

**Imperial College
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Projects

**Environmental
Research Group**

London Air Quality Network Summary Report 2021

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Title	London Air Quality Network – Summary Report 2021
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Customer	London Air Quality Network
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1 Introduction

This report details the results of air pollution measurements made on the London Air Quality Network during 2021. Measurements have been presented with specific reference to the UK Air Quality Strategy (AQS) Objectives and the EU Limit Values.

The London Air Quality Network (LAQN) is a unique resource, providing robust air pollution measurements that are essential to underpin air quality management and health studies. The public face of the network, the LondonAir web site (www.londonair.org.uk), is visited by thousands of Londoners seeking hourly updated air pollution information.

The LAQN was formed in 1993 to coordinate and improve air pollution monitoring in London. The majority of London's 33 boroughs supply measurements to the network with additional measurements from local authorities surrounding London, thereby providing an overall perspective of air pollution in London and the Home Counties.

The LAQN is operated and managed by the Environmental Research Group (ERG) at Imperial College London. QA/QC audits are carried out by the National Physical Laboratory (NPL). Each borough funds air quality monitoring in its own area. The Department of Environment, Food and Rural Affairs (Defra) funds ERG to operate the Marylebone Road site. Analysis of LAQN measurements has been augmented by measurements from affiliated and directly-funded Defra sites in London. Measurements from Defra sites were provided by Ricardo Energy and Environment from the National Air Quality Archive and were included within the LAQN database. Transport for London also funds monitoring to help assess the air pollution impacts of the Congestion Charging Scheme and Low Emission Zone and some sites are funded by Business Improvement Districts (BIDs) or other local organisations.

Pollution concentrations in 2020 were affected by the Covid-19 pandemic, which led to major changes in the types of activities that cause much of the ambient air pollution in the UK, such as traffic and industry. Some restrictions remained in place during parts of 2021. There may be some residual effects on air quality measurements during this period compared with before the pandemic.

2 Air quality Strategy Objectives and EU Limit Values

There is ample evidence of the adverse health effects caused by air pollution (WHO, 2006 and 2021). In response to these health impacts, the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (Defra, 2008) sets out the UK's way forward on air quality issues, details objectives to be achieved, and proposes measures to help reach them. These UK objectives largely reflect EU Limit Values (EC, 2008). The GLA and the London boroughs and district councils outside the capital have responsibilities for the management of air quality and must work towards the attainment of AQS objectives. The AQS Objectives and EU Limit Values are detailed in Table 1. Monitoring progress towards the attainment of these Objectives and Limit Values forms a core activity for the LAQN.

Pollutant	Concentration	Measured as	To be achieved by (UK)	To be achieved by (EU)
Carbon Monoxide (CO)	10.0 mg m ⁻³	Maximum daily running 8-hour mean	31 December 2003	1 January 2005
Nitrogen Dioxide (NO ₂)	200 µg m ⁻³ not to be exceeded more than 18 times a year	1-hour mean	31 December 2005	1 January 2010
	40 µg m ⁻³	Annual mean	31 December 2005	1 January 2010
Sulphur dioxide (SO ₂)	350 µg m ⁻³ , not to be exceeded more than 24 times a year	1-hour mean	31 December 2004	1 January 2005
	125 µg m ⁻³ , not to be exceeded more than 3 times a year	24-hour mean	31 December 2004	1 January 2005
	266 µg m ⁻³ , not to be exceeded more than 35 times a year	15-minute mean	31 December 2005	n/a
Ozone (O ₃)	100 µg m ⁻³ not to be exceeded more than 10 times a year	8 hourly running or hourly mean	31 December 2005	n/a
Ozone (O ₃)	Target of 120 µg/m ³ not to be exceeded more than 25 times a year averaged over 3 years		n/a	31 December 2010
Particles (PM ₁₀) (gravimetric)	50 µg m ⁻³ , not to be exceeded more than 35 times a year	Daily mean	31 December 2004	1 January 2005
	40 µg m ⁻³	Annual mean	31 December 2004	1 January 2005
Particles (PM _{2.5}) (gravimetric)	25 µg m ⁻³	Annual mean	2020	2010
	20% cut in urban background exposure	Annual mean	2010 - 2020	2010 - 2020

Table 1: AQS Objectives and EU Limit Values.

3 Results

The AQS Objective results measured at LAQN sites during 2021 are detailed in Tables 2 to 8.

Key to site types:

RU	=	Rural
S	=	Suburban
U	=	Urban background
R	=	Roadside
K	=	Kerbside
I	=	Industrial

Key to network and funding status

AA	=	Affiliated to UK AURN. Final data set published by DEFRA
A	=	AURN DEFRA funded. Final data set published by DEFRA
T	=	TfL funded
O	=	Other non-local authority funding (annotated in brackets after site name)

All other instruments are funded by the respective local authorities

3.1 Carbon Monoxide

Site Name	Type	Capture Rate (%)	No occurrences of rolling 8hr mean $\geq 10\text{mgm}^{-3}$ (8.6ppm)	Achieved?
Kensington and Chelsea - North Ken ^{AA}	U	40	0	n/a
Westminster - Marylebone Road ^{AA}	K	84	0	n/a

Table 2: AQS Objective results for CO

Summary

- Large reductions in CO over last 20 years with the introduction of catalytic converters on petrol vehicles.
- Although neither site achieved the 90% data capture requirement, concentrations were well below the 10mgm^{-3} threshold. This objective has not been exceeded in London since 2000.
- Only two LAQN sites now measure CO.

3.2 Nitrogen Dioxide

Site Name	Type	Capture Rate (%)	Annual Mean $\leq 40 \mu\text{g m}^{-3}$	Annual Mean Achieved?	No more than 18 occurrences of hourly mean $> 200 \mu\text{g m}^{-3}$	Hourly Mean Achieved?
Barking and Dagenham - Rush Green	S	90	17	yes	0	yes
Barking and Dagenham - Scrattons Farm	S	94	20	yes	0	yes
Bexley - Belvedere	S	100	16	yes	0	yes
Bexley - Belvedere West	U	100	17	yes	0	yes
Bexley - Slade Green ^{AA}	S	96	19	yes	0	yes
Brent - ARK Franklin Primary Academy	R	100	31	yes	0	yes
Brent - Ikea	R	98	46	no	2	yes
Brent - John Keble Primary School	R	100	29	yes	0	yes
Brent - Neasden Lane	I	99	30	yes	0	yes
Bromley - Harwood Avenue	R	97	22	yes	0	yes
Camden - Bloomsbury ^A	U	98	27	yes	0	yes
Camden - Holborn (Central District Alliance) ^O	K	99	36	yes	0	yes
Camden - Swiss Cottage ^{AA}	K	70	41	n/a	2	n/a
City of London - Beech Street	R	85	31	n/a	0	n/a
City of London - The Aldgate School	U	97	23	yes	0	yes
City of London - Walbrook Wharf	R	96	46	no	0	yes
Croydon - Norbury	K	99	39	yes	0	yes
Croydon - Purley Way A23	R	99	26	yes	0	yes
Ealing - Acton Vale	U	69	21	n/a	0	n/a
Ealing - Hanger Lane Gyrotory	R	100	49	no	0	yes
Ealing - Horn Lane	I	100	32	yes	0	yes
Ealing - Western Avenue	R	100	36	yes	0	yes
Enfield - Bowes Primary School	R	99	30	yes	0	yes
Enfield - Bush Hill Park	S	100	18	yes	0	yes
Enfield - Derby Road	R	100	24	yes	0	yes
Enfield - Prince of Wales School	U	92	18	yes	0	yes
Greenwich - A206 Burrage Grove	R	100	27	yes	0	yes
Greenwich - Blackheath	R	100	30	yes	0	yes
Greenwich - Eltham ^{AA}	S	90	15	yes	0	yes
Greenwich - Falconwood	R	97	27	yes	0	yes
Greenwich - Fiveways Sidcup Rd A20	R	100	31	yes	0	yes
Greenwich - John Harrison Way	R	97	25	yes	0	yes
Greenwich - Plumstead High Street	R	100	25	yes	0	yes
Greenwich - Trafalgar Road (Hoskins St)	R	95	33	yes	0	yes
Greenwich - Tunnel Avenue ^T	R	95	34	yes	0	yes
Greenwich - Westhorne Avenue	R	94	26	yes	0	yes
Greenwich - Woolwich Flyover	R	100	40	yes	0	yes
Hackney - Old Street ^T	R	100	33	yes	0	yes
Haringey - Priory Park South ^{AA}	U	91	18	yes	0	yes
Haringey - Haringey Town Hall ^{AA}	R	96	32	yes	0	yes
Harrow - Stanmore	U	100	16	yes	0	yes
Havering - Rainham	R	99	23	yes	0	yes
Havering - Romford	R	99	28	yes	0	yes

Site Name	Type	Capture Rate (%)	Annual Mean $\leq 40 \mu\text{g m}^{-3}$	Annual Mean Achieved?	No more than 18 occurrences of hourly mean $> 200 \mu\text{g m}^{-3}$	Hourly Mean Achieved?
Islington - Arsenal	U	86	20	n/a	0	n/a
Islington - Holloway Road	R	100	29	yes	0	yes
Kensington and Chelsea - North Ken ^{AA}	U	99	20	yes	0	yes
Kingston Upon Thames - Cromwell Road	R	96	51	no	0	yes
Kingston Upon Thames - Kingston Vale	R	100	26	yes	0	yes
Kingston Upon Thames - Tolworth Broadway	R	98	31	yes	0	yes
Lambeth - Bondway Interchange	I	95	36	yes	0	yes
Lambeth - Brixton Road	K	100	62	no	4	yes
Lambeth - Streatham Green	U	65	28	n/a	0	n/a
Lewisham - Catford	U	82	25	n/a	0	n/a
Lewisham - Deptford	U	99	20	yes	0	yes
Lewisham - Honor Oak Park	U	90	16	yes	0	yes
Lewisham - Loampit Vale	R	99	35	yes	0	yes
Lewisham - New Cross	R	59	31	n/a	0	n/a
Lewisham - Laurence House Catford	R	12	29	n/a	0	n/a
Newham - Britannia Gate ^T	R	96	26	yes	0	yes
Newham - Cam Road	R	91	23	yes	0	yes
Newham - Hoola Tower ^T	R	81	22	n/a	0	n/a
Newham - Wren Close	U	96	21	yes	0	yes
Redbridge - Gardner Close	R	99	26	yes	0	yes
Redbridge - Ley Street	U	98	25	yes	0	yes
Reigate and Banstead - A23 Hooley	R	91	41	no	0	yes
Reigate and Banstead - Horley ^{AA}	S	95	15	yes	0	yes
Reigate and Banstead - Horley South East	S	97	14	yes	0	yes
Reigate and Banstead - Poles Lane	RU	98	10	yes	0	yes
Richmond Upon Thames - Barnes Wetlands	S	85	14	n/a	0	n/a
Richmond Upon Thames - Castelnau	R	98	21	yes	0	yes
Sevenoaks - Bat and Ball	R	94	20	yes	0	yes
Sevenoaks - Greatness Park	U	78	12	n/a	0	n/a
Southwark - A2 Old Kent Road ^{AA}	R	97	29	yes	0	yes
Southwark - Elephant and Castle	U	88	23	n/a	0	n/a
Southwark - Lower Road	R	93	28	yes	0	yes
Southwark - South Circular Road	R	39	29	n/a	0	n/a
Southwark - Tower Bridge Road	R	66	34	n/a	10	n/a
Southwark - Vicarage Grove	R	85	40	n/a	0	n/a
Sutton - Beddington Lane north	I	99	22	yes	0	yes
Sutton - Beddington Village	R	89	24	n/a	0	n/a
Sutton - Wallington	K	99	43	no	1	yes
Sutton - Worcester Park	K	95	43	no	0	yes
Thurrock - Dock Road Tilbury	R	94	29	yes	0	yes
Thurrock - London Road (Grays) ^A	U	98	21	yes	0	yes
Thurrock - London Road (Purfleet)	R	88	42	n/a	0	n/a
Thurrock - Stanford-le-Hope ^{AA}	R	99	22	yes	0	yes

Site Name	Type	Capture Rate (%)	Annual Mean $\leq 40 \mu\text{g m}^{-3}$	Annual Mean Achieved?	No more than 18 occurrences of hourly mean $> 200 \mu\text{g m}^{-3}$ (104.7ppb)	Hourly Mean Achieved?
Tower Hamlets - Blackwall ^T	R	99	37	yes	0	yes
Tower Hamlets - Mile End Road ^{AA}	R	99	22	yes	0	yes
Wandsworth - Battersea	R	89	28	n/a	0	n/a
Wandsworth - Lavender Hill (Clapham Jct)	R	95	35	yes	0	yes
Wandsworth - Putney	U	91	27	yes	0	yes
Wandsworth - Putney High Street	K	94	62	no	1	yes
Wandsworth - Putney High Street Facade	R	89	57	n/a	0	n/a
Wandsworth - Tooting High Street	R	45	36	n/a	0	n/a
Wandsworth - Wandsworth Town Hall	U	82	29	n/a	0	n/a
Westminster - Cavendish Square	R	98	32	yes	0	yes
Westminster - Covent Garden	U	99	24	yes	0	yes
Westminster - Duke Street (Grosvenor) ^O	R	97	30	yes	0	yes
Westminster - Ebury Street (Grosvenor) ^O	R	72	22	n/a	0	n/a
Westminster - Elizabeth Bridge	R	99	30	yes	0	yes
Westminster - Horseferry Road ^A	U	97	24	yes	0	yes
Westminster - Marylebone Road ^{AA}	K	94	43	no	0	yes
Westminster - Oxford Street	K	92	34	yes	0	yes
Westminster - Oxford Street East	R	99	37	yes	0	yes
Westminster - Regent St (Crown Estate) ^O	R	80	36	n/a	0	n/a
Westminster - Strand (Northbank BID) ^O	R	99	43	no	3	yes
Westminster - Waterloo Pl (Crown Estate)	R	95	36	yes	0	yes
Windsor and Maidenhead - Aldebury Road	U	99	14	yes	0	yes
Windsor and Maidenhead - Clarence Road	R	96	24	yes	0	yes
Windsor and Maidenhead - Frascati Way	R	99	26	yes	0	yes

Table 3: AQS Objective results for NO₂

NO₂ ppbV measurements have been converted to $\mu\text{g m}^{-3}$ by multiplying by 1.9125 as recommended in Defra's Local Air Quality Management Technical Guidance (Defra, 2016).

Summary

- 76 sites out of 87 that achieved the 90% data capture requirement met the annual mean objective for nitrogen dioxide (NO₂) of not exceeding $40 \mu\text{g m}^{-3}$.
- All sites achieved the hourly mean objective of no more than 18 occurrences of an hourly mean greater than $200 \mu\text{g m}^{-3}$.
- A similar proportion of sites (13%) failed to achieve the annual mean objective in 2021 compared to 12% in 2020 and 35% in 2019.
- No sites failed to achieve the hourly mean objective for NO₂ in 2021 or 2020 compared to 2 sites in 2019 and 6 sites in 2018.
- The number of hourly exceedences fell at many sites, the highest being 4 exceedences, in comparison with 8 in 2020 and 21 in 2019. This is the continuation of a sharp downward trend which has seen the number of hourly exceedences fall from over 1500 at three London sites in 2014.

- In 2020, pollution concentrations were affected by restrictions introduced due to the Covid-19 pandemic which is likely to have reduced annual NO₂ concentrations. Although some restrictions remained in place for parts of 2021, it is encouraging that the number of exceedances did not return to previous levels.
- New guidelines announced by the WHO in 2021 (WHO, 2021) suggest a reduction of the NO₂ annual mean limit to 10 µgm⁻³. No LAQN sites achieved this target in 2021.
- The largest source of NO₂ in London is diesel traffic emissions (GLA, 2022).

3.3 Nitrogen Oxides

Site Name	Type	Capture Rate (%)	Annual Mean NO _x as NO ₂ ug _m ⁻³
Barking and Dagenham - Rush Green	S	90	23
Barking and Dagenham - Scrattons Farm	S	94	30
Bexley - Belvedere	S	100	21
Bexley - Belvedere West	U	100	23
Bexley - Slade Green ^{AA}	S	96	26
Brent - ARK Franklin Primary Academy	R	100	57
Brent - Ikea	R	98	98
Brent - John Keble Primary School	R	100	45
Brent - Neasden Lane	I	99	56
Bromley - Harwood Avenue	R	97	33
Camden - Bloomsbury ^A	U	98	35
Camden - Holborn (Central District Alliance) ^O	K	99	64
Camden - Swiss Cottage ^{AA}	K	70	71
City of London - Beech Street	R	85	46
City of London - The Aldgate School	U	97	30
City of London - Walbrook Wharf	R	96	93
Croydon - Norbury	K	99	89
Croydon - Purley Way A23	R	99	52
Ealing - Acton Vale	U	69	31
Ealing - Hanger Lane Gyrotory	R	100	146
Ealing - Horn Lane	I	100	58
Ealing - Western Avenue	R	100	72
Enfield - Bowes Primary School	R	99	56
Enfield - Bush Hill Park	S	100	25
Enfield - Derby Road	R	100	45
Enfield - Prince of Wales School	U	92	27
Greenwich - A206 Burrage Grove	R	100	40
Greenwich - Blackheath	R	100	51
Greenwich - Eltham ^{AA}	S	90	19
Greenwich - Falconwood	R	97	47
Greenwich - Fiveways Sidcup Rd A20	R	100	66
Greenwich - John Harrison Way	R	97	39
Greenwich - Plumstead High Street	R	100	41
Greenwich - Trafalgar Road (Hoskins St)	R	95	63
Greenwich - Tunnel Avenue	R	95	61
Greenwich - Westthorne Avenue	R	94	44
Greenwich - Woolwich Flyover	R	100	103
Hackney - Old Street ^T	R	100	59
Haringey - Priory Park South ^{AA}	U	91	22
Haringey - Haringey Town Hall ^{AA}	R	96	53
Harrow - Stanmore	U	100	21
Havering - Rainham	R	99	38
Havering - Romford	R	99	54
Islington - Arsenal	U	86	26
Islington - Holloway Road	R	100	49

Site Name	Type	Capture Rate (%)	Annual Mean NO _x as NO ₂ ug _m ⁻³
Kensington and Chelsea - North Ken ^{AA}	U	99	25
Kingston Upon Thames - Cromwell Road	R	96	116
Kingston Upon Thames - Kingston Vale	R	100	47
Kingston Upon Thames - Tolworth Broadway	R	98	61
Lambeth - Bondway Interchange	I	95	65
Lambeth - Brixton Road	K	100	155
Lambeth - Streatham Green	U	65	45
Lewisham - Catford	U	82	38
Lewisham - Deptford	U	99	25
Lewisham - Loampit Vale	R	99	62
Lewisham - New Cross	R	59	54
Lewisham - Laurence House Catford	R	12	57
Newham - Britannia Gate	R	96	44
Newham - Cam Road	R	91	34
Newham - Hoola Tower	R	81	31
Newham - Wren Close	U	96	27
Redbridge - Gardner Close	R	99	42
Redbridge - Ley Street	U	98	45
Reigate and Banstead - A23 Hooley	R	91	92
Reigate and Banstead - Horley ^{AA}	S	95	23
Reigate and Banstead - Horley South East	S	97	21
Reigate and Banstead - Poles Lane	RU	98	12
Richmond Upon Thames - Barnes Wetlands	S	85	17
Richmond Upon Thames - Castelnuau	R	98	32
Sevenoaks - Bat and Ball	R	94	38
Sevenoaks - Greatness Park	U	78	16
Southwark - A2 Old Kent Road ^{AA}	R	97	56
Southwark - Elephant and Castle	U	88	29
Southwark - Lower Road	R	93	42
Southwark - South Circular Road	R	39	50
Southwark - Tower Bridge Road	R	66	69
Southwark - Vicarage Grove	R	85	73
Sutton - Beddington Lane north	I	99	34
Sutton - Beddington Village	R	89	40
Sutton - Wallington	K	99	90
Sutton - Worcester Park	K	95	90
Thurrock - Dock Road Tilbury	R	94	52
Thurrock - London Road (Grays) ^A	U	98	32
Thurrock - London Road (Purfleet)	R	88	102
Thurrock - Stanford-le-Hope ^{AA}	R	99	40
Tower Hamlets – Blackwall ^T	R	99	75
Tower Hamlets - Mile End Road ^{AA}	R	99	45
Wandsworth - Battersea	R	89	43
Wandsworth - Lavender Hill (Clapham Jct)	R	95	59

Site Name	Type	Capture Rate (%)	Annual Mean NO _x as NO ₂ µgm ⁻³
Wandsworth - Putney	U	91	38
Wandsworth - Putney High Street	K	94	143
Wandsworth - Putney High Street Facade	R	89	118
Wandsworth - Tooting High Street	R	45	71
Wandsworth - Wandsworth Town Hall	U	82	44
Westminster - Cavendish Square	R	98	55
Westminster - Covent Garden	U	99	29
Westminster - Duke Street (Grosvenor) ^o	R	97	41
Westminster - Ebury Street (Grosvenor) ^o	R	72	28
Westminster - Elizabeth Bridge	R	99	49
Westminster - Horseferry Road ^A	U	97	31
Westminster - Marylebone Road ^{AA}	K	94	101
Westminster - Oxford Street	K	92	62
Westminster - Oxford Street East	R	99	68
Westminster - Regent St (Crown Estate) ^o	R	80	64
Westminster - Strand (Northbank BID) ^o	R	99	70
Westminster - Waterloo PI (Crown Estate) ^o	R	95	60
Windsor and Maidenhead - Aldebury Road	U	99	21
Windsor and Maidenhead - Clarence Road	R	96	44
Windsor and Maidenhead - Frascati Way	R	99	50

Table 4: Annual Mean values for NO_x

NO_x ppbV measurements have been converted to µgm⁻³ by multiplying by 1.9125 as recommended in Defra's Local Air Quality Management Technical Guidance (Defra, 2016). There are no AQS Objectives for NO_x.

3.4 Ozone

Site Name	Type	Capture Rate (%)	No more than 10 days where maximum rolling 8hr mean $\geq 100 \mu\text{g m}^{-3}$ (50ppb)	Achieved?
Bexley - Belvedere West	U	100	9	yes
Bexley - Slade Green	S	99	8	yes
Brent - Ikea ^T	R	0	0	n/a
Camden - Bloomsbury ^A	U	99	5	yes
Greenwich - Eltham ^{AA}	S	44	4	n/a
Greenwich - Falconwood	R	83	0	n/a
Greenwich - Plumstead High Street	R	93	0	yes
Greenwich - Westthorne Avenue ^T	R	38	0	n/a
Greenwich - Woolwich Flyover ^T	R	97	0	yes
Hackney - Old Street ^T	R	100	2	yes
Haringey - Priory Park South ^{AA}	U	93	7	yes
Kensington and Chelsea - North Ken ^{AA}	U	98	11	no
Lewisham - Honor Oak Park ^{AA}	U	93	9	yes
Redbridge - Ley Street	U	61	3	n/a
Reigate and Banstead - Poles Lane	RU	96	21	no
Richmond Upon Thames - Barnes Wetlands	S	91	9	yes
Sevenoaks - Greatness Park	U	81	10	n/a
Southwark - Elephant and Castle	U	92	14	no
Thurrock - London Road (Grays) ^A	U	95	5	yes
Tower Hamlets - Blackwall ^T	R	87	0	n/a
Westminster - Marylebone Road ^{AA}	K	93	0	yes
Westminster - Waterloo PI (Crown Estate) ^O	R	97	2	yes

Table 5: AQS Objective results for O₃

O₃ ppbV measurements have been converted to $\mu\text{g m}^{-3}$ by multiplying by 1.9957.

Summary

- 14 sites out of 17 which achieved the 90% data capture requirement met the 8 hourly mean AQS objective for O₃ of no more than ten days measuring a daily mean greater than or equal to $100\mu\text{g m}^{-3}$.
- 3 sites exceeded the objective: two urban background sites in central London boroughs and one rural site in Surrey. This was a large reduction in the number of sites that exceeded the objective in 2020 when 11 sites exceeded the objective. There were fewer exceedance days at most sites compared to 2020, the maximum number being 21, compared to 2020 when six sites had over 30 exceedance days.
- O₃ is a regional pollutant and higher concentrations occur in hot sunny conditions. It is greater away from busy roads as it is scavenged by NO_x from traffic. There were more exceedance days in 2020 compared to recent years, likely to be due to reduced NO_x concentrations due to the Covid-19 pandemic, a warm and sunny spring and heatwave conditions in August. In 2021, the smaller number of sites exceeding the objective was more typical of the pattern seen for much of the period since 2010.

3.5 Sulphur Dioxide

Site Name	Type	Capture Rate (%)	No more than 35 occurrences of 15min mean $\geq 350 \mu\text{g m}^{-3}$ (100ppb)	Achieved?
Barking and Dagenham - Rush Green	S	94	0	yes
Bexley - Slade Green ^{AA}	S	100	0	yes
Camden - Bloomsbury ^A	U	82	0	n/a
Kensington and Chelsea - North Ken ^{AA}	U	69	0	n/a
Lambeth - Bondway Interchange	I	100	0	yes
Thurrock - London Road (Grays) ^A	U	96	0	yes
Westminster - Marylebone Road ^{AA}	K	95	0	yes

Table 6: AQS Objective results for SO₂

SO₂ ppbV measurements have been converted to $\mu\text{g m}^{-3}$ by multiplying by 2.6609 as recommended in Defra's Local Air Quality Management Technical Guidance (Defra, 2016).

Summary

- All five sites that achieved the 90% data capture requirement achieved the AQS objective of no more than 35 occurrences of 15 minute mean greater than $350 \mu\text{g m}^{-3}$ for SO₂.
- No 15 minute mean SO₂ measurements greater than $350 \mu\text{g m}^{-3}$ were recorded at any LAQN site.
- The 15 minute mean objective is the most stringent of the current AQS objectives for SO₂.

3.6 Particulate Matter PM₁₀

Site Name	Type	Capture Rate (%)	Annual Mean <= 40 ug ^m - ³	Annual Mean Achieved?	No more than 35 occurrences of daily mean >= 50ug ^m - ³	Daily Mean Achieved?
Barking and Dagenham - Scrattons Farm	S	99	18	yes	2	yes
Bexley - Belvedere	S	99	18	yes	4	yes
Bexley - Belvedere FDMS	S	88	16	n/a	3	n/a
Bexley - Belvedere West	U	99	17	yes	2	yes
Bexley - Belvedere West FDMS	U	96	14	yes	1	yes
Bexley - Slade Green FIDAS	S	100	14	yes	1	yes
Brent - ARK Franklin Primary Academy	R	99	18	yes	1	yes
Brent - Ikea	R	99	26	yes	16	yes
Brent - John Keble Primary School	R	97	18	yes	0	yes
Brent - Neasden Lane	I	100	21	yes	2	yes
Bromley - Harwood Avenue	R	96	15	yes	0	yes
Camden - Bloomsbury ^A	U	95	16	yes	0	yes
Camden - Swiss Cottage ^{AA}	K	59	17	n/a	0	n/a
City of London - Beech Street	R	96	15	yes	0	yes
City of London - The Aldgate School	U	95	16	yes	1	yes
City of London - Upper Thames Street	R	69	20	n/a	6	n/a
Ealing - Acton Vale	U	56	17	n/a	1	n/a
Ealing - Hanger Lane Gyrotory	R	100	20	yes	3	yes
Ealing - Horn Lane ^{AA}	I	90	26	yes	13	yes
Ealing - Horn Lane TEOM	I	98	23	yes	7	yes
Ealing - Western Avenue	R	98	25	yes	11	yes
Enfield - Bowes Primary School	R	85	15	n/a	0	n/a
Greenwich - A206 Burrage Grove	R	85	13	n/a	0	n/a
Greenwich - Blackheath	R	96	19	yes	2	yes
Greenwich - Eltham	S	75	12	n/a	0	n/a
Greenwich - Falconwood	R	100	19	yes	4	yes
Greenwich - Fiveways Sidcup Rd A20	R	94	21	yes	3	yes
Greenwich - John Harrison Way	R	99	20	yes	3	yes
Greenwich - Trafalgar Road (Hoskins St)	R	97	19	yes	2	yes
Greenwich - Westthorne Avenue	R	94	17	yes	1	yes
Greenwich - Woolwich Flyover	R	90	20	yes	5	yes
Hackney - Old Street ^T	R	99	19	yes	0	yes
Harrow - Pinner Road	R	79	18	n/a	0	n/a
Harrow - Stanmore	U	88	15	n/a	0	n/a
Havering - Rainham	R	71	14	n/a	0	n/a
Havering - Romford	R	57	19	n/a	0	n/a
Islington - Arsenal	U	85	19	n/a	2	n/a
Islington - Holloway Road	R	93	19	yes	1	yes
Kensington and Chelsea - North Ken FDMS ^{AA}	U	100	14	yes	1	yes
Kensington and Chelsea - North Ken FIDAS ^{AA}	U	98	14	yes	1	yes
Kingston Upon Thames - Cromwell Road	R	99	28	yes	13	yes

Site Name	Type	Capture Rate (%)	Annual Mean <= 40 ug ^m - ³	Annual Mean Achieved?	No more than 35 occurrences of daily mean >= 50ug ^m - ³	Daily Mean Achieved?
Kingston Upon Thames - Kingston Vale	R	98	18	yes	1	yes
Kingston Upon Thames - Tolworth Broadway	R	66	21	n/a	0	n/a
Lambeth - Bondway Interchange	I	98	46	no	142	no
Lambeth - Brixton Road	K	100	25	yes	10	yes
Lambeth - Streatham Green	U	99	17	yes	1	yes
Lewisham - Honor Oak Park ^{AA}	U	97	14	yes	0	yes
Lewisham - Loampit Vale	R	95	19	yes	3	yes
Lewisham - New Cross	R	41	20	n/a	2	n/a
Marylebone Road - Fidas	K	97	17	yes	3	yes
Merton - Merton Road	R	45	23	n/a	3	n/a
Newham - Cam Road	R	92	17	yes	0	yes
Newham - Wren Close	U	95	18	yes	2	yes
Redbridge - Gardner Close	R	70	16	n/a	0	n/a
Redbridge - Ley Street	U	58	14	n/a	0	n/a
Reigate and Banstead - Horley	S	100	15	yes	0	yes
Reigate and Banstead – Horley FDMS	S	96	13	yes	0	yes
Reigate and Banstead - Poles Lane	RU	62	14	n/a	0	n/a
Reigate and Banstead- Earlswood Depot	I	38	16	n/a	0	n/a
Richmond Upon Thames - Barnes Wetlands	S	94	15	yes	0	yes
Richmond Upon Thames - Castelnuau	R	99	16	yes	0	yes
Sevenoaks - Bat and Ball	R	100	18	yes	2	yes
Sevenoaks - Greatness Park	U	99	17	yes	2	yes
Southwark - A2 Old Kent Road BAM ^{AA}	R	95	21	yes	9	yes
Southwark - A2 Old Kent Road FIDAS	R	100	17	yes	7	yes
Southwark - Elephant and Castle	U	98	14	yes	2	yes
Southwark - Lower Road	R	78	15	n/a	2	n/a
Southwark - South Circular Road	R	39	12	n/a	0	n/a
Southwark - Tower Bridge Road	R	93	18	yes	6	yes
Southwark - Vicarage Grove	R	81	16	n/a	2	n/a
Sutton - Beddington Lane north	I	99	18	yes	1	yes
Sutton - Beddington Village	R	80	17	n/a	0	n/a
Sutton - Wallington	K	99	18	yes	0	yes
Sutton - Worcester Park	K	66	15	n/a	0	n/a
Thurrock - London Road (Grays) ^A	U	87	17	n/a	1	n/a
Thurrock - London Road (Purfleet)	R	87	22	n/a	6	n/a
Thurrock - Stanford-le-Hope ^{AA}	R	84	17	n/a	2	n/a
Tower Hamlets – Blackwall ^T	R	43	18	n/a	0	n/a
Wandsworth - Battersea	R	97	23	yes	9	yes
Wandsworth - Lavender Hill (Clapham Jct)	R	96	19	yes	0	yes
Wandsworth - Tooting High Street	R	86	23	n/a	4	n/a
Westminster - Cavendish Square	R	98	22	yes	5	yes
Wandsworth - Putney	U	96	16	yes	0	yes
Wandsworth - Putney High Street	K	81	20	n/a	3	n/a

Site Name	Type	Capture Rate (%)	Annual Mean \leq 40 $\mu\text{g m}^{-3}$	Annual Mean Achieved?	No more than 35 occurrences of daily mean \geq 50 $\mu\text{g m}^{-3}$	Daily Mean Achieved?
Westminster - Marylebone Road FDMS ^{AA}	K	74	16	n/a	1	n/a
Westminster - Oxford Street	K	94	20	yes	6	yes

Table 7: AQS Objective results for PM₁₀.

All PM₁₀ measurements have been converted to reference equivalent by the methods recommended in Defra's Local Air Quality Management Technical Guidance (Defra, 2016), i.e. TEOM measurements have been corrected using the Volatile Correction Model (VCM) and heated and unheated BAM measurements have been corrected using the divisors 1.2 and 1.035 respectively.

Summary

- 58 of the 59 sites that achieved the 90% data capture requirement met the annual mean AQS objective of 40 $\mu\text{g m}^{-3}$ for PM₁₀.
- One site did not meet the annual mean AQS objective of 40 $\mu\text{g m}^{-3}$ for PM₁₀. This site is thought to be affected by a local source of particulate emissions and is classified as an industrial site.
- The same site did not meet the daily mean objective of no more than 35 days with a daily mean greater than 50 $\mu\text{g m}^{-3}$.
- 46 of the sites that achieved the 90% data capture requirement achieved the 2006 WHO guideline value of not exceeding 20 $\mu\text{g m}^{-3}$ as an annual mean (WHO, 2006). This is a small improvement on the proportion of sites that achieved this target in 2020 (78% in 2021 compared to 72% in 2020).
- However, in 2021, the WHO announced new guidelines (WHO, 2021) which cut the PM₁₀ recommended annual mean limit to 15 $\mu\text{g m}^{-3}$. 13 sites achieved this. Although an improvement compared to 2020 when eight sites achieved the target, this leaves 78% of sites exceeding the target.

3.7 Particulate Matter PM_{2.5}

Site Name	Type	Instrument	Capture Rate (%)	Annual Mean ug ^m - ³
Bexley - Slade Green FDMS ^{AA}	S	FDMS	100	9
Bexley - Slade Green FIDAS ^{AA}	S	FIDAS	100	9
Brent - ARK Franklin Primary Academy	R	TEOM*	96	7
Brent - Ikea ^T	R	BAMH	97	13
Bromley - Harwood Avenue	R	BAMH	89	10
Camden - Bloomsbury ^A	U	FDMS	36	11
Camden - Swiss Cottage ^{AA}	K	FDMS	64	10
City of London - Farringdon Street	K	BAMH	41	10
City of London - The Aldgate School	U	BAMH	90	11
Croydon - Norbury Manor	U	BAMH	87	9
Greenwich - A206 Burrage Grove	R	FDMS	94	11
Greenwich - Eltham ^{AA}	S	FIDAS	90	8
Greenwich - Falconwood	R	FDMS	92	13
Greenwich - John Harrison Way	R	FDMS	77	11
Greenwich - Plumstead High Street	R	FDMS	56	9
Greenwich - Trafalgar Road (Hoskins St)	R	TEOM*	93	8
Greenwich - Westthorne Avenue	R	FDMS	87	7
Greenwich - Woolwich Flyover ^T	R	TEOM*	64	8
Hackney - Old Street ^T	R	TEOM*	94	8
Havering - Rainham	R	FDMS	72	9
Kensington and Chelsea - North Ken ^{AA}	U	FDMS	100	9
Kensington and Chelsea - North Ken ^{AA}	U	FIDAS	98	9
Lewisham - Deptford	U	BAMH	68	9
Lewisham - Honor Oak Park ^{AA}	U	FIDAS	97	9
Lewisham - New Cross	R	FDMS	40	15
Newham - Britannia Gate ^T	R	BAMH	25	12
Newham - Cam Road	R	BAMH	58	12
Newham - Wren Close	U	BAMH	67	13
Redbridge - Gardner Close	R	BAM*	84	10
Redbridge - Ley Street	U	BAMH	77	10
Southwark - A2 Old Kent Road	R	FIDAS	100	9
Southwark - Elephant and Castle	U	FIDAS	98	9
Southwark - Lower Road	R	FIDAS	79	9
Southwark - South Circular Road	R	FIDAS	39	7
Southwark - Tower Bridge Road	R	FIDAS	93	10
Southwark - Vicarage Grove	R	FIDAS	81	10
Sutton - Beddington Lane north	I	BAMH	98	10
Thurrock - Dock Road Tilbury	R	BAMH	97	11
Thurrock - Stanford-le-Hope ^{AA}	R	BAMH	89	12
Tower Hamlets - Blackwall ^T	R	FDMS	64	11
Westminster - Elizabeth Bridge	R	BAMH	99	10
Westminster - Marylebone Road ^{AA}	K	BAMH	2	11
Westminster - Marylebone Road FDMS ^{AA}	K	FDMS	86	11
Westminster - Waterloo PI (Crown Estate) ^O	R	FIDAS	98	9

Table 8: Annual mean results for PM_{2.5}

FIDAS measurements have been corrected using the divisor 1.06, as recommended in in Defra’s Local Air Quality Management Technical Guidance (Defra, 2016). Instruments marked with a * are not considered a reference equivalent measurement method and do not currently have an agreed correction method, so should be interpreted with caution.

Summary

- All 17 sites with data capture of 90% or more that used a reference equivalent measurement method achieved the UK Objective of $25 \mu\text{g m}^{-3}$ as an annual mean.
- 12 sites with a data capture of 90% or more that used a reference equivalent measurement method achieved the 2006 WHO guideline value of $10 \mu\text{g m}^{-3}$ (WHO, 2006) in 2021 which is an improvement compared to 2020 when nine sites achieved this target.
- However, in 2021, the WHO recommended this limit be reduced to $5 \mu\text{g m}^{-3}$ (WHO, 2021) as an annual mean based on increased evidence of the harm caused by these very small particles. No sites achieved this target in 2020.

4 References

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