South Cambridgeshire District Council

Short term air quality monitoring in Fen Drayton, Cambridgeshire

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July 2024

Executive Summary

Air quality was monitored in the South Cambridgeshire village of Fen Drayton using Zephyr monitoring technology during the period March 2024 to June 2024 due to concern from a resident about burning by a local public house. Monitoring was carried out by South Cambridgeshire District Council within the resident's garden. It was found that concentrations of the main pollutants, nitrogen dioxide and particulate matter, were comfortably below the national objectives for annual mean concentrations and there were no exceedances of the short-term objectives, representing good average air quality. Annual means for the more stringent World Health Organization (WHO) guideline values were also achieved for PM_{10}, although $PM_{2.5}$ levels and annualised nitrogen dioxide levels slightly exceeded the WHO guideline values, which was expected given that over 90% of the world's population live in locations where this is exceeded. This is in line with long-term concentrations measured across the South Cambridgeshire district and reflects the rural nature of the area.

It was not possible to identify any clear local pollution events caused by solid fuel burning during this monitoring study. However, regional events were identified where levels of $PM_{2.5}$ were elevated across the region on various monitoring systems. These may have been related to continental pollution. Localised elevated levels of particulate matter were recorded towards the end of the study that have been attributed to pollen from flowers directly below the monitor. Although pollen can cause hay fever it is not thought to have the same long term health impacts associated with particulate matter from burning or other man-made sources.

Although this study did not identify any specific burning events, the importance of reducing particulate matter pollution remains high with emerging evidence that there is no safe level of particulate matter air pollution. South Cambridgeshire residents can help to improve local air quality through actions such as reducing idling of car engines and increasing walking and cycling where possible. Reducing solid fuel burning and only burning Woodsure Ready to Burn certified wood will also help to reduce particulate matter pollution. 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 (NO_2) – 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 PM_{10}) – 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 contributing to conditions such as heart and lung disease.

Real-time monitoring – see also continuous monitoring – monitoring which uses an instrument that takes readings at regular intervals (e.g. every 10 seconds or every hour) and therefore can give a concentration attributed to a specific time, typically with results available in real-time via remote connectivity.

$\mu g/m^3$ – 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.

Results of Zephyr air quality monitoring in Fen Drayton, Cambridgeshire

Introduction

Purpose of this report

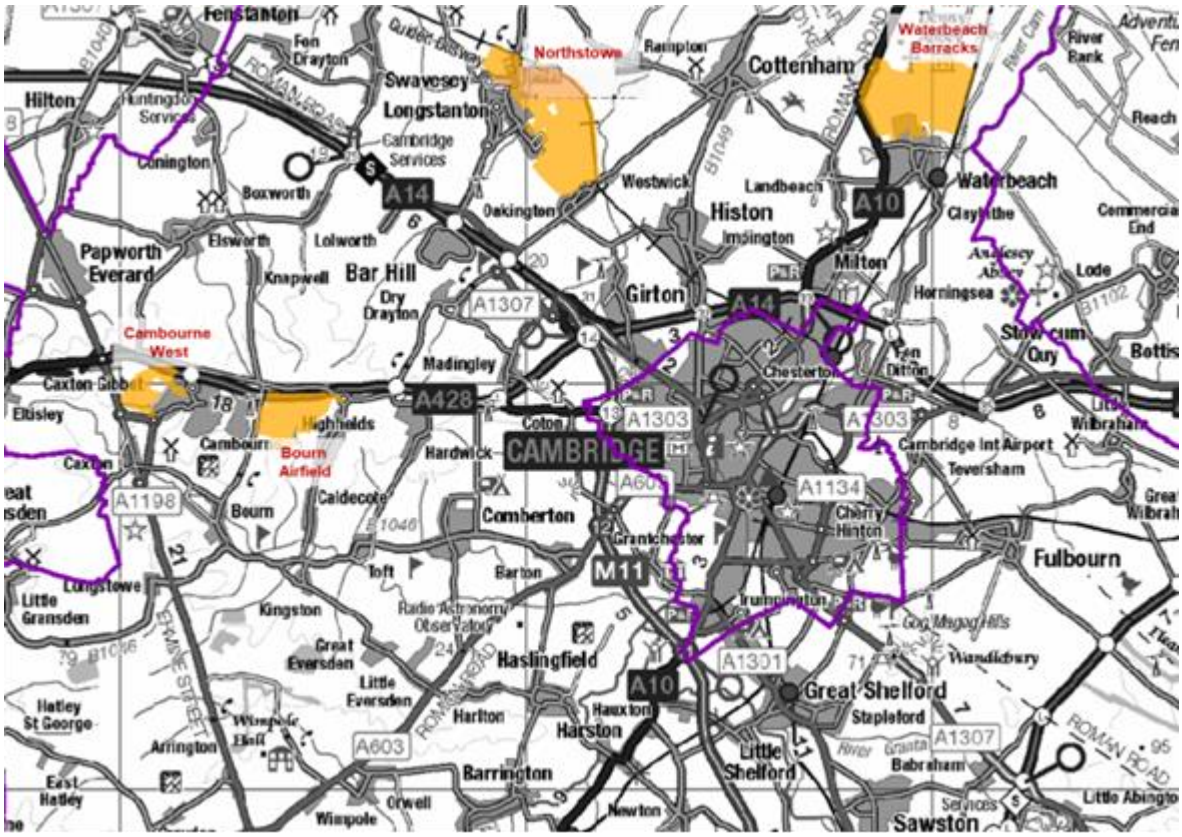
This is a report to provide information on the short-term air quality monitoring study undertaken in the South Cambridgeshire village of Fen Drayton, using ‘Zephyr’ monitoring technology. Monitoring was carried out during the period March 2024 to June 2024. The study was designed to be a short-term study monitoring air quality following concern about smoke coming from the chimney of the neighbouring public house.

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 in the most recent full year monitoring results. This means we benefit from cleaner air to breathe and less pollution related health problems. However, there is significant new evidence that there is no safe level of certain pollutants and the district is undergoing significant growth to keep up with the increase in demand for housing with major developments, including Northstowe (10,000 dwellings), Waterbeach Barracks (6000-10,000 dwellings), Bourn Airfield and Cambourne West, shown in Figure 1.

Nitrogen dioxide air pollution in the district is mainly related to road traffic, which is likely to increase due to these areas of growth, and the major roads running through the district, including the A14 and M11/A11 corridors.

Figure 1 – Locations of major development sites in South Cambridgeshire



Particulate matter pollution, however, is related to a wider range of pollution sources, including both natural sources (for example dust, pollen and sea salt) and made man sources (transport, industry and domestic solid fuel burning, which nationally contributed 27% of the $PM_{2.5}$ emissions in 2021 according to Defra).

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 such as asthma, lung conditions or heart disease. In South Cambridgeshire, 5.8% of all deaths in people aged 30 and over in 2022 were attributable to long term exposure to particulate air pollution and this is the same as the figure for England as a whole. 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 new Zephyr monitors which are used for short term monitoring projects. Although the air quality in South Cambridgeshire is generally good when compared to more urban areas, there is emerging evidence that even low levels of pollutants can cause health impacts, and the World Health Organization (WHO) have published ambitious targets for some pollutants that are lower than the national objectives. South Cambridgeshire District Council has, in its Air Quality Strategy, committed to working towards the WHO guideline values.

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 of concern, nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). They 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 domestic solid fuel burning. Zephyr sensors can be used in isolation or deployed as a network of sensors across a wider area to build up a more detailed picture.

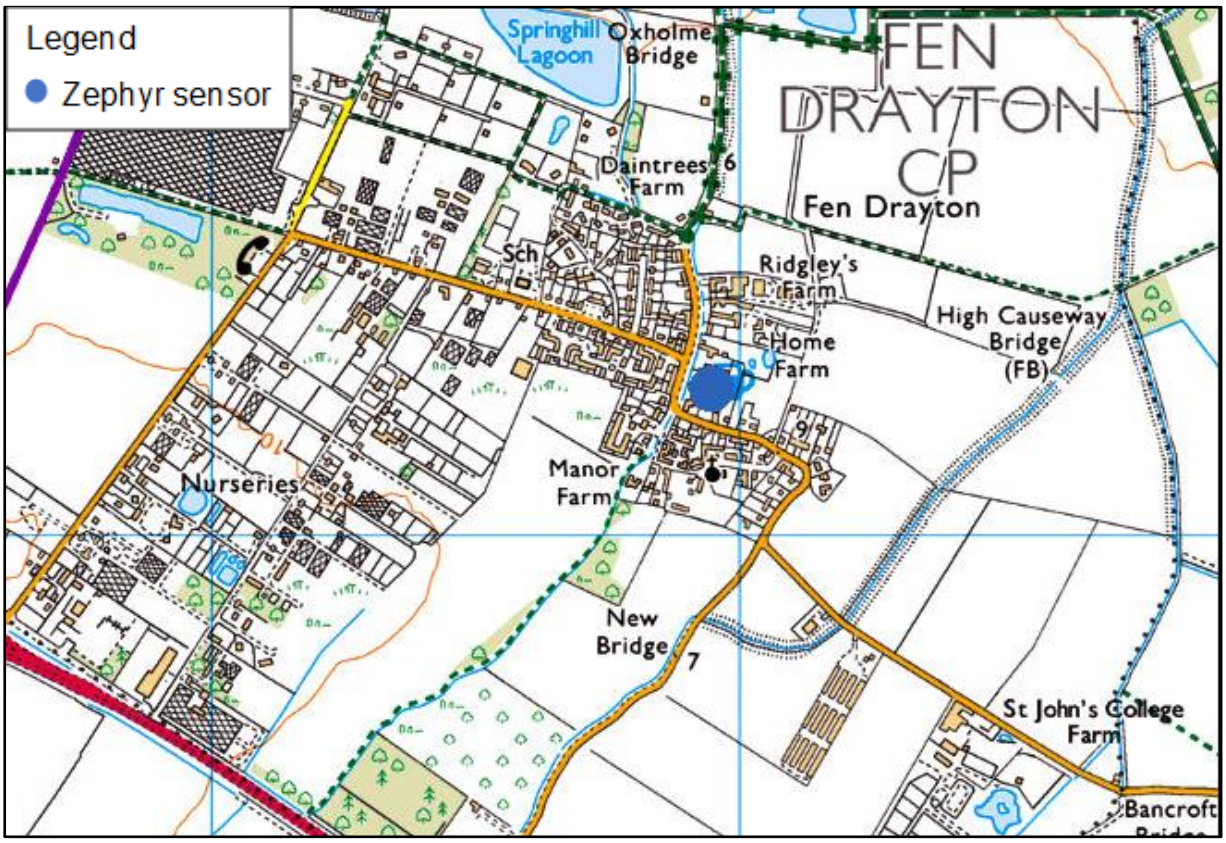
The data from a Zephyr sensor cannot be treated with the same confidence as that from one of our continuous monitor stations, where the data is 'ratified' after checks, however, it has been shown to provide accurate indicative measurements and is comparable to the continuous monitors and therefore appropriate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

Monitoring Location

Fen Drayton was selected due to a resident raising concerns about the impact of the solid fuel burning from a neighbouring public house. Smoke and particulates from domestic solid fuel burning can cause a localised 'spike' in pollution that could potentially have health impacts.

The monitor was located on a wooden structure in the rear garden of the concerned resident, to be representative of the air quality at their property. It measured the main pollutants of concern, nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$), among others. The location of the Zephyr can be seen on Figure 2.

Figure 2 – Location of the Zephyr sensor in Fen Drayton



Monitoring Data and Comparison with Objectives

The average monthly concentrations measured in the period March 2024 to June 2024 are shown in Table 1, below, with the UK annual mean objective and the more stringent WHO guideline values shown for information. This data is also represented in Figures 3 to 4.

Table 1 – Zephyr Air Quality data – monthly average concentrations

	Pollutant monthly average concentration / µg/m³		
Month	NO_2	$PM_{2.5}$	PM_{10}
March 2024	7.8	7.3	12.2
April 2024	9.5	3.9	6.6
May 2024	9.1	10.2	15.9
June 2024 (up to 20 June only)	11.8	15.6	21.2
UK Objective (annual mean)	40	10*	40
WHO Guideline values (annual mean)	10	5	15

*target to be achieved by 2040

Figure 3 – Zephyr Air Quality data – monthly average concentrations compared to national annual mean objectives

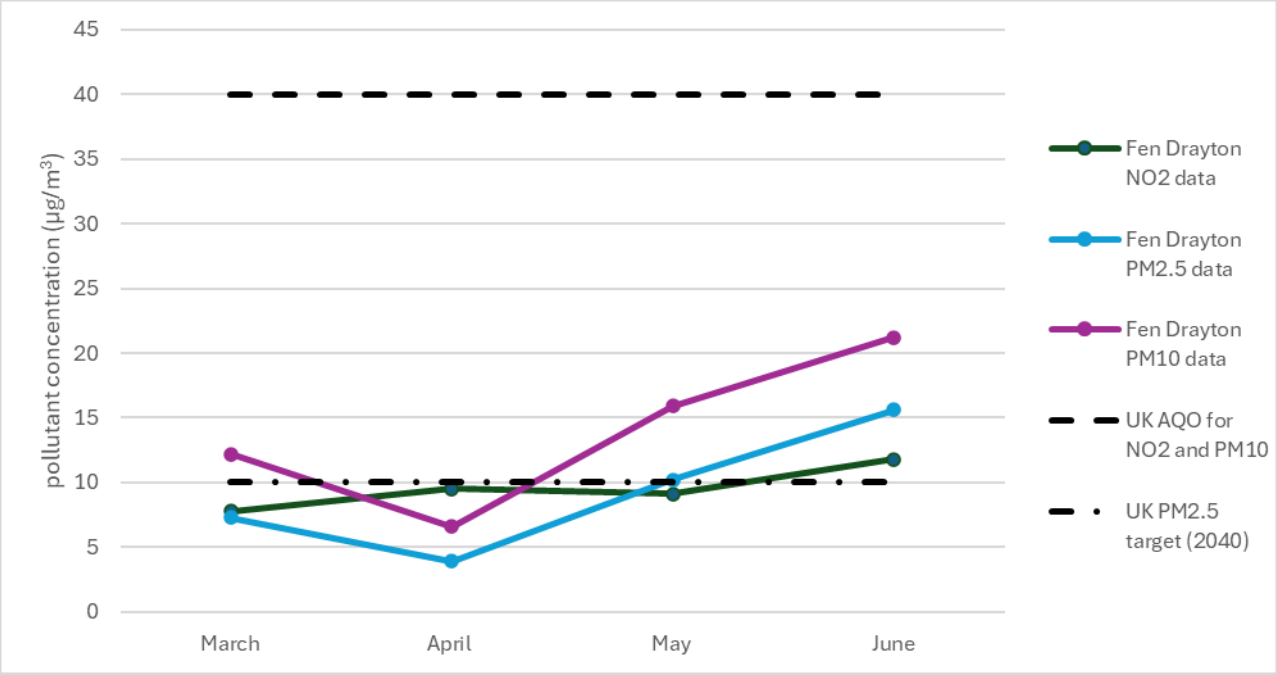
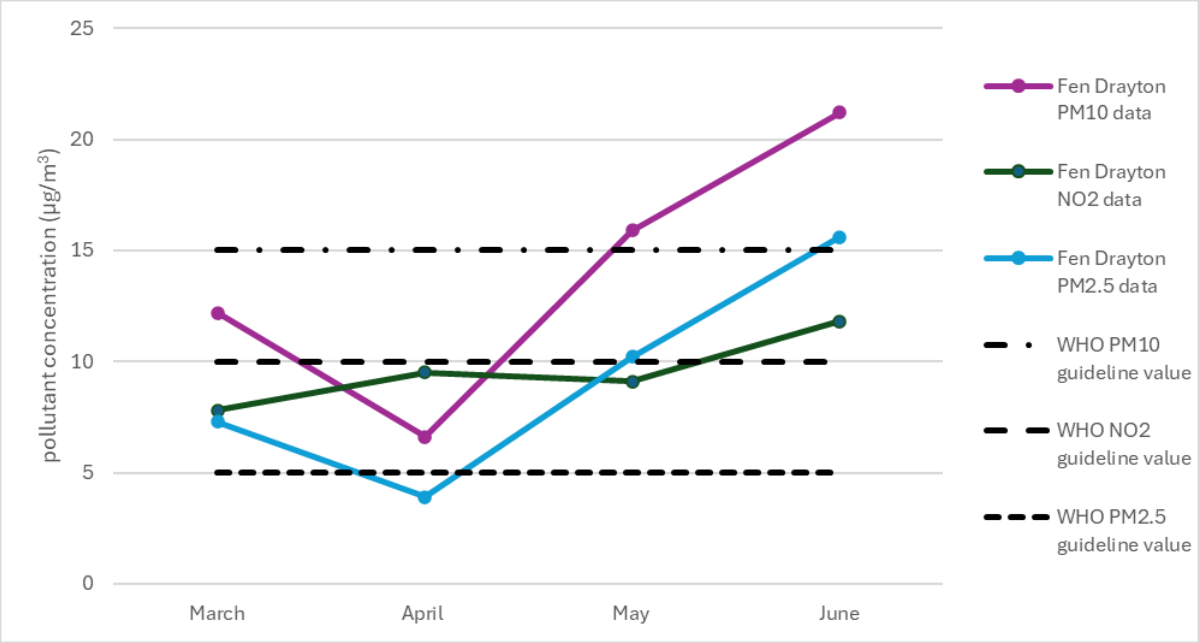


Figure 4 – Zephyr Air Quality data – monthly average concentrations compared to WHO guideline values



The data recorded in Fen Drayton was also compared to that recorded in the same monitoring period by the Council's automatic monitoring stations for each pollutant, the results of which can be seen on the South Cambridgeshire automatic monitoring portal (https://scambs-airquality.ricardo-aea.com/). The results recorded from the automatic monitors were similar to the results from the Zephyr indicating reliability of the results from the Zephyr.

In addition, the average concentrations of each pollutant for the whole period (March 2024 to June 2024) 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 four 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 2023/4 data from a range of ratified 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 Data – annualised annual mean concentrations

	Pollutant average concentration / µg/m^3		
	NO_2	$PM_{2.5}$	PM_{10}
Measured data average March 2024 – June 2024	9.6	9.3	14
Annualisation factor	1.29	0.87	0.935
Annualised annual mean – Barton Zephyr	12.4	8.1	13.1
UK Air Quality Objective (annual mean)	40	10*	40
WHO Guideline value (annual mean)	10	5	15

*to be achieved by 2040

As shown in Table 1 and Table 2, the long-term annual mean concentrations of the main pollutants of concern at the Fen Drayton Zephyr monitoring location are significantly below the UK national objectives for NO_2 and PM_{10} and below the 2040 target for $PM_{2.5}$, indicating good air quality. The $PM_{2.5}$ concentration is above the ambitious World Health Organisation annual guideline value, announced in September 2021 of 5µg/m^3, although it should be noted that over 90% of the world's population live in an area where this guideline value is exceeded. $PM_{2.5}$ remains well below the current UK objective of 10 µg/m^3 to be achieved by 2040 as set in The Environmental Targets (Fine Particulate Matter) (England) Regulations 2022. 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 NO_2 and 24-hour means for PM_{10}. 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
March 2024	0	0
April 2024	0	0
May 2024	0	0
June 2024 (up to 20 June only)	0	0
UK 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
*** The WHO do not have short term objectives

As shown in Table 3, there were no exceedances of the short-term objectives for NO_2 with the highest hourly average was recorded at 7pm on the 24 May 2024 as 43.2µg/m^3 which is below the UK annual mean objective.

For PM_{10} the maximum recorded 24-hour mean value was 41.13µg/m^3 on the 20 June 2024, which is discussed in more detail below.

Short term PM events

As noted above, Particulate Matter pollution is normally dominated by regional events rather than local circumstances. When comparing results from monitors across the district the readings follow very similar results that show consistent trends and concentrations of particulate matter pollution. However, when a local pollution event, such as a bonfire or chimney smoke, occurs this can be identified by comparing results from several monitors and looking for short term ‘spikes’ in PM levels.

Figures 5, 6 and 7, below, show $PM_{2.5}$ data from multiple monitors (including SCDC Zephyrs at Fen Drayton, Great Shelford, Waterbeach and Impington as well as SCDC operated continuous monitors and a DEFRA operated background monitor located at Wicken Fen in East Cambridgeshire) for periods covering 9 to 12 March 2024; 14 to 17 May 2024 and 11 to 14 June 2024. These graphs are intended as representative snapshots of the data and have been chosen to demonstrate specific circumstances.

Figure 5: Comparison of $PM_{2.5}$ data from 9 to 12 March 2024 for four monitoring stations

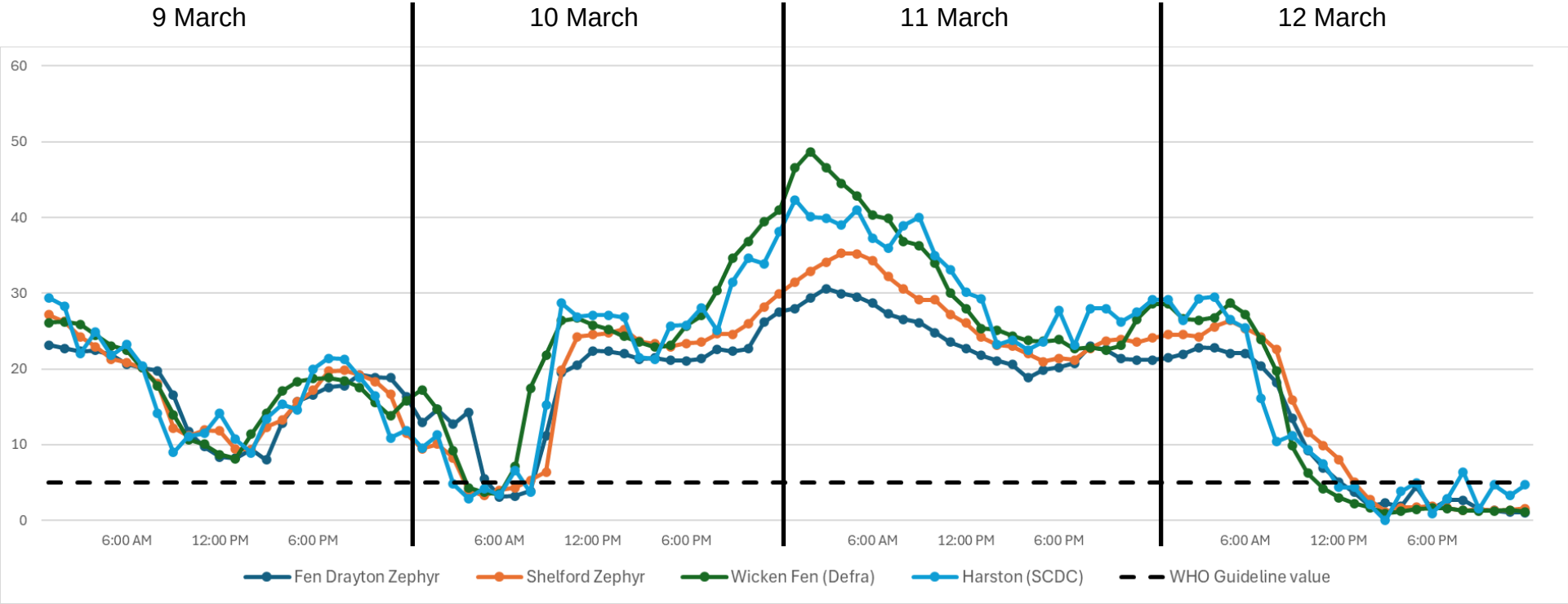


Figure 5, showing data between the 9 and 12 March 2024, indicates levels of $PM_{2.5}$ are elevated at Fen Drayton for a number of days; however, this is shown to be the same at all of the monitors, including the remote Defra background monitor, indicating that this is a regional event rather than a local event. Concentrations of $PM_{2.5}$ increase and decrease at similar times at all sites, which verifies the accuracy of the Zephyr monitor. No local events are identified during his time period.

Figure 6: Comparison of $PM_{2.5}$ data from 14 to 17 May 2024 for four monitoring stations

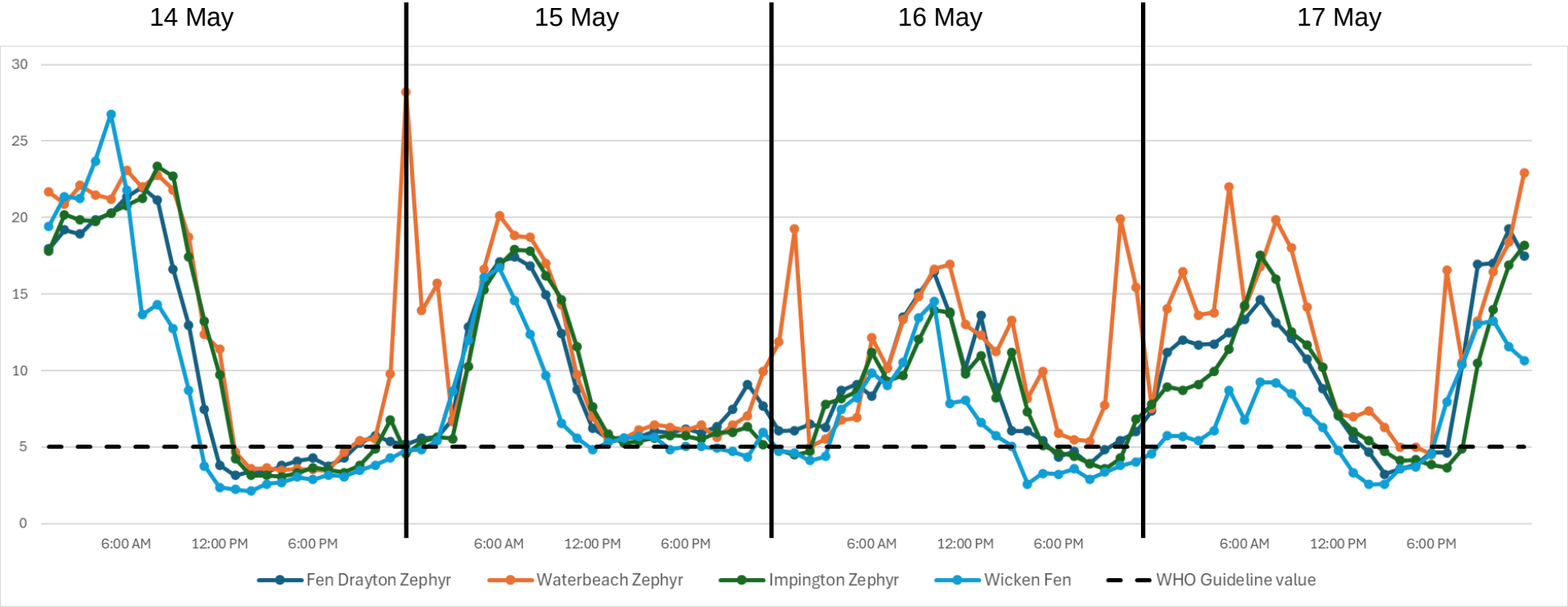


Figure 6 shows data between the 14 and 17 May 2024, displaying periods of elevated and lower concentrations of $PM_{2.5}$ pollution with all sites again following a similar pattern indicating dominance by regional factors. The exception to this is the Zephyr monitor at Waterbeach that is detecting numerous local events with significant pollution 'spikes' at numerous times of day indicating a local source of pollution. These local pollution events will be discussed further in the Waterbeach report when published. No significant local events are identified at the Fen Drayton monitor point during this period.

Figure 7: Comparison of $PM_{2.5}$ data from 11 to 14 June 2024 for four monitoring stations

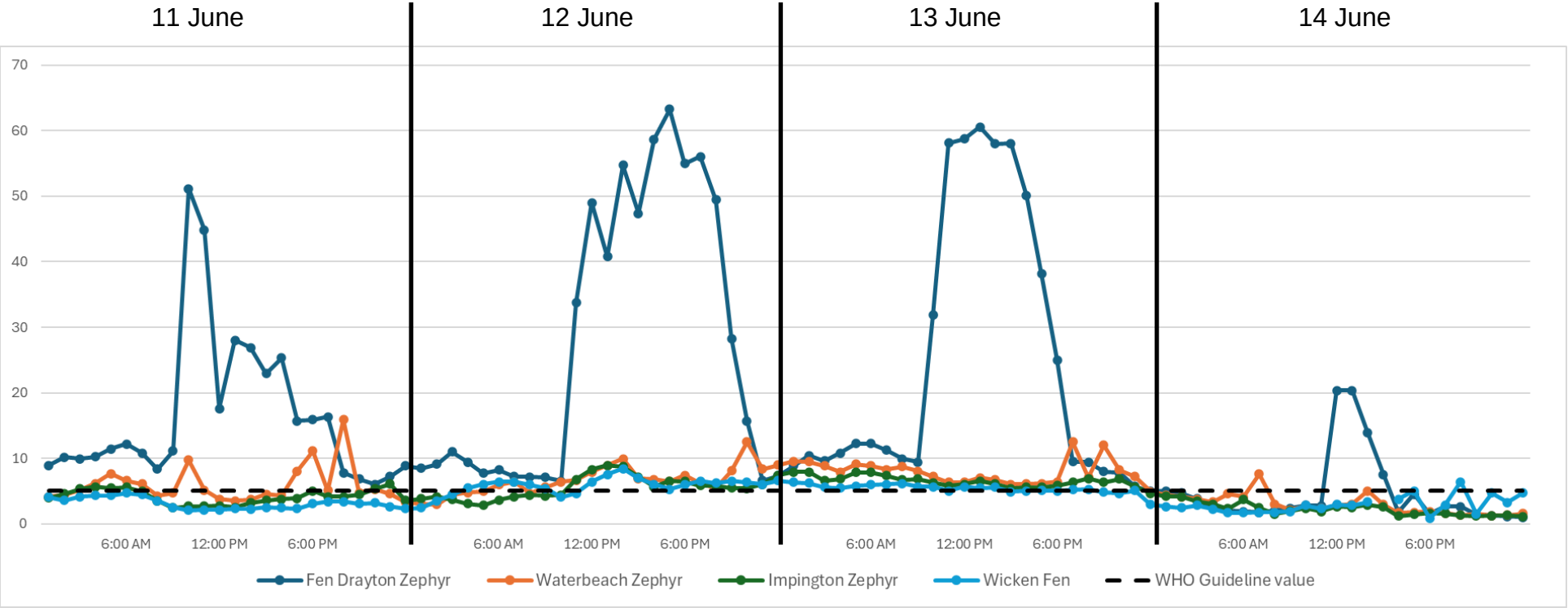


Figure 7 shows high levels of $PM_{2.5}$ during the daylight hours of the 11, 12, 13 and, to a lesser extent, on the 14 June. This pattern was not observed at any of the other monitors during this period indicating it was a local occurrence. This pattern started around the 7 June and continued until the 20 June when the study ended due to a fault with the monitor. Smaller localised pollution 'spikes' can be seen at the Waterbeach Zephyr, however, the different timing of these spikes and the smaller size indicates that they are from a different source.

Following a site visit to investigate the high levels of $PM_{2.5}$, it was considered likely that these daily spikes in pollution were caused by pollen from vegetation that had grown directly below the monitor. The monitor was positioned lower than for some other studies as it was located in a private garden and, since the monitor was installed, significant flowering vegetation had grown directly beneath the monitor inlet. The significant and sudden increase in levels of $PM_{2.5}$ in the morning would relate to the flowers opening with a decrease in the evening when the flowers close. Levels of $PM_{2.5}$ were lower on wetter days which would also correspond to pollen being the source. The start of these daily events would also correspond to the likely start of flowering.

Summary

The data measured by the Zephyr monitor in the period March 2024 to June 2024 shows that the air quality at the monitored location in Fen Drayton is generally good, with estimated annual mean concentrations of the main pollutants of concern well below all of the relevant national objectives. PM_{10} was also below the highly ambitious WHO guideline value. NO_2 was slightly above the WHO guideline value after annualisation, although a longer study would give greater confidence in this result. $PM_{2.5}$ was slightly above the WHO guideline value, however, over 90% of the worlds population live in locations where this is exceeded and this should not be taken as being poor air quality. There were no exceedances of the short-term national objectives.

When compared to other local monitoring stations, the $PM_{2.5}$ data showed good correlation with the other local monitoring sites using a variety of different monitoring methods. This gives us confidence that the results obtained for the Zephyr are valid and accurate. It was not possible to identify any short term pollution 'spikes' that could be attributable to local burning events such as domestic solid fuel burning. There may be a number of reasons for this, such as the study not starting until March when solid fuel burning may be reducing as the weather is warming. Wind speed, direction and atmospheric pressure will have influenced the behaviour of any smoke plumes from solid fuel burning. It is possible that pollution incidents may have occurred in the vicinity, but the associated smoke did not pass directly over the monitor inlet.

The Zephyr did pick up significant levels of $PM_{2.5}$ (as well as PM_{10}) associated with pollen from flowers directly below the monitor. It is known that pollen can cause issues such as hay fever, however, pollen is not thought to have the same impact as some other forms of PM, such as PM from burning, which can contain compounds that are more harmful to long term health. This study is important in understanding the complex mix of sources that make up the levels of Particulate Matter measured throughout the district.

Although this study did not directly identify any local solid fuel burning pollution events, wider evidence highlights the importance of reducing solid fuel burning and the impact that it can have both locally and nationally. Other studies by SCDC have identified elevated $PM_{2.5}$ pollution spikes likely associated with domestic burning and the *Air quality strategy: framework for local authority delivery*, published by Defra, last updated August 2023 states that domestic burning of solid fuels accounted for 27% of $PM_{2.5}$ in 2021. Ideas on how to play a role in improving local air quality can be found in Appendix 2.

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 exposure. 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 issues, such as strokes and dementia. 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 around 40 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 three 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. There have now been over ten of these studies all available on at Air quality monitoring - South Cambs District Council (scambs.gov.uk).

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. 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 (NO_2) – 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_{10} 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 body.

What are the air quality objectives?

For NO_2 and PM_{10} 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 NO_2 and daily means for PM_{10}). South Cambridgeshire District Council does not currently have any AQMAs, although there has historically been an AQMA along a stretch of the A14, which 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 7. 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, a national target, to be achieved by 2040, of 10µg/m^3 has been set with an associated exposure reduction target of 35% by 2040 (on a 2018 baseline).

Table 7 – 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

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 is evidence that there is no safe level of air pollution and $PM_{2.5}$ levels remain above WHO guideline values and so action to reduce pollution further is still required. Tthere are actions we can all take to improve air quality 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 needs 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 fuels 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://woodsure.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 4 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 March 2024 to June 2024 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. A full year from July 2023 to June 2024 was used for the annual mean concentrations as the monitoring covered two calendar years.

NO_2:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	4.9	4.4	1.11
Northampton Spring Park	9.3	7.2	1.29
Norwich	7.6	5.2	1.46
Average ratio	-	-	**1.29**

PM_{10}:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	9.5	10.4	0.91
Norwich	10.7	11.2	0.96
Average Ratio	-	-	**0.935**

$PM_{2.5}$:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	5.7	6.6	0.86
Northampton Spring Park	7.6	9.0	0.84
Norwich	6.8	7.4	0.92
Average ratio	-	-	**0.87**