods. Monitoring was carried out outside of Comberton Village College, next to their bus waiting bays. It was found that concentrations of the main pollutants, nitrogen dioxide (NO₂) and particulate matter, were comfortably below the national objectives for annual mean concentrations representing good air quality in the locality.

When comparing term time averages vs. holiday averages, there was a 22.27% increase in NO₂ during spring term vs the Christmas holiday period and a 22.11% increase in NO₂ during spring term vs May half term. This shows that NO₂ is consistently higher during school term time when the buses are present, compared to the holiday periods.

The data shows that there were significant peaks in NO₂ emissions between 08:30 - 08:45 and 15:00 – 15:15 during term time. NO₂ is the main pollutant of concern associated with vehicle emissions, suggesting that buses may be idling outside the Village College during pick-up and drop-off periods.

South Cambridgeshire District Council will share the results of this study with other colleges within the district and with Cambridgeshire County Council, who organise school transport in the district. We hope to be able to work with our partners, and Comberton Village College to deter buses and vehicles from idling outside of the College.

This report can be read alongside the yearly Air Quality Annual Status Report (ASR) and the reports from other localised studies, which are available on our [website](#).



Glossary

Annualisation – a calculation process used to estimate an average concentration for a full year from a shorter period.

Annual mean – the average concentration across a full calendar year.

AQMA – Air Quality Management Area – an area where air pollutant concentrations exceed or are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives.

Continuous monitor/monitoring station – instruments which measure air pollution all the time and therefore can give a concentration attributed to a specific time.

Diffusion tube – small plastic tube containing a metal mesh which is coated with a chemical that absorbs nitrogen dioxide. This is exposed to the air in a fixed location for a known amount of time, usually a month, and then sent to a lab for analysis. This provides an average concentration for the time it is exposed.

Nitrogen dioxide (NO₂) – a gas predominantly formed following the burning of fossil fuels, which can cause irritation of the airways and exacerbate symptoms of other conditions.

Particulate matter (PM_{2.5} and PM₁₀) – the number refers to the size of the particulates in micrometres (one millionth of a metre) – a mix of solid particles and liquid droplets of various sizes and composition, the smallest of which can get into the blood and be transported around the body.

Real-time monitoring – see also continuous monitoring – monitoring which takes place at regular intervals all the time and therefore can give a concentration attributed to a specific time.

µg/m³ – micrograms per cubic metre, the standard units of measurement of air pollutants including nitrogen dioxide and particulate matter.

Zephyr – a type of relatively compact and lightweight air pollution sensors that measure harmful gases and particle matter in real-time.



Zephyr monitoring in Comberton

Introduction

Purpose of this report

This is a report to provide information on the short-term air quality monitoring study at Comberton Village College using mobile Zephyr monitoring technology. Monitoring was carried out during the period November 2024 – July 2025. The study was designed to be a short-term study monitoring air quality outside Comberton Village Collage as part of South Cambridgeshire District Council's studies of air quality around schools across the district. It also serves to create additional local awareness of air quality in our area and enable people to make informed choices around how they can impact on improving air quality in their area.

Air Quality in South Cambridgeshire

South Cambridgeshire is a rural district which enjoys generally good air quality, with both short-term and long-term pollution levels below the national objectives at all monitored locations. This means we benefit from cleaner air to breathe and less pollution related health problems.

Air quality is an important topic as air pollution can impact our health, particularly effecting the most vulnerable, including children and those with underlying conditions. Air quality is monitored across the district using a network of diffusion tubes and continuous monitoring stations, which provide accurate air quality measurements in real-time, in addition to the mobile Zephyr monitors to be used for short term monitoring. For more information and detail on the importance of air quality and air quality in South Cambridgeshire, please refer to Appendix 1 – Air Quality Frequently Asked Questions or visit our [website](#). Additionally, ideas on how anyone can play a role in improving local air quality can be found in Appendix 2 – How to get Involved with Local Air Quality.



The 'Zephyr' Air Quality Sensor

Zephyr monitors are compact and lightweight air pollution sensors that measure harmful gases and particles in real-time, including the main pollutants known to be emitted by vehicles (NO₂ and PM₁₀ and PM_{2.5} particulate matter). Zephyrs can run off internal batteries or be powered by a solar panel and can therefore be fixed in a specific location, mostly commonly a lamp post, or used as a mobile monitor. The sensors provide detailed air quality measurements in real-time to help identify pollution hotspots at a localised level, for example busy junctions. Other potential studies include investigating air quality around schools and looking into the impacts of wood burning stoves. Zephyr sensors can be used in isolation individually or deployed as a network of sensors across a wider area to build up a more detailed picture.¹

The data from a Zephyr sensor cannot be treated with the same confidence as that from one of our continuous monitor stations, where the data is 'ratified' after checks, however it has been shown to provide accurate indicative measurements and is therefore appropriate for a wide range of studies, including this.

Monitoring Location

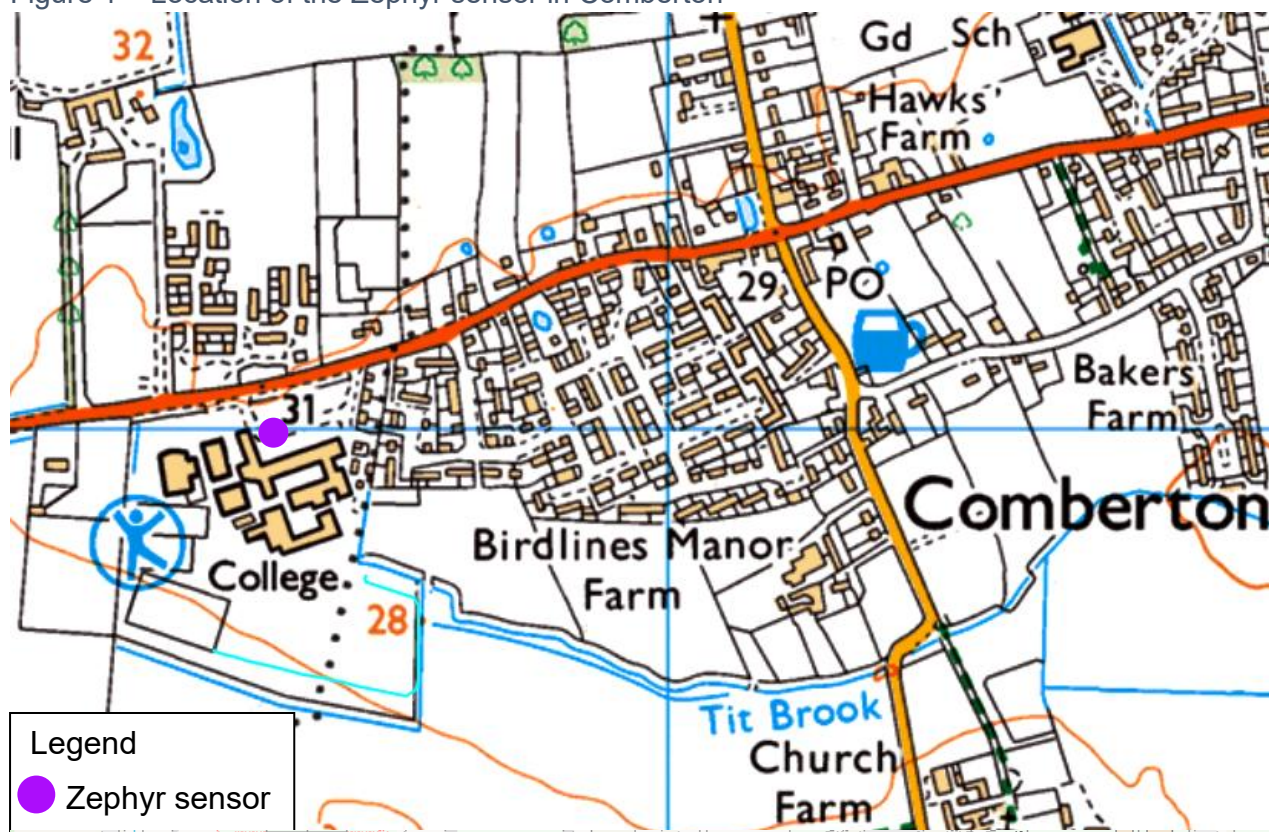
Comberton Village College approached South Cambridgeshire District Council owing to concerns raised by the school regarding the impact of idling buses outside the school at drop-off and pick-up times.

The Zephyr monitor was located on a lamppost outside of the school entrance, situated adjacent to the bus layby. This location was selected owing to this being an area where pupils congregate on arrival and departure from school each day. The Zephyr measured the main pollutants of concern, nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}). The location of the Zephyr can be seen on Figure 1, below.

¹ <https://www.earthsense.co.uk/zephyr>

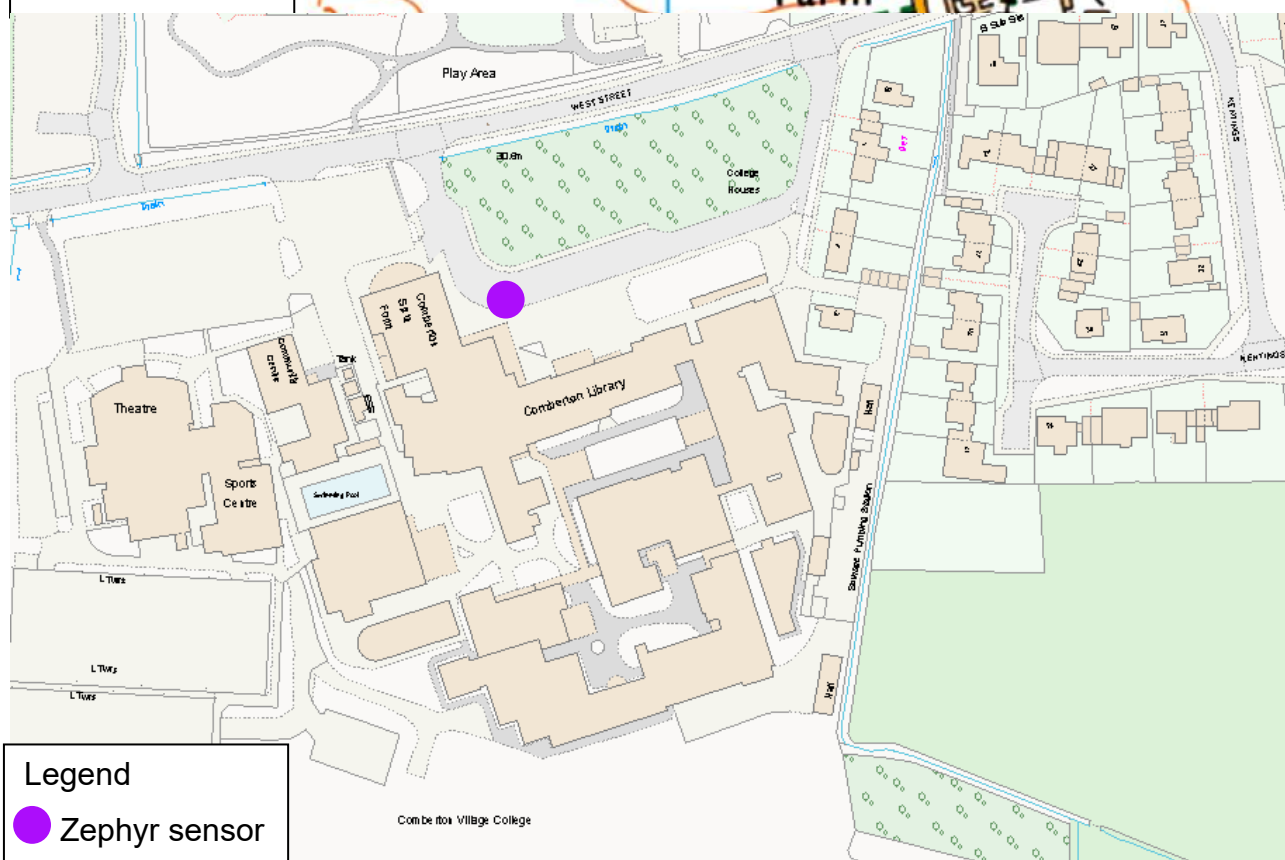


Figure 1 – Location of the Zephyr sensor in Comberton



Legend

● Zephyr sensor



Legend

● Zephyr sensor



Monitoring Data and Comparison with Objectives

The average monthly concentrations measured at the Zephyr location in the period November 2024 to July 2025 are shown in Table 1, with the annual mean objective shown for information. The exact date range was from November 7th 2024 to July 20th 2025, which followed an initial 'settling in' period of the instrument. This data is also represented in Figure 2.

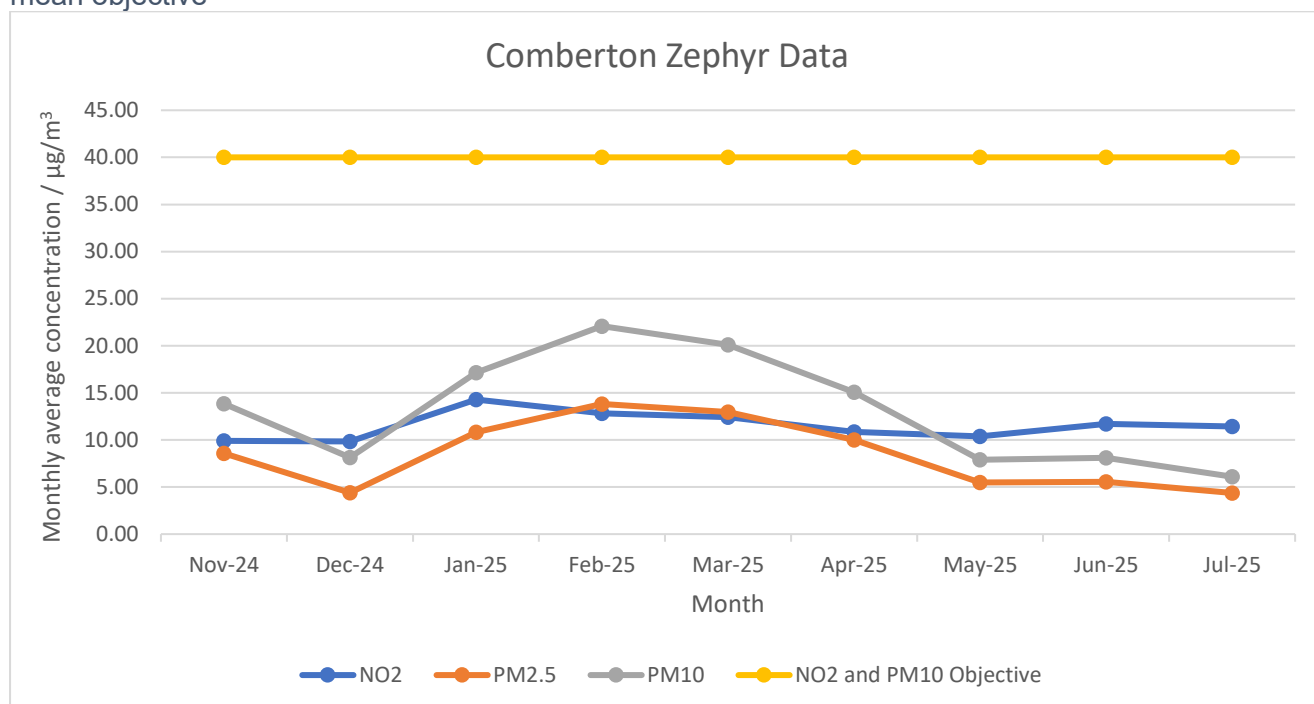
Table 1 – Zephyr Air Quality data – monthly average concentrations

Month	Pollutant monthly average concentration / $\mu\text{g}/\text{m}^3$		
	NO ₂	PM ₁₀	PM _{2.5}
November 2024	9.90	13.85	8.58
December 2024	9.84	8.14	4.40
January 2025	14.28	17.15	10.82
February 2025	12.83	22.08	13.82
March 2025	12.40	20.08	12.96
April 2025	10.85	15.06	20.01
May 2025	10.38	7.88	5.48
June 2025	11.70	8.09	5.55
July 2025	11.44	6.10	4.37
Objective (annual mean)	40	40	10 [†]

[†] not part of the Local Air Quality Management (LAQM) requirements, but SCDC are targeting this to be achieved by 2029 in line with the Greater Cambridge Air Quality Strategy 2024.



Figure 2 – Zephyr Air Quality data – monthly average concentrations and national annual mean objective

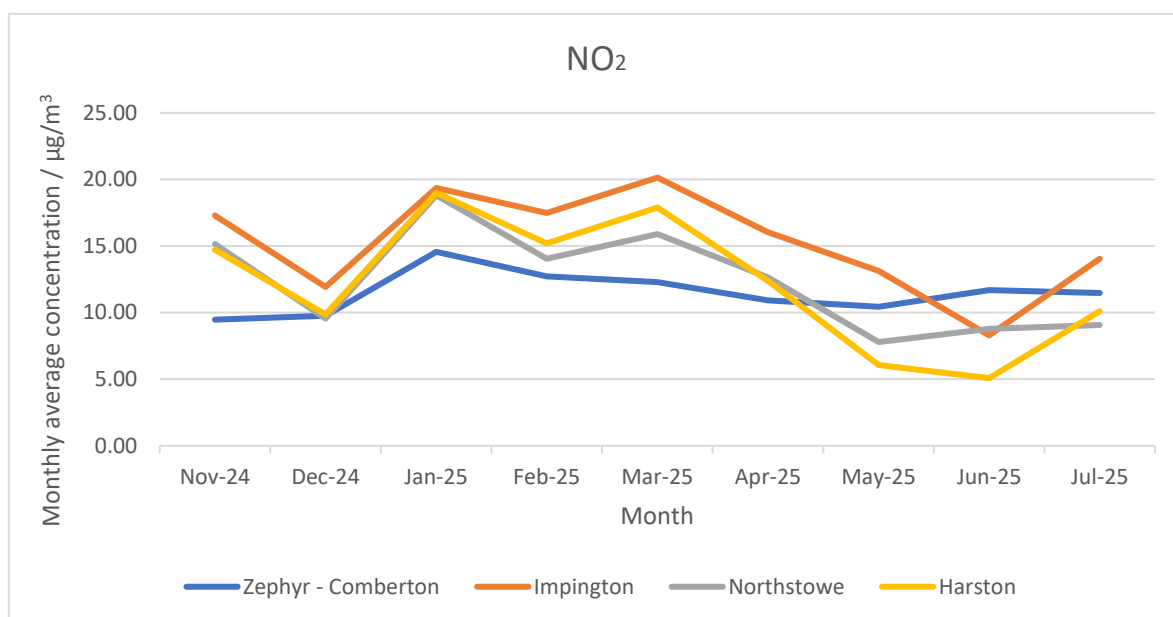


Executive Summary: Graph showing monthly average pollutant concentrations for nitrogen dioxide and particulate matter 10 and 2.5 from November 2024 to July 2025. The graph shows all pollutant values well below the national average.

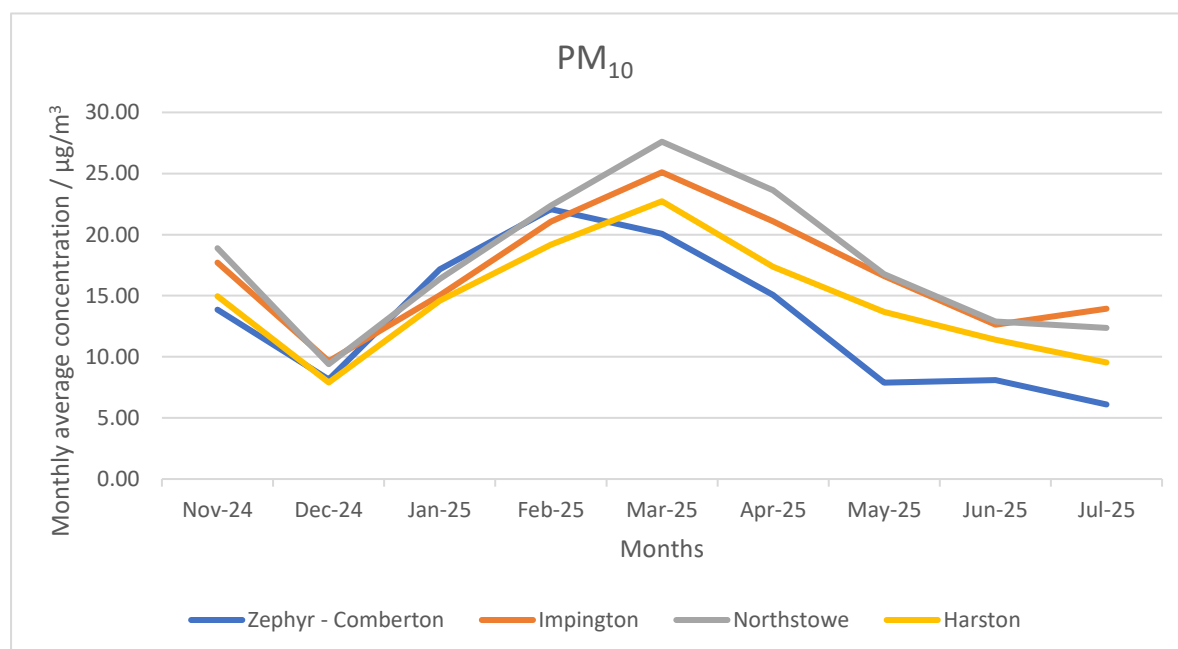
The data recorded in Comberton was also compared to that recorded in the same monitoring period by the Council's automatic monitoring stations for each pollutant. As shown in Figure 3, below, the data and trends recorded by the Comberton Zephyr are consistent with those seen at other monitoring locations across the district. This suggests that there can be a reasonably high degree of confidence in the data collected by the Zephyr monitor.



Figure 3 – Comparison of Comberton Zephyr data to automatic monitoring sites in South Cambridgeshire for all pollutants



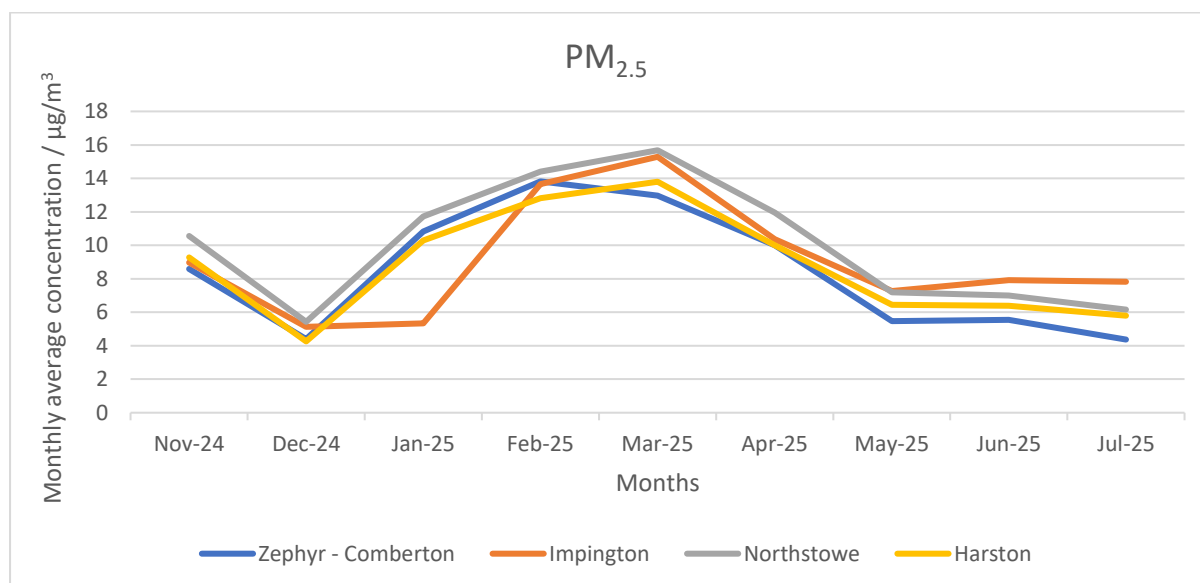
Executive Summary: Graph showing monthly average for nitrogen dioxide at South Cambridgeshire District Council's three automatic monitoring locations and at the Zephyr location in Comberton. The graph shows the data trends are similar so the results can be relied upon.



Executive Summary: Graph showing monthly average for particulate matter 10 at South Cambridgeshire District Council's three automatic monitoring locations and at



the Zephyr location in Comberton. The graph shows the data trends are similar so the results can be relied upon.



Executive Summary: Graph showing monthly average for particulate matter 2.5 at South Cambridgeshire District Council's three automatic monitoring locations and at the Zephyr location in Comberton. The graph shows the data trends are similar so the results can be relied upon

In addition, the average concentrations of each pollutant for the whole period November 2024 – July 2025 were calculated and then 'annualised' to give estimated annual mean concentrations to allow better comparison to the annual mean objectives. Annualisation is a calculation process used to estimate an average concentration for a full year from a shorter period, such as the approximately 9 months in this study. This is done to avoid the annual average being influenced by short-term events or seasonal changes, such as one day of high pollution like bonfire night, or pollution concentrations often being higher in the winter than the summer. The data was annualised using 2024 data from a range of continuous monitoring background sites and is shown in Table 2, below. Full annualisation details are available in Appendix 3 – Annualisation of short-term data.



Table 2 – Zephyr Air Quality Data – annualised annual mean concentrations – 2024 annual mean

	Pollutant average concentration / $\mu\text{g}/\text{m}^3$		
	NO ₂	PM ₁₀	PM _{2.5}
Measured data average November 24 – July 25	11.51	13.16	7.82
Annualisation factor	0.88	0.94	0.86
Annualised annual mean – Comberton Zephyr	10.16	12.35	6.73
Objective (annual mean)	40	40	25*

*not part of the Local Air Quality Management (LAQM) requirements

As shown in Table 1 and Table 2, the long-term annual mean concentrations of the main pollutants of concern at the Comberton Zephyr are significantly below the national objectives for NO₂ and PM₁₀, indicating good air quality. The PM_{2.5} concentration is above the ambitious World Health Organisation (WHO) guidelines announced in September 2021, although it is below the WHO interim target level of 10 $\mu\text{g}/\text{m}^3$ which was set to be achieved by 2029 and remains well below the current UK objective of 25 $\mu\text{g}/\text{m}^3$ (this objective does not form part of the Local Air Quality Management regime which covers local authorities).

Typically, PM_{2.5} is a pollutant that is more regional than local as it can travel long distances suspended in the air. Therefore, its concentration is often more impacted by national and regional sources and less by local factors than other pollutants (such as nitrogen dioxide).

The Zephyr also allows measurements of the short-term concentrations of pollutants, which are studied through 1-hour means for NO₂ and 24-hour means for PM₁₀. These are presented and compared to the national objectives in Table 3, below. The short-term objectives are presented as hourly/daily concentrations that should not be exceeded more than a certain number of times in a year. There is currently no short-term objective for PM_{2.5}.



Table 3 – Zephyr Air Quality data – short-term average concentrations

Month	Number of exceedances of short-term objective	
	NO ₂ 1-hour mean	PM ₁₀ 24-hour mean
November 2024	0	0
December 2024	0	0
January 2025	0	0
February 2025	0	0
March 2025	0	1
April 2025	0	0
May 2025	0	0
June 2025	0	0
July 2025	0	0
Objective	200 µg/m ³ *	50 µg/m ³ **

*Not to be exceeded more than 18 times a year

**Not to be exceeded more than 35 times per year

As shown in Table 3, there were no exceedances of the short-term objectives for NO₂ and one exceedance of the short-term PM₁₀ objective. The relevant maximum short-term concentrations of the pollutants were also recorded. For NO₂ the maximum 1-hour concentration measured during the nine-month period was 54.76 µg/m³, which occurred at 9am on 10th June; this is well under the 200 µg/m³ threshold and was the only 1-hour concentration above 50 µg/m³ recorded. For PM₁₀, the maximum 24-hour concentration recorded was 60.35 µg/m³, recorded on the 10th March, which is above the 50 µg/m³ objective. On review of Met Office data, it is likely that this was due to a nationwide pollution event caused by Saharan dust. Although PM_{2.5} has no short-term objective, the maximum value recorded also occurred on 10th March during the nationwide pollution event.

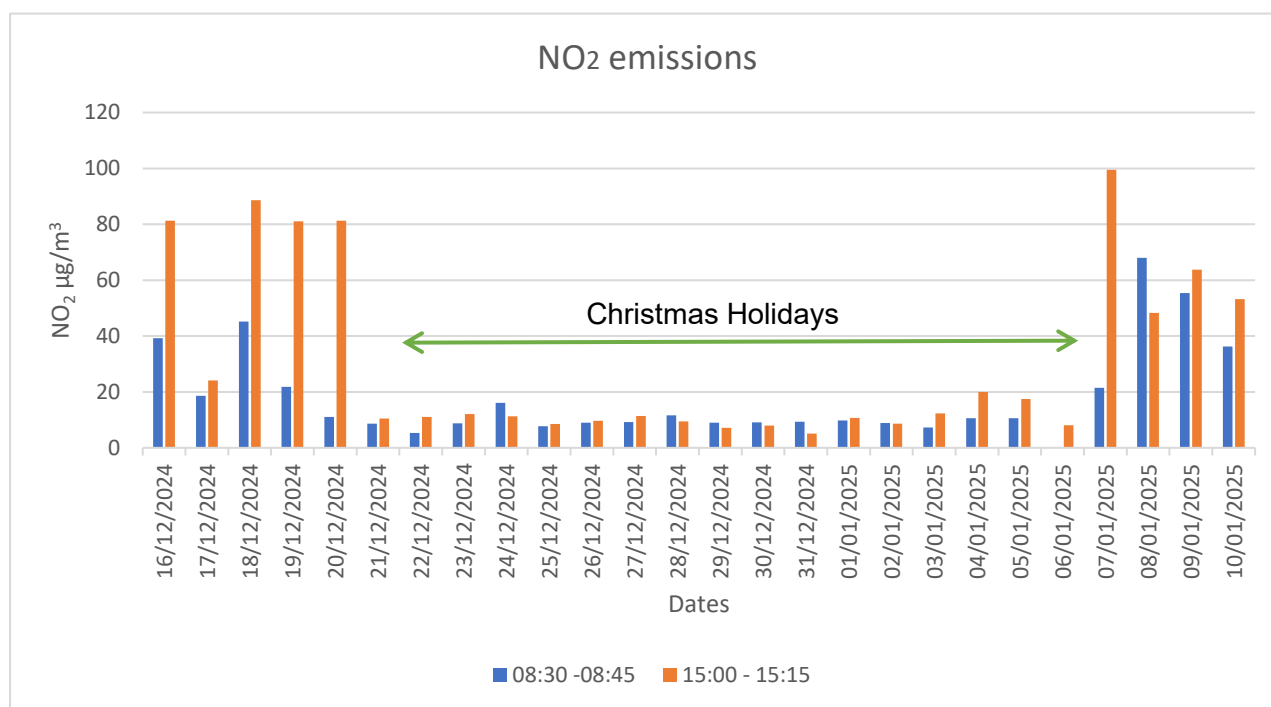


The aim of this study was to understand whether idling buses outside of Comberton Village College were creating high levels of short-term exposure of air pollutants. Nitrogen dioxide (NO₂) is the main pollutant associated with idling vehicles.

An initial review of the data was undertaken and there were obvious peaks in the hourly data around 9am and 3pm. Further analysis was undertaken, looking at the data in 15-minute intervals, with the spikes in data being between 08:30 – 08:45 and 15:00-15:15. We expect that this correlates with the times when buses are either dropping students or waiting to collect students from the school.

The graphs in Figures 5 and 6 compare the 15-minute peak periods during term time and the Christmas holidays and May half term. These two school holiday periods were selected because they occur in different seasons, allowing greater confidence that any observed fluctuations in the data are attributable to term-time versus holiday effects rather than seasonal variables such as temperature.

Figure 5 – Comparison of NO₂ between 08:30 – 08:45 and 15:00 – 15:15, during school term time vs. the Christmas holiday period



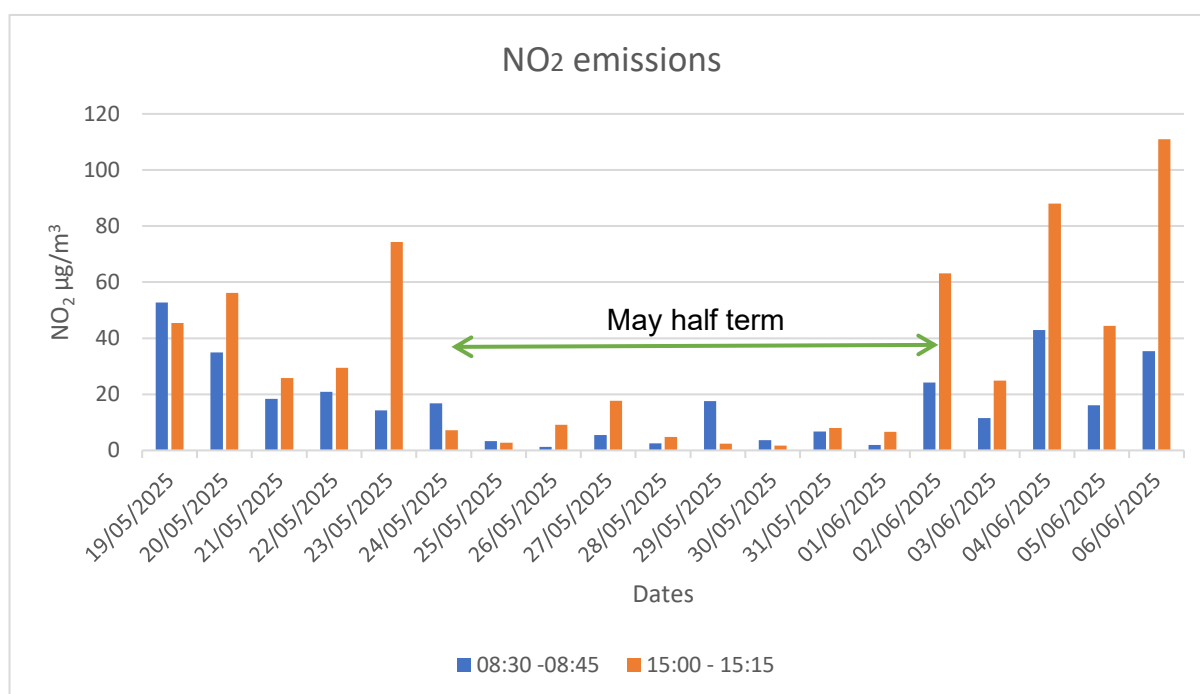
Executive summary: Graph showing nitrogen dioxide emissions from 16th December 2024 until 10th January 2025 between the time of 08:30 – 08:45 and 15:00 – 15:15.



The graph shows a group in nitrogen dioxide emissions throughout the Christmas holiday period.

Figure 5 compares data for one week prior to the Christmas holidays, during the Christmas holidays and for one week after the Christmas holidays. There is a clear reduction in NO₂ levels between 08:30 – 08:45 and 15:00 – 15:15 during the school holidays, suggesting that school traffic and potentially idling buses are attributing to the short-term exposure peaks during term time.

Figure 6 – Comparison of NO₂ between 08:30 – 08:45 and 15:00 – 15:15, during school term time vs. May half term



Executive summary: Graph showing nitrogen dioxide emissions from 19th May 2025 until 6th June 2025 between the time of 08:30 – 08:45 and 15:00 – 15:15. The graph shows a group in nitrogen dioxide emissions throughout the May half term holiday period.

Figure 6 shows data one week prior to May half term, during May half term and for week after the half term holiday period. Again, there is a clear reduction in NO₂ level between 08:30 – 08:45 and 15:00 – 15:15 during the school holidays. The fact that this trend has happened during two different school holiday periods at different times



of the year, gives further confidence that the short-term peak exposure shown in the data is as a result of school traffic and potential idling.

Further data analysis has been carried out to compare average pollutant values between term time and the Christmas holidays and May half term holidays, shown below in Table 4. This table shows that in general, NO₂ is consistently higher during term time when compared to school holidays.

Table 4 – Comparison of pollutant concentrations between the school holidays and term time

-	Pollutant average concentration / $\mu\text{g}/\text{m}^3$
	NO ₂
Christmas holidays	10.23
Spring Term time	13.17
Difference (%)	22.27
May half term holiday	10.26
Spring Term time	13.17
Difference (%)	22.11



Summary

The data measured by the Zephyr real-time monitor in the period November 2024 – July 2025 shows that the air quality in Comberton remains good, with estimated annual mean concentrations (as well as the measured monthly averages) of the main pollutants known to be emitted by vehicles, below the national objectives. There was one exceedance of PM₁₀ short-term national objective during the study period, however that is likely to have been caused by a nationwide pollution event.

The data showed short-term exposure peaks of NO₂ during term-time between the hours of 08:30-08:45 and 15:00-15:15, highlighting that idling vehicles are likely to be adding to air pollution at these times. The graphs in Figures 5 and 6 show the comparison of short-term NO₂ peaks during term time vs. the school holidays. The evidence is convincing that school traffic and potentially idling buses are causing short-term increases in NO₂. When looking at the percentage increase in pollution during, there is an approximately 22% increase in average NO₂ exposure during term time compared to school holidays. The increase in exposure is deemed unnecessary and could be reduced if vehicles stop idling at pick-up and drop-off times.

South Cambridgeshire District Council will share the results of this study with other colleges within the district and with Cambridgeshire County Council, who organise school transport in the district. We hope to be able to work with our partners, and Comberton Village College to deter buses and vehicles from idling outside of the College.



Appendix 1 – Air Quality Frequently Asked Questions

Why is air quality important?

There are a number of reasons air quality is important. In particular, polluted air is the biggest environmental threat to health in the UK. It is linked to up to 36,000 deaths per year from long-term exposure². The main impacts of poor air quality are contributing to heart and lung conditions, but air quality has also been linked to a wide range of issues³. Air pollution also particularly effects the most vulnerable, including children and older people and those with existing lung and heart conditions. Air quality also strongly links to climate change, as many of the causes of the issues are the same, such as the burning of fossil fuels. This means that actions taken to improve air quality also helps prevent climate change.

How does the Council monitor air quality?

South Cambridgeshire District Council operates a monitoring network of over 30 locations across the district, made up of diffusion tubes and three continuous monitoring sites, which measure air quality accurately in real-time. This existing monitoring network allows the long-term monitoring of trends and changes in air quality across the district. Live data from the three continuous monitoring stations are available at <https://scambs-airquality.ricardo-aea.com/>. In addition, the Council has purchased two Zephyr air quality sensors which provide real-time measurements for the main pollutants of concern from a single monitor. These can be used for shorter-term monitoring to identify hotspots of pollution or be used in a range of targeted studies to complement our existing monitoring network. The first of these instruments was installed in Harston, with subsequent monitors installed in Cambourne, Northstowe, Histon, Girton, Swavesey, Milton, Waterbeach, Barton, Shelford and most recently Fen Drayton.

² Defra. Air quality appraisal: damage cost guidance, July 2020

³ Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017



What else does the Council do around air quality?

As well as monitoring air quality, the Council acts to improve air quality through its Green to the Core focus, including an air quality strategy designed to go beyond simply meeting the national objectives, Zero Carbon Community Grants to fund community initiatives to improve sustainability, such as encouraging and enabling cycling which in turn helps air quality, and by considering air quality during the planning process^{4,5}. Ideas on how anyone can play a role in improving local air quality can be found in Appendix 2 – How to get Involved with Local Air Quality.

What are the main pollutants of concern?

The main pollutants of concern are:

- Nitrogen Dioxide (NO₂) – a gas predominantly formed following the burning of fossil fuels, which can cause irritation of the airways and exacerbate symptoms of other conditions
- Particulate Matter (PM₁₀ and PM_{2.5}), where the number refers to the size of the particulates in micrometres – a mix of solid particles and liquid droplets of various sizes and composition, the smallest of which can get into the blood and be transported around the body⁶

What are the air quality objectives?

For NO₂ and PM₁₀ national objective levels have been set which must be achieved by local authorities, otherwise an Air Quality Management Area (AQMA) must be declared for the objective which is being exceeded. Objectives have been set for both long-term concentrations (measured as annual means) and short-term concentrations (hourly means for NO₂ and daily means for PM₁₀). South

⁴ Being green to our core <https://www.scambs.gov.uk/your-council-and-democracy/performance-and-plans/our-business-plan/>

⁵ Zero Carbon Communities Grant <https://www.scambs.gov.uk/community-development/grants/zero-carbon-communities-grant/>.

⁶ Defra, Clean Air Strategy, 2019



Cambridgeshire District Council does not currently have any AQMAs. The historic AQMA along the A14 between Bar Hill and Milton, which was declared in 2008 for NO₂ annual mean and PM₁₀ 24-hour mean, was revoked in early 2022 due to sustained compliance with the relevant objectives in line with Defra guidance and the Council's constitution. The Air Quality Objectives applicable to local authorities through the Local Air Quality Management (LAQM) requirements in England are set out in Table 5. In addition, local authorities are expected to work towards reducing emissions and concentrations of PM_{2.5} (particulate matter with a diameter of 2.5 µm or less), although there is currently no legal objective for local authorities.

Table 5 – Air Quality Objectives in England

Pollutant	Air Quality Objective – Concentration	Air Quality Objective – Measured as
Nitrogen Dioxide (NO ₂)	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO ₂)	40 µg/m ³	Annual mean
Particulate Matter (PM ₁₀)	50 µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM ₁₀)	40 µg/m ³	Annual mean
Sulphur Dioxide (SO ₂)	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO ₂)	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO ₂)	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean

If air pollution is a result of vehicles utilising the A14, how can local residents change this?

There are a number of way local residents can have an impact on air quality through everyday actions, such as those mentioned in **Error! Not a valid bookmark self-reference..** Many of these are very small changes that can add up to a big impact.



Appendix 2 – How to get Involved with Local Air Quality

Annual reports and details on air quality monitoring are available on our website, <https://www.scambs.gov.uk/environment/pollution/air-pollution/local-air-quality-management/>, and you can share your views via our email address, air.quality@scambs.gov.uk.

Although air quality in the South Cambridgeshire District is generally good, with concentrations below the objectives, there are actions we can all take to improve it further. Ways you can help to improve air quality in South Cambs include:

- Minimise car use wherever possible:
 - Avoid using your car for short trips (under 2 miles) - short trips are very polluting as modern engines need to reach a very high temperature to work efficiently; on short trips it won't reach that temperature.
 - For short journeys try cycling or walking more often – this helps you stay healthy and saves you money in fuel costs.
 - For longer journeys consider public transport options.
 - Use journey-planning apps such as MyBusTrip or MotionMap for travel by bus, train, walking and cycling.
- Switch it off – don't leave your car engine idling if you are stationary e.g. waiting to pick someone up, in a traffic jam or waiting at level crossings.
- When driving, use techniques that help you use less fuel, like driving more slowly and smoothly.
 - You could use 10% less fuel by following the tips on the AA website http://www.theaa.com/motoring_advice/fuels-and-environment/drive-smart.html.
 - Like switching your engine off when stationary, this will not only reduce your emissions of air pollution but will save fuel and therefore money too!
- Consider making your next vehicle an electric vehicle.
- Join a car club or car-share regularly.
- Consider working at home where possible – the first Covid-19 lockdown showed widespread improvements in the air quality as the amount people travelled reduced.



- Use less energy at home – consider a smart meter to monitor usage and be aware of boiler standards.
- Opt for ‘green energy’ tariffs where available or switch to renewable sources of heating or power.
- Reduce the use of solid fuel stoves and open fires – domestic burning is now the single biggest source of particulate matter pollution in the UK (greater than traffic and industry).
 - If you are burning wood or coal ensure any fuel used meets the new standards of moisture content and emissions – more information is available at <https://woodsurre.co.uk/are-you-ready-to-burn/>
- Make your children aware of the impact that day to day activities have on air quality.



Appendix 3 – Annualisation of short-term data

Annualisation is a calculation process used to estimate an average concentration for a full year from a shorter period, such as the 6 months in this study. Annualisation ratios are worked out as a ratio of the average concentration in a full year (annual mean (Am)) to the average in the actual monitoring period measured (period mean (Pm)), using data from background continuous sites. The average concentration from the Zephyr data during the monitoring period is then multiplied by that ratio to give an estimate of the average concentration at the Zephyr for a full year.

The data from the period November 2024 to July 2025 was annualised according to the process set out in box 7.9 of Defra's Local Air Quality Management Technical Guidance (TG16). Continuous monitoring background sites were used for the annualisation calculations. Full year data for 2024 was used for the annual mean concentrations.

NO₂:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	5.4	6.85	0.87
Northampton Spring Park	10.90	12.16	0.90
Norwich Lakenfields	9.87	11.18	0.88
Average ratio	-	-	0.88

PM₁₀:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	14.41	15.44	0.93
Norwich Lakenfields	12.66	13.40	0.94
Average ratio	-	-	0.94



PM_{2.5}:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	8.87	10.54	0.84
Northampton Spring Park	8.65	9.94	0.87
Norwich Lakenfields	8.36	9.58	0.87
Average ratio	-	-	0.86