BREATHE LONDON NETWORK AIR QUALITY MONITORING REPORT (2021–2022)

January 2024

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Executive Summary

The Breathe London Network was established in 2020 to make reliable air quality monitoring data more accessible to local communities in London. Its network of low cost, easy to install and maintain air quality sensors complements London's network of high accuracy reference analysers, helping to monitor and map air pollution across the city.

Breathe London empowers citizens with the evidence they need to manage their exposure to air pollution and to campaign for a healthier environment. Having grown rapidly from 136 sensors to over 450 sites, its sensors have been installed in priority locations such as schools, hospitals, and residential communities. The Breathe London model has been so successful that it is now being replicated in other cities around the world through Breathe Cities to reduce air pollution, cut carbon emissions, and improve public health.

This report summarises the data for the first two years (2021 and 2022) of operation of Breathe London, providing an overview of annual average nitrogen dioxide (NO_2) and particulate matter ($PM_{2.5}$) concentrations for sites with sufficient data capture. The report reveals that the annual average concentration of both NO_2 and $PM_{2.5}$ exceeded World Health Organization (WHO) guidelines at all sites with sufficient data capture in both years, underlining the importance of ongoing efforts to address air pollution in London.

Nitrogen Dioxide

The report reveals that in 2021, annual average NO_2 concentrations ranged from 15 μgm^{-3} to 46 μgm^{-3} and in 2022 ranged from 16 μgm^{-3} to 43 μgm^{-3}. **All 284 sites with sufficient data capture recorded concentrations exceeding the WHO annual average NO_2 guideline value of 10 μgm^{-3} in both 2021 and 2022. The majority (98%) also exceeded the WHO interim target of 20 μgm^{-3}**. In 2022, the annual average concentrations of nine sites also exceeded the less stringent UK legal objective of 40 μgm^{-3}.

The annual average NO_2 concentrations data shows that **for 2022, all school sites exceeded both the WHO guideline of 10 μgm^{-3} and the WHO interim target of 20 μgm^{-3}.** Most sites (72%) measured an annual average of between 20 μgm^{-3} and 30 μgm^{-3}, 19 sites measured an average of between 30 and 40 μgm^{-3} and two sites exceeded 40 μgm^{-3}, the UK legal objective. **No hospital sites met either the WHO NO_2 guideline of 10 μgm^{-3} or the WHO NO_2 interim target of 20 μgm^{-3} in either 2021 or 2022.** Most sites measured an average of between 20 and 30 μgm^{-3} with a couple exceeding 30 μgm^{-3}.

Particulate Matter

In 2021 annual average $PM_{2.5}$ concentrations ranged from 7 μgm^{-3} to 17 μgm^{-3} and in 2022 concentrations ranged from 7 μgm^{-3} to 16 μgm^{-3}. **All sites exceeded the WHO annual average guideline for $PM_{2.5}$ in both 2021 and 2022.** Almost half of the sites met the WHO interim target and UK legal objective of 10 μgm^{-3} in 2021, though this figure reduced to a third as more sites were added to the network in 2022. Most sites measured between 10 and 15 μgm^{-3} for both years.

The annual average PM$_{2.5}$ concentrations data shows that **no school sites met the WHO annual average guideline of 5 µgm^{-3} in 2021 or 2022.** This is consistent with London overall, including for 2025 and 2030 forecasts from the London Atmospheric Inventory 2019[1]. **Over half of the school sites measured an average below 10 µgm^{-3}, which is the level that the Mayor has committed to London meeting by 2030 and the UK legal objective to meet by 2040**, indicating that this objective could be achieved much sooner than the government's data suggests.

All hospital sites exceeded the WHO annual average guideline for PM$_{2.5}$ in 2021 and 2022. Over half of the sites each year measured an annual average below 10 µgm^{-3}, meeting the interim WHO target and the limit that London has committed to meeting by 2030. The rest of the sites measured between 10 and 15 µgm^{-3}.

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[1] https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2019

Introduction

Air quality monitoring is an essential tool for understanding air pollution, tracking trends, and understanding the impacts of policies to improve air quality.

London has the most comprehensive air quality monitoring network of any city in the world with over 100 reference grade air quality monitoring sites and over 1,800 passive diffusion tubes, managed by London boroughs, along with the Breathe London Network. The reference sites provide accurate continuous air quality monitoring data which is crucial for research and regulatory reporting. Near real-time data is viewable on the LondonAir website and provides a snapshot of air quality. It is important to note that these snapshots are not representative of air pollution levels and that annual concentrations should be used when assessing air pollution.

The Breathe London Network helps make air quality data more accessible by providing a lower cost, easy to install and easy to maintain alternative for monitoring air quality in London. This supplements the existing essential reference monitoring network, which is used for formal air quality reporting to meet the requirements of the London Local Air Quality Management (LLAQM) statutory process. The network enables wider coverage, providing hyper-local, accurate and reliable data to Londoners and the opportunity for communities and businesses to choose where to monitor pollution. The programme empowers communities to monitor air pollution in their neighbourhoods and use the data to lobby for change. While small sensors are not as accurate as reference-grade analysers, by co-locating small sensors with the LondonAir reference network, the Breathe London network provides users with the best possible data set from their nodes.

The programme builds on the Mayor's Breathe London pilot which was supported by Clean Air Fund and ran from 2018 to 2020. The pilot monitored pollution in around 100 locations as well as mobile monitoring using Google Street View cars. The data from the pilot project can be found here.

In 2020 the Mayor of London decided to fund a new four-year programme of the Breathe London air quality network, delivered by the Environmental Research Group at Imperial College London. This programme started with 136 sensors deployed across London at priority locations such as schools, hospitals, residential communities and reference monitor co-location sites, funded by the Mayor.

This report summarises the data for the first two years (2021 and 2022) of the Breathe London Network, providing an overview of annual average nitrogen dioxide (NO_2) and particulate matter ($PM_{2.5}$) concentrations for sites with sufficient data capture (defined as >75% for the year). The report also includes a more in-depth consideration of the data for selected sites along with a comparison of the Breathe London sensor data with reference site data for sites where these two monitoring types are co-located.

The network

The Breathe London Network started with 136 sensors deployed across London at priority locations such as schools, hospitals, residential communities and reference monitor co-location sites, wholly funded by the Mayor.

The network has since grown and evolved rapidly thanks to the mechanism available through Imperial College London for London boroughs, businesses and individuals to 'buy in' to the network and fund their own sites. The growth has included many sites funded by London boroughs, NHS Clinical Commissioning Groups (CCGs), Bloomberg Philanthropies, and other partners, with sensors now deployed at wide range of locations including schools, hospitals and certain cultural institutions.

Now in its fourth year, the programme comprises over 400 Breathe London monitoring sites across London. The full list of sites is available on the [Breathe London website](#).

Communities Programme

The Breathe London Communities Programme empowers communities to monitor air pollution in their neighbourhoods and use the data to lobby for change. In 2021, Bloomberg Philanthropies joined the Mayor by investing in providing, through Imperial College London, 60 additional Breathe London sensors to diverse community groups across London to locate in an area of their choosing, over period of three years. The groups are also being supported in using the data by specialists at Imperial College London, through both online and in person workshops, providing them the tools to utilise the data in their campaigns.

The sensors have been awarded to community groups in three rounds of applications. Round 1 of the Communities Programme launched in early 2022 and provided the first 10 community sensors. Round 2 launched in December 2022 and provided another 30 groups with Breathe London sensors. The third and final round of 20 community groups were announced in August 2023.

The air quality sensors and data

Sensors

The Breathe London Network uses [Node-S](#) sensors supplied by the network partners [Clarity Movement Co](#). The sensors are compact, lightweight devices that can be attached to street furniture, such as lampposts, and run on either solar power or mains electricity. The sensors collect measurements of NO_2 and $PM_{2.5}$ every few minutes.

Calibration

Prior to being deployed to site, all Breathe London sensors undergo a calibration process and are co-located for a period at the Honor Oak Park air quality monitoring supersite. This enables a comparison to be made of the sensor and reference monitor data to ensure that the sensors are meeting the required accuracy criteria and that the sensors are standardised.

Co-location

There are 19 sensors in the network permanently co-located at London Air Quality Network reference air quality monitoring sites enabling constant comparisons of sensor data with reference data. This enables a dynamic network scaling algorithm to be applied to the whole network, using the comparisons between the sensor and the reference site measurements. The algorithm also takes into account other factors such as humidity and ozone as well as the NO_2 and $PM_{2.5}$ readings. This hybrid approach was developed by Imperial College London to improve the accuracy of the sensor data.

Data

All the data from the Breathe London network is publicly available in near real time on the Breathe London website. The website provides a map of current air quality, graphs for each site and enables the hourly data for each site to be downloaded for all to use. An application programming interface (API) is available for developers/researchers to access the data directly.

While the calibration and data scaling processes improve the accuracy of the sensor data, it is important to note that the data from the sensors are still classed as indicative. Further information on the network accuracy can be found on the Breathe London website along with the quarterly Network Reports.

World Health Organization Air Quality Guidelines and UK Legal Limits

The World Health Organization (WHO) updated their health-based guidelines for air quality in 2021, the first update since 2005. The new air quality guidelines reflect the best available health evidence and WHO's recommendations continue to be recognised globally as the targets that should be met to protect public health. The table below gives the annual average WHO guidelines along with the current UK legal objectives.

Pollutant	Averaging Time	2021 WHO Guideline	UK Legal Limit
NO_2	Annual	10 μgm^{-3}	40 μgm^{-3}
$PM_{2.5}$	Annual	5 μgm^{-3}	10 μgm^{-3} (to be met by 2040)

Nitrogen Dioxide (NO_2)

This section presents the annual average NO_2 concentrations for 2021 and 2022 for all Breathe London monitoring sites that achieved a data capture of at least 75% for the year[2]. Additional sites were continuously added to the network throughout the two years, therefore sites added to the network after the first quarter of each calendar year have been excluded for that year as they will not have achieved 75% data capture and will not have been in operation long enough to provide a representative annual average.

Table 1 summarises the number of Breathe London monitoring sites within each concentration band relating to the WHO air quality guideline, WHO interim targets and UK legal objective for annual average NO_2 for 2021 and 2022. It is important to note that the number of sites increased from 26 in 2021 to 284 in 2022. This is reflected in the increased percentage of sites at various concentration levels in Table 1. This increase does not reflect an increase or decrease in concentrations at original (2021) sites but reflects the increase in sites seen in 2022. **Table 2** lists the full site locations and their annual average NO_2 concentration for 2021 and 2022, ordered alphabetically by London borough.

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[2] The data capture rate is the percentage of the year for which data are available for the site. The 75% threshold is used elsewhere in UK regulatory reporting and has been adopted in this report in order to ensure that the average is representative of a year to account for seasonal variation.

Table 1 Summary of NO$_2$ annual averages

Annual average concentration	Number of sites 2021	Percentage of sites 2021	Number of sites 2022	Percentage of sites 2022
<10 µgm^{-3} WHO air quality guideline	0	0%	0	0%
10- 20 µgm^{-3}	4	15%	5	2%
20- 30 µgm^{-3}	16	62%	184	65%
30- 40 µgm^{-3}	3	12%	86	30%
>40 µgm^{-3} UK Legal Objective	3	12%	9	3%
Total number of sites	26	-	284	-

In 2021 annual average concentrations ranged from 15 µgm^{-3} to 46 µgm^{-3} and in 2022 ranged from 16 µgm^{-3} to 43 µgm^{-3}. **Table 1** shows that out of the 284 sites with sufficient NO$_2$ data, all sites recorded concentrations exceeding the WHO annual average NO$_2$ guideline value for both years. The majority (98%) also exceeded the WHO interim target of 20 µgm^{-3}. Nine sites recorded an average still exceeding the legal objective in 2022. These sites are all roadside or kerbside sites within the boroughs of Brent, Croydon, Harrow, Merton, Sutton and Westminster.

Table 2 gives the full site list and the annual average NO$_2$ concentration for 2021 and 2022. Monitoring sites have only been included if they have an annual average for at least one of the two years, therefore any sites installed after March 2022 are not included and will be in the next annual report. In the table 'DC' indicates that the data capture for that year was below 75% and blank indicates the sensor was not installed yet at that location.

For 2021 there were 26 sites and for 2022 there were 28 sites which had sufficient data available to calculate the annual average NO$_2$ concentration. For sites that have data from both years the percentage change is given.

The NO$_2$ concentrations reported in Table 2 have been colour coded according to bandings related to the WHO guideline and interim targets for annual average NO$_2$:

Annual Average NO$_2$ Concentration
<10 µgm^{-3} meeting WHO Guideline
10- 20 µgm^{-3} meeting WHO interim target 3
20- 30 µgm^{-3} meeting WHO interim target 2
30- 40 µgm^{-3} meeting the UK legal objective
>40 µgm^{-3} exceeding UK legal objective

Table 2 shows that at the majority of sites (16 sites) with data for both years, the annual average NO$_2$ concentration reduced between 2021 and 2022 but increased at a further nine

sites. The largest reduction in NO$_2$ concentrations over the two years was seen in Greenwich at the A2 Falconwood reference co-location site which recorded a reduction of 6.9 µgm^{-3} in NO$_2$ (a 20% reduction). The largest increase in NO$_2$ was observed at the North Kensington co-location site, which increased by 2.1 µgm^{-3} or 11%.

Table 2 Annual average NO$_2$ concentrations [µgm^{-3}] for 2021 and 2022

Site name	Site type	Borough	Location type	2021 [µgm^{-3}]	2022 [µgm^{-3}]	% Change 2021-2022
Barking Food Forest	Urban Background	Barking and Dagenham	NA	-	22.9	-
Goresbrook School, Dagenham	Urban Background	Barking and Dagenham	School	DC	27.3	-
Heathway – Station Parade	Roadside	Barking and Dagenham	NA	-	32.6	-
High Road (Sainsbury's)	Roadside	Barking and Dagenham	NA	-	33.9	-
Wood Lane (Morrisons)	Roadside	Barking and Dagenham	NA	-	29.0	-
Cat Hill Allotments	Roadside	Barnet	NA	DC	26.8	-
Martin Primary School-Playground	Urban Background	Barnet	School	DC	30.4	-
The Orion Primary School		Barnet	School	DC	25.7	-
Wessex Gardens Primary School	Urban Background	Barnet	School	DC	29.3	-
Brampton Primary Academy – Bexley	Urban Background	Bexley	School	DC	24.8	-
Cray Road Allotments	Urban Background	Bexley	NA	DC	19.7	-
Peareswood Primary School – Bexley	Roadside	Bexley	School	DC	29.0	-
Slade Green (reference co-location)	Urban Background	Bexley	Co-Location	18.1	17.2	-5.1%
A406 Hanger Lane by Waverley Gardens	Urban Background	Brent	NA	DC	32.6	-
Brent Ikea (reference co-location)	Roadside	Brent	Co-Location	46.4	42.1	-9.2%
Carlton Vale Road, Kilburn Park School	Roadside	Brent	NA	DC	37.4	-
Harlesden High Street	Roadside	Brent	NA	-	40.6	-
Wembley High Road, Cafe Quarter	Roadside	Brent	NA	DC	30.6	-

Site name	Site type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021-2022
Poverest Allotments	Urban Background	Bromley	NA	DC	23.8	-
Princess Royal Hospital	Roadside	Bromley	Hospital	DC	22.2	-
Ampthill Square Estate	Roadside	Camden	NA	DC	25.0	-
Christopher Hatton Primary School		Camden	School	DC	32.3	-
Gospel Oak Primary School		Camden	School	DC	25.8	-
Great Ormond Street Hospital	Roadside	Camden	Hospital	24.5	24.5	-0.2%
Royal Free Hospital	Roadside	Camden	Hospital	24.1	23.5	-2.7%
Byward Street / Great Tower Street	Roadside	City of London	NA	DC	27.5	-
Middlesex Street Estate	Urban Background	City of London	NA	DC	21.3	-
Biddulph Road	Roadside	Croydon	NA	DC	28.5	-
Cromwell Road - Selhurst	Roadside	Croydon	NA	DC	29.1	-
Croydon – Whitehall Lane	Roadside	Croydon	NA	DC	33.4	-
Croydon University Hospital	Roadside	Croydon	Hospital	DC	33.5	-
Dennett Road-Broad Green	Roadside	Croydon	NA	DC	26.5	-
Dingwall Road	Roadside	Croydon	NA	DC	23.9	-
Havelock Road - Addiscombe	Roadside	Croydon	NA	DC	26.8	-
Midhurst Road - Broad Green	Roadside	Croydon	NA	DC	23.2	-
Mint Walk	Roadside	Croydon	NA	DC	28.3	-
Montague Road – Broad Green	Roadside	Croydon	NA	DC	27.5	-
Napier Road	Roadside	Croydon	NA	DC	28.3	-
Sydenham Road - Selhurst	Roadside	Croydon	NA	DC	40.5	-
A40 Western Avenue / Old Oak Common Lane	Roadside	Ealing	NA	DC	35.4	-
Ark Byron Primary Academy		Ealing	School	DC	34.5	-
Billets Hart Allotments	Urban Background	Ealing	NA	DC	22.9	-
Featherstone Primary School	Roadside	Ealing	School	DC	25.0	-

Site name	Site type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021-2022
Rumi Mosque, Enfield	Urban Background	Enfield	NA	DC	31.3	-
A2 Falconwood (reference co-location)	Roadside	Greenwich	Co-Location	34.6	27.8	-19.8%
Beresford Square, Woolwich, London SE18 6AY	Urban Background	Greenwich	NA	DC	26.8	-
Burrage Grove (reference co-location)	Urban Background	Greenwich	Co-Location	26.2	25.5	-2.8%
Ceres Road, j/w Bannockburn Road – Bannockburn Primary School	Roadside	Greenwich	School	DC	24.9	-
Eltham (reference co-location)	Urban Background	Greenwich	Co-Location	15.3	DC	-
Greenwich University -Student Union, Avery Hill Campus	Roadside	Greenwich	NA	DC	23.0	-
Haimo Primary School		Greenwich	School	DC	26.4	-
Horn Link Way j/w Peartree Way	Roadside	Greenwich	NA	DC	27.4	-
John Harrison Way (reference co-location)	Roadside	Greenwich	Co-Location	23.2	23.4	0.8%
John Wilson Street, Woolwich, adjacent to St Mary Magdalene C of E School	Roadside	Greenwich	School	DC	25.2	-
Royal Hill, London, SE10 8RZ, adjacent to James Wolfe Primary School	Roadside	Greenwich	School	DC	24.0	-
St Mary Magdalene CE School		Greenwich	School	DC	25.9	-
Westhorne Avenue (reference co-location)	Urban Background	Greenwich	Co-Location	24.9	23.1	-7.4%
Amhurst Road, Hackney	Roadside	Hackney	NA	DC	28.0	-
William Patten Primary School		Hackney	School	DC	27.5	-
313-321 North End Road -H&F	Roadside	Hammersmith and Fulham	NA	DC	34.8	-

Site name	Site type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021-2022
366 North End Road – H&F	Roadside	Hammersmith and Fulham	NA	DC	30.4	-
Charing Cross Hospital	Urban Background	Hammersmith and Fulham	Hospital	21.1	21.0	-0.4%
Melcombe Primary School		Hammersmith and Fulham	School	DC	33.4	-
North Middlesex University Hospital	Roadside	Haringey	Hospital	26.4	24.9	-5.8%
Shelbourne Road	Roadside	Haringey	NA	-	30.3	-
Tottenham Hale – Haringey	Roadside	Haringey	NA	DC	33.2	-
High Street Wealdstone	Roadside	Harrow	NA	-	42.5	-
St Jerome Bilingual School, Station Road	Roadside	Harrow	School	DC	28.0	-
Bedfords Park Walled Garden	Urban Background	Havering	NA	DC	23.2	-
Cotleigh Road – Havering	Roadside	Havering	NA	DC	24.4	-
Fontain Avenue - Havering	Roadside	Havering	NA	DC	22.7	-
Rainham (reference co-location)	Roadside	Havering	Co-Location	21.7	23.2	6.8%
Scotts Primary School		Havering	School	DC	32.8	-
Harlington High Street, Hillingdon	Roadside	Hillingdon	NA	DC	26.7	-
Tavistock Road, Hillingdon	Roadside	Hillingdon	NA	DC	23.1	-
Gillette Corner – Hounslow	Roadside	Hounslow	NA	DC	35.0	-
Hogarth Roundabout – Great West Road Chiswick	Roadside	Hounslow	NA	DC	32.9	-
William Hogarth School		Hounslow	School	DC	35.4	-
Prior Weston Primary School		Islington	School	DC	29.2	-
St John's Upper Holloway CE Primary School		Islington	School	DC	30.8	-
Whitehall Park School	Roadside	Islington	School	DC	27.6	-
Al Maanar, Acklam Road – Kensington	Roadside	Kensington and Chelsea	NA	DC	22.6	-

Site name	Site type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021-2022
Holy Trinity Church of England Primary School	Urban Background	Kensington and Chelsea	School	DC	27.8	-
Kensington High Street	Roadside	Kensington and Chelsea	NA	DC	26.9	-
North Kensington (reference co-location)	Urban Background	Kensington and Chelsea	Co-Location	18.9	21.0	11.1%
Royal Marsden Hospital	Roadside	Kensington and Chelsea	Hospital	30.3	30.7	1.4%
Sloane Street	Roadside	Kensington and Chelsea	NA	DC	35.9	-
South Kensington Underground Station	Roadside	Kensington and Chelsea	NA	DC	32.3	-
St Mary Abbots Primary School		Kensington and Chelsea	School	DC	32.7	-
Bandon Hill Primary and Sherwood Hill – Kingston	Roadside	Kingston upon Thames	School	DC	29.5	-
Carshalton Boys Sports College – North	Roadside	Kingston upon Thames	School	DC	25.6	-
Carshalton Boys Sports College – South	Roadside	Kingston upon Thames	School	DC	27.6	-
Cheam Fields Primary	Roadside	Kingston upon Thames	School	DC	28.6	-
Christ Church Surbiton C of E Primary School	Roadside	Kingston upon Thames	School	DC	26.6	-
Kingston Hospital, Kingston	Roadside	Kingston upon Thames	Hospital	DC	27.2	-
Latchmere & St Agatha's Schools – North	Roadside	Kingston upon Thames	School	DC	28.2	-
Latchmere & St Agatha's Schools - East	Roadside	Kingston upon Thames	School	DC	26.1	-
Lovelace Primary School	Roadside	Kingston upon Thames	School	DC	26.9	-
Malden & Coombe Horticultural Society	Urban Background	Kingston upon Thames	NA	DC	33.4	-
Robin Hood Juniors – Kingston	Roadside	Kingston upon Thames	School	DC	34.0	-
St John's C of E Primary school	Roadside	Kingston upon Thames	School	DC	25.2	-

Site name	Site type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021-2022
St Matthew's Primary school	Roadside	Kingston upon Thames	School	DC	31.2	-
St Annes RC Primary School		Lambeth	School	DC	32.0	-
St Thomas' Hospital	Urban Background	Lambeth	Hospital	21.9	21.3	-2.5%
Stockwell Primary		Lambeth	School	DC	32.7	-
Sunnyhill Primary School	Urban Background	Lambeth	School	-	24.2	-
Broadway Theatre Lewisham		Lewisham	NA	DC	20.0	-
Honor Oak Park – Solar (reference co-location)	Urban Background	Lewisham	Co-Location	17.9	16.3	-8.8%
Honor Oak Park Mains (reference co-location)	Urban Background	Lewisham	Co-Location	DC	16.2	-
New Cross (reference co-location)	Urban Background	Lewisham	Co-Location	DC	27.1	-
South Circular – Junction with Well Meadow Road	Roadside	Lewisham	NA	DC	26.0	-
South Circular opposite Bowness Road	Roadside	Lewisham	NA	DC	28.9	-
St James Hatcham C of E School		Lewisham	School	DC	26.5	-
19th Wimbledon Scout Group	Urban Background	Merton	NA	DC	22.2	-
All Saints	Urban Background	Merton	School	DC	25.3	-
Beddington Ln	Roadside	Merton	NA	DC	26.6	-
Belvedere Avenue	Roadside	Merton	NA	DC	24.0	-
Benedict Road	Roadside	Merton	NA	DC	27.3	-
Bishopsford Rd	Roadside	Merton	NA	DC	28.2	-
Botsford Rd/Whatley Avenue	Roadside	Merton	NA	DC	23.9	-
Burlington Rd	Roadside	Merton	NA	DC	28.1	-
Burlington Rd	Roadside	Merton	NA	DC	37.8	-
Burlington Road/Belmont Avenue	Roadside	Merton	NA	DC	29.5	-
Bushey Rd	Roadside	Merton	NA	-	26.7	-
Cambridge Rd	Roadside	Merton	NA	DC	26.7	-

Site name	Site type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021-2022
Carshalton Rd	Roadside	Merton	NA	DC	32.6	-
Chilmark Rd	Roadside	Merton	NA	DC	30.3	-
Church Rd	Roadside	Merton	NA	DC	25.4	-
Church Rd	Roadside	Merton	NA	DC	27.1	-
Colliers Wood, 80-82 High Street, London SW19 2BY	Roadside	Merton	NA	DC	36.7	-
Commonside E	Roadside	Merton	NA	DC	27.8	-
Coombe Ln	Roadside	Merton	NA	DC	25.5	-
Croydon Rd	Roadside	Merton	NA	DC	26.9	-
Deburgh Road	Roadside	Merton	NA	DC	26.0	-
Durnsford Rd	Roadside	Merton	NA	DC	29.3	-
Eagle House School	Roadside	Merton	School	DC	38.2	-
Eastfields Rd	Roadside	Merton	NA	DC	31.7	-
Effra Rd	Roadside	Merton	NA	DC	23.5	-
Elm Rd West	Roadside	Merton	NA	DC	29.4	-
Endeavour Way	Roadside	Merton	NA	DC	27.8	-
Furness Rd	Roadside	Merton	NA	DC	29.5	-
Garfield Rd	Roadside	Merton	NA	DC	30.4	-
Grand Drive	Roadside	Merton	NA	DC	28.8	-
Green Ln North	Roadside	Merton	NA	DC	32.9	-
Green Ln South	Roadside	Merton	NA	DC	28.9	-
Havana Rd	Roadside	Merton	NA	DC	31.0	-
Haydons Rd	Roadside	Merton	NA	DC	32.6	-
Kingston Rd	Roadside	Merton	NA	DC	33.7	-
Lake Rd	Roadside	Merton	NA	DC	24.4	-
London Rd	Roadside	Merton	NA	DC	38.0	-
London Rd	Roadside	Merton	NA	DC	38.4	-
London Rd/Merton Civic	Roadside	Merton	NA	DC	25.8	-
Malmesbury Rd	Roadside	Merton	NA	DC	26.6	-
Martin Way-B286	Roadside	Merton	NA	DC	29.7	-
Merton Rd	Roadside	Merton	NA	DC	35.2	-
Middleton Rd	Roadside	Merton	NA	DC	27.9	-
Morden Primary School	Roadside	Merton	School	DC	29.7	-
Park Community School	Roadside	Merton	School	DC	43.0	-
Parkside	Roadside	Merton	NA	DC	28.0	-
Plough Ln	Roadside	Merton	NA	DC	30.7	-
Plough Ln	Roadside	Merton	NA	DC	31.6	-
Recreation Way	Roadside	Merton	NA	DC	32.3	-
Rowan Rd	Roadside	Merton	NA	DC	32.0	-

Site name	Site type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021-2022
Sandy Ln	Roadside	Merton	NA	DC	27.0	-
Seely Rd	Roadside	Merton	NA	DC	24.6	-
South Gardens	Roadside	Merton	NA	DC	26.4	-
Southey Rd	Roadside	Merton	NA	DC	27.6	-
Spencer Rd	Roadside	Merton	NA	DC	29.3	-
St Marks Rd	Roadside	Merton	NA	DC	25.8	-
St Marys Primary School Russell Rd – Merton	Roadside	Merton	School	DC	29.8	-
St Mary's Road	Roadside	Merton	NA	DC	27.9	-
St Peter St Paul P/S	Roadside	Merton	School	DC	30.7	-
Streatham Road/Links Rd	Roadside	Merton	NA	-	33.4	-
The Broadway	Roadside	Merton	NA	DC	31.2	-
Tudor Drive	Roadside	Merton	NA	DC	33.2	-
Waterfall Rd	Roadside	Merton	NA	DC	31.1	-
Wates Way	Roadside	Merton	NA	DC	33.1	-
Weir Rd	Roadside	Merton	NA	DC	27.8	-
Wimbledon High School	Roadside	Merton	School	DC	27.7	-
Wimbledon High St	Roadside	Merton	NA	DC	33.3	-
Woodside	Roadside	Merton	NA	DC	25.2	-
Woodside/Worcester Rd	Roadside	Merton	NA	DC	25.3	-
Alma Street	Urban Background	Newham	NA	DC	18.4	-
Newham University Hospital	Urban Background	Newham	Hospital	22.7	22.4	-1.5%
Silvertown Tunnel access corridor – Silvertown Way	Roadside	Newham	NA	DC	28.2	-

Site name	Site type	Borough	Location type	2021 [μgm^{-3}]	2022 [μgm^{-3}]	% Change 2021-2022
Elmhurst Gardens	Urban Background	Redbridge	NA	-	22.2	-
Ley Street (reference co-location)	Urban Background	Redbridge	Co-Location	22.2	20.9	-5.7%
Oakdale Junior School		Redbridge	School	DC	29.0	-
Redbridge Ley Street BLEN	Roadside	Redbridge	NA	DC	28.2	-
Redbridge-Gants Hill	Roadside	Redbridge	NA	DC	31.0	-
Redbridge-South Woodford	Roadside	Redbridge	NA	DC	24.1	-
A316, Chertsey Court, Clifford Ave, nr Chertsey Corner, SW14 8AD	Roadside	Richmond upon Thames	NA	DC	31.3	-
Broad St, Teddington, nr Tescos + j/w Queens Rd TW11	Roadside	Richmond upon Thames	NA	DC	35.5	-
Burtons Road, Hampton Hill, west of j/w Albert Road, on railway bridge	Roadside	Richmond upon Thames	NA	DC	29.2	-
Burtons Road, (north side – relocated) Hampton Hill, nr j/w High St	Roadside	Richmond upon Thames	NA	DC	25.9	-
Church Rd A311	Roadside	Richmond upon Thames	NA	DC	29.8	-
Deer Park Schl/Lidl, Richmond Rd, opp j/w Morley Rd, E Twickenham	Roadside	Richmond upon Thames	School	DC	29.0	-
East Sheen Primary School		Richmond upon Thames	School	DC	22.8	-
George Street, Richmond	Roadside	Richmond upon Thames	NA	DC	27.1	-
Hampton Court Rd	Roadside	Richmond upon Thames	NA	DC	30.4	-
Hampton Ct Rd west bounds	Roadside	Richmond upon Thames	NA	DC	27.5	-

Site name	Site type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021-2022
High St Teddington, nr Post Office and M&S	Roadside	Richmond upon Thames	NA	DC	31.8	-
High St, Barnes, nr j/w St Anns Rd, SW13	Roadside	Richmond upon Thames	NA	DC	26.6	-
High St, Hampton Hill, opposite j/w Windmill Rd.	Roadside	Richmond upon Thames	NA	DC	34.9	-
High St, Hampton Wick	Roadside	Richmond upon Thames	NA	DC	31.0	-
High St, Mortlake, opp j/w Vineyard Path, SW14	Roadside	Richmond upon Thames	NA	DC	29.4	-
High St, Whitton	Roadside	Richmond upon Thames	NA	DC	33.8	-
Hospital Brg Rd, north of Montrose Ave, Turing House School development	Roadside	Richmond upon Thames	NA	DC	29.1	-
Kew Rd, before j/w South Circ/ Kew Green	Roadside	Richmond upon Thames	NA	DC	33.7	-
Kew Rd, nr entrance to Kew Gardens, (opp j/w The Avenue)	Roadside	Richmond upon Thames	NA	DC	31.0	-
Kew Rd, Richmond, nr taxi rank/opposite Richmond station	Roadside	Richmond upon Thames	NA	DC	37.8	-
King St, Twickenham	Roadside	Richmond upon Thames	NA	DC	28.1	-
Lwr Rich Rd, Chertsy Corner, nr j/w houses, opp cnr of Chtsy Ct, VS nr Kingsway,	Roadside	Richmond upon Thames	NA	DC	31.6	-
Manor Rd, west bound	Roadside	Richmond upon Thames	NA	DC	29.0	-
Paradise Rd, Richmond	Roadside	Richmond upon Thames	NA	DC	30.3	-
Park Rd, Hampton Hill, nr j/w High St, TW11,	Roadside	Richmond upon Thames	NA	DC	36.7	-
Petersham Rd, opp Russell School, TW10	Roadside	Richmond upon Thames	NA	DC	29.6	-

Site name	Site type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021-2022
Queens School, Cumberland Rd,	Roadside	Richmond upon Thames	School	DC	25.7	-
RFU Stadium, Whitton Rd j/w A316	Roadside	Richmond upon Thames	NA	DC	32.7	-
Richmond Pk, Richmond Gate, top of Star and Garter Hill	Roadside	Richmond upon Thames	NA	DC	29.8	-
Richmond upon Thames Schl + Richmond College, Egerton Rd, Twickenham	Roadside	Richmond upon Thames	School	DC	26.2	-
Rocks Lane, opp houses, SW13	Roadside	Richmond upon Thames	NA	DC	38.6	-
Shackleton Lane, Fulwell	Roadside	Richmond upon Thames	NA	DC	29.7	-
Sheen Lane, south of j/w Vernon Rd, nr zebra crossing, SW14	Roadside	Richmond upon Thames	NA	DC	30.9	-
South Rd, outside Lidl, nr j/w Wellington/Hampton Rd TW2	Roadside	Richmond upon Thames	NA	DC	30.4	-
St John the Baptiste Primary Sch, Lwr Teddington Rd KT1 4HQ (between Seymour Rd and Broom Pk)	Roadside	Richmond upon Thames	School	DC	29.2	-
St Margaret's Road, Twickenham	Roadside	Richmond upon Thames	NA	DC	25.7	-
St Margarets Rd, opposite St Margarets station, TW1	Roadside	Richmond upon Thames	NA	DC	31.9	-
St Richard Reynolds College, Clifden Rd, north of j/w Copthall Gdns TW1	Roadside	Richmond upon Thames	NA	DC	28.5	-
Staines Rd, Twickenham jct	Roadside	Richmond upon Thames	NA	DC	26.8	-
Stanley Juniors Sch, Strathmore Rd, Teddington TW11 8UH	Roadside	Richmond upon Thames	School	DC	28.2	-
Station Rd Hampton	Roadside	Richmond upon Thames	NA	DC	25.3	-

Site name	Site type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021-2022
Strawberry Vale, Teddington	Roadside	Richmond upon Thames	NA	DC	27.8	-
Teddington High St	Roadside	Richmond upon Thames	NA	DC	25.6	-
Twickenham Academy	Roadside	Richmond upon Thames	NA	DC	27.0	-
Twickenham railway bridge, London Rd, Twickenham	Roadside	Richmond upon Thames	NA	DC	26.4	-
Upper Richmond Road West	Roadside	Richmond upon Thames	NA	DC	38.6	-
Winchester Rd, St Stephens Primary School	Roadside	Richmond upon Thames	School	DC	27.2	-
Charlotte Sharman Primary School	Urban Background	Southwark	School	DC	25.2	-
Elephant & Castle (reference co-location)	Urban Background	Southwark	Co-Location	22.8	21.2	0.0%
Guy's Hospital	Roadside	Southwark	Hospital	DC	26.2	-
London Wildlife Trust Centre For Wildlife Gardening	Urban Background	Southwark	NA	DC	22.3	-
Oliver Goldsmith Primary School		Southwark	School	DC	26.4	-
SWK-BL1: Croxted Road / Guernsey Grove	Roadside	Southwark	NA	DC	26.3	-
SWK-BL2: Croxted Road/Dalkeith Road	Roadside	Southwark	NA	DC	27.3	-
Tower Bridge Primary School	Roadside	Southwark	School	DC	33.6	-
All Saints Carshalton C of E Primary School	Roadside	Sutton	School	DC	32.5	-
Beddington Lane North (reference co-location)	Roadside	Sutton	Co-Location	20.1	22.1	10.0%
Cheam Common Junior Academy	Roadside	Sutton	School	DC	29.8	-
Cheam Park Farm Primary Academy	Roadside	Sutton	School	DC	27.8	-
Harris Academy Carshalton	Roadside	Sutton	School	DC	40.8	-
Muschamp Primary School	Roadside	Sutton	School	DC	24.8	-

Site name	Site type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021-2022
Royal Marsden, Sutton	Roadside	Sutton	Hospital	DC	23.5	-
St Elpheges Infants and Juniors	Roadside	Sutton	School	DC	27.7	-
St Philomena's/St Mary's	Roadside	Sutton	School	DC	28.9	-
St. Helier's Hospital, Sutton	Roadside	Sutton	Hospital	DC	26.7	-
Alice Model Nursery School		Tower Hamlets	School	DC	31.3	-
Blackwall Tunnel Approach (reference co-location)	Roadside	Tower Hamlets	Co-Location	37.3	39.3	5.3%
Bonner Primary School		Tower Hamlets	School	DC	29.3	-
Chrisp Street Market – Tower Hamlets	Roadside	Tower Hamlets	NA	DC	24.3	-
Marner Primary School		Tower Hamlets	School	DC	29.3	-
Meath Gardens Children's Centre		Tower Hamlets	NA	DC	25.6	-
Oaklands Secondary School		Tower Hamlets	School	DC	29.3	-
Rachel Keeling Nursery	Urban Background	Tower Hamlets	School	DC	30.0	-
Royal London University Hospital	Urban Background	Tower Hamlets	Hospital	22.7	21.7	-4.5%
Blackhorse Lane & Forest -Waltham Forest	Urban Background	Waltham Forest	NA	DC	27.0	-
Church Lane - Waltham Forest	Roadside	Waltham Forest	NA	DC	28.6	-
Whipps Cross Hospital	Urban Background	Waltham Forest	Hospital	21.2	21.1	-0.5%
Whipps Cross/ A12 Cambridge Park Road	Roadside	Waltham Forest	NA	DC	32.1	-
Bedford Hill – Wandsworth	Roadside	Wandsworth	NA	DC	30.0	-
Chesterton Primary School	Urban Background	Wandsworth	School	DC	23.6	-
Griffin School – Wandsworth	Roadside	Wandsworth	School	DC	23.8	-
St Annes C of E Primary School		Wandsworth	School	DC	31.8	-
Boston Place	Roadside	Westminster	NA	DC	25.8	-

Site name	Site type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021-2022
Enford Street	Roadside	Westminster	NA	-	26.6	-
Hallfield Estate	Roadside	Westminster	NA	DC	33.4	-
Horseferry Road (reference co-location)	Urban Background	Westminster	Co-Location	20.9	22.2	6.1%
Marylebone Road – Mains (reference co-location)	Kerbside	Westminster	Co-Location	41.8	42.7	2.2%
Marylebone Road – Solar (reference co-location)	Kerbside	Westminster	Co-Location	41.8	42.6	1.8%
Marylebone Road / Baker Street	Roadside	Westminster	NA	DC	36.2	-
Piccadilly Circus	Urban Background	Westminster	NA	DC	25.5	-
Rossmore Road	Roadside	Westminster	NA	-	28.8	-
St Clement Danes CE School	Urban Background	Westminster	School	DC	27.6	-
St Stephen's CE Primary School	Roadside	Westminster	School	-	26.6	-
Strand/Wellington Street	Roadside	Westminster	NA	DC	27.3	-

Particulate Matter (PM₂.₅)

Table 3 summarises the number of monitoring sites within concentration bands relating to the WHO guideline, interim targets, and legal objective for PM₂.₅ for 2021 and 2022. For 2021 there were 26 sites and for 2022 there were 284 sites which had sufficient data available to calculate the annual average PM₂.₅ concentration. It is important to note that the number of sites increased from 26 in 2021 to 285 in 2022. This is reflected in the increased percentage of sites at various concentration levels in table 1. This increase does not reflect an increase or decrease in concentrations at original (2021) sites but reflects the increase in sites seen in 2022. In 2021 annual average concentrations ranged from 7 μgm⁻³ to 17 μgm⁻³ and in 2022 concentrations ranged from 7 μgm⁻³ to 16 μgm⁻³.

Table 3 Summary of PM$_{2.5}$ annual averages

Annual average concentration	Number of sites 2021	Percentage of sites 2021	Number of sites 2022	Percentage of sites 2022
<5 µgm^{-3} meeting WHO Guideline	0	0%	0	0%
5- 10 µgm^{-3} meeting legal objective & WHO interim target	11	42%	89	31%
10- 15 µgm^{-3}	14	54%	194	69%
>15 µgm^{-3}	1	4%	1	0%
Total number of sites	26	-	284	-

Table 3 shows that all sites exceeded the WHO annual average guideline for PM$_{2.5}$ for both years. Almost half of the sites met the WHO interim target and legal objective of 10 µgm^{-3} in 2021, though this figure reduced to a third as more sites were added to the network in 2022. The majority of sites measured between 10 and 15 µgm^{-3} for both years. One site in each year measured an average over 15 µgm^{-3}, this was the Brent Ikea co-location site in 2021 which averaged 16.9 µgm^{-3} for the year and Mint Walk in Croydon at 16.2 µgm^{-3} in 2022. The Brent Ikea site has since reduced by 23% to 13.1 µgm^{-3} in 2022.

Table 4 gives the full site list and the annual average PM$_{2.5}$ concentration for 2021 and 2022. As with NO$_2$, monitoring sites have only been included if they have an annual average for at least one of the two years, therefore any sites installed after March 2022 are not included and will be in the next annual report. DC indicates that the data capture for that year was below 75% and blank indicates the sensor was not installed yet at that location. For sites that have data from both years the percentage change is given.

The results have been colour coded according to the WHO guideline and interim targets:

Annual average concentration
<5 µgm^{-3} meeting WHO Guideline
5- 10 µgm^{-3} meeting UK legal objective[3]
10- 15 µgm^{-3} exceeding UK legal objective
>15 µgm^{-3}

The results in **Table 4** show that of the 25 sites with sufficient data to provide an annual average for both 2021 and 2022, 21 sites measured a reduction in PM$_{2.5}$ concentrations and 4 sites measured an increase. The largest reduction was seen at Blackwall Tunnel Approach reference co-location site which reduced by 33% from 14.6 µgm^{-3} to 9.8 µgm^{-3}. The sites which

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[3] The UK legal objective for PM$_{2.5}$ is an annual average concentration of 10 µgm^{-3}, to be met by 2040. London has committed to meeting this objective a decade earlier, by 2030.

had increases in concentration changed by a much smaller amount than the changes at the sites that saw reductions. The largest increase was recorded at North Kensington reference co-location site which increased by 5.9%, however this was only a small increase in actual terms from 8.8 µgm^{-3} to 9.3 µgm^{-3}. The other sites that saw increases in PM$_{2.5}$ concentration included one site with an increase of 4.2% and with 2 sites only increasing by less than 1%.

Table 4 Annual average PM$_{2.5}$ concentrations [µgm^{-3}] for 2021 and 2022

Site name	Site Type	Borough	Location type	2021 [µgm^{-3}]	2022 [µgm^{-3}]	% Change 2021 - 2022
Barking Food Forest	Urban Background	Barking and Dagenham	NA	-	8.5	-
Goresbrook School, Dagenham	Urban Background	Barking and Dagenham	School	DC	10.1	-
Heathway – Station Parade	Roadside	Barking and Dagenham	NA	-	12.3	-
High Road (Sainsbury's)	Roadside	Barking and Dagenham	NA	-	11.5	-
Wood Lane (Morrisons)	Roadside	Barking and Dagenham	NA	-	11.5	-
Cat Hill Allotments	Roadside	Barnet	NA	DC	10.9	-
Martin Primary School-Playground	Urban Background	Barnet	School	DC	8.5	-
The Orion Primary School		Barnet	School	DC	10.2	-
Wessex Gardens Primary School	Urban Background	Barnet	School	DC	9.1	-
Brampton Primary Academy – Bexley	Urban Background	Bexley	School	DC	8.4	-
Cray Road Allotments	Urban Background	Bexley	NA	DC	8.6	-
Peareswood Primary School – Bexley	Roadside	Bexley	School	DC	11.8	-
Slade Green (reference co-location)	Urban Background	Bexley	Co-Location	9.3	9.3	-0.3%
A406 Hanger Lane by Waverley Gardens	Urban Background	Brent	NA	DC	9.5	-
Brent Ikea (reference co-location)	Roadside	Brent	Co-Location	16.9	13.1	-23.0%
Carlton Vale Road, Kilburn Park School	Roadside	Brent	NA	DC	10.8	-
Harlesden High Street	Roadside	Brent	NA	-	9.2	-
Wembley High Road, Cafe Quarter	Roadside	Brent	NA	DC	12.1	-

Site name	Site Type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021 - 2022
Poverest Allotments	Urban Background	Bromley	NA	DC	8.2	-
Princess Royal Hospital	Roadside	Bromley	Hospital	DC	10.0	-
Ampthill Square Estate	Roadside	Camden	NA	DC	10.9	-
Christopher Hatton Primary School		Camden	School	DC	9.1	-
Gospel Oak Primary School		Camden	School	DC	10.3	-
Great Ormond Street Hospital	Roadside	Camden	Hospital	9.4	8.9	-5.0%
Royal Free Hospital	Roadside	Camden	Hospital	10.6	9.6	-9.8%
Byward Street / Great Tower Street	Roadside	City of London	NA	DC	10.0	-
Middlesex Street Estate	Urban Background	City of London	NA	DC	8.8	-
Biddulph Road	Roadside	Croydon	NA	DC	12.2	-
Cromwell Road - Selhurst	Roadside	Croydon	NA	DC	13.2	-
Croydon – Whitehall Lane	Roadside	Croydon	NA	DC	11.7	-
Croydon University Hospital	Roadside	Croydon	Hospital	DC	10.1	-
Dennett Road-Broad Green	Roadside	Croydon	NA	DC	12.1	-
Dingwall Road	Roadside	Croydon	NA	DC	12.5	-
Havelock Road - Addiscombe	Roadside	Croydon	NA	DC	12.0	-
Midhurst Road - Broad Green	Roadside	Croydon	NA	DC	12.0	-
Mint Walk	Roadside	Croydon	NA	DC	16.2	-
Montague Road – Broad Green	Roadside	Croydon	NA	DC	11.3	-
Napier Road	Roadside	Croydon	NA	DC	12.7	-
Sydenham Road - Selhurst	Roadside	Croydon	NA	DC	12.6	-
A40 Western Avenue / Old Oak Common Lane	Roadside	Ealing	NA	DC	9.7	-
Ark Byron Primary Academy		Ealing	School	DC	10.3	-
Billets Hart Allotments	Urban Background	Ealing	NA	DC	10.1	-
Featherstone Primary School	Roadside	Ealing	School	DC	11.5	-

Site name	Site Type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021 - 2022
Rumi Mosque, Enfield	Urban Background	Enfield	NA	DC	10.8	-
A2 Falconwood (reference co-location)	Roadside	Greenwich	Co-Location	11.2	10.3	-7.4%
Beresford Square, Woolwich, London SE18 6AY	Urban Background	Greenwich	NA	DC	8.6	-
Burrage Grove (reference co-location)	Urban Background	Greenwich	Co-Location	10.8	10.9	0.4%
Ceres Road, j/w Bannockburn Road – Bannockburn Primary School	Roadside	Greenwich	School	DC	9.7	-
Eltham (reference co-location)	Urban Background	Greenwich	Co-Location	10.1	DC	-
Haimo Primary School		Greenwich	School	DC	9.4	-
Horn Link Way j/w Peartree Way	Roadside	Greenwich	NA	DC	10.9	-
John Harrison Way (reference co-location)	Roadside	Greenwich	Co-Location	12.2	11.3	-7.9%
John Wilson Street, Woolwich, adjacent to St Mary Magdalene C of E School	Roadside	Greenwich	School	DC	9.5	-
Royal Hill, London, SE10 8RZ, adjacent to James Wolfe Primary School	Roadside	Greenwich	School	DC	9.7	-
St Mary Magdalene CE School		Greenwich	School	DC	9.7	-
Westhorne Avenue (reference co-location)	Urban Background	Greenwich	Co-Location	9.3	8.6	-7.0%
Amhurst Road, Hackney	Roadside	Hackney	NA	DC	12.3	-
William Patten Primary School		Hackney	School	DC	9.8	-
313-321 North End Road -H&F	Roadside	Hammersmith and Fulham	NA	DC	11.0	-
366 North End Road – H&F	Roadside	Hammersmith and Fulham	NA	DC	11.2	-

Site name	Site Type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021 - 2022
Charing Cross Hospital	Urban Background	Hammersmith and Fulham	Hospital	7.5	6.8	-8.8%
Melcombe Primary School		Hammersmith and Fulham	School	DC	8.9	-
North Middlesex University Hospital	Roadside	Haringey	Hospital	10.3	10.7	4.2%
Shelbourne Road	Roadside	Haringey	NA	-	9.9	-
Tottenham Hale – Haringey	Roadside	Haringey	NA	DC	9.1	-
High Street Wealdstone	Roadside	Harrow	NA	-	12.7	-
St Jerome Bilingual School, Station Road	Roadside	Harrow	School	DC	12.5	-
Bedfords Park Walled Garden	Urban Background	Havering	NA	DC	10.4	-
Cotleigh Road – Havering	Roadside	Havering	NA	DC	12.1	-
Fontain Avenue - Havering	Roadside	Havering	NA	DC	9.8	-
Rainham (reference co-location)	Roadside	Havering	Co-Location	11.1	10.8	-2.8%
Scotts Primary School		Havering	School	DC	10.9	-
Harlington High Street, Hillingdon	Roadside	Hillingdon	NA	DC	10.5	-
Tavistock Road, Hillingdon	Roadside	Hillingdon	NA	DC	10.6	-
Gillette Corner – Hounslow	Roadside	Hounslow	NA	DC	11.1	-
Hogarth Roundabout – Great West Road Chiswick	Roadside	Hounslow	NA	DC	9.8	-
William Hogarth School		Hounslow	School	DC	9.4	-
Prior Weston Primary School		Islington	School	DC	8.7	-
St John's Upper Holloway CE Primary School		Islington	School	DC	8.5	-
Whitehall Park School	Roadside	Islington	School	DC	11.0	-
Al Maanar, Acklam Road – Kensington	Roadside	Kensington and Chelsea	NA	DC	9.9	-

Site name	Site Type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021 - 2022
Holy Trinity Church of England Primary School	Urban Background	Kensington and Chelsea	School	DC	9.3	-
Kensington High Street	Roadside	Kensington and Chelsea	NA	DC	11.3	-
North Kensington (reference co-location)	Urban Background	Kensington and Chelsea	Co-Location	8.8	9.3	5.9%
Oxford Gardens Primary School		Kensington and Chelsea	School	DC	8.6	-
Royal Marsden Hospital	Roadside	Kensington and Chelsea	Hospital	10.6	9.7	-7.9%
Sloane Street	Roadside	Kensington and Chelsea	NA	DC	10.6	-
South Kensington Underground Station	Roadside	Kensington and Chelsea	NA	DC	10.0	-
St Mary Abbots Primary School		Kensington and Chelsea	School	DC	9.9	-
Bandon Hill Primary and Sherwood Hill – Kingston	Roadside	Kingston upon Thames	School	DC	11.7	-
Carshalton Boys Sports College – North	Roadside	Kingston upon Thames	School	DC	9.8	-
Carshalton Boys Sports College – South	Roadside	Kingston upon Thames	School	DC	10.8	-
Cheam Fields Primary	Roadside	Kingston upon Thames	School	DC	11.3	-
Christ Church Surbiton C of E Primary School	Roadside	Kingston upon Thames	School	DC	10.4	-
Kingston Hospital, Kingston	Roadside	Kingston upon Thames	Hospital	DC	11.1	-
Latchmere & St Agatha's Schools – North	Roadside	Kingston upon Thames	School	DC	10.4	-
Latchmere & St Agatha's Schools - East	Roadside	Kingston upon Thames	School	DC	10.1	-
Lovelace Primary School	Roadside	Kingston upon Thames	School	DC	9.5	-
Malden & Coombe Horticultural Society	Urban Background	Kingston upon Thames	NA	DC	8.6	-
Robin Hood Juniors – Kingston	Roadside	Kingston upon Thames	School	DC	10.1	-

Site name	Site Type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021 - 2022
St John's C of E Primary school	Roadside	Kingston upon Thames	School	DC	9.9	-
St Matthew's Primary school	Roadside	Kingston upon Thames	School	DC	10.5	-
St Annes RC Primary School		Lambeth	School	DC	8.5	-
St Thomas' Hospital	Urban Background	Lambeth	Hospital	8.5	7.8	-7.7%
Stockwell Primary		Lambeth	School	DC	9.2	-
Sunnyhill Primary School	Urban Background	Lambeth	School	-	8.4	-
Broadway Theatre Lewisham		Lewisham	NA	DC	7.5	-
Honor Oak Park – Solar (reference co-location)	Urban Background	Lewisham	Co-Location	9.1	8.1	-10.3%
Honor Oak Park Mains (reference co-location)	Urban Background	Lewisham	Co-Location	DC	8.1	-
New Cross (reference co-location)	Urban Background	Lewisham	Co-Location	DC	12.0	-
South Circular – Junction with Well Meadow Road	Roadside	Lewisham	NA	DC	13.0	-
South Circular opposite Bowness Road	Roadside	Lewisham	NA	DC	12.8	-
St James Hatcham C of E School		Lewisham	School	DC	8.6	-
19th Wimbledon Scout Group	Urban Background	Merton	NA	DC	8.4	-
All Saints	Urban Background	Merton	School	DC	8.8	-
Beddington Ln	Roadside	Merton	NA	DC	12.9	-
Belvedere Avenue	Roadside	Merton	NA	DC	11.3	-
Benedict Road	Roadside	Merton	NA	DC	12.4	-
Bishopsford Rd	Roadside	Merton	NA	DC	12.5	-
Botsford Rd/Whatley Avenue	Roadside	Merton	NA	DC	11.7	-
Burlington Rd	Roadside	Merton	NA	DC	12.8	-
Burlington Rd	Roadside	Merton	NA	DC	11.8	-
Burlington Road/Belmont Avenue	Roadside	Merton	NA	DC	11.9	-
Bushey Rd	Roadside	Merton	NA	-	11.5	-

Site name	Site Type	Borough	Location type	2021 [µgm^{-3}]	2022 [µgm^{-3}]	% Change 2021 - 2022
Cambridge Rd	Roadside	Merton	NA	DC	11.4	-
Carshalton Rd	Roadside	Merton	NA	DC	13.0	-
Chilmark Rd	Roadside	Merton	NA	DC	13.1	-
Church Rd	Roadside	Merton	NA	DC	12.8	-
Church Rd	Roadside	Merton	NA	DC	11.8	-
Colliers Wood, 80-82 High Street, London SW19 2BY	Roadside	Merton	NA	DC	11.0	-
Commonside E	Roadside	Merton	NA	DC	12.5	-
Coombe Ln	Roadside	Merton	NA	DC	12.0	-
Croydon Rd	Roadside	Merton	NA	DC	11.1	-
Deburgh Road	Roadside	Merton	NA	DC	11.5	-
Durnsford Rd	Roadside	Merton	NA	DC	12.2	-
Eagle House School	Roadside	Merton	School	DC	13.2	-
Eastfields Rd	Roadside	Merton	NA	DC	12.2	-
Effra Rd	Roadside	Merton	NA	DC	11.8	-
Elm Rd West	Roadside	Merton	NA	DC	12.1	-
Endeavour Way	Roadside	Merton	NA	DC	12.3	-
Furness Rd	Roadside	Merton	NA	DC	12.4	-
Garfield Rd	Roadside	Merton	NA	DC	12.3	-
Grand Drive	Roadside	Merton	NA	DC	12.6	-
Green Ln North	Roadside	Merton	NA	DC	13.5	-
Green Ln South	Roadside	Merton	NA	DC	12.7	-
Havana Rd	Roadside	Merton	NA	DC	12.1	-
Haydons Rd	Roadside	Merton	NA	DC	11.7	-
Kingston Rd	Roadside	Merton	NA	DC	12.7	-
Lake Rd	Roadside	Merton	NA	DC	12.1	-
London Rd	Roadside	Merton	NA	DC	13.1	-
London Rd	Roadside	Merton	NA	DC	13.0	-
London Rd/Merton Civic	Roadside	Merton	NA	DC	11.7	-
Malmesbury Rd	Roadside	Merton	NA	DC	12.2	-
Martin Way-B286	Roadside	Merton	NA	DC	12.0	-
Merton Rd	Roadside	Merton	NA	DC	12.3	-
Middleton Rd	Roadside	Merton	NA	DC	11.2	-
Morden Primary School	Roadside	Merton	School	DC	12.7	-
Park Community School	Roadside	Merton	School	DC	11.8	-
Parkside	Roadside	Merton	NA	DC	11.9	-
Plough Ln	Roadside	Merton	NA	DC	11.6	-
Plough Ln	Roadside	Merton	NA	DC	11.6	-
Recreation Way	Roadside	Merton	NA	DC	12.5	-
Rowan Rd	Roadside	Merton	NA	DC	13.8	-

Site name	Site Type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021 - 2022
Sandy Ln	Roadside	Merton	NA	DC	12.6	-
Seely Rd	Roadside	Merton	NA	DC	11.3	-
South Gardens	Roadside	Merton	NA	DC	12.5	-
Southey Rd	Roadside	Merton	NA	DC	11.4	-
Spencer Rd	Roadside	Merton	NA	DC	11.6	-
St Marks Rd	Roadside	Merton	NA	DC	12.4	-
St Marys Primary School Russell Rd – Merton	Roadside	Merton	School	DC	12.8	-
St Mary's Road	Roadside	Merton	NA	DC	11.2	-
St Peter St Paul P/S	Roadside	Merton	School	DC	11.6	-
Streatham Road/Links Rd	Roadside	Merton	NA	-	9.0	-
The Broadway	Roadside	Merton	NA	DC	12.9	-
Tudor Drive	Roadside	Merton	NA	DC	12.1	-
Waterfall Rd	Roadside	Merton	NA	DC	11.8	-
Wates Way	Roadside	Merton	NA	DC	11.2	-
Weir Rd	Roadside	Merton	NA	DC	12.0	-
Wimbledon High School	Roadside	Merton	School	DC	11.3	-
Wimbledon High St	Roadside	Merton	NA	DC	12.0	-
Woodside	Roadside	Merton	NA	DC	11.7	-
Woodside/Worcester Rd	Roadside	Merton	NA	DC	11.0	-
Alma Street	Urban Background	Newham	NA	DC	10.1	-
Newham University Hospital	Urban Background	Newham	Hospital	9.9	8.7	-12.2%
Silvertown Tunnel access corridor – Silvertown Way	Roadside	Newham	NA	DC	10.8	-
Elmhurst Gardens	Urban Background	Redbridge	NA	-	7.9	-
Ley Street (reference co-location)	Urban Background	Redbridge	Co-Location	12.0	9.7	-19.3%
Oakdale Junior School		Redbridge	School	DC	9.7	-
Redbridge Ley Street BLEN	Roadside	Redbridge	NA	DC	10.1	-
Redbridge-Gants Hill	Roadside	Redbridge	NA	DC	8.6	-
Redbridge-South Woodford	Roadside	Redbridge	NA	DC	10.7	-

Site name	Site Type	Borough	Location type	2021 [µgm⁻³]	2022 [µgm⁻³]	% Change 2021 - 2022
A316, Chertsey Court, Clifford Ave, nr Chertsey Corner, SW14 8AD	Roadside	Richmond upon Thames	NA	DC	13.0	-
Broad St, Teddington, nr Tescos + j/w Queens Rd TW11	Roadside	Richmond upon Thames	NA	DC	10.1	-
Burtons Road, Hampton Hill, west of j/w Albert Road, on railway bridge	Roadside	Richmond upon Thames	NA	DC	10.9	-
Burtons Road, (north side – relocated) Hampton Hill, nr j/w High St	Roadside	Richmond upon Thames	NA	DC	12.5	-
Church Rd A311	Roadside	Richmond upon Thames	NA	DC	13.0	-
Deer Park Schl/Lidl, Richmond Rd, opp j/w Morley Rd, E Twickenham	Roadside	Richmond upon Thames	School	DC	10.9	-
East Sheen Primary School		Richmond upon Thames	School	DC	8.2	-
George Street, Richmond	Roadside	Richmond upon Thames	NA	DC	10.7	-
Hampton Court Rd	Roadside	Richmond upon Thames	NA	DC	12.9	-
Hampton Ct Rd west bounds	Roadside	Richmond upon Thames	NA	DC	12.3	-
High St Teddington, nr Post Office and M&S	Roadside	Richmond upon Thames	NA	DC	10.7	-
High St, Barnes, nr j/w St Anns Rd, SW13	Roadside	Richmond upon Thames	NA	DC	11.7	-
High St, Hampton Hill, opposite j/w Windmill Rd.	Roadside	Richmond upon Thames	NA	DC	11.2	-
High St, Hampton Wick	Roadside	Richmond upon Thames	NA	DC	13.3	-
High St, Mortlake, opp j/w Vineyard Path, SW14	Roadside	Richmond upon Thames	NA	DC	12.1	-
High St, Whitton	Roadside	Richmond upon Thames	NA	DC	13.5	-

Site name	Site Type	Borough	Location type	2021 [µgm^{-3}]	2022 [µgm^{-3}]	% Change 2021 - 2022
Hospital Brg Rd, north of Montrose Ave, Turing House School development	Roadside	Richmond upon Thames	NA	DC	10.0	-
Kew Rd, before j/w South Circ/ Kew Green	Roadside	Richmond upon Thames	NA	DC	12.2	-
Kew Rd, nr entrance to Kew Gardens, (opp j/w The Avenue)	Roadside	Richmond upon Thames	NA	DC	10.5	-
Kew Rd, Richmond, nr taxi rank/opposite Richmond station	Roadside	Richmond upon Thames	NA	DC	13.5	-
King St, Twickenham	Roadside	Richmond upon Thames	NA	DC	14.0	-
Lwr Rich Rd, Chertsy Corner, nr j/w houses, opp cnr of Chtsy Ct, VS nr Kingsway,	Roadside	Richmond upon Thames	NA	DC	12.7	-
Manor Rd, west bound	Roadside	Richmond upon Thames	NA	DC	13.0	-
Paradise Rd, Richmond	Roadside	Richmond upon Thames	NA	DC	12.8	-
Park Rd, Hampton Hill, nr j/w High St, TW11,	Roadside	Richmond upon Thames	NA	DC	12.0	-
Petersham Rd, opp Russell School, TW10	Roadside	Richmond upon Thames	NA	DC	13.0	-
Queens School, Cumberland Rd,	Roadside	Richmond upon Thames	School	DC	12.1	-
RFU Stadium, Whitton Rd j/w A316	Roadside	Richmond upon Thames	NA	DC	11.1	-
Richmond Pk, Richmond Gate, top of Star and Garter Hill	Roadside	Richmond upon Thames	NA	DC	12.9	-
Richmond upon Thames Schl + Richmond College, Egerton Rd, Twickenham	Roadside	Richmond upon Thames	School	DC	12.9	-
Rocks Lane, opp houses, SW13	Roadside	Richmond upon Thames	NA	DC	12.6	-

Site name	Site Type	Borough	Location type	2021 [µgm^{-3}]	2022 [µgm^{-3}]	% Change 2021 - 2022
Shackleton Lane, Fulwell	Roadside	Richmond upon Thames	NA	DC	9.5	-
Sheen Lane, south of j/w Vernon Rd, nr zebra crossing, SW14	Roadside	Richmond upon Thames	NA	DC	12.2	-
South Rd, outside Lidl, nr j/w Wellington/Hampton Rd TW2	Roadside	Richmond upon Thames	NA	DC	10.2	-
St John the Baptiste Primary Sch, Lwr Teddington Rd KT1 4HQ (between Seymour Rd and Broom Pk)	Roadside	Richmond upon Thames	School	DC	9.5	-
St Margarets Rd, opposite St Margarets station, TW1	Roadside	Richmond upon Thames	NA	DC	9.4	-
St Margaret's Road, Twickenham	Roadside	Richmond upon Thames	NA	DC	12.6	-
St Richard Reynolds College, Clifden Rd, north of j/w Copthall Gdns TW1	Roadside	Richmond upon Thames	NA	DC	10.5	-
Staines Rd, Twickenham jct	Roadside	Richmond upon Thames	NA	DC	12.6	-
Stanley Juniors Sch, Strathmore Rd, Teddington TW11 8UH	Roadside	Richmond upon Thames	School	DC	10.2	-
Station Rd Hampton	Roadside	Richmond upon Thames	NA	DC	12.6	-
Strawberry Vale, Teddington	Roadside	Richmond upon Thames	NA	DC	12.6	-
Teddington High St	Roadside	Richmond upon Thames	NA	DC	12.6	-
Twickenham Academy	Roadside	Richmond upon Thames	NA	DC	12.0	-
Twickenham railway bridge, London Rd, Twickenham	Roadside	Richmond upon Thames	NA	DC	12.3	-
Upper Richmond Road West	Roadside	Richmond upon Thames	NA	DC	12.9	-

Site name	Site Type	Borough	Location type	2021 [μgm⁻³]	2022 [μgm⁻³]	% Change 2021 - 2022
Winchester Rd, St Stephens Primary School	Roadside	Richmond upon Thames	School	DC	14.7	-
Charlotte Sharman Primary School	Urban Background	Southwark	School	DC	8.7	-
Elephant & Castle (reference co-location)	Urban Background	Southwark	Co-Location	9.1	9.2	0.5%
Guy's Hospital	Roadside	Southwark	Hospital	DC	10.3	-
London Wildlife Trust Centre For Wildlife Gardening	Urban Background	Southwark	NA	DC	8.4	-
Oliver Goldsmith Primary School		Southwark	School	DC	8.9	-
SWK-BL1: Croxted Road / Guernsey Grove	Roadside	Southwark	NA	DC	9.9	-
SWK-BL2: Croxted Road/Dalkeith Road	Roadside	Southwark	NA	DC	9.7	-
Tower Bridge Primary School	Roadside	Southwark	School	DC	10.6	-
All Saints Carshalton C of E Primary School	Roadside	Sutton	School	DC	8.6	-
Beddington Lane North (reference co-location)	Roadside	Sutton	Co-Location	10.6	10.3	-3.1%
Cheam Common Junior Academy	Roadside	Sutton	School	DC	11.7	-
Cheam Park Farm Primary Academy	Roadside	Sutton	School	DC	10.2	-
Harris Academy Carshalton	Roadside	Sutton	School	DC	10.0	-
Muschamp Primary School	Roadside	Sutton	School	DC	9.9	-
Royal Marsden, Sutton	Roadside	Sutton	Hospital	DC	14.9	-
St Elpheges Infants and Juniors	Roadside	Sutton	School	DC	10.0	-
St Philomena's/St Mary's	Roadside	Sutton	School	DC	10.1	-
St. Helier's Hospital, Sutton	Roadside	Sutton	Hospital	DC	12.6	-
Alice Model Nursery School		Tower Hamlets	School	DC	9.2	-

Site name	Site Type	Borough	Location type	2021 [μgm^{-3}]	2022 [μgm^{-3}]	% Change 2021 - 2022
Blackwall Tunnel Approach (reference co-location)	Roadside	Tower Hamlets	Co-Location	14.6	9.8	-32.7%
Bonner Primary School		Tower Hamlets	School	DC	8.9	-
Chrisp Street Market – Tower Hamlets	Roadside	Tower Hamlets	NA	DC	11.8	-
Marner Primary School		Tower Hamlets	School	DC	8.6	-
Meath Gardens Children's Centre		Tower Hamlets	NA	DC	10.4	-
Oaklands Secondary School		Tower Hamlets	School	DC	9.3	-
Rachel Keeling Nursery	Urban Background	Tower Hamlets	School	DC	11.5	-
Royal London University Hospital	Urban Background	Tower Hamlets	Hospital	10.2	9.3	-9.1%
Blackhorse Lane & Forest -Waltham Forest	Urban Background	Waltham Forest	NA	DC	9.3	-
Church Lane - Waltham Forest	Roadside	Waltham Forest	NA	DC	9.7	-
Whipps Cross Hospital	Urban Background	Waltham Forest	Hospital	9.1	8.1	-10.9%
Whipps Cross/ A12 Cambridge Park Road	Roadside	Waltham Forest	NA	DC	9.8	-
Bedford Hill – Wandsworth	Roadside	Wandsworth	NA	DC	12.0	-
Chesterton Primary School	Urban Background	Wandsworth	School	DC	10.9	-
Griffin School – Wandsworth	Roadside	Wandsworth	School	DC	10.5	-
St Annes C of E Primary School		Wandsworth	School	DC	8.9	-
Boston Place	Roadside	Westminster	NA	DC	9.6	-
Enford Street	Roadside	Westminster	NA	-	9.4	-
Hallfield Estate	Roadside	Westminster	NA	DC	10.1	-
Horseferry Road (reference co-location)	Urban Background	Westminster	Co-Location	9.8	8.8	-10.0%
Marylebone Road – Mains (reference co-location)	Kerbside	Westminster	Co-Location	11.8	10.2	-13.8%

Site name	Site Type	Borough	Location type	2021 [μgm^{-3}]	2022 [μgm^{-3}]	% Change 2021 - 2022
Marylebone Road – Solar (reference co-location)	Kerbside	Westminster	Co-Location	11.6	10.2	-12.0%
Marylebone Road / Baker Street	Roadside	Westminster	NA	DC	11.1	-
Piccadilly Circus	Urban Background	Westminster	NA	DC	9.2	-
Rossmore Road	Roadside	Westminster	NA	-	9.2	-
St Clement Danes CE School	Urban Background	Westminster	School	DC	9.6	-
St Stephen's CE Primary School	Roadside	Westminster	School	-	9.5	-
Strand/Wellington Street	Roadside	Westminster	NA	DC	10.9	-

Schools

Monitoring air quality at schools has a priority for the Breathe London Network, with 41 of the 136 initial sites funded by the Mayor being located at schools and many more funded by boroughs. Several community groups also chose to locate their sensors at schools through the Breathe London Community Programme.

The total number of sensors located at schools is currently 146, of which 75 had enough NO_2 data to calculate annual averages for 2022 and be included in **Table 2**, and 76 had enough $PM_{2.5}$ data to be included in **Table 3**. No schools had sufficient data capture in 2021 to be included in **Table 2** or **Table 3**.

Table 5 Summary of NO₂ annual averages at schools

Annual average concentration	Number of sites 2022	Percentage of sites 2022
< 10µgm^{-3} meeting WHO Guideline	0	0%
10- 20µgm^{-3}	0	0%
20- 30µgm^{-3}	54	72%
30- 40µgm^{-3}	19	25%
> 40µgm^{-3} exceeding Legal Objective	2	3%

Table 5 summarises the annual average NO_2 concentrations at the school sites in relation to the WHO guideline and interim targets. The data shows that for 2022, all school sites exceeded both the WHO guideline of 10 µgm^{-3} and also the WHO interim target of 20 µgm^{-3}. The majority of sites (72%) measured an annual average of between 20 µgm^{-3} and 30 µgm^{-3}, 19 sites measured an average of between 30 and 40 µgm^{-3} and two sites exceeded 40 µgm^{-3}, the legal objective.

Table 6 Summary of PM₂.₅ annual averages at schools

Annual average concentration	Number of sites 2022	Percentage of sites 2022
< 5µgm^{-3} meeting WHO Guideline	0	0%
5- 10µgm^{-3} meeting legal objective & WHO interim target	40	53%
10- 15gm^{-3}	36	47%
> 15µgm^{-3}	0	0%

Table 6 summarises the annual average $PM_{2.5}$ concentrations at schools in 2022 in relation to the WHO Guideline. No school sites currently meet the WHO annual average guideline of 5 μgm^{-3}. Over half of the school sites measured an average below 10 μgm^{-3}, which is the level that the Mayor has committed to London meeting by 2030 and the UK legal objective to meet by 2040, indicating that this objective is achievable much sooner than the government's target date.

As there are too many monitoring sites to look at individually, two schools have been selected to analyse the data in more detail. The sites were selected based upon the highest data capture rates and representing one urban background and one roadside site and one inner and one outer London site.

- Wessex Gardens Primary School – an urban background site in Barnet installed on June 13, 2021.

- Tower Bridge Primary School – a roadside site in Southwark installed on May 25, 2021.

Figure 1 and **Figure 2** show the weekly average NO_2 and $PM_{2.5}$ concentrations at each school and a smoothed trend line. The smoothed line removes the weekly fluctuations and gives a clearer indication of the general trend over time. The graphs show that both sites follow a broadly similar weekly pattern, with concentrations being higher at the Tower Bridge site. The trendline shows the usual pattern of seasonal variation for NO_2 with concentrations being higher in the winter than in the summer months.

Wessex Gardens school averaged 29.3 μgm^{-3} for NO_2 in 2022 and 9.1 μgm^{-3} for $PM_{2.5}$ whereas Tower Bridge Primary averaged 33.6 μgm^{-3} for NO_2 and 10.6 μgm^{-3} for $PM_{2.5}$.
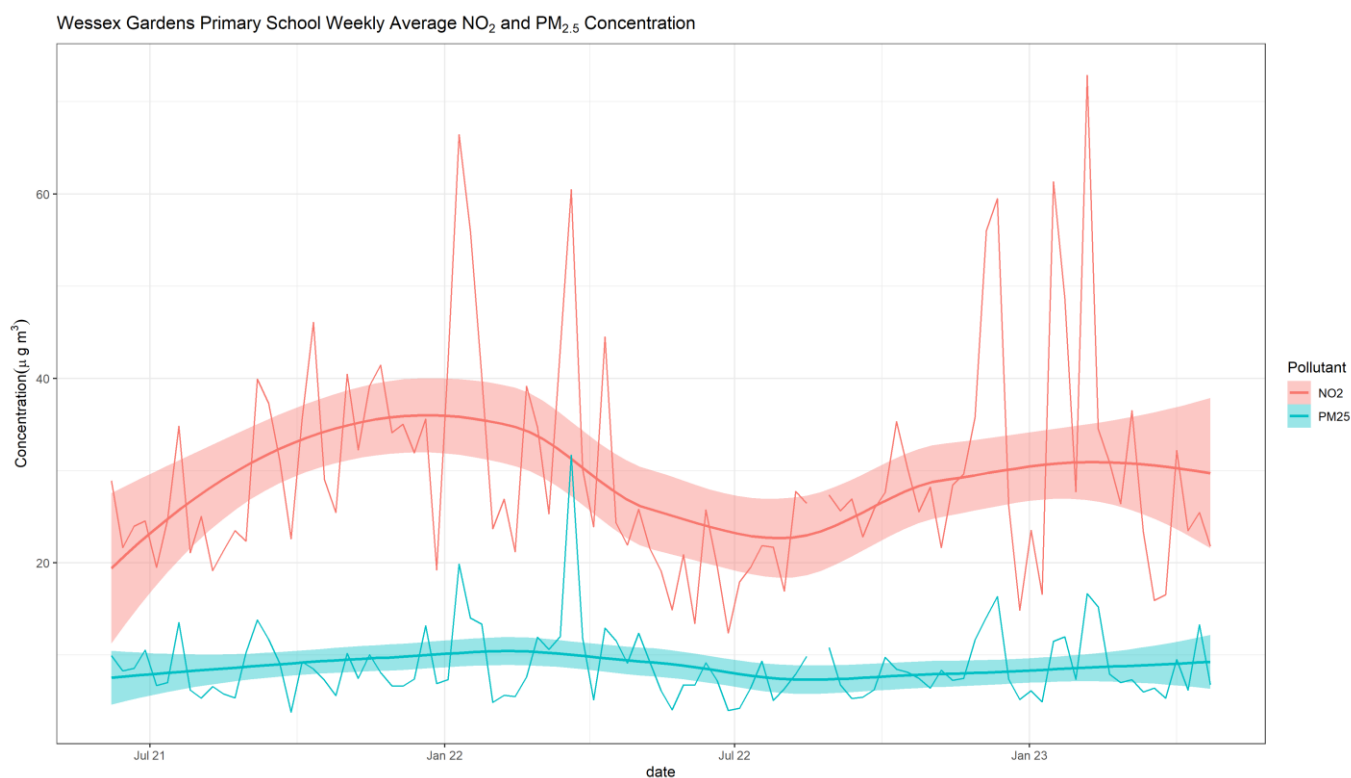
Figure 1: Weekly average concentrations at Wessex Gardens Primary School
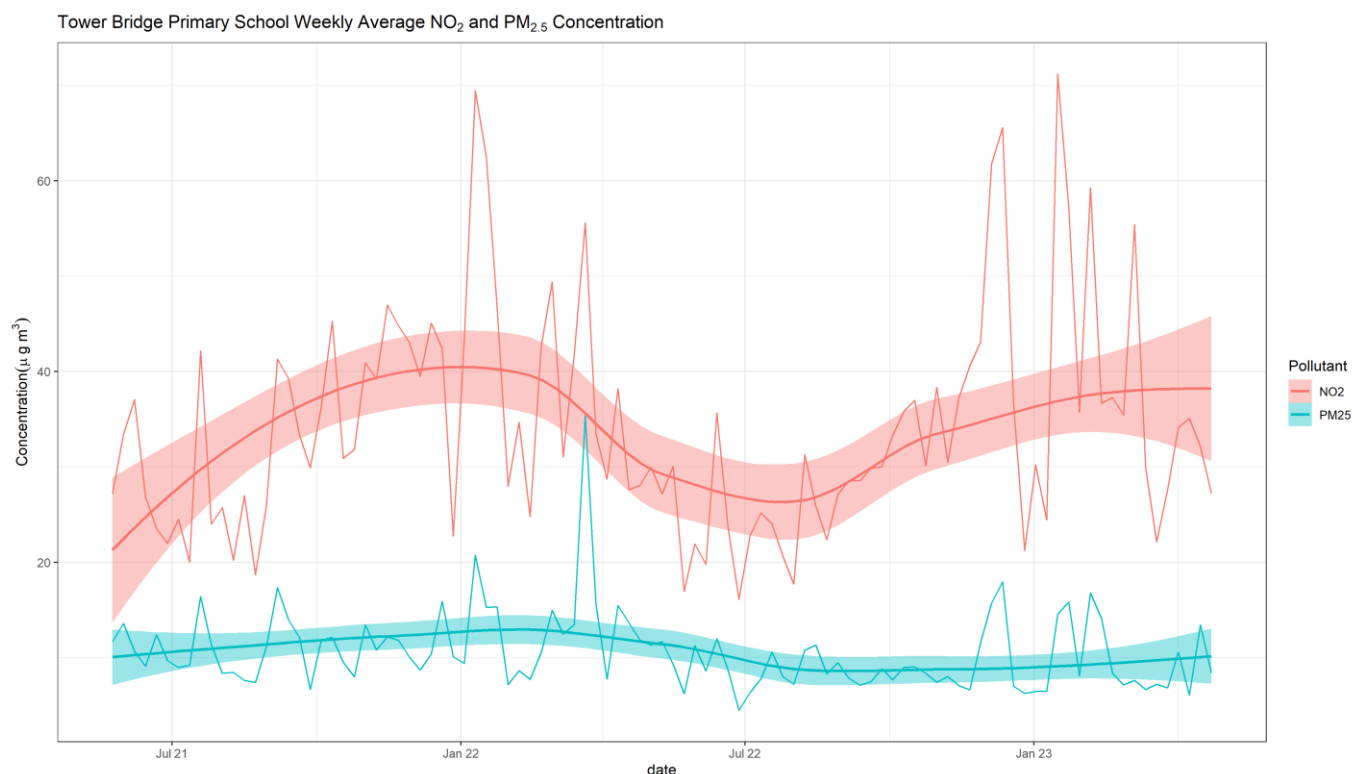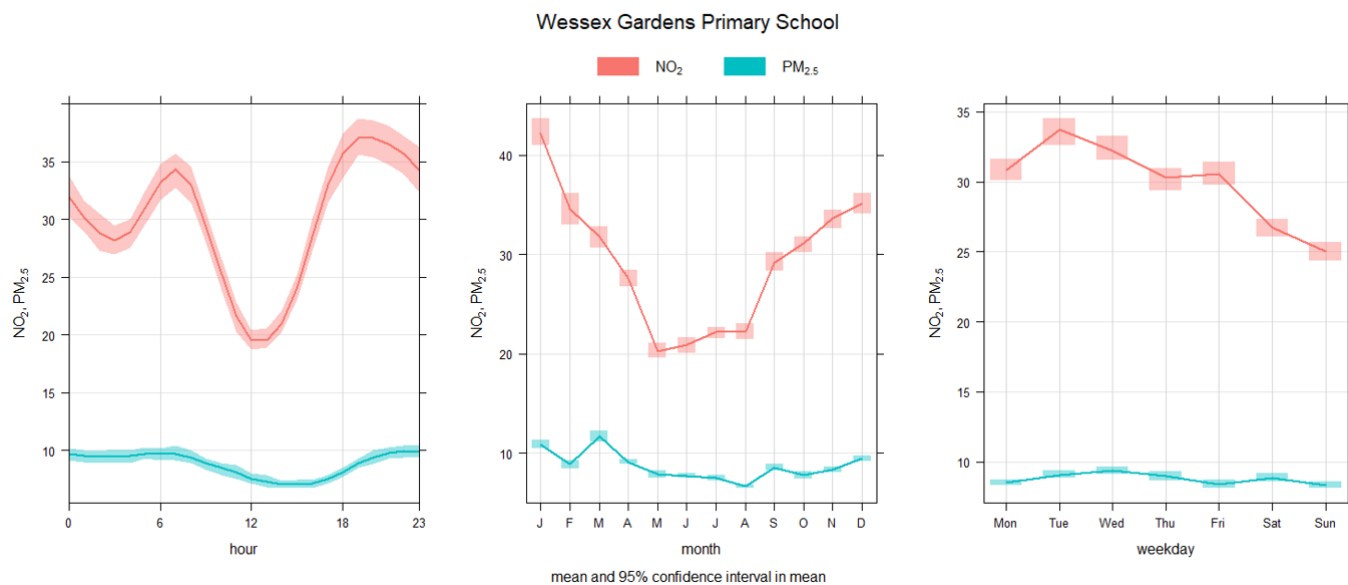
Figure 2: Weekly average concentrations at Tower Bridge Primary School

Figure 3 and **Figure 4** show the average pattern of variation in concentrations at each site through the hours of the day, the months, and the days of the week. Both sites follow a broadly similar pattern with Tower Bridge school having higher average concentrations. Wessex Gardens school has a larger diurnal variation with the lowest NO_2 concentrations being seen on average in the middle part of the day, whereas at Tower Bridge school the lowest NO_2 concentrations being recorded in the early hours of the morning. This is likely related to traffic movements at morning and evening rush hours and is unlikely to change unless more action can be taken to reduce traffic movements near these schools. The Mayor has already taken action to support schools in improving air quality through his School Audit Programme and his School Streets programme. The Breathe London monitoring network previously found that School Streets reduce nitrogen dioxide by up to 23% during morning drop off[4].

At both sites NO_2 concentrations are at their highest in the month of January. This seasonality can be attributed to elevated NO_2 levels in winter months during the heating season with reduced levels in summer months due to a reduction in domestic heating use. Additionally, in summer months, photochemical reactions split NO_2 in the formation of ozone. $PM_{2.5}$ concentrations have much less variation and are generally lower in the afternoons at both sites.

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[4] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/environment-publications/school-streets-air-quality-study

Figure 3: Wessex Gardens Primary school average hourly, monthly and daily variation in NO₂ and PM₂.₅ concentrations [μgm⁻³]
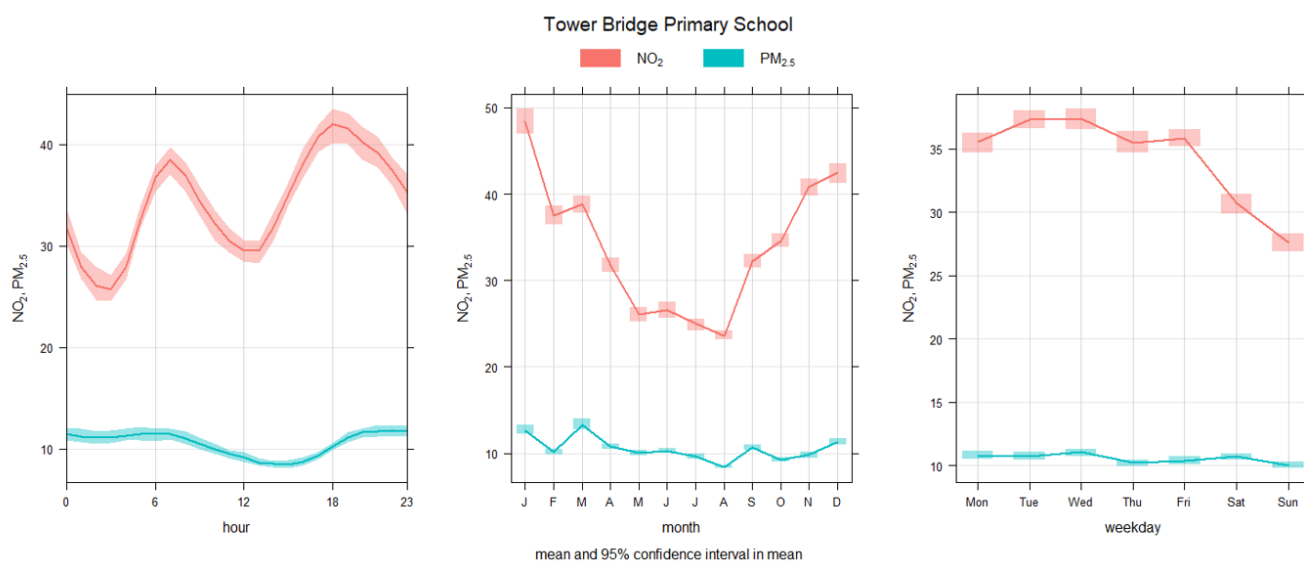
Figure 4: Tower Bridge Primary school average hourly, monthly and daily variation in NO₂ and PM₂.₅ concentrations [μgm⁻³]

Hospitals

Hospitals are another priority location for monitoring for the Breathe London Network, with 25 sites currently in the network. Fifteen hospital sites were funded by the Mayor of London and have sufficient data for annual averages to be included in **Table 2** for NO_2 and **Table 4** for $PM_{2.5}$. Ten additional hospital sites have since been added to the network later in 2022, funded by the NHS Southeast London CCG, but did not have sufficient data to be included in this analysis.**Error! Reference source not found.**

Table 7 Summary of NO_2 annual averages at hospital sites

Annual average concentration	Number of sites 2021	Percentage of sites 2021	Number of sites 2022	Percentage of sites 2022
<10μgm^{-3} ^{meeting} WHO Guideline	0	0%	0	0%
10- 20μgm^{-3}	0	0%	0	0%
20- 30μgm^{-3}	8	89%	13	87%
30- 40μgm^{-3}	1	11%	2	13%
>40μgm^{-3} exceeding Legal Objective	0	0%	0	0%

Table 7 summarises the annual average NO_2 concentrations at hospital sites in relation to the WHO guidelines and interim targets. No hospital sites met either the WHO NO_2 guideline of 10 μgm^{-3} or the WHO NO_2 interim target of 20 μgm^{-3} in either year. The majority of sites measured an average of between 20 and 30 μgm^{-3} with a couple exceeding 30 μgm^{-3}. These were Croydon University Hospital at 33.5 μgm^{-3} and Royal Marsden Hospital measuring 30.7 μgm^{-3} in 2022.

**Table 8 Summary of $PM_{2.5}$ annual averages at hospital sites**

Annual average concentration	Number of sites 2021	% of sites 2021	Number of sites 2022	% of sites 2022
< 5μgm^{-3} meeting WHO Guideline	0	0%	0	0%
5- 10μgm^{-3} meeting legal objective & WHO interim target	5	56%	8	53%
10- 15gm^{-3}	4	44%	7	47%
>15 μgm^{-3}	0	0%	0	0%

Table 8 shows that for both years all hospital sites exceeded the WHO annual average guideline for PM$_{2.5}$. Over half of the sites each year measured an annual average below 10 µgm^{-3}, meeting the interim WHO target and the limit that London has committed to meeting by 2030. The rest of the sites measured between 10 and 15 µgm^{-3}.

As with the school sites, two hospital sites have been selected to analyse the data in more detail. These sites are:
- Great Ormond Street Hospital (GOSH), a roadside site in Camden, installed on 28 January 2021.
- Whipps Cross Hospital, an urban background site in Waltham Forest, installed on 22 January 2021.

Figure 5 and **Figure 6** show the weekly average NO$_2$ and PM$_{2.5}$ concentrations at GOSH and Whipps Cross Hospital, along with the smoothed trendlines. At GOSH, NO$_2$ concentrations peaked in winter in early 2022 and again in the following winter, with much lower concentrations seen in the summer months with some weeks averaging as low as 14 µgm^{-3}. The readings at Whipps Cross Hospital follow broadly the same pattern as GOSH, but with slightly lower concentrations on average, with NO$_2$ averaging 21 µgm^{-3} for both 2021 and 2022, whereas at GOSH the average NO$_2$ was 24.5 µgm^{-3} for both years.
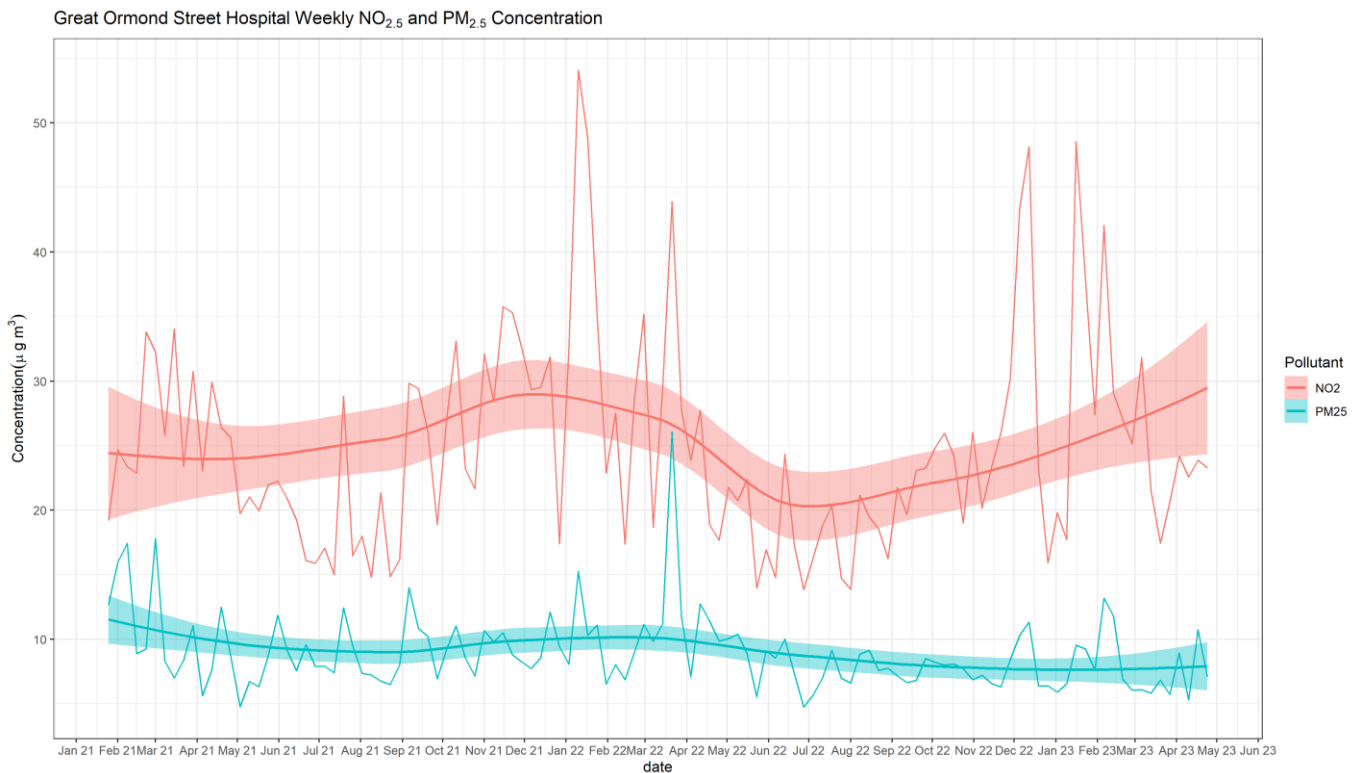

Figure 5: Weekly average concentrations at Great Ormond Street Hospital
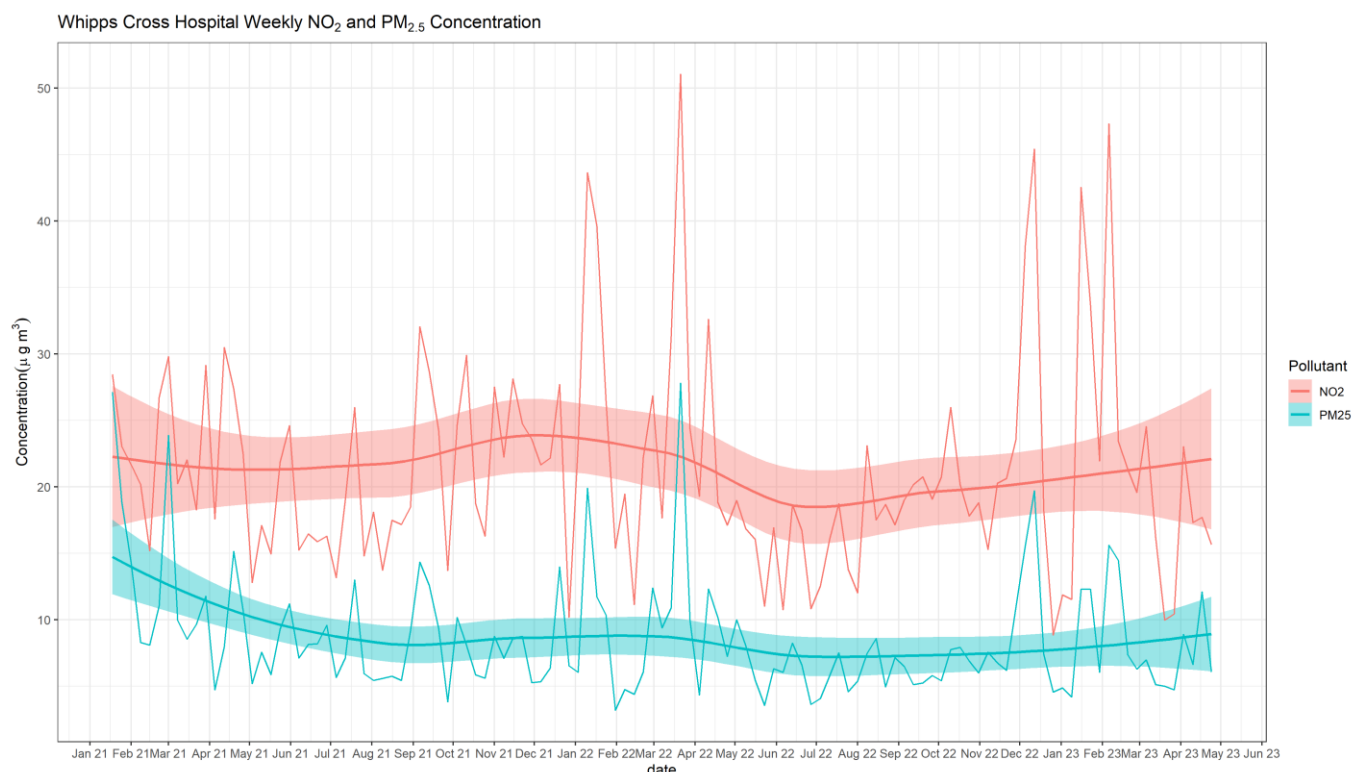
Figure 6: Weekly average concentrations at Whipps Cross Hospital

Figure 7 and **Figure 8** show how the NO$_2$ and PM$_{2.5}$ concentrations at GOSH and Whipps Cross vary through the day, week and months. Clear trends are seen for NO$_2$, with peak concentrations in the morning and evening rush hours. Whipps Cross has a much larger diurnal variation than GOSH, with average NO2 concentrations reducing in the middle of the day, whereas at GOSH concentrations were lowest in the night. PM$_{2.5}$ concentrations were generally lower during the day than the night. Through the year, concentrations for both NO$_2$ and PM$_{2.5}$ were higher in the winter months, and the beginning of the week generally saw higher concentrations for both pollutants than the end of the week and the weekends.
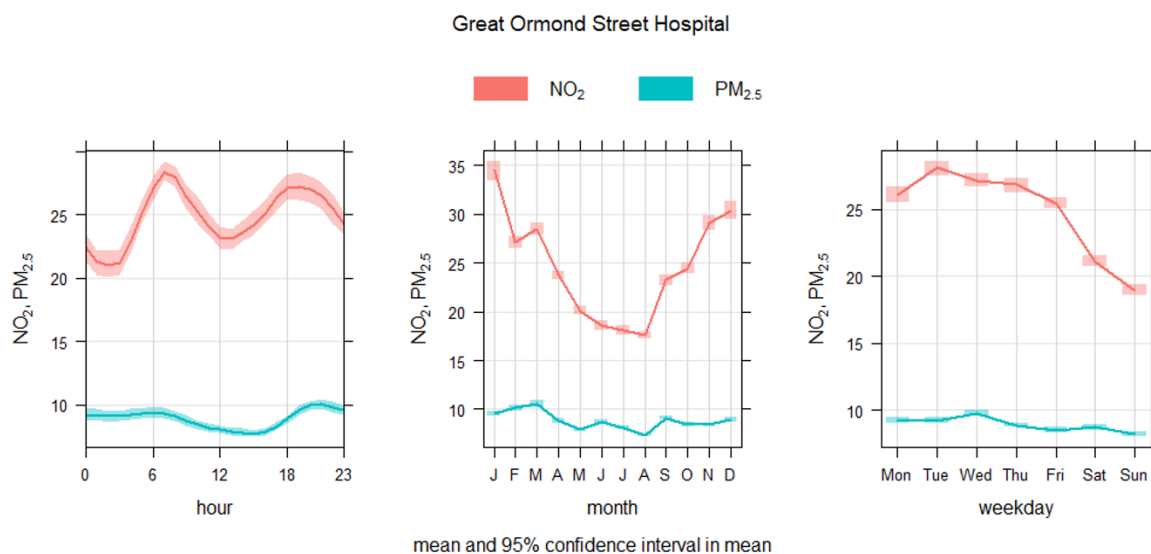
Figure 7: Great Ormond Street Hospital average hourly, monthly and daily variation in NO$_2$ and PM$_{2.5}$ concentrations [μgm^{-3}]

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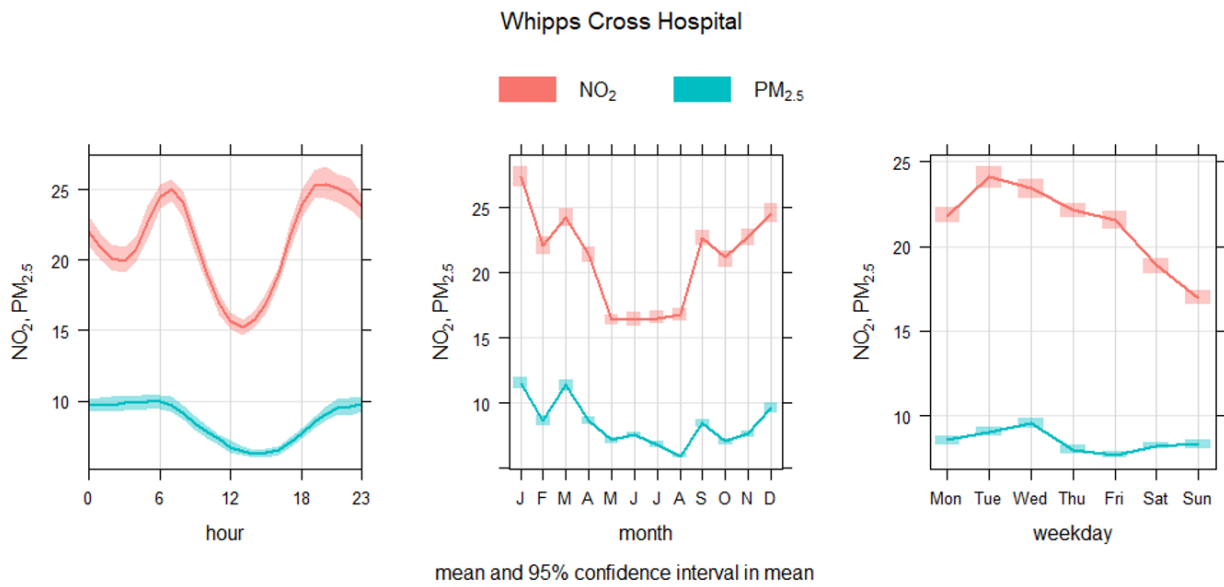
Figure 8: Whipps Cross Hospital average hourly, monthly and daily variation in NO$_2$ and PM$_{2.5}$ concentrations [μgm^{-3}]

Communities Programme

The Breathe London Communities Programme empowers communities by providing them with fully funded air quality sensors to place in locations of their choosing. Selected community groups are also provided with support to better understand the data and use it in their campaigns and lobbying activities. The programme is supported by Bloomberg Philanthropies.

Forty diverse community groups across London have so far received Breathe London sensors with the final twenty announced in August. These final groups are now in the process of receiving sensors. As this element of the Breathe London Programme came later in the programme, none of the community sensor sites were installed in 2021 and only five had sufficient data capture for 2022 to be included in **Table 2** and **Table 4**. Therefore, the analysis carried out for schools and hospital sites has not been undertaken for the community sites.

The full list of community groups receiving Breathe London sensors so far can be found in **Appendix 1**, and more detailed information about each group can be found on the Breathe London website community pages.

Co-located sites

Table 9 provides the annual average NO_2 concentrations for all 19 co-located Breathe London sites, alongside the annual average for the corresponding reference site for each year. DC indicates the data capture was less than 75% for the year for both Breathe London sensors (BL) and the reference sites, in line with reference site reporting requirements.

Table 9 Annual average NO_2 concentration [μgm^{-3}] at co-located sites

Name	Site Type	Borough	BL 2021	Reference 2021	BL 2022	Reference 2022
Slade Green (reference co-location)	Urban Background	Bexley	18.1	19.0	17.2	17.6
Brent Ikea (reference co-location)	Roadside	Brent	46.4	46.3	42.1	43.1
A2 Falconwood (reference co-location)	Roadside	Greenwich	34.6	26.8	27.8	21.7
Burrage Grove (reference co-location)	Urban Background	Greenwich	26.2	26.9	25.5	26.0
Eltham (reference co-location)	Urban Background	Greenwich	15.3	14.5	DC	DC
John Harrison Way (reference co-location)	Roadside	Greenwich	23.2	25.2	23.4	23.2
Westhorne Avenue (reference co-location)	Urban Background	Greenwich	24.9	26.2	23.1	DC
Rainham (reference co-location)	Roadside	Havering	21.7	22.5	23.2	22.9
North Kensington (reference co-location)	Urban Background	Kensington and Chelsea	18.9	19.5	21.0	15.5
Honor Oak Park - Solar (reference co-location)	Urban Background	Lewisham	17.9	16.4	16.3	16.0
Honor Oak Park Mains (reference co-location)	Urban Background	Lewisham	DC	16.4	16.2	16.0
New Cross (reference co-location)	Urban Background	Lewisham	DC	DC	27.1	27.2
Ley Street (reference co-location)	Urban Background	Redbridge	22.2	24.5	20.9	DC
Elephant & Castle (reference co-location)	Urban Background	Southwark	22.8	22.8	21.2	21.9
Beddington Lane North (reference co-location)	Roadside	Sutton	20.1	21.9	22.1	24.4
Blackwall Tunnel Approach (reference co-location)	Roadside	Tower Hamlets	37.3	37.4	39.3	DC
Horseferry Road (reference co-location)	Urban Background	Westminster	20.9	24.2	22.2	21.8
Marylebone Road - Mains (reference co-location)	Kerbside	Westminster	41.8	42.9	42.7	42.1
Marylebone Road - Solar (reference co-location)	Kerbside	Westminster	41.8	42.9	42.6	42.1
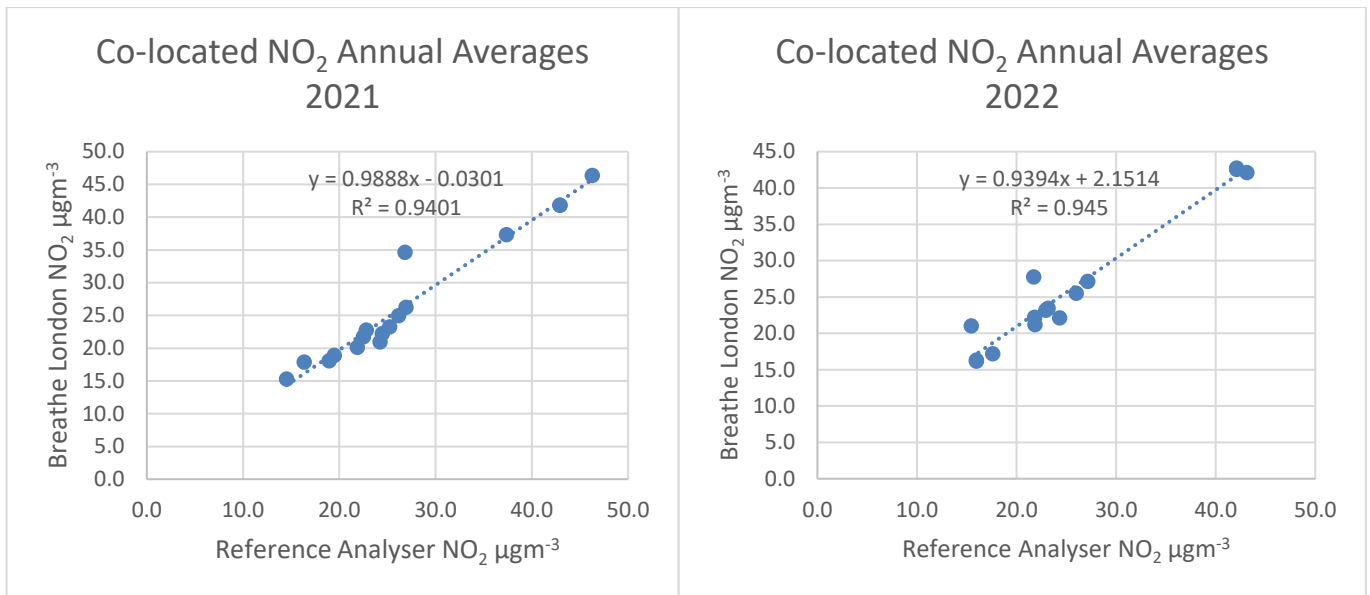
Figure 9: Comparison of Breathe London and reference site NO₂ annual averages for 2021 and 2022.

Figure 9 compares the annual average NO₂ concentrations for each co-located pair of monitors for 2021 and 2022. The charts demonstrate that there is a very close correlation between the sensor data and the reference data with an R^2 value over 0.9 for both years. In 2021, one site can be considered an outlier, A2 Falconwood in Greenwich, with the Breathe London sensor measuring 35 µgm⁻³ and the reference monitor measuring 27 µgm⁻³.

Table 10 provides the annual average $PM_{2.5}$ concentrations recorded by the Breathe London sensors at the 19 co-location sites along with the corresponding annual average from the reference site for 2021 and 2022.

Table 10 Co-located sites annual average PM₂.₅ concentration [µgm⁻³]

Name	Site Type	Borough	BL 2021	Reference 2021	BL 2022	Reference 2022
Slade Green (reference co-location)	Urban Background	Bexley	9.3	DC	9.3	DC
Brent Ikea (reference co-location)	Roadside	Brent	16.9	13.5	13.1	12.8
A2 Falconwood (reference co-location)	Roadside	Greenwich	11.2	13.1	10.3	DC
Burrage Grove (reference co-location)	Urban Background	Greenwich	10.8	10.9	10.9	11.6
Eltham (reference co-location)	Urban Background	Greenwich	10.1	8.0	DC	DC
John Harrison Way (reference co-location)	Roadside	Greenwich	12.2	10.5	11.3	9.7
Westhorne Avenue (reference co-location)	Urban Background	Greenwich	9.3	7.5	8.6	DC
Rainham (reference co-location)	Roadside	Havering	11.1	DC	10.8	10.2
North Kensington	Urban	Kensington	8.8	8.6	9.3	8.5

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Name	Site Type	Borough	BL 2021	Reference 2021	BL 2022	Reference 2022
(reference co-location)	Background	and Chelsea				
Honor Oak Park - Solar (reference co-location)	Urban Background	Lewisham	9.1	8.8	8.1	8.1
Honor Oak Park Mains (reference co-location)	Urban Background	Lewisham	DC	8.8	8.1	8.1
New Cross (reference co-location)	Urban Background	Lewisham	DC	DC	12.0	DC
Ley Street (reference co-location)	Urban Background	Redbridge	12.0	10.2	9.7	8.8
Elephant & Castle (reference co-location)	Urban Background	Southwark	9.1	9.1	9.2	9.4
Beddington Lane North (reference co-location)	Roadside	Sutton	10.6	10.2	10.3	10.1
Blackwall Tunnel Approach (reference co-location)	Roadside	Tower Hamlets	14.6	DC	9.8	DC
Horseferry Road (reference co-location)	Urban Background	Westminster	9.8	10.1	8.8	8.1
Marylebone Road - Mains (reference co-location)	Kerbside	Westminster	11.8	-	10.2	-
Marylebone Road - Solar (reference co-location)	Kerbside	Westminster	11.6	-	10.2	-
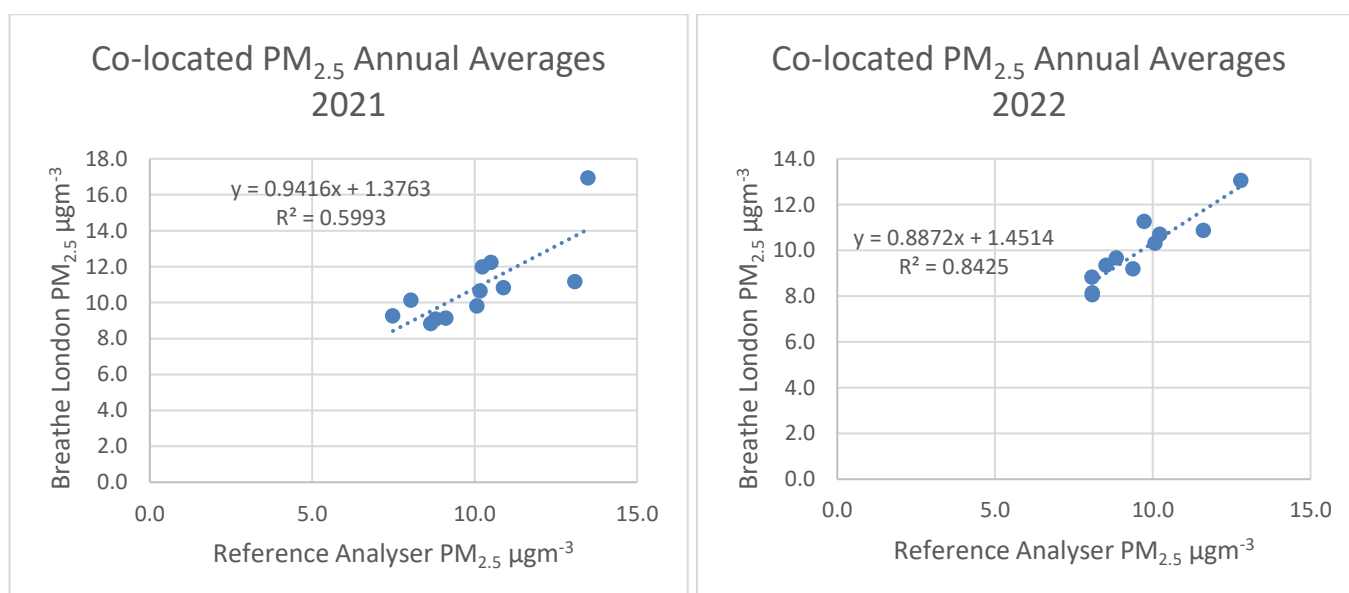
Figure 10: Comparison of Breathe London and reference site PM$_{2.5}$ annual averages for 2021 and 2022.

Figure 10 shows that the data for PM$_{2.5}$ was slightly less well correlated than for the NO$_2$ data. In 2021, there was one site for which the difference between the Breathe London data and the reference data was much greater than the rest, at Brent Ikea, where the Breathe London sensor data for PM$_{2.5}$ averaged 3.5 µgm^{-3} higher than the reference site. The rest of the Breathe

London sites measured a range of between 2.1 µgm^{-3} higher and 1.9 µgm^{-3} lower than their co-located reference sites.

The data for 2022 was much closer correlated (R^2 = 0.8), with the biggest difference in annual average PM$_{2.5}$ between a Breathe London sensor and reference site being 1.5 µgm^{-3} at John Harrison Way in Greenwich, where the Breathe London sensor averaged 11.3 µgm^{-3} and the reference site measured 9.7 µgm^{-3}.

Conclusion

The Breathe London Network is providing local, reliable and accurate air quality data to communities across London. The network has grown rapidly since its launch in 2020, from 136 initial sites to over 400 in two years. The breadth of partner organisations makes the network unique, including schools, hospitals, boroughs, cultural institutions, and community groups.

The hybrid monitoring network utilises London's comprehensive, crucial reference monitoring network to provide ongoing calibrations via 19 permanently co-located sites, improving the accuracy of the Breathe London sensors. This can be seen by the high levels of correlation between the sensor and the reference site data in the analysis in the report.

The Breathe London Monitoring data for 2021 and 2022 is consistent with data from the London reference network in showing that nowhere in London currently meets the WHO's annual average air quality guidelines, showing that more work must be done to ensure all Londoners can breathe cleaner air.

Appendix 1

Full list of Breathe London Community groups.

Round 1

Community Group	Borough
Thames Ward Community Project	Barking and Dagenham
Harlesden Neighbourhood Forum	Brent
Croydon Climate Action	Croydon
Rectory Road Residents Association	Hackney
Victoria Park Harriers	Hackney
Healthy Streets Tottenham Hale	Haringey
Earls Court Action Society	Kensington and Chelsea
South Woodford Society	Redbridge
Shadwell Responds	Tower Hamlets
St Stephen's CE Primary School	Westminster

Round 2

Community Group	Borough
Christ's College Finchley Breathe	Barnet
Residents Action on Climate and Health	Barnet
NW7hub	Barnet
Green Our Neighbourhood	Barnet
Friends of Woodcock Park	Brent
Bromley Living Streets	Bromley
Brunswick Tenants and Residents Association	Camden
Ealing Transition	Ealing
CASH (Clean Air for Southall and Hayes)	Ealing
Heron Practice	Hackney
Parents Air Quality and Road Safety Group	Hackney
Haringey Fixers	Haringey
Friends of St James Primary School	Haringey
Rainham Against Pollution	Havering
Hounslow Borough Respiratory Support Group	Hounslow
Friends of Finsbury Park and Finsbury Park Stroud Green Neighbourhood Forum	Islington
Lancaster West Residents Association	Kensington & Chelsea
Friends of Rosendale PTA	Lambeth
London Early Years Foundation Brixton	Lambeth

Community Group	Borough
Stockwell Main Road Communities	Lambeth
Florence Road Residents Group	Lewisham
Climate Action Lewisham	Lewisham
Beckton Community Air Quality Group	Newham
Born Everywhere, Made in Newham (BEMIN)	Newham
Mums for Lungs Redbridge	Redbridge
Harris Primary Academy East Dulwich	Southwark
Save our Safer Streets	Tower Hamlets
Poplar HARCA	Tower Hamlets
New City College	Tower Hamlets
Hyde Park Estate Residents	Westminster

Round 3

Community Group	Borough
Copers Cope Area Residents' Association	Bromley
Green Westbourne – Stow Community Centre	Harrow
David Smith – Little Ninja	Wandsworth
Sunny Docks Farm	Southwark
R-Urban Poplar and Leaders in Community	Tower Hamlets
Islington Clean Air Parents	Islington
Sustainable Merton	Merton
Havering Cyclists	Havering
Falcon Residents Association and Bloomsbury Air	Camden
Residents Group in Ealing	Ealing
Fitzrovia Trust	Camden
Northwood's Voice Limited	Hillingdon
Willesden Green Town Team	Brent
Friends of Limehouse	Tower Hamlets
Neon	Lambeth
Trussel Trust Foodbank	Barnet
Thames Life	Barking and Dagenham
Newington Green/ Green Lanes	Haringey
Clean Air for Beck Square	Waltham Forest
RUSS Community Land Trust	Lewisham