

Agenda Item 9.

TITLE	Air quality and health
FOR CONSIDERATION BY	Health Overview and Scrutiny Committee on Monday, 16 July 2018
WARD	None Specific;
KEY OFFICER	Julie Hotchkiss, Interim Consultant in Public Health

OUTCOME / BENEFITS TO THE COMMUNITY

The impact of air pollution on health is significant – any action which the committee might initiate to improve air quality would help reduce premature death and disability.

RECOMMENDATION

That committee members consider the findings, discuss how the Borough might do more to improve air quality. The committee may choose to make recommendations to Council or other partners to that end.

SUMMARY OF REPORT

This report describes the key pollutants, then details the health effects in terms of premature death, disability and impacts on specific groups of the population. It goes on to detail local air quality monitoring and management. It describes current activities being undertaken in the Council to improve air quality and poses some further potential actions for discussion.

Background

Introduction

As the air has become visibly “cleaner” with the reduction in grimy coal particulates and dirty emissions from buses, the general public has become, perhaps, relaxed about air pollution. The pollutants which make the greatest impact on health nowadays are invisible – they are tiny microscopic particles. Poor air quality remains a significant health issue. It has been estimated that removing all fine particulate air pollution would have a bigger impact on life expectancy in England and Wales than eliminating passive smoking or road traffic accidents(1). The economic cost from the impacts of air pollution in the UK is estimated at £9-19 billion every year(2). This is comparable to the economic cost of obesity (£2.6-15.8 billion)(3). A 2017 study in the Lancet found that particulate matter air pollution was the 5th highest mortality risk factor in 2015, causing 4.2 million deaths (7.6% of global deaths)(1). In the UK, particulate air pollution was thought to be the cause of nearly 29,000 deaths when calculated in 2008, with an associated loss of 340,000 life years(3). This report describes the key pollutants, then details the health effects in terms of premature death, disability and impacts on specific groups of the population. It goes on to detail local air quality monitoring and management

The key pollutants

Particulate matter - We measure and report on concentration of particles with a diameter of less than 10 micrometres (μm) the measure being called PM10 and the even smaller 2.5 μm (PM 2.5). The size of particles is important because those that are less than 10 μm in diameter tend not to be filtered out by the nose and those that are less than 2.5 μm are able to penetrate deep into the lungs. Very small particles from 0.1 to 0.001 μm are so small that they can pass into the circulation(13). The majority of data on the health effects of air pollution available is related to PM, as it has the strongest epidemiological link to health outcomes(12-14). Primary emissions from road traffic, including the non-exhaust component, make a significant (about 30-50%) contribution to PM 2.5 levels in urban areas (especially diesel engines)(15)

Ozone is a molecule constructed of oxygen atoms. It forms a natural barrier, known as the ‘Ozone Layer’ in the upper atmosphere protecting the Earth from the Sun’s damaging ultraviolet radiation. However, at lower atmospheric levels ozone exposure represents a substantial risk to human and animal health and vegetation. Ozone is made through chemical reactions of other emissions rather than being directly emitted; therefore it is considered a secondary pollutant. As many factors, including atmospheric conditions, sunlight and direct emissions affect the creation and destruction of ozone, it is difficult to regulate and monitor effectively. Ozone itself is a respiratory irritant and can have an impact on other health conditions. When ozone is broken down it then creates other pollutants which have also their own effects on health(6-9).

Nitrogen-based compounds (NO_x) are a pollutant that is produced when petrol, diesel or natural gas are burned and, unlike ozone, is a direct emission. There is evidence that high levels of nitrogen dioxide act as a respiratory irritant and, over a long period of time, affect how well our lungs work, particularly among those with asthma. Studies have suggested NO_x may contribute to impaired lung development and recurrent respiratory illnesses in children(10-12).

Pollutants do not occur in isolation, it is important to look at the mix, as reducing one pollutant may cause increased concentration of another. For example, reducing levels

of nitrous oxide (NO) causes a rise in ozone due to less of it being able to be broken down. Some pollutants in combination have a synergistic effect (e.g. sulphur dioxide (SO₂) and nitrates, although SO₂ levels have continued to decrease, nationally SO₂ decreased 29% from 2015 to 2016.

Sources

Pollution can come from a point source, i.e. coming from a single point such as a power station, construction sites, farming, home and commercial heating and industrial processes or mobile produced by road transport, aircraft emissions, rail and shipping. Pollution can be blown from where it arises, e.g. burning rubbish, ploughing fields, demolition, volcanic eruptions, etc – this is known as fugitive pollution.

Reducing air pollution requires action to reduce domestic emissions as well as working closely with international partners to reduce transboundary emissions (pollutants blown over from other countries) which, at times, can account for a significant proportion of pollutant concentrations experienced in the UK (for example, it is estimated that sources outside of the UK account for 35-50% of measured ambient particulate matter concentrations(12, 14).

Health effects – deaths

Damage occurs across a lifetime, from a baby’s first weeks in the womb all the way through to the years of older age(4).

PM 2.5 is associated with increased risks of death and ill health. It is linked to respiratory diseases with both short and long term consequences and is also linked to cardiovascular diseases leading to heart attacks and strokes(4).

Estimating the effects of air pollution locally is difficult because people die after a lifetime of exposure, and on any given day one could not identify and count which people have died from a heart attack earlier than they would have done if they hadn’t been exposed to the current pollution levels.

To overcome this difficulty, we apply mathematical models to the population structure and death data (mortality rates) using local pollution data to give us the fraction of “attributable” deaths. Latest data available is for 2016 and is shown in Table 1.

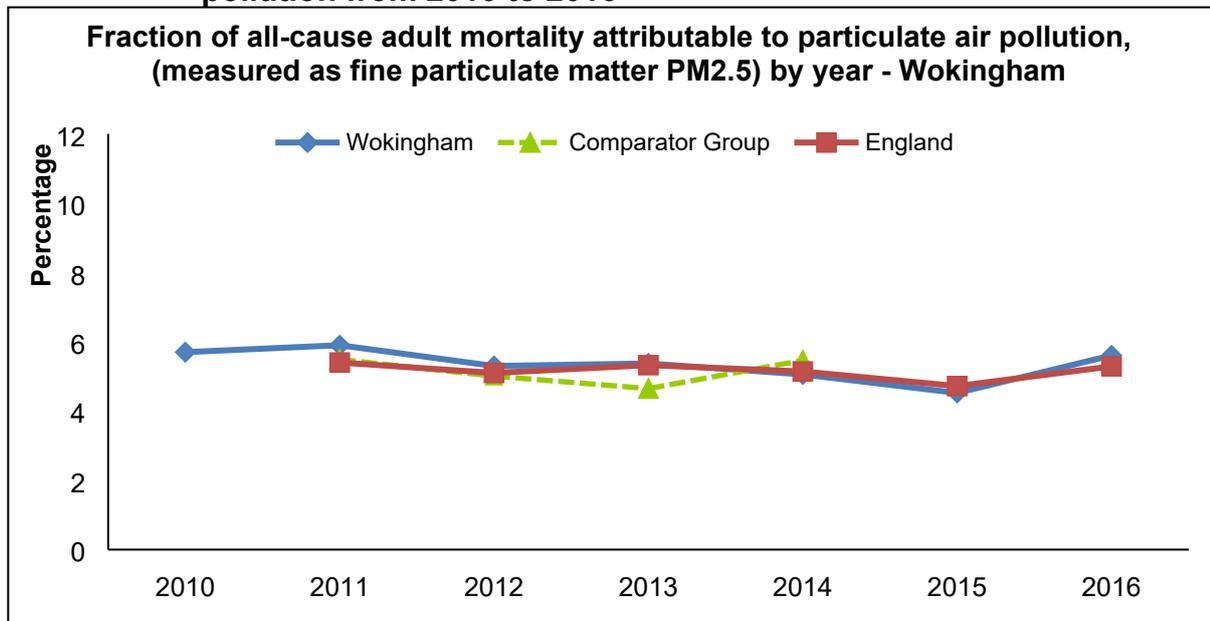
Table 1 Fraction of Mortality attributable to Particulate (PM2.5) air pollution for Berkshire local authorities, the South East and England

Area	% deaths attributable to PM2.5
Wokingham	5.6
West Berkshire	5.0
Reading	5.9
RB Windsor and Maidenhead	5.6
Slough	6.2
Bracknell Forest	5.6
SE Region	5.5
England	5.3

Source: Public Health Outcome Framework (PHOF) - health protection data
Indicator 3.01

The trend in the fraction since 2010 has been remarkably consistent in Wokingham, the South East and England, as shown in Figure 1. However, the trend in *number* of deaths attributable to particulate pollution over the last 5 years has decreased, even though particulate pollution level has not come down. This is because the total number of deaths from the principal causes (heart attack, stroke and respiratory disease) is decreasing.

Figure 1 Trend in Fraction of Mortality attributable to Particulate (PM2.5) air pollution from 2010 to 2016



Source: PHE, Public Health Profiles 2018

To put this into context we can look at the other contributory factors to “early” preventable death, which is taken to be a death before 75 years old.

Error! Reference source not found. shows the premature mortality due to human-made PM 2.5 pollution, in Wokingham and the South East of England, when compared to common causes of preventable mortality; such as cancers and cardiovascular disease. The rate in Wokingham is somewhat comparable to that for preventable respiratory disease in those under 75. (Please note there is a proportion of overlap between some of the other preventable mortalities and preventable mortality due to human-made PM 2.5).

Table 1: Mortality rates attributable to major preventable conditions (2015)

	Wokingham	South East
Indicator	Mortality rate per 100,000	
Preventable cancers in under 75s	64	74
Preventable cardiovascular disease in under 75s	34	39
Premature mortality attributable to PM 2.5	11.2	11.7
Preventable respiratory disease in under 75s	10	15
Preventable liver disease in under 75s	9	13
Communicable diseases	10	9
Suicides	6	10
TOTAL PREVENTABLE MORTALITY	131	161

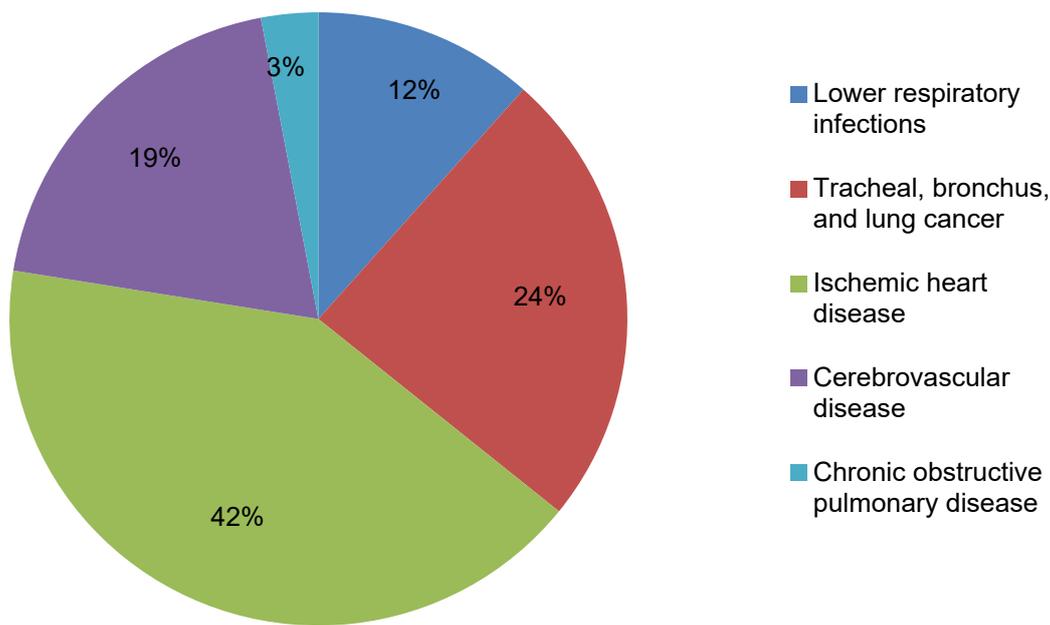
Source: [Public Health Outcomes Framework \(PHOF\), Mortality rankings, PHE](#)

Health effects – disability

Pollution does not just kill people, it can make them ill, often for a number of years – it is useful to consider the “burden of disease” which combines death and disability. The measure known as a Disability-adjusted life year (DALY) is commonly used. This measure adds together the years of life lost due to early death, and the years spent living with disability or ill-health.

Figure 2 shows the breakdown of the different health conditions affected by ambient particulate matter as a percentage of the South East rate of 388 DALYs per 100,000 population.

Figure 2: Disability adjusted life years per 100,000 population attributable to ambient particulate matter pollution in the South East region, 2013.



Source: Data from Global Burden of Disease [Viz Hub](#)

Lung and respiratory conditions combine to make up 39% of DALYs attributed to ambient particulate air pollution, however much more of the ill health is manifest in cardiovascular disease. In this figure cardiovascular disease is broken down into ischaemic heart disease (42%), and cerebrovascular disease (stroke) 19%. Although the contribution of particulate air pollution to total attributable DALYs is relatively small at 2%, exposure to particulate air pollution is responsible for nearly a quarter (22%) of attributable DALYs secondary to lower respiratory tract infections (e.g. pneumonia).

Table 2 – Comparison of DALYs for diseases contributing to ambient particulate matter pollution for the South East (2013)

Overall DALYs South East England	Overall	Lower respiratory infections (in children under 5)	Tracheal, bronchus, and lung cancer (in 75 and overs)	Ischaemic heart disease (in 75 and overs)	Cerebrovascular disease (in 75 and overs)	Chronic obstructive pulmonary disease (in 75 and overs)
Risk factor	DALYs per 100,000					
Smoking	2215	95	640	236	118	628.0
High body-mass index	2201	-	-	475	237	-
High systolic blood	1766	-	-	749	425	-

pressure						
High fasting plasma glucose	1344	-	-	339	118	-
Alcohol use	965	51	-	-73	61	-
High total cholesterol	818	-	-	767	51	-
Diet low in fruits	589	-	101	216	221	-
Drug use	425	-	-	-	-	-
Ambient particulate matter pollution	387	45	94	162	76	12
Iron deficiency	276	-	-	-	-	-
Occupational exposure to asbestos	230	-	169	-	-	-
Second-hand smoke	27	4	4	12	7	-
Percentage of attributable risk due to ambient particulate matter pollution	2%	22%	9%	3%	4%	2%

Data from Global Burden of Disease [Viz Hub](#).

Health conditions in Wokingham

As stated previously PM air pollution has an attributable impact on respiratory and cardiovascular diseases. The Wokingham population is covered by what was Wokingham CCG, it merged with three other CCGs in April 2018 to form Berkshire West CCG, but the data presented below pertains to the Wokingham part of the current CCG: The data presented below are the most recent, although they cover different periods of time as they come from various sources. It is difficult to know the extent of the impact particulate pollution makes as health in Wokingham is so good compared to elsewhere.

- 6.3% of Wokingham CCG's population have asthma recorded on a GP register(17).
- Modelled estimates indicate that 11% of children (under 19) in the CCG have asthma(18, 19).

- In 2016/17, Wokingham CCG had 44 emergency admissions for asthma in under 19 year olds. This was a rate of 110 per 100,000 population, which was significantly better than the England rate of 166.
- 1.0% of Wokingham CCG's population have COPD recorded on a GP register, although 2.4% are estimated to have the condition(17). Modelled estimates indicate that 0.42% of under 19s in the CCG have COPD, which is approximately 164 children.
- In 2014-16, 78 people aged under 75 died from a respiratory disease in Wokingham, which is a rate of 19.4 per 100,000 population. This is significantly lower than the England rate of 33.8.
- In 2016/17, there were 484 admissions for coronary heart disease in Wokingham CCG. This was a rate of 326 per 100,000 population, which was significantly lower than the England rate of 515.
- In 2016/17, there were 207 admissions for stroke in Wokingham CCG. This was a rate of 141 per 100,000 population, which was significantly lower than the England rate of 169.

Inequalities in the health impacts of pollution

Air pollution is harmful to everyone; however it does affect some groups more than others:

Age:

Air pollution affects children more than adults because children tend to spend more time outdoors and because their lungs are still developing. Air pollution also affects older people more due to age-related loss of antioxidant defence mechanisms in the lung and elsewhere, because they are more likely to have developed chronic cardiorespiratory diseases(4).

Pregnancy:

Air pollution can affect the foetus during pregnancy, either indirectly through the health of the mother, or directly by affecting developing foetal organs and systems. These effects can have a permanent influence on growth and health throughout life. The evidence of harm due to air pollution to the foetus and the young child is not as strong as it is for adults, because the topic is relatively new and has not been so heavily researched. However systematic reviews have pointed towards PM2.5 exposure leading to low birthweight and pre-term birth(25, 26). It is likely that maternal air pollution exposure interacts with other stressors in pregnancy such as poor diet, tobacco smoking and exposure to certain drugs. Moreover, the evidence for the effects of air pollution on cardiovascular disease and death in later life is very strong, so it is logical to conclude that reducing exposure to air pollution from as early an age as possible will be beneficial in order to reduce morbidity and early death(13, 27).

Deprivation:

There are well-documented inequalities in the distribution of pollutants in the UK, although the relationship with deprivation is not straightforward. In general, deprived communities live in poorer-quality environments that experience higher levels of air pollution. Deprivation has also been identified as increasing susceptibility to PM in a number of separate studies. A review by the Institute of Occupational Medicine(27) reported that poorer communities were more vulnerable to the effects of PM10 exposure, including morbidity and mortality. Other factors closely associated with deprivation, such as obesity and pre-existing cardiovascular and respiratory diseases,

also increase vulnerability. Less access to decent housing, green spaces, jobs and healthy food all contribute to poor health. These stressful conditions may also affect the body's response to air pollution(27).

Disability and long-term conditions:

DEFRA guidance advises that children, adults and older people with existing medical conditions such as cardiovascular or respiratory conditions, including asthma are more vulnerable to poor air quality.

Local air quality management

The major source of air pollutants in Wokingham Borough is road transport, and in particular the contribution from the M4 has been identified as significant. The main pollutant of concern is nitrogen dioxide (NO₂) and three Air Quality Management Areas (AQMA) have been declared for exceedances of the annual mean NO₂ objective. These are located in Wokingham Town Centre, Twyford Crossroads and along, and 60m either side of, the M4 throughout the whole of the borough (https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=318).

We have an air quality monitoring programme which is reviewed annually. We undertake nitrogen dioxide monitoring at 42 sites using passive diffusion tubes and 1 site (within the Wokingham Town Centre AQMA) using a continuous monitor. The latter enables us to measure the 1 hour exposure and annual mean concentrations of pollutants and the diffusion tubes give us an annual level. We monitor the known hotspot locations (in and close to the AQMA) as well as locations where the levels are close to but not exceeding the Air Quality Objective levels. We are currently installing an additional continuous monitor at Twyford Crossroads.

NO₂ levels in 2017 have generally shown a decrease of 2016 levels for the diffusion tube sites. Overall the levels have been reducing over the last 5 years to 2017. The automatic monitoring unit in Peach Street Wokingham recorded a level of 38.1 µg/m³, which was not an exceedance of the annual mean NO₂ objective, although 3 diffusion tubes located within the Wokingham Town Centre AQMA showed an exceedance. There was no exceedance of the 1 hour NO₂ objective with 15 of the 18 exceedances permitted. Within the M4 AQMA, there were no exceedances of the annual mean NO₂, with a reduction in levels in Shinfield, which may be due to the new A327 road layout.

Analysis of Issues

What Wokingham Borough Council is doing about air quality and its impact on health

1. The Air Quality Action Plans for Twyford and Wokingham AQMA were developed, including consultation and a Stakeholder workshop, in 2017, and the final Plans were agreed and published in March 2018.
2. Consideration of air quality comes in early in the design and master-planning stage of new developments and the Council's Development Management staff work with developers to ensure that the infrastructure: estate layout, provision and siting of pedestrian (including people requiring mobility aids) and cycle routes, crossings and space for bus stops will maximise people's ability to get around without generating pollution.

3. In addition to the hard infrastructure, measures to promote alternatives to the car are also part of development. Developers must pay £450 per new house to support the new residents to use alternatives to the car. The provision of local information (Welcome Packs) containing site specific travel information and incentives for “active travel” and use of public transport (e.g. free bus pass for a week). This work is branded as “My Journey” - Your one stop destination for travel information and advice in and around Wokingham borough: <http://www.myjourneywokingham.com/>
4. The 2018 Annual Report of the Director of Public Health this year is called “Creating the Right Environments for Health” and as well as giving an attractive overview of the topic with local examples, it provides a comprehensive review of the evidence to date on the impact of the natural environment on health. Its recommendations include that:
 - i. Local authorities and other agencies should continue to encourage community initiatives that make the most of natural space available, with the aim of improving mental health, increasing physical activity and strengthening communities.
 - ii. Existing green space should be improved and any new developments should include high quality green spaces. The use of professional design and arrangements to ensure the ongoing management of natural environments should be considered if spaces are to be sustainable.
 - iii. Opportunities to increase active transport should be considered when designing new green spaces and in the improvement of existing space
5. Local arrangements for Heatwave management include the sending of messages to at-risk groups to provide advance warnings for hot weather and severe heatwaves and associated poorer air quality.
6. The Local Transport Plan development considers how to reduce air pollution by reducing traffic, but smoothing traffic flows, as start/stop driving worsens air quality. The measures described above for new developments need to be incorporated into existing communities where possible. These and other measures are needed to bring about “modal shift” – i.e. getting fewer journeys made by private car.
7. The Health and Wellbeing Strategy 2017 – 2021 aims to create resilient communities, improve mental health and reduce health inequalities – actions to increase physical activity and get more of the population to make journeys by active travel will help improve air quality.
8. The “Mode Shift Star” scheme has been taken up by the majority of the borough’s schools. (Schools are no longer required to produce School Travel Plans). On the achievement of “stars” bonuses of up to £2,000 are awarded.
9. Continue and expand the continuous and passive air quality monitoring programmes.

More work needed:

- Improve the local population's knowledge of the impact of air pollution on health and to raise understanding that improving air quality would help to improve healthy life expectancy and reduce early death from cardio-respiratory diseases.
- Shift population attitudes from thinking of the car as the first choice of transport.
- Expand personalised travel planning
- Check that those members of the public particularly susceptible to air pollution such as those with asthma and chronic obstructive pulmonary disease (COPD) understand what to do (requires an audit) (26).
- Encourage schemes that recognise excellent levels of environmental and energy saving performance for the vehicles that operate within their area.
- Introduce intelligent transport systems that maximise the efficiency of the highway network and also give real time information on traffic delays and journey times, car parking availability, and bus arrival times; together, these allow people to make better informed travel choices and also reduce traffic emissions – potential for SMART city.
- Encourage the use of vehicles with 'cleaner' fuels such as petrol or LNG rather than diesel.
- Install electric vehicle charging points.
- Promote energy efficiency and sustainable transport to businesses in the borough.

Partner Implications
Item for discussion only, and committee may choose to take further action which could have wider implications

Reasons for considering the report in Part 2
N/A

List of Background Papers
None

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