

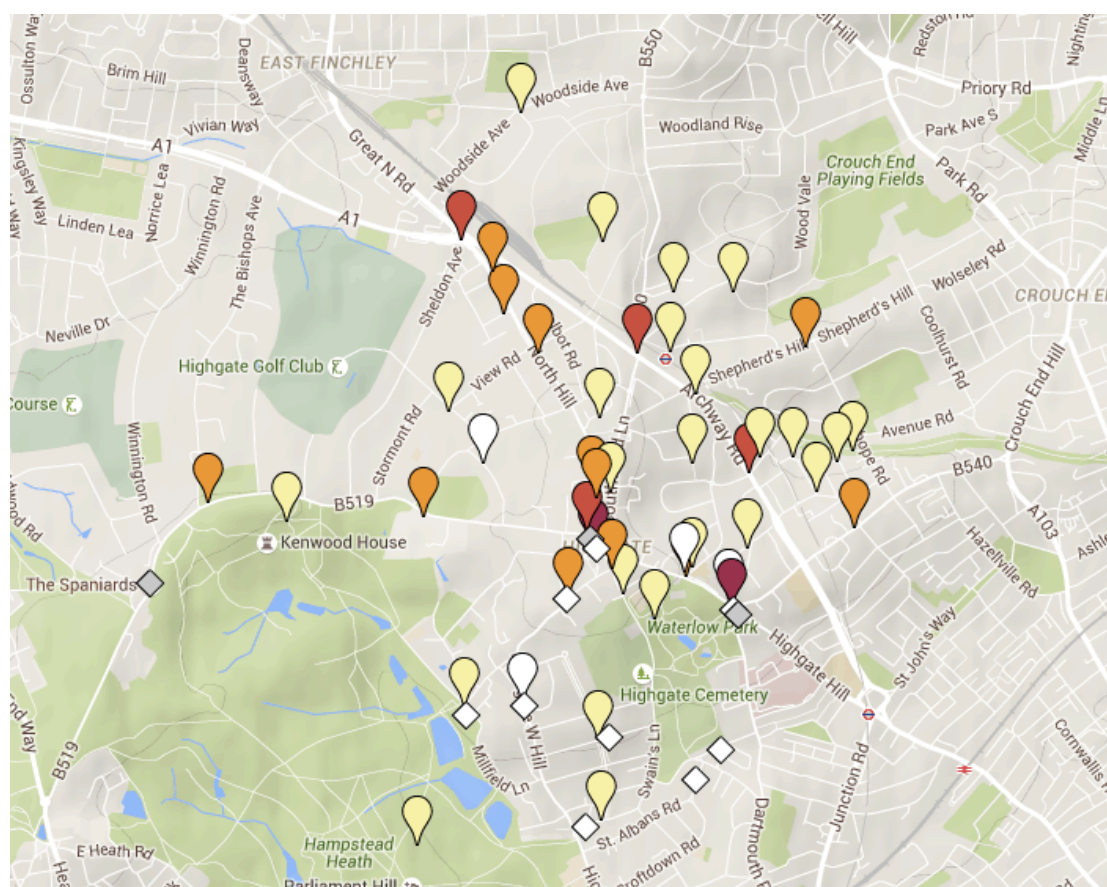
Highgate's air quality

This is a report about air pollution in Highgate. At its core is an air quality survey initiated by the Highgate Neighbourhood Forum, crowd-funded thanks to the generosity of local residents, with fieldwork conducted by pupils of Highgate School. Marjolaine Briscoe led the team from the school and, with members of the Forum, contributed to the writing of this report. With thanks to everyone who helped to make this possible.







April 2016

Highgate's main roads have illegal and health-damaging levels of air pollution according to the first set of results from the community's survey.

The Highgate Neighbourhood Forum financed the survey by crowd funding and worked with pupils from Highgate School to place 45 sensors around Highgate to measure NO₂ levels. (The sensors were put up in mid-March and collected, to be sent for processing, a month later. See some background [here](#).) Some 41 sensors returned valid results as four were removed or in some way damaged.



The readings are summarised in the map which allocates each result to one of five categories:

-  purple pins show the locations of the highest pollution – at least 50µg/m³ (milligrams per cubic metre).
-  red pins – between 40 and 49µg/m³
-  orange pins - between 30 and 39µg/m³
-  yellow pins – less than 29µg/m³
-  white pins indicate where no reading was validated.
-  diamonds are locations of readings by other organisations in previous years.

The pattern is quite clear. Highgate's main roads have very high – illegal – levels of NO₂ pollution. The two purple readings on Highgate Hill and the High Street were both 54µg/m³ (milligrams per cubic metre). The red readings (on Archway Road and Aylmer Road) are between 40 and 49µg/m³. These are above the legal limit of 40µg/m³. This represents a serious and persistent health risk at the heart of our community.

Most of the readings on the secondary roads in the area, including Hampstead Lane, North Hill, North Road, Shepherds Hill and Hornsey Lane, were between 30 and 40µg/m³ (and are marked orange on the map). The side roads all had readings below 30µg/m³ with the lowest being just under 20, on Hampstead Heath and in Queens Wood.

The level of NO₂ recorded is highly localised so the precise location of the diffusion tubes is very important. Small differences can, the experts say, materially affect the results. It is possible to choose sampling sites to be “representative” of pollution in the wider areas or put them at traffic black spots – trying to get the highest reading possible. Some people will take about “kerb side” measures as being within 5m of the road, “roadside” being between 5-20m of the road, and “ambient” or background being beyond 20m. Putting the sensor on a traffic light in the middle of the road should give a higher reading than putting it on a post on the pavement, or behind a wall a few metres from the road.

The height also makes a difference. We put them just out of reach so that that they were less likely to be tampered with. That means, of course, that the air breathed by a pedestrian is likely to be more polluted as it is closer to the main source – the exhaust of the vehicle.

The impact of the precise location can perhaps be seen in our results for the Archway Road. The sensors by the Woodman pub (on a post in the green triangle opposite the pub) and on a lamp post by Northwood Road were close to the road

– and recorded readings in the mid 40s. The sensor by the Boogaloo was on a tree trunk towards the back of the sitting area between the pub and Gonnerman’s – and gave a reading of 29µg/m³. It is quite possible that a few metres and a few trees can take the reading half way from an illegal level (40µg/m³ +) to the underlying ambient level seen in our woods and parks (around 20µg/m³). This is good news. Although breathing the air on our main roads is not to be advised, it does mean that back gardens of houses or pubs on the main roads do not suffer from anything like the same problem.

We are hoping to repeat some of the readings later in the year and learning more about the impact of distance and trees in reducing pollution is something we will look at given we now have a good overall picture of Highgate’s pollution hot spots.

By way of background, an annex at the end of this blog deals with the following FAQs:

- What is NO₂?
- Why is NO₂ dangerous?
- What is the legal limit of 40µg/m³?
- How we used diffusion tubes to measure NO₂?
- How does Highgate compare to other parts of London and elsewhere?
- What have the authorities have been doing?
- Links for further reading.

It is important to bear in mind the variability in the figures given for each sensor. The readings are said to have an accuracy of + or – 8%. That is to say that a reading of 40µg/m³ means the “true” value is likely to be in the range 37 to 43. Accordingly, small differences between readings should be ignored. For example, this means that there is no significance to be attached to the difference between the readings of 43, 45 and 46 at three points on Archway Road, but it is significant that those readings are higher than on the side roads. There are also natural fluctuations in the level of pollution for which the exact reasons remain unknown to us.

Our results can be set against two previously-collected sets of figures we are aware of for Highgate.

Firstly, Haringey collects monthly data of NO₂ levels using diffusion tubes like ours at three points in Highgate on a rolling monthly basis. Two are on Archway Road and one is near Highgate Primary school. Their average figures from 12 readings in 2015 were:

- 30µg/m³ for the primary school. This is very close to our 33µg/m³, but they had monthly readings through 2015 that ranged between 26 and 34 (excluding the highest and lowest months).
- 41µg/m³ for near Buildbase, again very close to our 38µg/m³ recorded by the Wellington gyratory system. Here their figures ranged between 36 and 47 (excluding the highest and lowest months).
- 47µg/m³ for the southern end of Archway Road, close to the 46µg/m³ we recorded near Northwood Road. The range here was between 38 and 54.

We can be reassured that our readings were so close to the council's average readings while noting that, as seen in the council's figures, the readings can easily fluctuate in a range of about 10µg/m³ from month to month. There's no obvious pattern to help explain this – school holidays or seasons, for example, do not.

We can also be reassured that our results are robust as they are broadly similar to those produced by the [Hampstead Forum](#) using the same diffusion tubes and processed in the same labs. They too have illegal readings (in the 50s) at locations similar to ours – main roads and busy junctions that have queues of traffic – and lower levels on quiet roads and near green spaces. Their highest reading was on Hampstead Lane by the Spaniards pub where, as locals will know, there is nearly always queuing traffic.

We are aware of a second set of results for Highgate produced by the [Green Party in 2013](#) and again in 2015. These figures present us with some issues as the readings are much higher – sometimes as much as 50% higher – than ours. We do not know which company they used for the sensors and cannot vouch for the quality of their data. There is no overlap between the locations of the Green Party data and council data to allow comparison.

It is worth noting that diffusion tubes have, due to their simplicity, limited accuracy. When surveys are done professionally diffusion tubes are accompanied by bias adjustments derived from professional-grade equipment (as explained in the annex to this report). These adjustments have shifted the diffusion tube reading by up to 20% - up or down – when used in Haringey. This could account for much of the difference between the Green readings and ours.

We can set the figures for Highgate in some context. [Haringey](#) has been measuring air quality at two sites in the borough (but not in Highgate) for some years. The long-running data sets (available on the Defra website) are from sites [located in Priory Park, N8](#) and on the High Road, N17, which are part of the national pollution monitoring system and are using professional equipment. The monitoring stations are affiliated to the Automatic Urban & Rural Network (AURN). AURN sites have Defra funding as the data is more rigorously scrutinised with traceability to EU standards. Defra's London AURN data manager is the [Environmental Research Group \(ERG\)](#), King's College London. ERG collates the data on a daily basis, validates it before sending it onto the national data managers; who ratify it to EU standards.

It looks, tentatively, as if the air in Priory Park is getting cleaner not dirtier. The annual average levels of NO₂ were in the twenties in 2011, 2013 and 2014 (there was no reading for 2012), compared to thirty-something in each of the 11 years from 2000 to 2010. Indeed, in the first four years up to 2003, the readings were 35µg/m³ or above and 34µg/m³ or below in the seven that followed. It might be that various actions, and education, are beginning to have some positive effect. Yet that data is in a park and the trends on the main roads are not encouraging. The reading at Haringey's other long-term site on the High Road N17 was at 48µg/m³ in 2014, among the highest figures recorded and there is no sign of a

downward trend at that location. It is quite possible that the ambient level of pollution is declining while pollution near roads is not.

The daily, detailed Haringey data does let us tentatively learn some things – and refute other suggestions. It shows:

- the daily volatility in the readings for NO₂ levels.
- that, averaged out over the weeks, there's no real seasonal pattern.
- that weekends tend to have lower pollution levels than the preceding working days but that difference is only significant about half the time.
- looking at the weekly data, that the school holiday periods do not leap out, suggesting that the impact of the school run is not pivotal. (The school run clogs up many roads near the schools for a short period each day but the associated traffic is modest in terms of the volume of traffic on London's main roads so has little impact on daily or weekly averages.)

Haringey's three diffusion tube sites in Highgate have data for the last five years. The data up to 2014 has been published. It also tentatively suggests that the latest published readings (2014) are a touch down on the peak seen at all three sites in 2012. Given the uncertainties and the limited number of observations it would be dangerous to draw too much of a conclusion for Highgate's pollution but it seems to be a common pattern over the borough. At least it seems reasonable to conclude that the situation is not getting any worse. (Data from [Haringey's "Air Quality Updating and Screening Assessment for 2014"](#), page 21/22.)

Our survey has given us the most thorough view of air pollution in Highgate but also shown that we need more data about the levels of pollution in very localised areas and what actually causes it. Accordingly, the forum will encourage both Haringey and Camden to take the pollution in Highgate seriously. The whole of Highgate needs to be looked at, including the village. Haringey has two sensor points on Archway Road and none on the (at least as) polluted roads through the village.

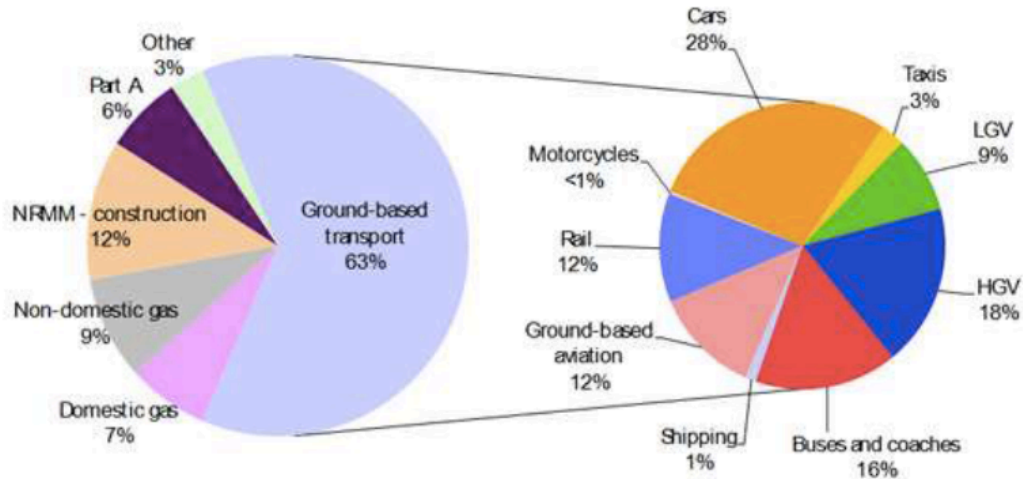
Only then, armed with more information, will we be able to say with more confidence what the best policies are to be pursued. Any actions will be set against the background of London's population rising and every more journeys being made.

What can we do in Highgate?

Air pollution in Highgate is largely due to the vast number of vehicles that travel through the area, mainly on the two main north-south arteries. It is not just personal vehicles but also HGVs, buses and taxis that emit pollution. We do not have pollution source figures for Highgate but the chart below shows the estimates for London. It suggests that goods vehicles contribute as much as private cars, and that taxis, buses and rail together contribute more. (The chart comes from Camden's [Clean air draft plan for 2016-2018](#) linked to from [here](#).) In Haringey, estimates suggest that about half of the NO₂ is caused by traffic (see the "[Air quality action plan](#)"). The dense network of roads and buildings also prevent

pollution from dispersing. The position in Highgate will not be very different (except there will be no contribution from ground-based airlines).

Sources of NO₂ in London (2010):



Source: Cleaner Air For London (LAEI 2010 data)

While there's only so much that we, as a community can do, we hope that this survey will raise awareness and galvanise action in both local campaigns and for change extending beyond Highgate. The power to make the changes of greatest impact rests with central government and the London Mayor, rather than local authorities.

But the [Highgate Forum](#) is doing what it can. We have added elements to the draft [neighbourhood plan](#) to reflect this emerging issue. For example, one policy, DH9, says that planning permission will only be given for developments on main roads (where pollution is high) if appropriate measures are taken to protect the users of the building from the pollution. Other policies consider car-free developments. The Plan also includes a number of community actions or initiatives (not formal policies) that we hope the community will press for. Examples include: make pavements safer and roads easier to cross, adjust CPZ times to reduce commuter use of cars, providing places to lock/store bikes, and introduce green routes for cycling.

We plan to present the results to TfL and ask them to prioritise the introduction of hybrid buses on the routes that pass through Highgate. Highgate Hill, [rumoured](#) to be the steepest hill used by buses in London, is a particular problem as is shown by the bus history, the number of buses that break down while trying the ascent, and the fumes spewed out by others.

Beyond that the forum will support campaigns and work with schools and other groups. Options to consider include promoting electric cars, car clubs, planting trees, encouraging large employers (such as schools and hospitals) to publish travel plans, and encouraging cycle lanes. Personal behaviour changes include walking, cycling or using public transport in the place of cars, car sharing,

combining errands into fewer trips, cut idling, choose lower emission cars, keeping tyres inflated and cars regularly serviced. Homes also contribute to pollution so fuel economy and efficiency measures can also play a part too.

The Forum would welcome comments on our plans as they evolve and help in delivering them. Please get in touch at info@forhighgate.org

Annex

FAQs:

- What is NO₂?
- Why is NO₂ dangerous?
- What is the legal limit of 40µg/m³?
- How we used diffusion tubes to measure NO₂?
- How does Highgate compare to other parts of London and elsewhere?
- What have the authorities have been doing?
- Links for further reading.

What is NO₂?

Nitrogen dioxide (NO₂) is a gas produced by the reaction of nitrogen and oxygen during the combustion process. These oxides of nitrogen, known as NOX (pronounced knocks), take part in chemical reactions in the air, changing into nitric acid and nitrates which may remain in the air as very small particles. It's not the only air pollutant that is measured (the government has seven on its list, including ozone and particulate matter) but it is an important one. Diesel vehicles produce more NO₂ and particulates (which the latest concerns) than petrol powered vehicles, as described [here](#).

Why is NO₂ dangerous?

As an irritant gas, NO₂ can damage cell membranes and proteins. High concentrations can produce airway inflammation (experienced as a cough, chest tightness and difficulty breathing), and may lead to narrowing of lung airways, particularly among people with pre-existing asthma. Studies have suggested that long term exposure to nitrogen dioxide can be associated to increases in non-accidental mortality (of up to 10,000 a year in London), cardiovascular diseases and lung cancer. Some studies suggest people living in areas with higher NO₂ exposures have poorer lung function. Other similar studies have not found this link. Plenty of reports can be found on the internet. Here's one from [GLA](#) and another from [Camden](#).

What is the legal limit of 40µg/m³ for NO₂?

An update on the legal wrangling can be found on, for example, the [Client Earth website](#). The latest [High Court correspondence](#) was on 28 April 2016.

The following paragraph is taken from the [Haringey website](#): *“Under Part IV on the Environment Act 1995, local authorities are required to periodically review and assess air quality in their area and identify areas where the air quality objectives are not likely to be met. The air quality objectives are set out for the seven pollutants in the Air Quality (England) Regulations 2000. The objectives are based on the health effects of air pollution. For areas where the air quality objectives are not likely to be achieved, local authorities have to declare Air Quality Management Areas (AQMA) and produce Air Quality Action Plans (AQAP) detailing measures to work towards the achieving the air quality objectives. Following extensive review and assessment of all seven pollutants, Haringey Council declared the whole borough an AQMA for the pollutants of PM₁₀ and NO₂ in July 2001. Haringey, like all authorities with AQMAs, has to produce annual reports to both Defra and the Greater London Authority (GLA) to show trends in air pollution and progress towards achievement of the air quality objectives for the pollutants concern.”* Haringey’s [latest annual report](#) was produced in May 2015. Table 1.1 of that document sets out the legal limits for each of the pollutants.

How we used diffusion tubes to measure NO₂?

The diffusion tubes are designed for passive monitoring of gaseous airborne NO₂. The air “diffuses” in rather than being pulled through by a pump. The ones we used are made from clear plastic and look like a short, thick pen, and come with a rubber stopper at each end. A steel mesh located at the end of the tube with the red stopper, coated with a chemical called triethanolamine (TEA), records exposure to NO₂. TEA absorbs nitrogen from the air when the white stopper is removed. The laboratory analysis delivers the reading which is an average over the period when the tube was exposed to the environment.

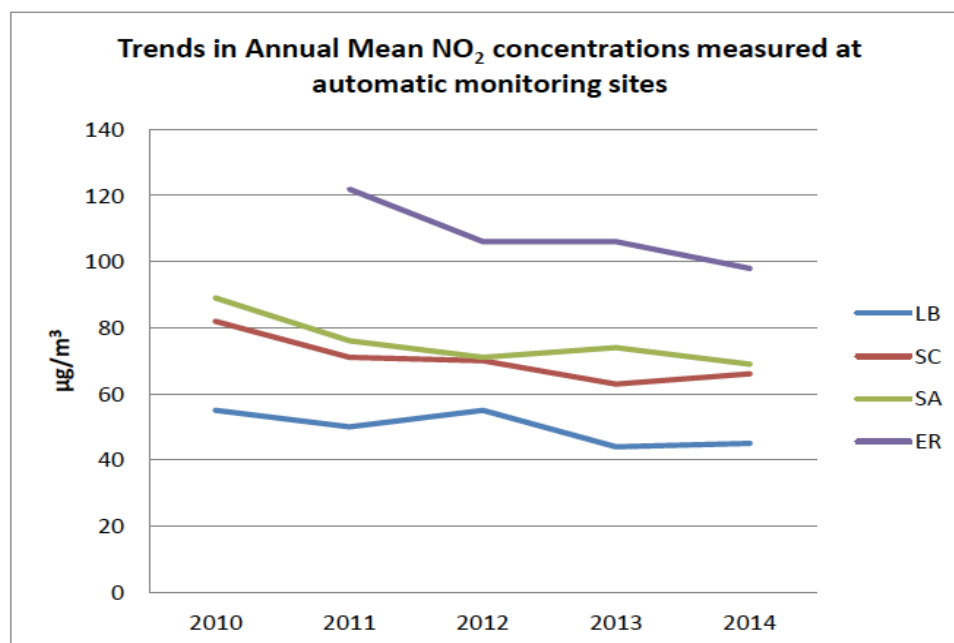
The Palmes-type diffusion tubes are widely used in the UK for indicative measurement of ambient concentrations of NO₂ in the context of Local Air Quality Management. However, no UK or international standard method currently exists for diffusion tube preparation or analysis. Consequently, there can be considerable variation in procedures among both supplying laboratories and end users. It is possible that readings from diffusion tubes can be up to 20% higher or lower than the “true” reading when made by professional quality equipment. Defra publishes adjustment factors – an explanation of which can be found on their [site](#). For more details, see an [AEA Report](#).

How does Highgate compare to other parts of London and elsewhere?

Some parts of Highgate have high levels of NO₂ pollution but they are low compared to some of the main streets in central London. Camden monitors

pollution at four central sites (Shaftesbury Avenue (SA), Bloomsbury (LB), Euston Road (ER) and Swiss Cottage (SC)) and, as the chart shows, pollution is very real problem. The source is page 13 of the [Camden clean air draft plan](#) for 2016-2018, linked to from this [page](#).

NO₂



Source: Camden monitoring data

London is pretty much mid range relative to other major cities but data quality is so variable that comparison is hard. A [study commissioned by GLA](#) and published in 2014 showed London to pretty much average. Vancouver, Sydney and Stockholm were top while many Indian and Chinese cities performed worst. London has some of the worse streets in Europe. The EU has set a limit for NO₂ of 40µg/m³ which is much lower than in the US or China, for example.

As London is more spread out, less densely populated, than many other cities, it is easier to find the London averages being lower than in other cities. Measurements taken at traffic sites are more likely to be where more people spend more time and thus experience more pollution than in parks where readings will be lower.

Some perspective on London's readings can be found on a website called [communitymaps.org.uk](#) where those who conducted surveys can plot their results.

What have the authorities been doing?

The authorities have not been inactive on the topic of air quality but seem not yet to have grasped the nettle and taken the really hard decisions. Haringey's action

is explained on these [pages](#) and Camden's [here](#). The GLA has many pages on [air quality](#) with initiatives [here](#).

It would be fair to say that to date most of the council action has been:

- monitoring (which seems to be more thorough than in many other cities and countries)
- offering advice about how to avoid the most polluted areas (walking on side streets not main roads)
- advising about how to make reductions in personal emissions (for example, by driving less).

But as more people become aware of the facts – through surveys such as ours – it seems likely that pressure for action will increase. Air pollution has been a big theme in the mayoral elections that are taking place and we'd expect to see the issue a key focus of the Mayor's next term.

London collectively now seems to be taking the issue seriously. It has the testing stations required by EU but many local authorities have added more (to total 157) and now there are citizen science project like ours adding to our knowledge.

Links for further reading

Defra air quality document:

<https://www.gov.uk/government/publications/2010-to-2015-government-policy-environmental-quality/2010-to-2015-government-policy-environmental-quality#appendix-5-international-european-and-national-standards-for-air-quality>

Defra's UK air database:

<https://uk-air.defra.gov.uk/>

ERG at London's King's College:

<http://www.londonair.org.uk/LondonAir/Default.aspx>

WHO air quality guidelines:

http://www.who.int/phe/health_topics/outdoorair/outdoorair_aqg/en/

Health reports – COMEAP and Public Health England:

<https://www.gov.uk/government/collections/comeap-reports>

The Clean Air in London campaign:

<http://cleanair.london/>

Activist lawyers:

<http://www.clientearth.org/>

Some information sheets on clean air:

<http://www.air-quality.org.uk/index.php>