AIR QUALITY Fact Sheet

The quality of the air in the local environment has an impact on the health of the public and ecosystems. There are several different gases which may be present in ambient air and which have been identified as having health impacts. These include nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and ground-level ozone (O_3). In addition, very small particles of dust can be inhaled and reach the inner airways and lungs.

Breathing in polluted air is linked to respiratory illnesses including Chronic Obstructive Pulmonary Disease (COPD)[1] and asthma[2]; cardiovascular disease[3]; and neurological impairments[4]. In 2016, it was reported that long-term exposure to air pollution could speed up cognitive decline in older adults thus indicating a possible link to earlier onset of Alzheimer's and other forms of dementia.[5] In June 2012, the International Agency for Research on Cancer (IARC) confirmed that fumes from diesel engines are carcinogenic[6]. Links have also been reported to diabetes and premature and low birth weight babies[7]. The effects of air pollution can, therefore, lead to breathlessness affecting people's physical capacity and mobility, hospital admissions and even premature mortality.

What do we know?

Facts and Figures

Data are available on concentrations of air pollutants at several locations within the London Borough of Sutton. As air pollution is not recorded as a contributing factor in data on hospital admissions, deaths, etc, accurate data on the health impacts of air pollution is not available. However, using various health impact studies, robust estimates can be made. Many of the studies focus on the health impacts from particles as these can be used as an indicator of exposure to other common pollutants in ambient air.

- The Committee on the Medical Effects of Air Pollutants (COMEAP) speculated that it is reasonable to consider that air pollution may have made some contribution to the earlier deaths of up to 200,000 people in the UK (the number dying of cardiovascular causes) with an average loss of life of about

[1] http://www.environment-health.ac.uk/publications/outdoor-air-pollution-and-respiratory-health-patients-copd
[2] EPUK, 2010, COMEAP Revises Air Quality and Asthma Position http://www.environmental-protection.org.uk/news/detail/?id=2701
http://www.envirotech-online.com/news/air-monitoring/6/breaking_news/main_roads_are_a_main_cause_of_asthma_in_children/22125/
[3] Tze Wai Wong et al, 1999, Air Pollution and Hospital Admissions for Respiratory and Cardiovascular Diseases in Hong Kong published in Occup Environ Medicine 1999;56:679-683 http://oem.bmj.com/content/56/10/679.full.pdf+html
[4] http://en.wikipedia.org/wiki/Neuroplastic_effects_of_pollution
[5] https://www.alzinfo.org/articles/air-pollution-raise-dementia-risk
[6] http://press.iarc.fr/pr213_E.pdf
[7] ClientEarth, The Health Impacts of Air Pollution http://www.clientearth.org/health-environment/clean-air/the-health-impacts-of-air-pollution-1427

two years per death affected, though that actual amount would vary between individuals[8].

- Air pollution is estimated to reduce the life expectancy of every person in the UK by an average of 7-8 months with estimated equivalent health costs of up to £20 billion each year[9]. A more recent assessment based on 2008 data estimates that this situation has improved slightly but still results in an average reduction in life expectancy of 6 months.

- It is estimated that 4,267 deaths in London in 2008 were attributable to long-term exposure to small particles[10].

- COMEAP estimate that for every 10µg/m^3 increase in $PM_{2.5}$, there is a 6% increase in annual all-cause death rates[11]. Based on this estimate, and taking into account factors such as the ward demographics and the predicted concentrations, the additional number of early deaths per ward has been estimated for a 10µg/m^3 increase in $PM_{2.5}$.

- Children living near roads with heavy-duty vehicle traffic have twice the risk of respiratory problems as those living near less congested streets[12].

[8] COMEAP, 2010, The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in UK https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/304641/COMEAP_mortality_effects_of_long_term_exposure.pdf

[9] House of Commons Environmental Audit Committee, 2011. http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenvaud/1024/1024.pdf

[10] Dr Brian Miller, 2010, Report on estimation of mortality impacts of particulate air pollution in London. http://www.london.gov.uk/sites/default/files/Health_Study_%20Report.pdf

[11] Dr Brian Miller, 2010, ibid

[12] World Health Organisation, Data and Statistics. http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/data-and-statistics (accessed 28/08/2014)

Targets

The European Union has issued an air quality Directive that sets standards for a variety of pollutants that are considered harmful to human health and the environment. These standards, which are based on WHO guidelines, include limit values, which are legally binding and must not be exceeded. The EU Directive, including the emission concentration limit values, has been transposed into English law by the Air Quality Standards Regulations and a national strategy developed. The table below shows the objectives that are set in the UK National Air Quality Strategy for the different pollutants that occur in ambient air:

Pollutant	Concentration	Measured as	Date to be achieved
Benzene	16.25 $\mu g/m^3$	Running annual mean	31.12.2003
	5.00 $\mu g/m^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu g/m^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu g/m^3$	Annual mean	31.12.2004
	0.25 $\mu g/m^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England.

These National Air Quality Objectives have been set in regulations which implement European Union Directives on ambient air quality. The EU Directives set limit values for the pollutants which take into account relevant World Health Organisation standards, guidelines and programmes. The limit values are legally binding on the member states and must not be exceeded. Although the result of the referendum on 23 June 2016 showed majority support for the UK leaving the EU, the air quality standards have been transposed into national legislation. Therefore, the requirement to meet the air quality standards will remain in place unless the relevant legislation is subsequently repealed.

A new European Union directive on ambient air quality and cleaner air entered into force in June 2008. This merges together four earlier directives and one Council decision.

Trends

The UK Air Quality Standards Regulations 2000, updated in 2010, sets standards for a variety of pollutants that are considered to be harmful to human health and the environment. These are based on EU limit values and are for a range of air pollutants, listed below:

- Benzene
- Benzo(a)pyrene
- Carbon monoxide (CO)
- Lead
- Nitrogen dioxide (NO_2)
- Oxides of nitrogen (NO_x)
- Particulate matter (PM_{10} & $PM_{2.5}$)
- Sulphur dioxide (SO_2)
- Ozone

Of the pollutants included in the Air Quality Standards Regulations, monitoring of the following has been carried out within London Borough of Sutton for several years:

- Nitrogen dioxide (NO_2)
- Ozone (O_3)
- Particulate matter (PM_{10}) i.e. particles with a diameter <10 microns

Particulate matter is defined according to its size. Coarse particulate matter is the more visible fraction which tends to get trapped very quickly after inhalation, for example by nasal hairs. Therefore, it is the smaller fractions (10 microns or less in diameter), which are of greater concern as they can penetrate much deeper into a person's airways and reach the lungs. London Borough of Sutton started monitoring particulate matter ($PM_{2.5}$) at a location in Beddington in July 2014.

The map below shows the locations where automatic monitoring of air pollutants takes place within the London Borough of Sutton:

Map 1: Locations of automatic Air Quality Monitoring Stations in London Borough of Sutton

The locations and types of sites are listed below:
Ecology Centre, Carshalton (Urban Background)
Woodcote Road, Wallington (Roadside)
Central Road, Worcester Park (Roadside)
Beddington Lane (Industrial)
Beddington Lane North (Industrial)

A monitoring station has been located in Beddington Lane since 2005. In April 2012, the site was relocated to a new position approximately 400m to the south and the previous site was closed. In 2014, the site was able to reopen with new monitors including the addition of a $PM_{2.5}$ monitor. An additional monitoring station was located in the same area (Therapia Lane) for a temporary period between 2010 and 2012.

Nitrogen dioxide (NO_2)

The National Air Quality Objective for the NO_2 annual average is **40**µg/m^3. The graph below shows the annual averages measured at automatic monitoring sites for the years where data is available.

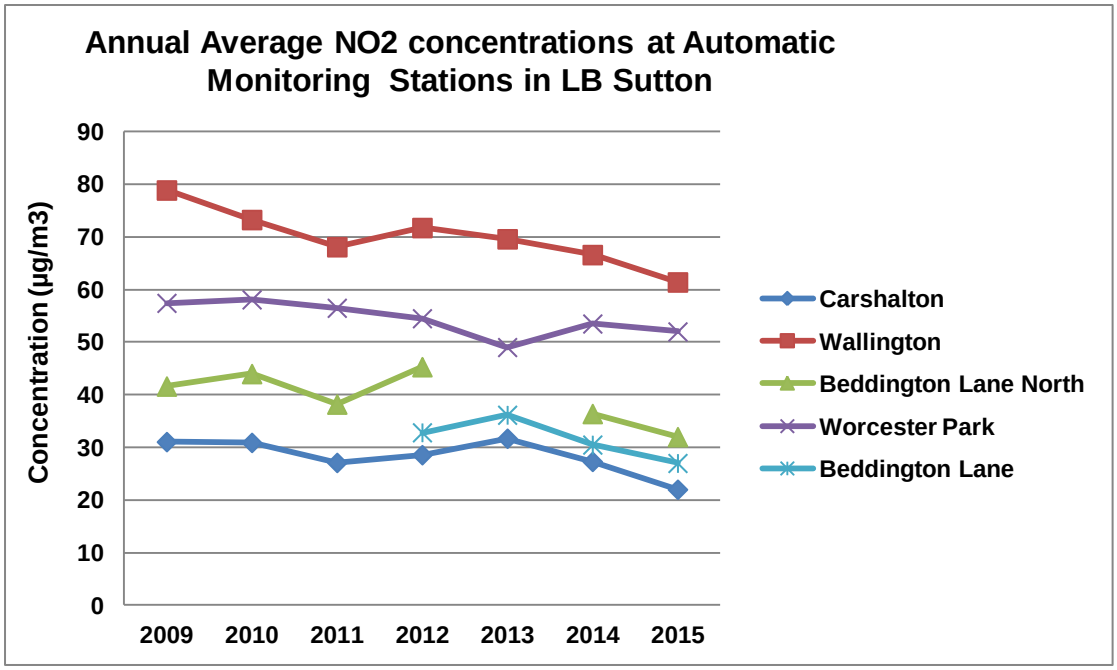

Fig 1.1: Trends in nitrogen dioxide annual averages

Note: The monitoring station in Beddington Lane was relocated in 2012 so data capture for this year at each of the 2 sites is low, thus affecting the accuracy of the calculated annual averages.

In addition to the automatic monitoring sites, London Borough of Sutton also gathers data on NO_2 concentrations using diffusion tubes which are passive monitors. These have a lesser degree of accuracy than the automatic monitors but provide indicative data that is used to calculate annual averages. Data is now collected at 24 different locations around the borough. The indicative monitors can easily be relocated which enables us to monitor at different locations according to need. A review of the locations was carried out in 2015 and a number of the sites were moved. Therefore, only those sites for which data is available for 3 or more years are shown in the graph.

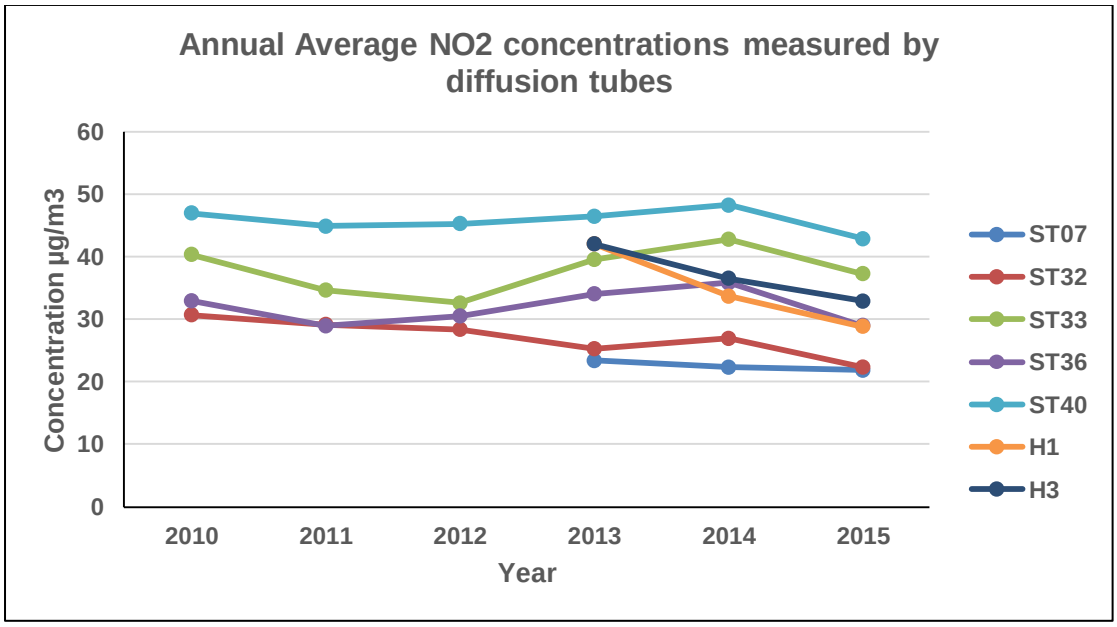

Fig 1.2: Trends in nitrogen dioxide annual averages at diffusion tubes locations

Ozone

Ozone is not included in the system of Local Air Quality Management owing to its trans-boundary nature. Responsibility for achieving the Objectives therefore rests at national level. Within the London Borough of Sutton, ozone is monitored only at Sutton 3 in Carshalton. The data is utilised by the national government for comparison against the national objective. The objective is no more than 10 days within a year when the maximum rolling 8-hour mean exceeds **100**µg/m^3.

Site ID	Location		2008	2009	2010	2011	2012	2013	2014	2015
Sutton 3	Ecology Centre, Carshalton	Max rolling 8-hourly mean	138	141	129	136	164	123.5	118.3	103.2
		No. of days max rolling 8-hour mean > 100 µg/m^3	20	12	8	19	9	4	6	2

Table 1.2: Ozone monitoring data (Sutton 3)

Particulate Matter (PM_{10})

The National Air Quality Objective for the PM_{10} annual average is **40**µg/m^3. The graph below shows the annual averages recorded at the borough's monitoring sites for those years where data is available.

Annual Average PM10 concentrations measured at automatic monitoring stations

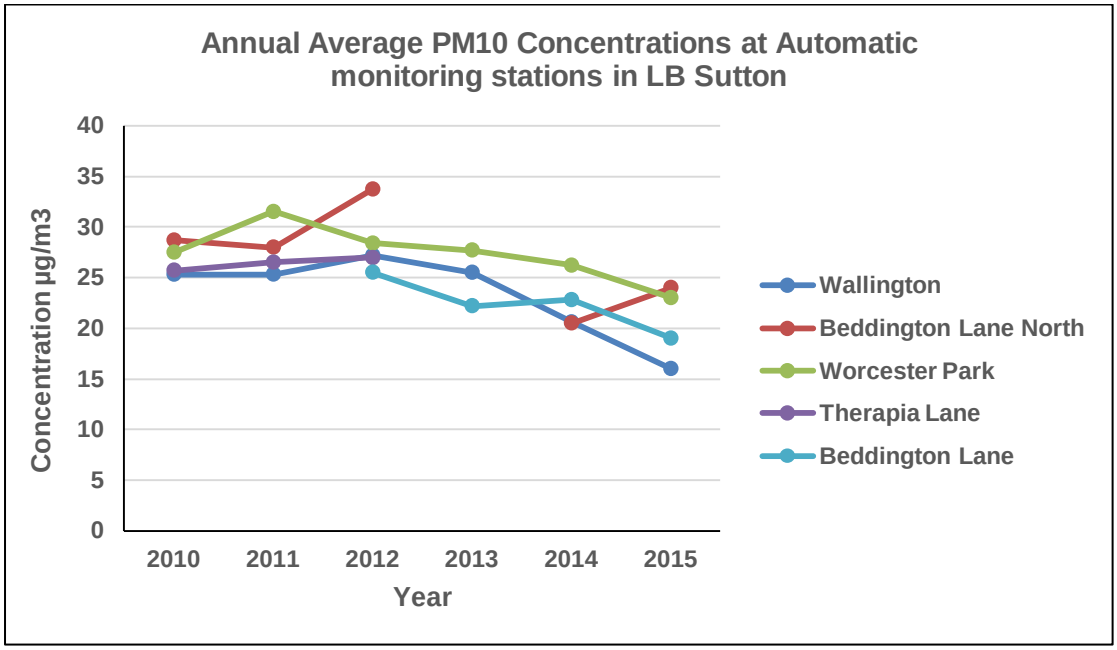

Fig 1.4: Trends in PM_{10} annual averages

Sulphur dioxide (SO_2)

There are several short-term objectives for sulphur dioxide which set a maximum number of exceedences that may occur annually. Monitoring of sulphur dioxide was carried out at Robin Hood Junior School until 2002. This consistently showed that no exceedences were occurring. To provide some quantification, the maximum 15-minute mean recorded in 2001 was 124µg/m^3 against an objective of 266µg/m^3 not to be exceeded more than 35 times within a year.

Performance

Concentrations of each of the pollutants included in the Air Quality Standards Regulations have been monitored and/or estimated then compared to the relevant standards (objectives). The table below lists each of the pollutants with the relevant objective and whether or not the objective was met in the most recent year for which data was available (2015).

Pollutant	Concentration	Measured as	Achieved in LBS (Y/N)
Benzene	16.25 $\mu g/m^3$	Running annual mean	Y
	5.00 $\mu g/m^3$	Running annual mean	Y
1,3-Butadiene	2.25 $\mu g/m^3$	Running annual mean	Y
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	Y
Lead	0.5 $\mu g/m^3$	Annual mean	Y
	0.25 $\mu g/m^3$	Annual mean	Y
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	Y
	40 $\mu g/m^3$	Annual mean	N
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	Y
	40 $\mu g/m^3$	Annual mean	Y
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	Y
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	Y
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	Y

From the above table, it can be seen that the objectives were not met for only one of the pollutants; NO_2. These are called 'exceedences'. Exceedences of the NO_2 annual

average objective occur at roadside locations within the borough while exceedences of the 1-hour mean objective were last recorded in 2013 at Woodcote Road, Wallington. Exceedences of the 1-hour mean objective are most likely to occur adjacent to those roads that are the most busy and congested with regular stop-start traffic.

To help put the situation in Sutton in a regional context, the highest 24-hour average for NO2 measured in the borough was 125.2µg/m3 measured at Woodcote Road, Wallington. The highest reading recorded at any monitoring station in London was 222.6µg/m3.

While exceedences of the 24-hour mean objective for PM_{10} have not occurred within the borough for many years, the recorded concentrations of this pollutant can be more variable as it is subject to influences both locally and further afield. The concentrations of PM_{10} are also greatly affected by meteorological conditions with particulates being carried substantial distances before grounding. Owing to this variability, the London Borough of Sutton has been declared an Air Quality Management Area for both nitrogen dioxide and particulates.

Local Views

Air quality is of significant concern to many local people and the subject often generates headlines in the national and local media. The 2010 Londoner Survey[13] found that pollution from traffic was the top environmental concern for Londoners.

There is no measure of local attitudes towards air quality within the borough that is carried out on a regular basis. The Council is required to keep DEFRA and the GLA updated on air quality trends and progress towards implementing measures in the Council's Air Quality Action Plan.

Often, it is specific local issues that generate feedback from local residents. Local views are gathered through consultation on specific issues including planning applications which may affect the local area and/or during community engagement events. London Borough of Sutton operates a 'Consultation Hub' bringing together consultation taking place among the Council's various departments and searches can be carried out to identify consultations relevant to a specific field of interest.

[13] The Annual London Survey carried out in early 2010

National and local strategies

The National Air Quality Strategy

The Environment Act 1995 put into legislation a requirement for a national strategy to be developed to tackle poor air quality and thereby reduce the associated risks to human health and the environment. Consequently, on March 12th 1997, the National Air Quality Strategy was published, with commitments to achieve new air quality objectives throughout the UK by 2005. A review of the Strategy was published in January 2000 and the most recent version was produced in July 2007.

The Air Quality Strategy aims to protect health and the environment without imposing unacceptable economic or social costs. It sets out standards and objectives for the 8 main health-threatening air pollutants in the UK. The standards are based on an assessment of the effects of each pollutant on public health. They are based on recommendations by the Expert Panel on Air Quality Standards, The European Union Air Quality Daughter Directive and the World Health Organisation. Local Authorities are responsible for seven of the eight air pollutants under Local Air Quality Management (LAQM).[14] The pollutant that is not covered by LAQM is ozone which is tackled at a national level.

Mayor's Air Quality Strategy

The Mayor of London is also required to keep under review an Air Quality Strategy for the Greater London area. The most recent version of the Mayor's Air Quality Strategy entitled 'Clearing the Air' was published in December 2010. The Strategy contains policies and proposals that aim to improve air quality across the Greater London area and thereby seek to ensure that the limit values for all pollutants in the area are achieved.

London Borough of Sutton Air Quality Action Plan

Although the London Borough of Sutton does not have an Air Quality Strategy for the borough, the whole borough has recently been declared an Air Quality Management Area (AQMA). Where an Air Quality Management Area is declared, the local authority is required to develop an Action Plan containing measures that seek to address the particular air quality problems identified. London Borough of Sutton published an Air Quality Action Plan in June 2013 which was based on the Action Plans drawn up for the previous smaller AQMAs. The Action Plan contains 34 measures that aim to reduce the levels of NO_2 and PM_{10} within the borough. Through closer work with Public Health and other stakeholders, a more co-ordinated approach will be adopted on the progress and implementation of the measures.

[14] Taken from www.air-quality.org.uk

Current Activity and Services

Although the whole borough is now declared as an AQMA and the Air Quality Action Plan therefore applies across the whole borough, certain areas will have specific local issues that can impact on air quality. Consequently, we will work to deliver an improvement in air quality across the borough but the solutions may require a tailored approach depending on the local circumstances. A project aimed at tackling the emissions from the industrial and commercial units within the Beddington North ward is currently being developed and funding has been secured to implement improvement measures over the next two years.

A Progress Report will be submitted to DEFRA each year outlining the progress made with each of the measures in the Council's Action Plan and these reports will be made available to view online. The measures which have been targeted within 2015-16 are as follows:

- Measures to work with business and commercial premises to reduce emissions from their fleets;
- Measures to increase awareness on air quality issues including promotion of the air pollution alert service AirTEXT and methods to help people reduce their exposure such as Walkit.com;
- Measures to Encourage the Use of Cleaner Technology and Alternative Fuels through the promotion of the uptake of electric vehicles and installation of infrastructure to support their recharging;
- Promotion of sustainable transport through improvements to the local environment including signage, landscaping and surfacing;
- Management of travel demand through implementation of appropriate parking policies and the use of planning controls in new developments;
- Measures to Reduce Emissions from Domestic Buildings through offering energy efficiency measures and advice.

In addition, London Borough of Sutton is looking at ways to improve community engagement and provide information to residents about air quality Therefore, the information and data available through the Council's website will be reviewed and we will provide input into a regional website that covers air quality across a wider area.

What is this telling us?

What are the key inequalities?

Air pollution can often travel some distance away from the source of emissions. Particulate matter, especially, can travel substantially so that concentrations within London are affected by emissions from mainland Europe as well as dust from the Sahara. The largest source of emissions within the borough of Sutton is motor vehicles and, consequently, the areas of poorest air quality are adjacent to the busiest roads. However, as mentioned, there are localised areas where emissions from industrial processes also make a significant contribution.

As the properties alongside busy roads tend to be cheaper and/or rented accommodation, it tends to be those from the lowest socio-economic groups who live in these areas and are, therefore, exposed to higher levels of air pollution. A close link has been shown between areas of high deprivation and pollution.

A recent study by the think tank Policy Exchange[15] sought to quantify the inequalities experienced. The research found the following:

- 5-10 year old children living in the 10% of areas with the lowest air quality in London are 41% more likely than the London average to be on free school meals.
- People living in the 10% of the areas with the lowest air quality are over 25% more likely than the London average to be on income support.

As highlighted in the 2010 Marmot Review[16], individuals in deprived areas experience more adverse health effects at the same level of exposure compared to those from less-deprived areas. This is, in part, because of a higher prevalence of underlying cardio-respiratory and other diseases, as well as greater exposure to air pollution as a result of homes being situated nearer to busy congested roads and with fewer green spaces.

Studies also show that the greatest burden of air pollution usually falls on the most vulnerable in the population, in particular, the young and elderly. The link between health inequalities and pollution is complex.[17]

Individuals particularly at risk also include those with existing respiratory problems and chronic illnesses such as asthma and chronic obstructive pulmonary disease (COPD). There are approximately 690,000 asthma sufferers in London and 230,000 individuals suffering from COPD.[18]

The Health Effects Institute (HEI) panel concluded that the evidence is sufficient to support a causal relationship between exposure to traffic-related air pollution and exacerbation of asthma. It also found suggestive evidence of a causal relationship with onset of childhood and asthma, non-asthma respiratory symptoms, impaired lung function, total and cardiovascular mortality, and cardiovascular morbidity, although the data are not sufficient to fully support causality.[19]

What are the key gaps in knowledge and/or services?

Although we have information on the current levels of air quality and studies demonstrate a link between air pollution and ill-health, there are still a number of gaps in our knowledge.

The main areas in which further information is needed are:

- The effects of different types of air pollution on hospital admissions and mortality i.e. whether a hospital admission can be attributed to air pollution and, if so, which particular pollutant has the greatest impact.
- The quantitative impacts on pollutant concentrations from individual measures in order to identify those that are the most effective.

[15] http://www.policyexchange.org.uk/images/publications/something%20in%20the%20air.pdf
[16] http://www.instituteofhealthequity.org/projects/fair-society-healthy-lives-the-marmot-review
[17] http://uk-air.defra.gov.uk/reports/cat09/0701110944_AQinequalitiesFNL_AEAT_0506.pdf
[18] www.london.gov.uk/publication/mayors-air-quality-strategy
[19] http://www.comeap.org.uk/images/stories/Documents/Statements/asthma/does%20outdoor%20air%20pollution%20cause%20asthma%20-%20comeap%20statement.pdf

What is coming on the horizon?

The move of Public Health into Local Authorities facilitates the integration of considerations of the wider determinant of health into the planning and delivery of local authority services. The Public Health Outcomes Framework is a set of indicators compiled by the Department of Health to measure how effectively the activities of each local authority are addressing the determinants of health. Within four domains, there are a total of 68 indicators. One of these indicators is Air Pollution.

Following the declaration of the whole borough as an Air Quality Management Area, work needs to begin on the measures included in the Action Plan. The Action Plan and the effectiveness of the measures need to be regularly reviewed and updated.

What should we be doing next?

The aim is to ensure that public health is protected by ensuring that no individuals are exposed to unhealthy levels of air pollution concentrations.

Therefore, we need to reduce exposure to air pollution but, more importantly, reduce emissions at source. While LB Sutton aims to ensure that we achieve compliance with the prescribed limit values for all pollutants, we will strive to go beyond this and continue to improve air quality in all areas. In this way, we aim to protect even the most vulnerable individuals from the potential health impacts from air pollution.

No one measure is going to deliver the necessary reductions so a package of measures needs to be implemented which requires co-operation and input from a variety of stakeholders. Furthermore, as some pollutants are brought into the borough from outside our area of jurisdiction, there are limitations to what can be achieved.

However, we need to ensure that the sources of air pollution that are emitted within the borough area and, therefore, within our remit, are controlled.

Therefore, we need to:

- Reduce emissions from transport by providing a range of sustainable alternatives with readily available information on the options, leading by example to promote cleaner technology and alternative fuels and using fiscal options to encourage cleaner vehicles while deterring the most-polluting;
- Reduce emissions from industry through providing advice and information to industrial operators while taking appropriate enforcement action where necessary;
- Reduce emissions from heating by supporting the uptake of energy-efficiency measures;
- Ensure that new developments do not result in increased air pollution nor place people in areas of poor air quality;
- Educate, encourage and advise people to change polluting modes of behaviour and reduce their exposure to harmful levels of air pollution.

Certain measures to improve air quality have significant co-benefits for health. These are listed below:

1. Motor traffic is responsible for air pollution and so measures that encourage people to use sustainable transport, such as walking and cycling would have the following benefits:

    - Create an environment that is more pleasant to walk and cycle, hence increasing physical activity levels
    - Reduce risks of injury and death from road traffic collisions
    - Reduce noise pollution which also enables people to open windows to buildings thus reducing the costs of air conditioning
    - Reduce community severance, increase community cohesion and social interactions
    - Contribute to reducing the urban heat island effect

2. Greater number of trees and vegetation:

    - Reduce risks from localised flooding
    - Contribute to urban cooling and help to contribute to reducing the urban heat island effect
    - Provide shade to enable people to keep cool and out of direct sunlight in sunny weather
    - Improve mental health and wellbeing
    - Improve resilience to climate change

3. Improving the energy efficiency of homes would reduce emissions from heating systems, which would have the additional benefits of:

    - Reducing fuel bills, thus reducing fuel poverty (which is the situation where households are required to spend more than 10% of their income to heat their homes to an appropriate temperature)
    - Reduces likelihood of damp and mould occurring, which aggravate respiratory disease
    - Reduce the number of falls in the home (falls are more likely to occur in cold homes due to poor blood circulation).