Environmental Health JSNA: Outdoor Air Quality

Wirral Intelligence Service

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For further information please contact:
Author: Sophie Patterson – Specialty Registrar in Public Health – Wirral Council – sophiepatterson@wirral.gov.uk

Wirral Intelligence Service
Email: wirralintelligenceservice@wirral.gov.uk

Background to JSNA – Joint Strategic Needs Assessment

What is a JSNA?
A Joint Strategic Needs Assessment, better known as a JSNA, is intended to be a systematic review of the health and wellbeing needs of the local population, informing local priorities, policies and strategies that in turn informs local commissioning priorities that will improve health and wellbeing outcomes and reduce inequalities throughout the Borough.

Who is involved?
Information from Council, NHS and other partners is collected and collated to inform the JSNA and this reflects the important role that all organisations and sectors have (statutory, voluntary, community and faith) in improving the health and wellbeing of Wirral's residents.

About this document
This JSNA section looks to contain the most relevant information on the topic and provides an overview of those related key aspects

How can you help?
If you have ideas or any suggestions about these issues or topics then please email us at wirralintelligenceservice@wirral.gov.uk or go to https://www.wirralintelligenceservice.org/

Version Number	Date	Authors
Version 4	November 2019	Sophie Patterson, Victoria Chatterton, John Highton, Rachael Musgrave

Content overview

Abstract	Air pollution is the most significant environmental risk to public health. This JSNA presents a summary of key air pollutants, the impact on health and priority actions in Wirral.
Intended or potential audience	**External** • Wirral Residents, Businesses, Partner organisations • Wirral partners via Health Protection Forum • Public Health Departmental Management Team • Environmental Health Departmental Management Team
Links with other topic areas	Chronic Obstructive Pulmonary Disease and Asthma, Cardiovascular Disease, Cancer, Health in Children, Older People, ,Diabetes, Obesity, Dementia, Health Protection, Transport and Climate & Health

Key findings

- Air pollution is the greatest single environmental risk to public health. Air pollutants that most significantly impact public health include particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2).
- Air pollution can compromise health outcomes, leading to a range of illnesses, increased hospital admissions and premature deaths.
- The mortality burden from exposure to outdoor air pollution in the UK is estimated to be approximately 40,000 deaths per year.
- The health problems resulting from exposure to air pollution have a high cost to individuals, society, businesses, and the health service, which are estimated to amount to more than £20 billion every year.
- Whilst air pollution is harmful to everyone, adverse effects fall disproportionately on the most marginalised and vulnerable.
- Estimating the impact of air pollution on health locally is challenging. However, in 2017, Public Health England estimated that the fraction of deaths attributable to particulate air pollution in Wirral (3.9%) was lower than the North West (4.1%) and England (5.1%).
- In January 2018, the number of NO_2 diffusion tubes monitoring air quality across Wirral was increased from 21 to 31. Check Local Insight for a map of the current locations.
- In 2018, 31 NO_2 diffusion tubes monitored air quality across Wirral. Only one monitor failed to meet objective target levels, but this reading was not deemed to be at a site of relevant public exposure.
- In 2018, $PM_{2.5}$ levels in Wirral were below the objective target levels set by the European Union and the World Health Organisation.
- While there are no air quality management areas in Wirral, reducing air pollutants remains a local public health priority.
- In July 2019, the Wirral cabinet unanimously passed a motion to declare a climate emergency, in line with the UK government and other local authorities. This builds on the established local Climate Change Strategy for Wirral, which also impacts positively on air quality.
- National guidance states the importance of local leadership and collaborative action between transportation services, planning departments and public health to improve air quality.
- Evidence suggests local action should prioritise co-benefit strategies, which not only improve air quality, but also improve wider health outcomes.
- A recent internal audit of Wirral's air quality interventions against recommendations from Public Health England identified concordance with guidance across a number of areas and suggested opportunities for further action.

Contents

Please note:

What does this JSNA consider?

Particulate matter (PM) refers to particles of both solid and liquid particles of organic and inorganic substances suspended in the air. PM_{10} are particles measuring 10 micrometres, sign used is µm, or less, whereas $PM_{2.5}$ is finer particles, with a diameter of less than 2.5 µm. PM originates from many sources, but the most relevant to health outcomes are traffic-generated dust (from road, brake and tyre wear) motor vehicle emissions, fossil fuel combustion and wood burning. With the increasing popularity of wood burning stoves, domestic wood burning has been recognised as an increasing contributor to $PM_{2.5}$ emissions (Hawkes, 2015). PM can remain in the air for weeks and travel hundreds of miles.

Nitrogen dioxide (NO_2) is formed when Nitric Oxide is oxidized by Ozone (O_3) or oxygen in the atmosphere. Alternatively, it can be formed directly through combustion. The main source of NO_2 is motor vehicle emissions. Specifically, motor vehicles are responsible for 80% of roadside NO_2 emissions (DEFRA, 2017). Diesel light duty vehicles (cars and vans) are key contributors to the burden of NO_2 in the UK, with the number of diesel vehicles increasing over the past decade.

$PM_{2.5}$ and NO_2 have the largest evidence-base for negative public health impacts of all outdoor air pollutants (NICE, 2017). Health outcomes are not routinely measured in assessments of air pollution, thus levels of ambient $PM_{2.5}$ and NO_2 are critical indicators of exposure to outdoor air pollution (NICE, 2017).

The terms PM_2 and PM_{10} and NO_2 will be used extensively throughout this document.

What do we know?

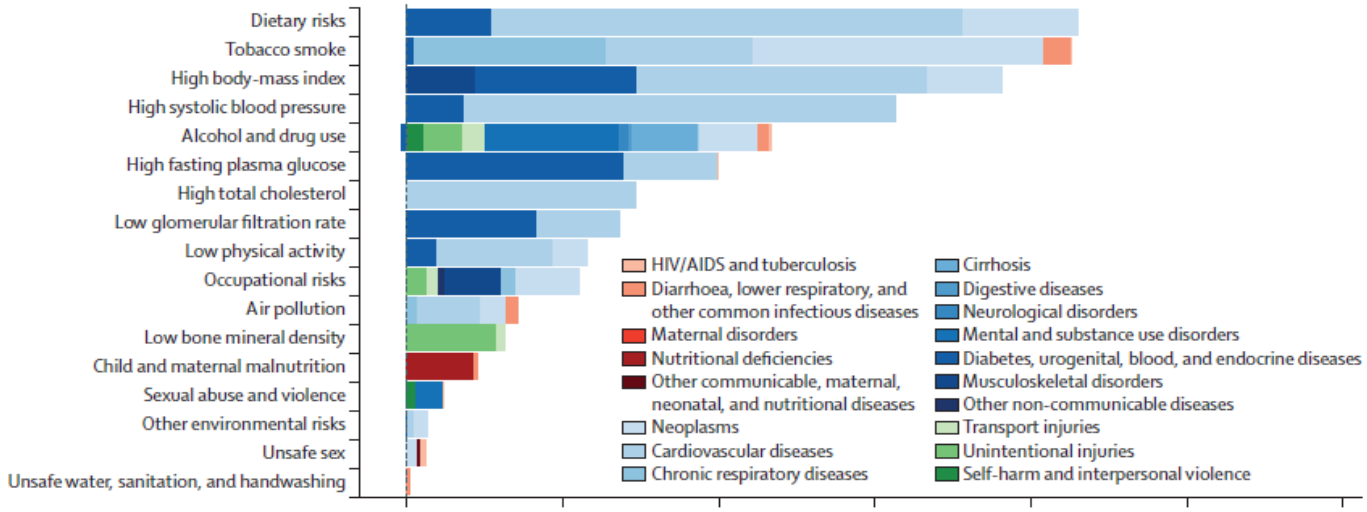
Why is this important?

Industrialisation, technological advancements and modern transportation systems have brought many benefits, however modern lifestyles continue to fuel the generation of air pollutants, which have notable health and environmental implications.

Healthcare Implications

The health impacts of pollution were the focus of the 2017 Chief Medical Officer's annual report for England. Specifically, air pollution is considered to be the greatest environmental risk to public health (Landrigan, 2017). It is a major contributor to the global burden of disease, increasing morbidity and mortality (Cohen et al, 2017). In 2015, ambient $PM_{2.5}$ was identified as the fifth greatest mortality risk factor globally (Cohen et al, 2017). Nationally, air pollution is one of the leading risk factors contributing to the burden of disease. In 2013, air pollution was estimated to account for 2% of disability-adjusted life-years lost in England (Newton et al, 2015) (**Figure 1**).

Figure 1: Disability-adjusted life-years (DALYs) attributed to key risk factors in England, 2013.



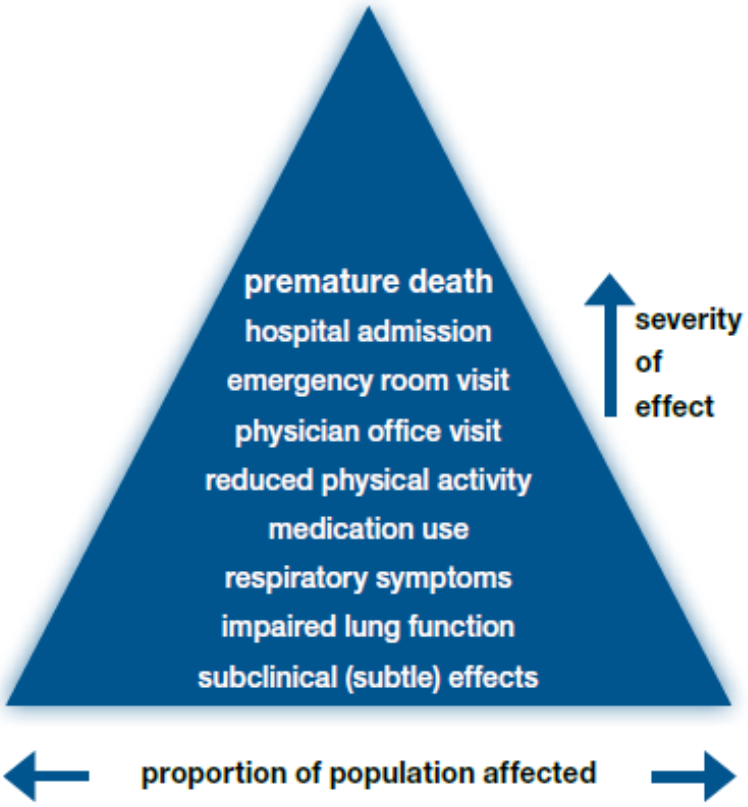
Source: Newton et al. Changes in health in England, with analysis by English regions and areas of deprivation, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet, 2015

Exposure to air pollutants has been shown to cause health problems across the life course. Short term exposure to air pollutants can precipitate exacerbations of respiratory conditions and increased hospitalisation (**Figure 2**). However, most significant health impacts arise from long-term exposure, causing increased morbidity and mortality from respiratory and cardiovascular disease (Royal College of Physicians, 2016). Emerging evidence suggests that exposure to air pollution can impair cognitive function and increase the risk of diabetes and obesity (Royal College of Physicians, 2016).

In 2013, the International Agency for Research on Cancer listed both outdoor air pollution and $PM_{2.5}$ (a key component of outdoor air pollution) as carcinogens. Furthermore, a report from the Royal College of Physicians estimated the mortality burden from exposure to outdoor air pollution in the UK to be 40,000 deaths per year (Royal College of Physicians, 2016).

Adverse social, health and economic costs incurred through exposure to air pollution are wide ranging, and are estimated to amount to over £20 billion per year in the UK, through absence from work and school, medication costs, hospitalisation and years of life lost (Environmental Audit Committee, 2010).

Figure 2: Air Pollution Health Pyramid.



Source: World Health Organisation, Health risk assessment of air pollution, General Principles, 2016

Environmental Implications

Some air pollutants can contribute to global climate change, which in turn compromises health, food and water supplies, and increases the risk of devastating environmental disasters (Watts et al, 2015) (for more information on climate change in our local area, see our JSNA on climate and health). Air pollution can damage ecosystems, compromising habitats and biodiversity. Agriculture and crop production can also be negatively impacted by air pollution, which has implications for food supply. Mobilising efforts to reduce air pollution would support national aims to promote sustainability within the Health and Social Care System to ensure resources are available to future generations (Sustainable Development Strategy for the Health and Social Care System 2014 – 2020). On a global scale, efforts to reduce air pollution are in line with a number of key sustainable development goals set by the United Nations (Landrigan 2017).

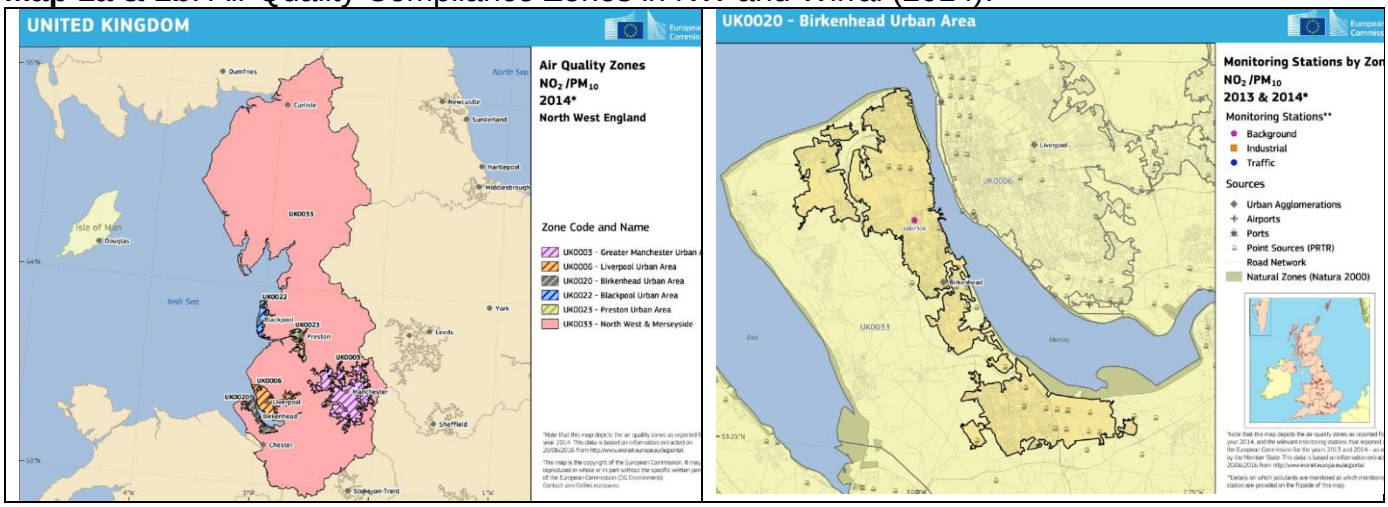
Legal Implications

Over the past decade, there has been increasing global awareness of the negative health impacts of air pollution, necessitating increased regulation and control of air quality. In the UK, action to manage and improve air quality is regulated by European Union (EU) legislation. The 2008 Ambient Air Quality Directive sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health, such as particulate matter (PM_{10} and $PM_{2.5}$) and Nitrogen Dioxide (NO_2), the nature and effects of such pollutants are discussed later in this report.

The 2008 directive replaced nearly all the previous EU air quality legislation and was established in English law through the Air Quality Standards Regulations, which were updated in 2010. The Government has also committed to the UNECE Gothenburg protocol and the National Emission Ceilings Directive, pledging to reduce five key pollutants (nitrogen oxides, fine particulate matter, sulphur dioxide, non-methane volatile organic compounds, and ammonia) below legally binding targets by 2020 and 2030, respectively.

The UK is divided into 43 geographical zones in which air quality and compliance with EU targets are continually assessed (see **Maps 1a &1b** below showing zones in the north west and specifically, the Birkenhead Urban Area zone, which includes neighbouring borough areas such as Ellesmere Port). Particular interest is placed on NO_2 and $PM_{2.5}$, deemed to represent the greatest risk to health in the UK (NICE, 2017). In 2016, EU targets for NO_2 were exceeded in 37 out of 43 zones in the UK based on measured or modelled concentrations, including the Birkenhead Urban Area (DEFRA, 2017).

Map 1a & 1b: Air Quality Compliance Zones in NW and Wirral (2014).



In recent years, as the evidence base of the negative impacts of air pollutants has strengthened, there has been heightened media and public interest in air pollution. As such, improving air quality was identified as a key priority by the UK Government in a policy paper released in July 2017 (DEFRA, 2017). In this publication, the government called for local leadership to drive efforts to improve air quality and mobilise action in air quality (DEFRA, 2017).

In January 2019, the Department for Environment, Food and Rural Affairs (DEFRA) published national clean air strategy, which detailed plans to reduce all major air pollutants, protect the environment and promote clean economic growth.

Actions within the strategy included adopting stricter World Health Organisation targets for air pollutants, introducing new legislation to promote air quality on a national level, and investing in research and technology (DEFRA, 2019). In 2019, Public Health England published an overview of actions available to national and local government to improve air quality and health (PHE, 2019).

Air Pollution and Public Health

A 2018 report from the Committee on the Medical Effects of Air Pollutants (COMEAP) estimated that long-term exposure to air pollution was linked to between 28,000-36,000 premature deaths in the UK each year (COMEAP, 2018).

Particulate Matter (PM)

$PM_{2.5}$ has been used as an indicator to calculate the burden of disease attributable to air pollution (Landrigan 2017). The small size of $PM_{2.5}$ means they can be easily inhaled into the lungs. In 2014, Public Health England's report 'Estimating Local Mortality Burdens associated with Particulate Air Pollution' estimated that the number of deaths per year among those aged 25+ attributed to anthropogenic (man-made) $PM_{2.5}$ was 25,002 nationally, with a total of 264,749 life-years lost.

Exposure to $PM_{2.5}$ has well documented impacts on the respiratory and cardiovascular systems. PM2.5 increases mortality from respiratory and cardiovascular causes, including stroke, Chronic Obstructive Pulmonary Disease (COPD), lung cancer and ischaemic heart disease.

The mechanism of action of fine particulates on the respiratory system is believed to be through triggering inflammatory responses, hyper-responsiveness, and remodelling of the airways, with impacts being more severe among individuals with pre-existing lung disease (Royal College of Physicians, 2016).

Short term exposure to fine particulates can exacerbate wheeze, bronchitis and asthma, leading to increased hospitalisation. Particulates may also carry surface-absorbed carcinogenic compounds into the lungs. In terms of cardiovascular impacts, $PM_{2.5}$ triggers deposition of plaques in the arteries increasing the risk of stroke, angina, and heart attacks.

The health impacts of air pollutants are experienced throughout the life course. $PM_{2.5}$ is small enough to cross the placental barrier and may influence foetal development (Royal College of Physicians, 2016). Previous work suggests that exposure to traffic-related air pollution can result in impaired foetal growth, resulting in low birth weight babies. There is also some evidence to suggest that long term exposure to PM_{10} and $PM_{2.5}$ is associated with increased risk of developing type II diabetes. Exposure to high levels of $PM_{2.5}$ may also be associated with impaired cognitive function (Royal College of Physicians, 2016).

Nitrogen Dioxide (NO_2)

Short-term exposure to NO_2 leads to irritation and inflammation of the airways, which can trigger a cough, wheeze, asthma or bronchitis, leading to impaired health, work absences or hospitalisation. More prolonged exposure to NO_2 can impair the lung development of children, reduce lung function in adults, and increase respiratory infections, putting further pressure on healthcare services (Royal College of Physicians, 2016).

Prolonged NO_2 exposure has been shown to lead to increased mortality from respiratory causes. In 2017, DEFRA estimated that NO_2 exposure reduced life expectancy in the UK by approximately 5 months, representing almost 23,500 deaths per year (DEFRA, 2017). There is some evidence to suggest that exposure to NO_2 during childhood can impair neurocognitive development, and that long term exposure to NO_2 is associated with increased risk of developing type II diabetes (Royal College of Physicians, 2016).

Indoor Air Quality

Most air quality legislation in the UK is concerned with ambient (outdoor) air quality. However, the contribution of indoor air pollutants from our homes and workplaces to morbidity and mortality is also relevant.

Estimates suggest that active urban Europeans spent around 85-90% of their time indoors, including time spent at home, in work and commuting (WHO, 2013). Notably, those who are most vulnerable to the impacts of air pollution (through ill health, or those who are very elderly or young) are more likely to spend a larger proportion of their time indoors, whether in private residences, hospitals, residential homes, care homes or nurseries. It is estimated that exposure to indoor air pollutants costs more than 204,000 healthy life years in the UK annually, with impacts manifested through an increased prevalence of asthma, lung cancer, and cardiovascular disease (National Institute for Health and Welfare, 2013), and annual healthcare costs amounting to “tens of millions of pounds” (Royal College of Physicians, 2016).

Outdoor air pollutants can move into indoor spaces through air exchange, compromising indoor air quality. In indoor environments, people can also be exposed to air pollution generated from tobacco smoke, including ultrafine PM, CO, NO_2, naphthalene and benzo[*a*]pyrene and benzene.
While the ban on smoking in public spaces has reduced exposure to second-hand smoke, this remains an issue in private establishments.

Indoor air pollution can also be generated through the burning of solid fuels, through unvented gas appliances or combustion equipment, releasing NO_2, CO and particulates. Other sources of indoor air pollution include building materials, textiles and chemicals or solvents (WHO, 2013).

Poor indoor air quality may be exacerbated in low quality housing, with old appliances, damp and poor ventilation, where mould, mildew or pests may accumulate. Indoor air quality may be compromised by efforts to conserve energy in the home, leading to reduced ventilation. Monitoring and enforcing air quality in private establishments remains a considerable challenge due to the lack of applicable regulations (Royal College of Physicians, 2016).

Building regulations require minimum standards for ventilation, construction materials and heating appliances in new build / adapted premises. Housing legislation addresses hazards such as mould, CO etc. in rented properties.

In the workplace, employees may be exposed to air pollution or inhaled hazards. The Global Burden of Disease study estimates that occupational exposure to pollutants was linked to 0.88 million deaths and 18.6 million disability-adjusted life years worldwide in 2015 (Global Burden of Disease, 2015). In the UK there are regulations in place to protect workers. Specifically, the Health and Safety at Work Act (1974) and Control of Substances Hazardous to Health (COSHH) Regulations regulate inhalation of dangerous substances at work.

Various national projects are currently underway to determine the impact of indoor air pollution on public health in the UK. In July 2017, the All Party Parliamentary Group for Healthy Homes and Buildings released the report “Building our Future Laying the Foundations for Healthy Homes and Buildings”, identifying the need to tackle the growing issue of indoor air pollution in building design and delivery.

In 2017, a new working party was established consisting of representatives from the Royal College of Paediatrics and Child Health, the Royal College of Physicians, Building Research Establishment and the Adaptation and Resilience in the Context of Change network to consider the impact of indoor air pollution in homes on health outcomes.

Facts, figures and trends (Wirral and beyond)

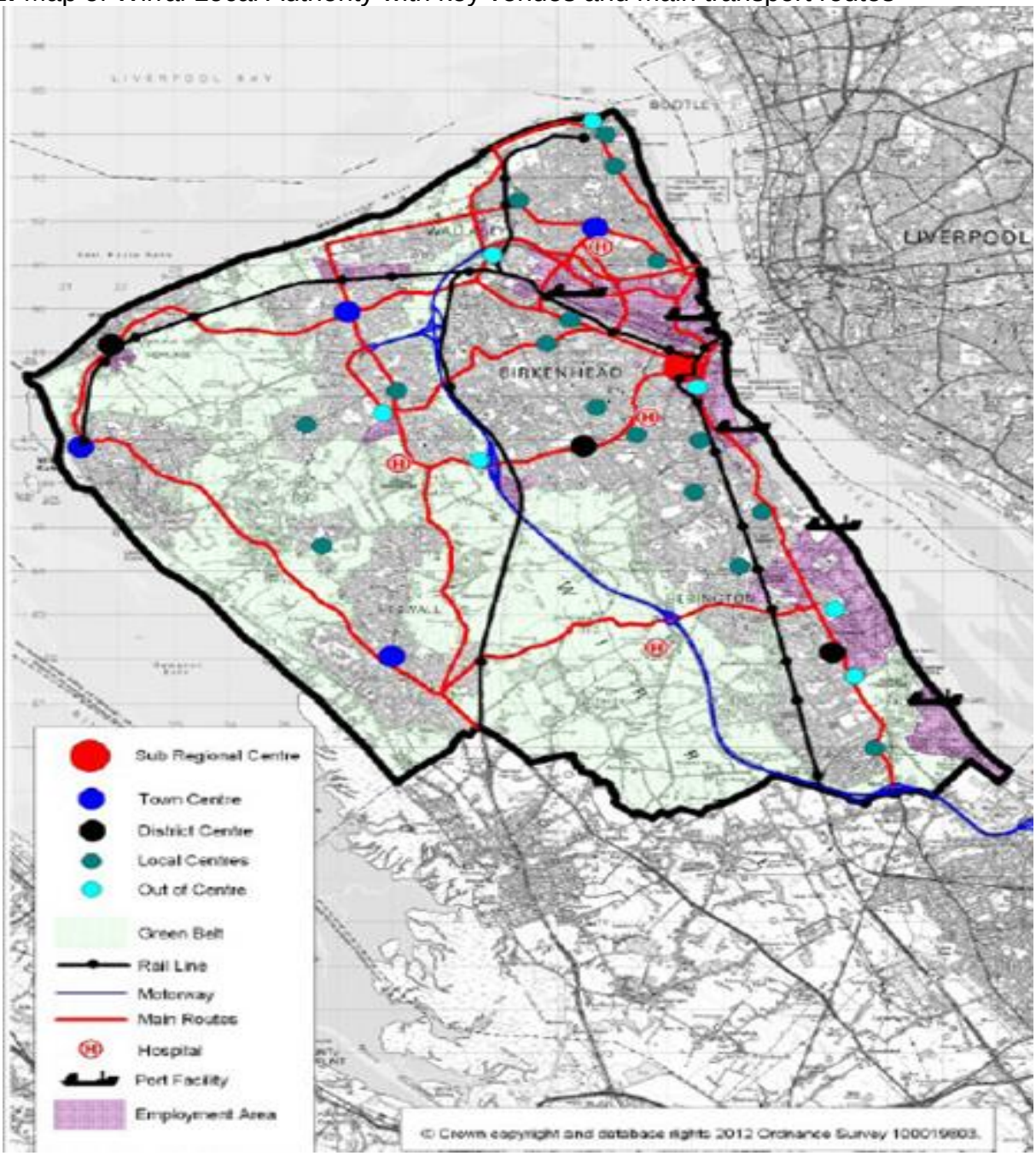
Wirral Council’s area is located on a peninsula, bordered by the River Dee and the River Mersey. The unique geography of Wirral influences the distribution of key pollutants within the borough. The east side of the peninsula, adjacent to the River Mersey, is urbanised with a large port area and numerous industries.

The west side of the peninsula is more rural, with large green belt areas of land. A major motorway runs through the peninsula, and several rail lines and main roads connect the local population (**Map 2**).

There are rail and road tunnel links between Wirral and Liverpool. Main urban centres (Birkenhead, New Brighton, Wallasey, and Prenton) are primarily located towards the East of the peninsula, centred on the more deprived regions of the borough.

Along with five other local councils, Wirral is part of the wider Liverpool City Region (LCR) combined authority.

Map 2: Map of Wirral Local Authority with key venues and main transport routes



Source: 2015 Updating and Screening Assessment for Wirral Borough Council.

Air pollutants monitored in Wirral

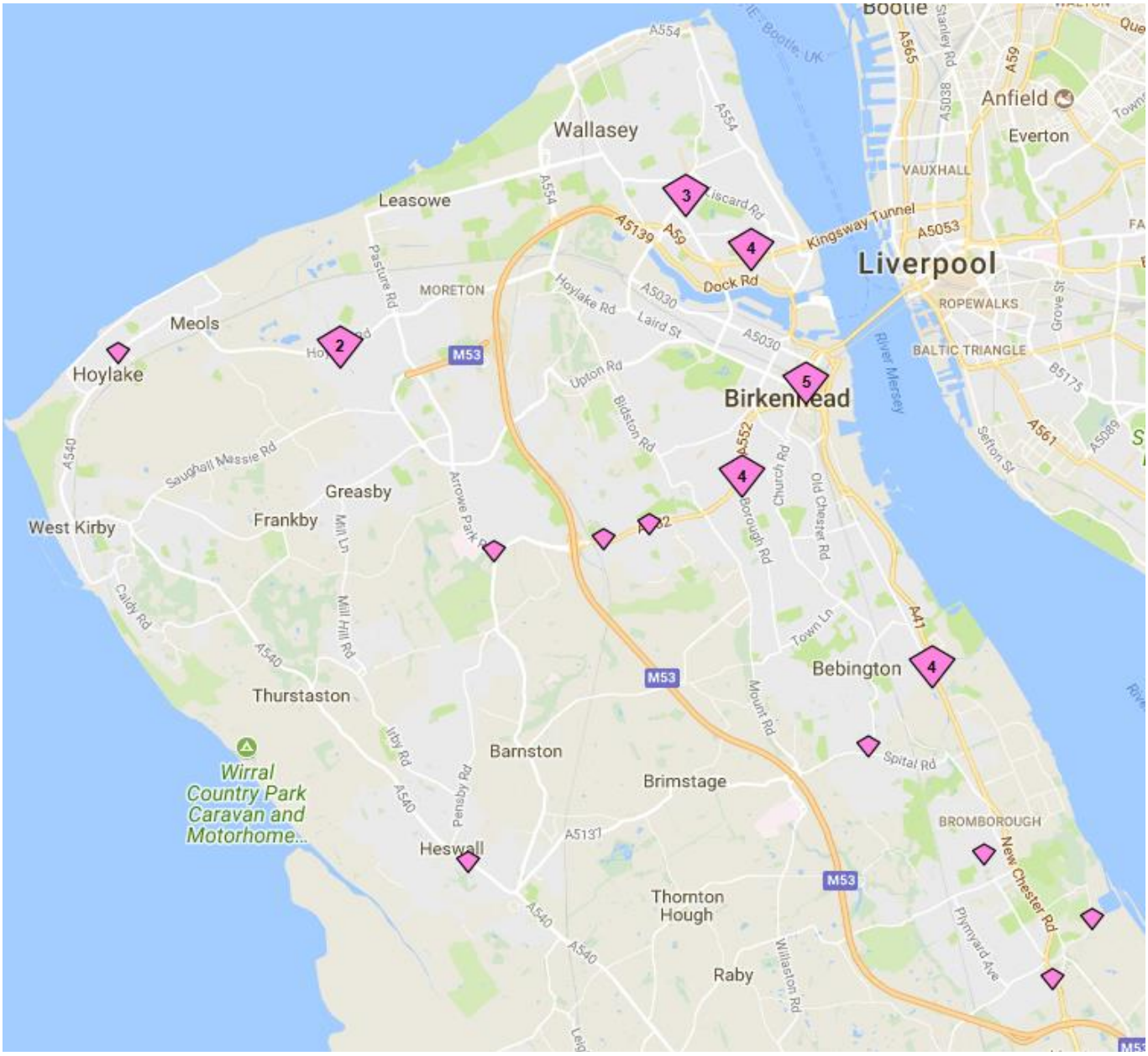
In accordance with national requirements, Wirral's Local Air Quality Management Programme monitors air pollutants at any site considered to represent a relevant exposure to the public.
Four key air pollutants are monitored in Wirral:

- Nitrogen dioxide (NO_2)
- Particulate matter$_{2.5}$ ($PM_{2.5}$)
- Benzene
- Ozone

NO_2 is the most closely monitored pollutant, in line with national priorities to reduce NO_2 concentrations below European Union targets (DEFRA, 2017). At the time of writing, Wirral Council utilised 31 passive (non-automatic) diffusion tubes and two Urban Background Air Quality Monitors to measure NO_2 (**Map 3**).

Monitoring locations are regularly reviewed by the Wirral Air Quality Group. At the end of 2018, six sites were discontinued, with the introduction of six new sites for 2019.

Map 3: Location groupings of 31 Nitrogen Dioxide (NO_2) monitors capturing air quality readings in Wirral in 2018.



Source: Wirral Intelligence Service (2019) https://wirral.communityinsight.org

Non-automatic benzene monitoring was reinitiated in the borough in 2015 in order to collect background benzene levels. Benzene is a volatile organic compound (VOC) and a well-known carcinogen. It has also been reported to cause central nervous system disorders, liver and kidney damage, reproductive disorders and birth defects (DEFRA, 2009).

Benzene is present naturally in low concentrations in the environment. It is also a minor constituent of petrol and can be formed during incomplete combustion of fossil fuels.

The two Urban Background Air Quality Monitors operational in Wirral are automatic, real time monitors which form part of the Automatic Urban Rural Network (AURN). Both provide continuous, real time NO_2 measurements, and one also monitors $PM_{2.5}$ and Ozone.

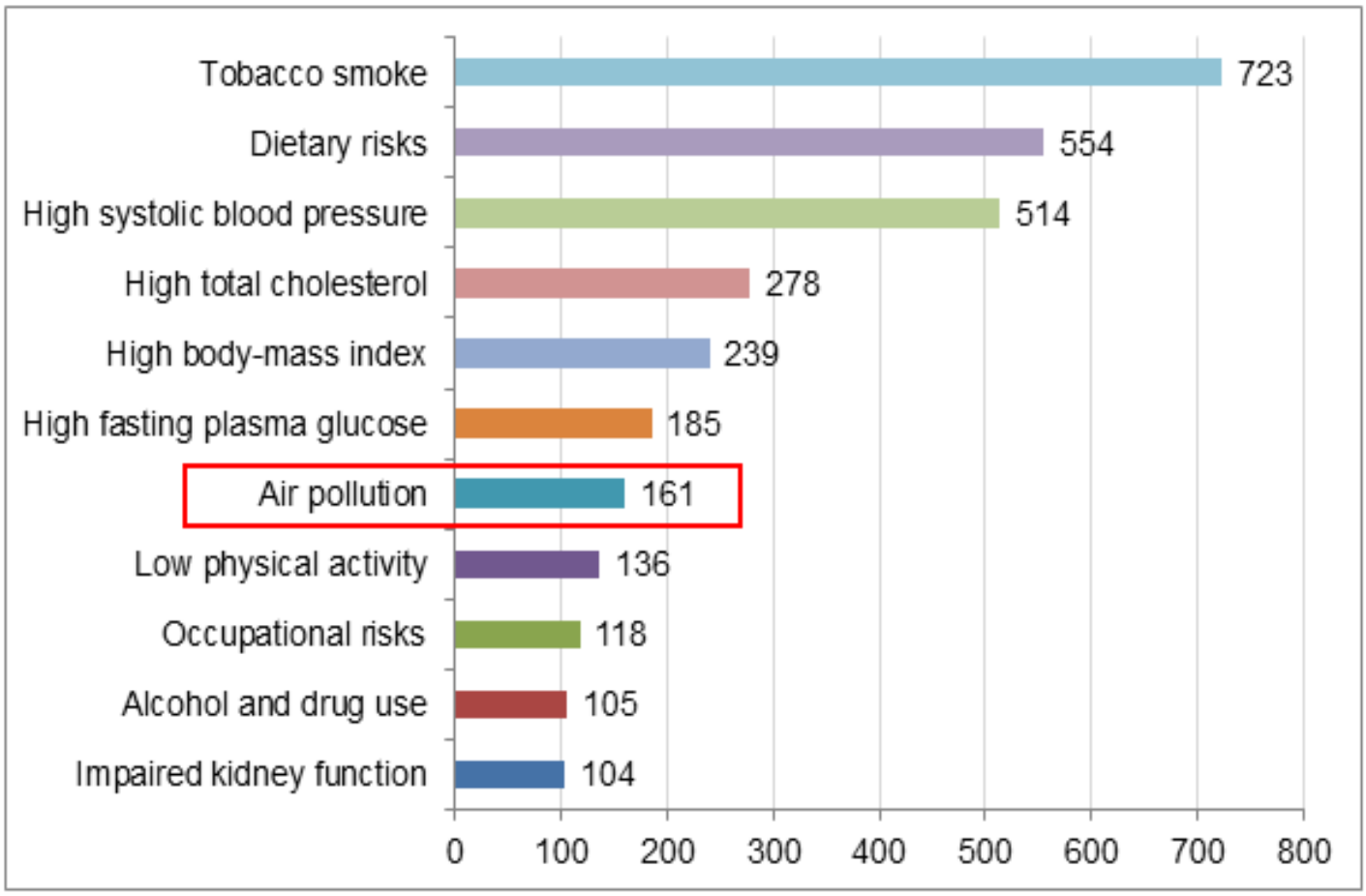
Ozone is generated over time by a reaction between pollutants in the atmosphere, commonly nitrogen oxides and volatile organic compounds (VOCs), in the presence of sunlight, and can have negative impacts on lung function and mortality (WHO, 2005).

Ozone is excluded from local air quality management as it is transported across long ranges, meaning emissions fuelling the generation of ozone are mostly from non-local sources.

Wirral discontinued monitoring PM_{10} in 2009 and SO_2 in 2007. In 2006, the annual maximum SO_2 concentration in Wirral was 56 µg/m3, with an annual mean of 6 µg/m3, both well below the recommended targets.

Based on data from the Global Burden of Disease study, 161 deaths in Wirral were attributed to air pollution in 2015 (**Figure 3**).

Figure 3: Estimated deaths from air quality risk factors in Wirral, 2015



Source: Wirral Long Term Condition Model 2017
Notes: Based on IHME GBD data for North West of England.

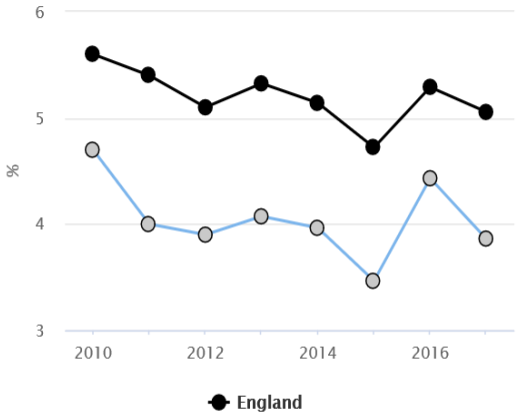
Public Health England estimates that 3.9% of deaths in Wirral in 2017 were attributable to particulate air pollution. This would represent 138 of the total 3,550 Wirral deaths reported by the Office of National Statistics that year.

The estimated attributable fraction for Wirral is lower than reported for the North West (4.1%) and England (5.1%) in 2017 (**Figure 4**).

Figure 4: Fraction of mortality attributable to particulate air pollution for Wirral, North West and England (2010 – 2017)

Fraction of mortality attributable to particulate air pollution Wirral — Proportion - %

Export chart as image | Show confidence intervals | Export table as CSV file



Recent trend: –

Period		Wirral				North West region	England
		Count	Value	Lower CI	Upper CI		
2010	○	-	4.7%	-	-	5.1%	5.6%
2011	○	-	4.0%	-	-	4.6%	5.4%
2012	○	-	3.9%	-	-	4.4%	5.1%
2013	○	-	4.1%	-	-	4.6%	5.3%
2014	○	-	4.0%	-	-	4.4%	5.1%
2015	○	-	3.5%	-	-	4.1%	4.7%
2016	○	-	4.4%	-	-	4.7%	5.3%
2017	○	-	3.9%	-	-	4.1%	5.1%

Source: Background annual average $PM_{2.5}$ concentrations for the year of interest are modelled on a 1km x 1km grid using an air dispersion model, and calibrated using measured concentrations taken from background sites in Defra's Automatic Urban and Rural Network (http://uk-air.defra.gov.uk/interactive-map.) Data on primary emissions from different sources and a combination of measurement data for secondary inorganic aerosol and models for sources not included in the emission inventory (including re-suspension of dusts) are used to estimate the anthropogenic (human-made) component of these concentrations. By approximating LA boundaries to the 1km by 1km grid, and using census population data, population weighted background $PM_{2.5}$ concentrations for each lower tier LA are calculated. This work is completed under contract to Defra, as a small extension of its obligations under the Ambient Air Quality Directive (2008/50/EC). Concentrations of anthropogenic, rather than total, $PM_{2.5}$ are used as the basis for this indicator, as burden estimates based on total $PM_{2.5}$ might give a misleading impression of the scale of the potential influence of policy interventions (COMEAP, 2012).

Source: Public Health England Fingertips, 2019
Notes: Fraction of annual all-cause adult mortality attributable to anthropogenic (human-made) particulate air pollution (measured as fine particulate matter, $PM_{2.5}$).

Since 1970, emissions of nitrogen dioxide (NO_2) and particulate matter ($PM_{2.5}$) and other volatile organic chemicals in the UK have fallen by 65 – 80% and are predicted to continue to reduce. However, there is now further evidence of the harm caused by air pollution. Estimating the health impact of air pollution for Wirral's population presents some challenges. There are no routine health data that measure the combined effects of the main pollutants.

High pollution over a longer time period also exacerbates harm from other risk factors affecting health; for example, smoking, harmful alcohol intake, diet and obesity. Genetic factors may also influence health outcomes. Currently air pollution is not recorded as a contributing cause of death on death certificates. It is also important to note that historical exposure to air pollution when air quality was worse may only manifest health impacts decades later.

Local, community and stakeholder views

The Wirral Council Air Quality Group was established in 2014 and unites representatives from the Council's Fleet Management team, Environmental Health, Public Health, Transport, Sustainability, Licensing and Forward Planning departments across Wirral Council. The group meets three-monthly to engage in multidisciplinary discussions around air quality issues within the region and to identify key areas for co-ordinated action.

On a regional scale, Wirral Council is also represented in the Liverpool City Region's (LCR) Air Quality Task Force and the Air Quality Technical Group (AQTECH).

The need to encourage engagement and participation with the community and stakeholders in local Air Quality action has been recognised. Work is ongoing to utilise opportunities, such as school projects, 'Be the Key' Clean Air Campaign and National Clean Air Day (discussed below).

What are we expecting to achieve? (Targets)

Understanding and monitoring the composition, levels and key sources of air pollution is important to inform policy decisions and interventions to improve air quality and public health. Air pollutants consist of natural or man-made substances that impact the composition of the air we breathe. Road transport, fuel combustion, industrial processes and agriculture are important sources of air pollution in the UK.

The Air Quality Standards Regulations 2010 mandate national-level monitoring of outdoor air pollutants in the UK:

- Particulate Matter (PM_{10} and $PM_{2.5}$)
- Nitrogen Dioxide (NO_2)
- Benzene
- 1,3 Butadiene
- Carbon Monoxide (CO)
- Lead
- Sulphur dioxide (SO_2)
- Ozone (O_3)
- Benzo(a)pyrene

All Local Authorities in the UK have a duty under the Environment Act 1995 Part IV to review and assess local air quality. The EU's Air Quality Directive defines standards by which air pollution can be assessed. The air quality objectives are set out in the Air Quality Standards Regulations 2010 (**Table 1)**.

DEFRA Local Air Quality Management Technical Guidance TG16 (updated in 2018) advises Local Authorities to undertake air quality monitoring in locations of relevant exposure, this would include residential building facades close to busy roads or junctions and point sources of industrial emissions.

These locations undergo periodic review and modification. Local Authorities must determine whether the air quality objectives are likely to be achieved. Where exceedances are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

The Air Quality Standards Regulations 2010 (as amended) require a maximum concentration for $PM_{2.5}$ of 25µg/m3, with the World Health Organisation target set lower at 10µg/m3. These regulations also set targets for the reduction in annual mean concentrations of $PM_{2.5}$ in urban background locations based on an initial "Average Exposure Indicator" (AEI) for 2010 (calculated using a 3-year rolling average). Percentage reduction targets are then set, according to the AEI. These reductions are applied to the national levels of $PM_{2.5}$.

Current EU and UK Regulations require that NO_2 levels should not exceed an average annual mean of 40 µg/m^3 at points of relevant exposure. While total emissions of NO_2 have been reducing over time, EU targets for NO_2 were exceeded in 38 out of 43 zones in the UK in 2013. As a result, the UK government has put increased focus on reducing NO_2 emissions.

For both $PM_{2.5}$ and NO_2, no safe level of exposure has been identified (where no negative health impacts occur). As such, continuing to reduce NO_2 levels below identified targets remains a key public health priority.

Table 1: Key Air Quality Objectives within the Air Quality Standards Regulations

Pollutant	Applies	Air Quality Objective (Concentration)	Air Quality Objective (Measured as)	Date to be achieved by	European Obligations	Date to be achieved by
Nitrogen dioxide (NO_2)	UK	200 µg/m^3 not to be exceeded >18 times/year	1-hour mean	31.12.2005	200 µg/m^3 not to be exceeded > 18 times/ year	01.01.2010
Nitrogen dioxide (NO_2	UK	40 µg/m^3	Annual mean	31.12.2005	40 µg/m^3	01.01.2010
Lead	UK	0.5 µg/m^3	Annual mean	31.12.2004	0.5 µg/m^3	01.01.2005
Lead	UK	0.25 µg/m^3	Annual mean	31.12.2008	None	None
Carbon monoxide (CO)	UK	10 mg/m^3	Maximum daily running 8 hour mean/in Scotland as running 8 hour mean	31.12.2003	10 mg/m^3	01.01.2005
1,3 butadiene	UK	2.25 µg/m^3	Running annual mean	31.12.2003	None	None
Polycyclic aromatic hydrocarbons	UK	0.25 ng/m^3 B[a]P	Annual average	31.12.2012	1.0 ng/m^3	31.12.2012
Sulphur dioxide (SO_2)	UK	266 µg/m^3 not to be exceeded > 35 times/ year	15 minute mean	31.12.2005	None	None
Sulphur dioxide (SO_2)	UK	350 µg/m^3 not to be exceeded > 24 times/ year	1 hour mean	31.12.2004	350 µg/m^3 not to be exceeded > 24 times/year	01.01.2005
Sulphur dioxide (SO_2)	UK	125 µg/m^3 not to be exceeded > 3 times/ year	24 hour mean	31.12.2004	125 µg/m^3 not to be exceeded > 3 times/ year	01.01.2005
Ozone (O_3)	UK	100 µg/m3 not to be exceeded > 10 times/ year	8 hour mean	31.12.2005	120 µg/m3 not to be exceeded by > 25 times/year, averaged over 3 years	31.12.2010
Particulate Matter ($PM_{2.5}$)	UK (except Scotland)	25 µg/m^3	Annual mean	2020	25 µg/m^3	2010
Particulate Matter ($PM_{2.5}$)	Scotland	10 µg/m^3	Annual mean	31.12.2020	25 µg/m^3	01.01.2015
Particulate Matter ($PM_{2.5}$)	UK urban areas	15% reduction in concentrations at urban background	Annual mean	2010-2020	20% reduction in concentrations at urban background	2010-2020

Pollutant	Applies	Air Quality Objective (Concentration)	Air Quality Objective (Measured as)	Date to be achieved by	European Obligations	Date to be achieved by
Particulate Matter (PM_{10})	UK	50 µg/m^3 not to be exceeded > 35 times/ year	24 hour mean	31.12.2004	50 µg/m^3 not to be exceeded > 35 times/ year	01.01.2005
Particulate Matter (PM_{10})	UK	40 µg/m^3	Annual mean	31.12.2004	40 µg/m^3	01.01.2005
Particulate Matter (PM_{10})	Scotland	50 µg/m^3 not to be exceeded > 7 times/ year	24 hour mean	31.12.2010	50 µg/m^3 not to be exceeded > 35 times/year	01.01.2005
Particulate Matter (PM_{10})	Scotland	18 µg/m^3	Annual mean	31.12.2010	40 µg/m^3	01.01.2005
Benzene	UK	16.25 µg/m^3	Running annual mean	31.12.2003	None	None
Benzene	England and Wales	5 µg/m^3	Annual average	31.12.2010	5 µg/m^3	01.01.2010
Benzene	Scotland and Northern Ireland	3.25 µg/m^3	Running annual mean	31.12.2010	None	None

Source: Air Quality Standards Regulations, DEFRA

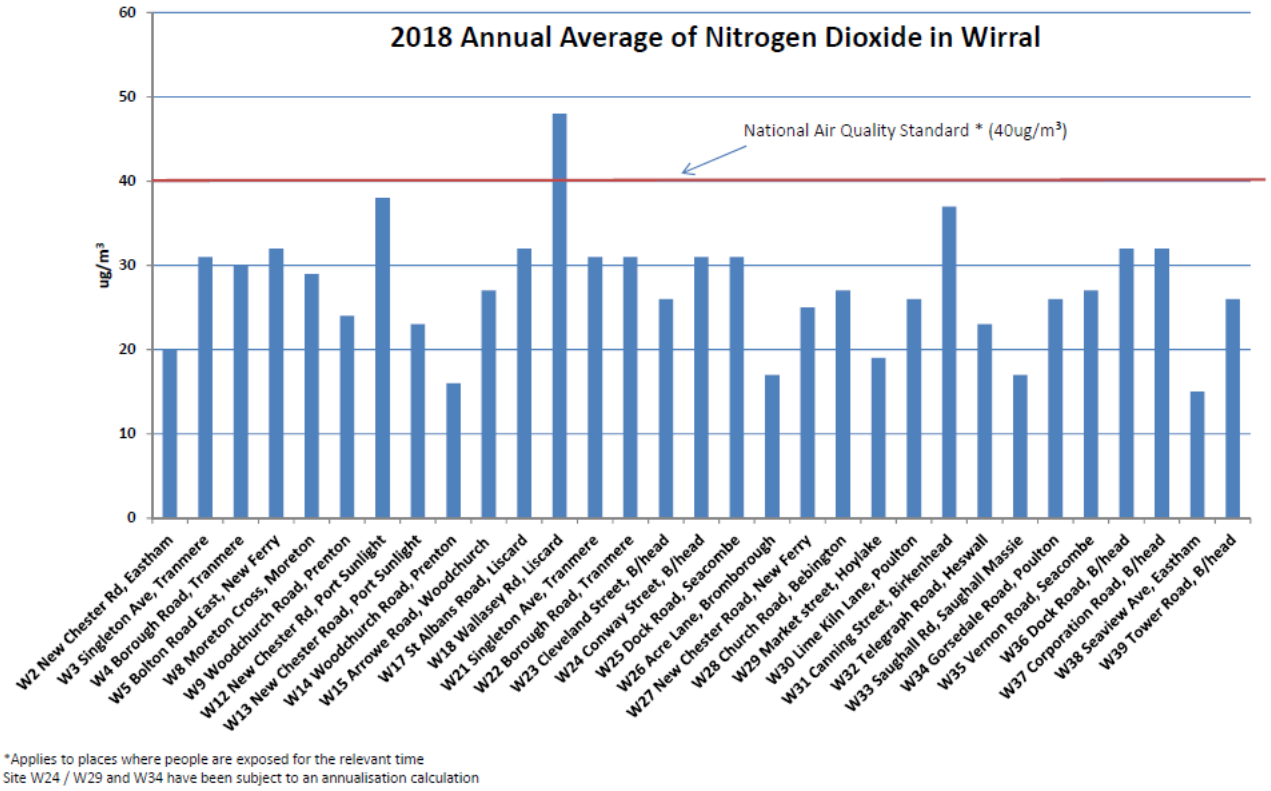
Content continues on page 18 below.

What are we achieving? (Performance)

Nitrogen Dioxide

NO_2 diffusion monitors are located at traffic hotspots determined by local intelligence, historical data, and input from transportation services. NO_2 readings for the 31 monitors present in 2018 are shown in **Figure 5**.

Figure 5: *Provisional Nitrogen Dioxide Air Quality results for Wirral, 2018



*Applies to places where people are exposed for the relevant time
Site W24 / W29 and W34 have been subject to an annualisation calculation

Source: Wirral Council Environmental Health Team.
Notes: The Annual Air Quality Objective applies to sites where there is relevant exposure e.g., facades of residential properties. Where, as in this case, monitoring is sometimes carried out at the kerbside, corrections are later applied to determine whether there are exceedances at points where there is relevant exposure to the public. The monitor at site W18 is deemed to be not a site of relevant public exposure. *Finalised figures are published in the Air Quality Annual Status Review once they have been verified by DEFRA.

An Explanation of Adjustments Made to Monitoring Figures:

Bias:
NO_2 diffusion tubes have a limited accuracy. Therefore, there is a national scheme to compare the results of tubes placed near real time monitors with the results from those monitors. This data is collected and used to produce "bias adjustment" factors which are regularly published. This information is used by us to correct the results from our tubes and provide the most accurate figure possible.

Distance Adjustment:
It is not always possible to monitor at the point where exposure may occur. In these circumstances DEFRA provide a tool to allow us to calculate exposure levels at the point where exposure occurs. E.g. we may monitor on a lamp post and then adjust the figure to calculate what it is estimated to be at the façade of a house.

Annualisation:
Where tubes are damaged or go missing for part of the year then DEFRA provide guidance of how to estimate an annual figure.

In 2018, annual mean nitrogen dioxide (NO_2) concentrations were below the national objective in almost all locations. After bias adjustment, one diffusion tube was above the National Air Quality Objective, recording 48µg/m3. This reading has been constantly elevated in recent years.

This monitor is located in a taxi rank in Liscard, which was determined to be a location whereby there is no 'relevant exposure' for the public, i.e., an area where the public would not be regularly present and thus not likely to be exposed for a period of time appropriate to the averaging period of the objective.

This is consistent with the Department for Environment, Food and Rural Affairs (DEFRA) Technical Guidance that authorities "*should not consider exceedances of the objectives at any location where relevant public exposure would not be realistic*" (2009, updated 2016).

Readings from 13 monitoring locations active between 2012-2018 demonstrate an overall decrease in NO2 concentrations, except the monitor on Wallasey Rd (discussed above) **(Table 2).**

Table 2: Comparison of annual mean nitrogen dioxide (NO2) concentrations (bias adjusted and annualised) between 2012 and 2018* at 13 sites consistently monitored over this time period.

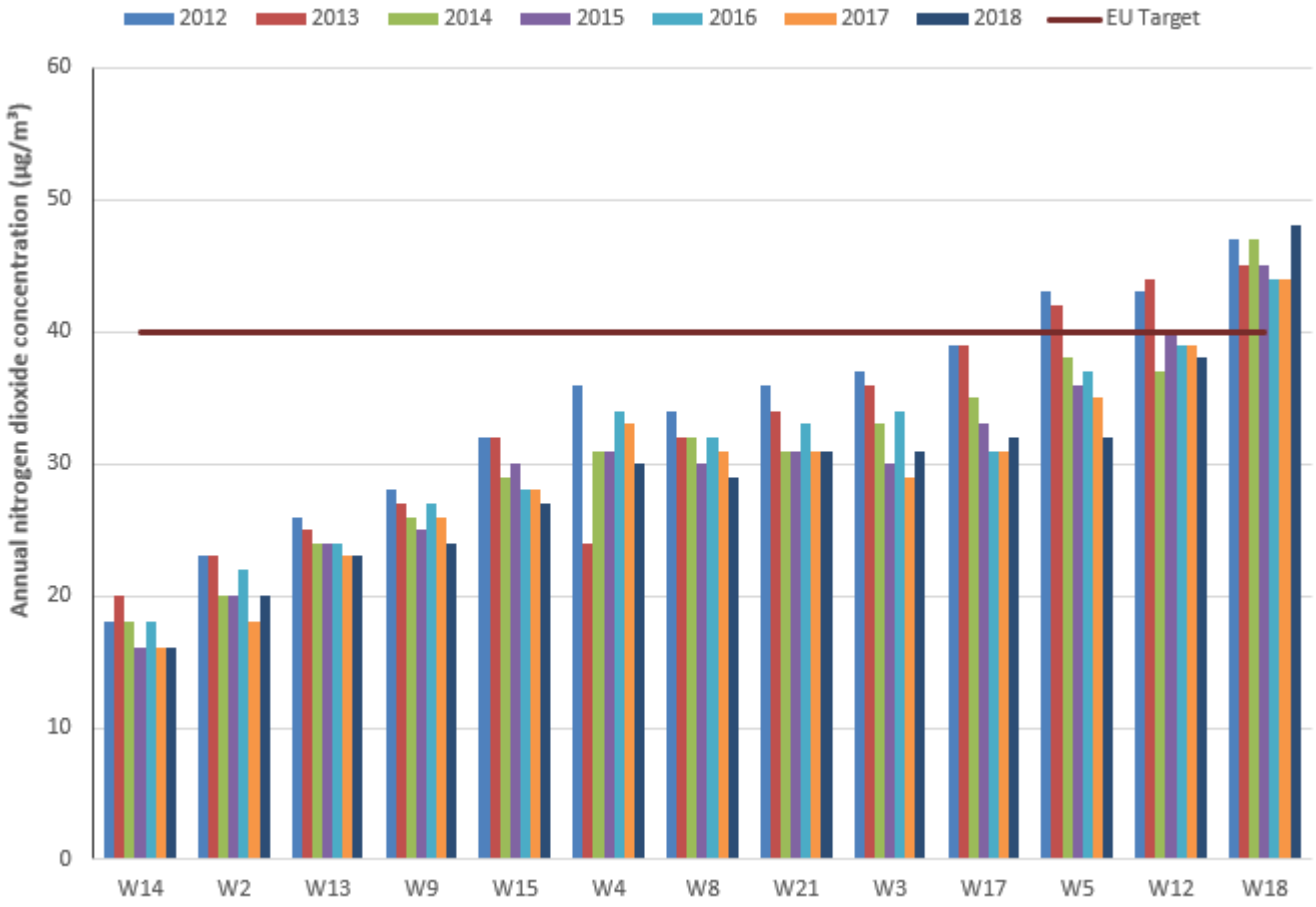
Site and Reference	NO_2 concentration 2012 (µg/m3)	Provisional NO_2 concentration 2018 (µg/m3)	Difference in NO_2 concentration between 2012 and 2018 (µg/m3)
Woodchurch Road W14	18	16	-2
New Chester Road W2	23	20	-3
New Chester Road W13	26	23	-3
Woodchurch Road W9	28	24	-4
Arrowe Park Road W15	32	27	-5
Singleton Avenue (151) W3	37	31	-6
St Albans Road W17	39	32	-7
Moreton Cross W8	34	29	-5
Singleton Avenue Lampost W21	36	31	-5
Borough Road W4	36	30	-6
Bolton Road East W5	43	32	-11
New Chester Road - Port Sunlight W12	43	38	-5
Wallasey Road W18	47	48	+1

Source: Wirral Air Quality Monitoring ASR 2019 and provisional data provided by Environmental Health.
Notes: The concentration of an air pollutant (e.g. NO_2) is given in **micrograms (one-millionth of a gram) per cubic meter** air or µg/m3. W – plus number – relates to the site reference for each air quality monitoring unit. *2018 data is at this time Provisional with data and being validated at a later date.

A more detailed annual trend in NO_2 concentrations across the monitoring sites between 2012 and 2018 is illustrated below (**Figure 6**).

When annual NO_2 concentrations are shown for the past seven years, most sites show a downward trend in annual NO_2 concentrations during this period.

Figure 6: Graph showing change in annual mean nitrogen dioxide (NO2) concentration (bias adjusted and annualised) over time at the 13 diffusion monitors across Wirral that were operational between 2012-2018*



Source: Data obtained from Wirral Air Quality Monitoring ASR 2019 and Wirral Council Environmental Health team.
Notes: *The Annual Air Quality Objective applies to sites where there is relevant exposure e.g., facades of residential properties. Where, as in this case, monitoring is sometimes carried out at the kerbside, corrections are later applied to determine whether there are exceedances at points where there is relevant exposure to the public. The monitor at site W18 is deemed to be not a site of relevant public exposure.

Particulate Matter ($PM_{2.5}$)

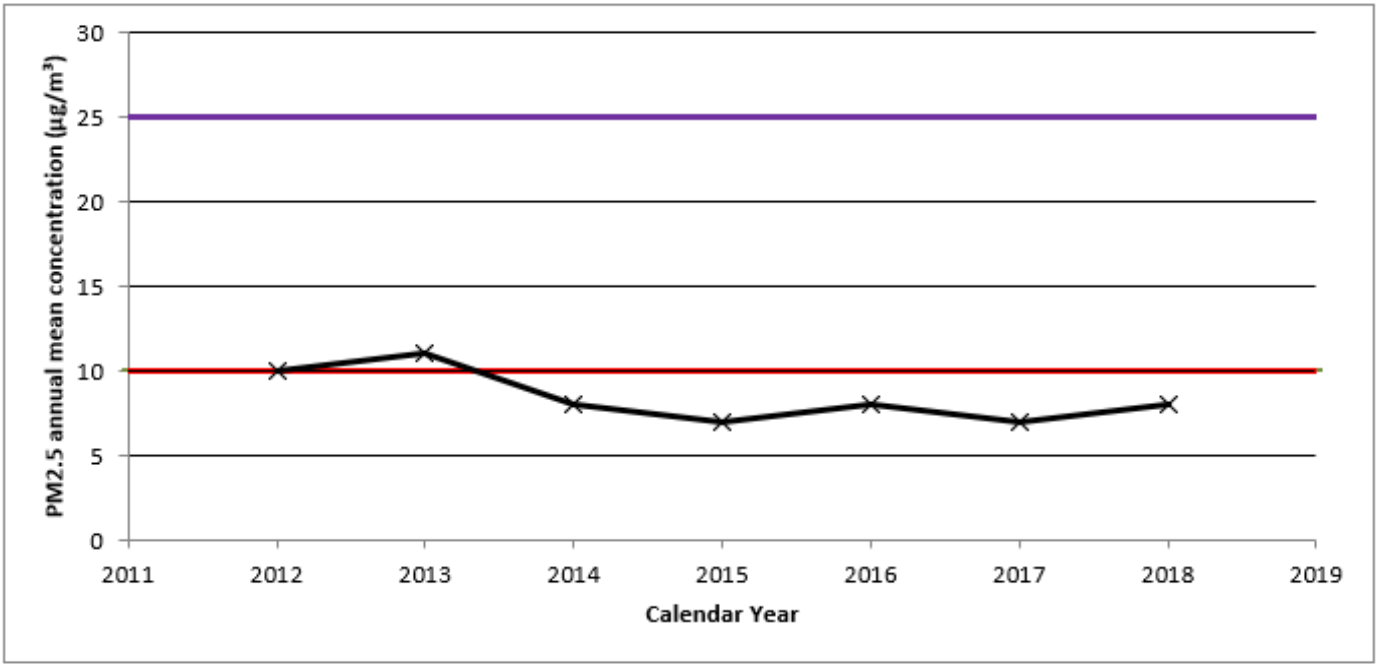
In line with national air quality management guidance, $PM_{2.5}$ monitoring is undertaken by one Urban Background Air Quality Monitor based in Victoria Park, Tranmere. From 2012 to 2018, the annual mean concentrations of $PM_{2.5}$ were 10 µg/m3, 11 µg/m3, 8 µg/m3, 7 µg/m3, 8 µg/m3, 7 µg/m3 and 8 µg/m3, respectively (**Figure 7**).

Since 2014, the annual mean concentrations of $PM_{2.5}$ have remained below both the World Health Organisation and the European Union standards.

These results are taken from hourly measured data and are not bias adjusted. It is important to acknowledge that this monitoring is undertaken at an urban background site and may not be representative of roadside readings, where $PM_{2.5}$ concentrations are likely to be higher.

In 2010, Wirral had an initial "Average Exposure Indicator" (AEI) of 9.33. The target for the reduction in annual mean concentrations of $PM_{2.5}$ in urban background locations in Wirral based on this initial AEI was 10%. The three-year rolling average AEI for 2016 was 7.7ug/m3, demonstrating a reduction of 10%, which met the suggested target. Regulations suggest that once the AEI has reached 8.5 µg/m3 and is maintained at or below this level, the reduction target is zero.

Figure 7: Trend in urban background particulate matter ($PM_{2.5}$) captured by the urban background air quality monitor in Tranmere, 2012-2018.

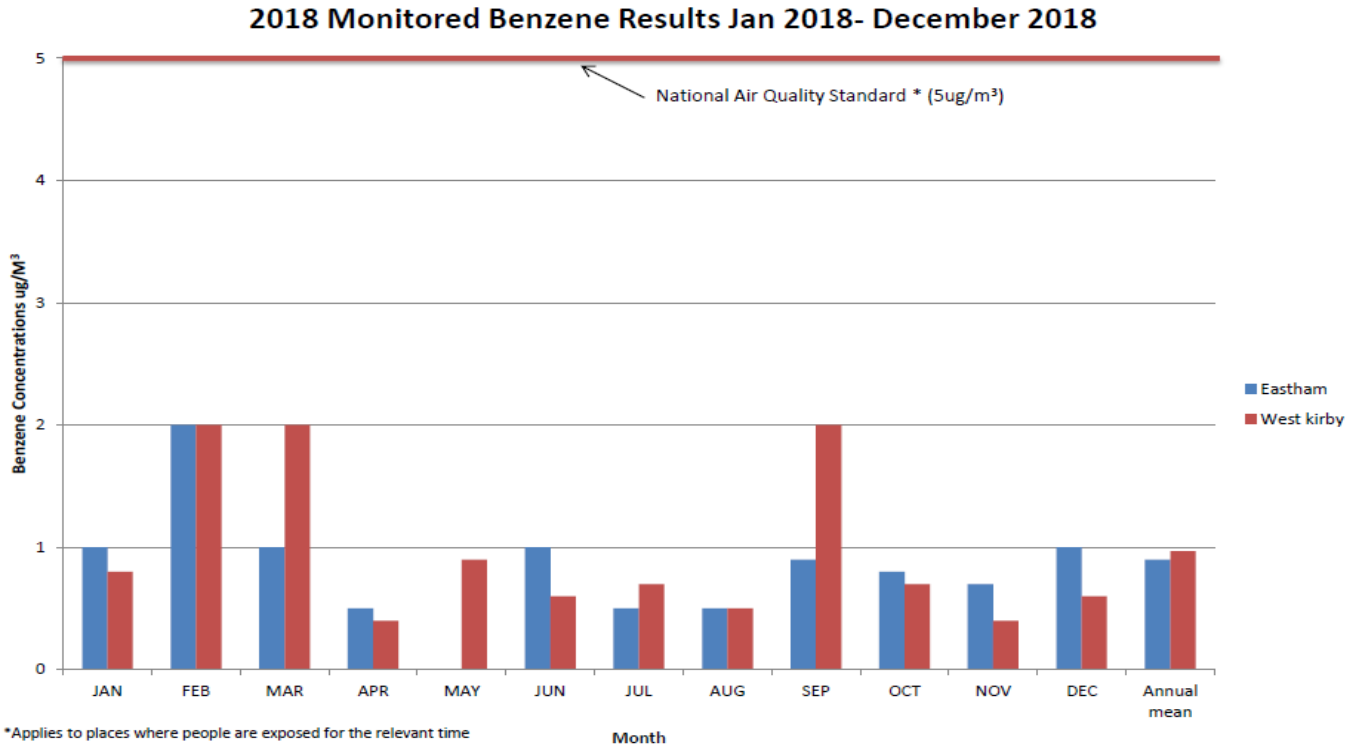


Source: Data drawn from Wirral Air Quality Monitoring Annual Status Report, 2019
Notes: *The concentration of an air pollutant (e.g. ozone) is given in micrograms (one-millionth of a gram) per cubic meter air or µg/m3. Purple line on graph is European Union air quality standards set at 25 micrograms (one-millionth of a gram) per cubic meter air or µg/m3 whilst World Health Organisation sets its acceptable concentration level at 10 micrograms (one-millionth of a gram) per cubic meter air or µg/m3.

Benzene

Benzene monitoring in Wirral resumed in two locations in 2015. There is marked seasonal variation in outdoor air concentrations of benzene, with concentrations higher in the winter. In 2018, monthly benzene concentrations in the two locations were below 5ug/m3 (**Figure 8**).

Figure 8: Monitored benzene results in Eastham and West Kirby, 2018.



Source: Wirral Council: Air Quality. Monitoring Results for Benzene, 2018

What is this telling us?

Wirral currently has no Air Quality Management Areas (AQMA), and annual nitrogen dioxide (NO_2) concentrations have decreased across the majority of diffusion monitors in the Borough over the past year. However, it is important to keep longer term trends under review as weather, roadworks etc. may affect short term year on year comparisons. Particulate matter ($PM_{2.5}$) levels in Wirral remain below both European Union (EU) and World Health Organisation (WHO) recommendations.

Current recommendations from both the EU and WHO suggest there is no safe level of exposure of $PM_{2.5}$ and NO_2, with negative health impacts reported below the objective concentrations. The NO_2 monitor at the Liscard taxi rank continues to record levels above the National Air Quality Objective. Whilst this is not considered to represent a relevant exposure under the current regulations, the Council is working to reduce NO_2 pollutant levels in the area through the implementation of anti-idling legislation and direct work with taxi operators (discussed further below).

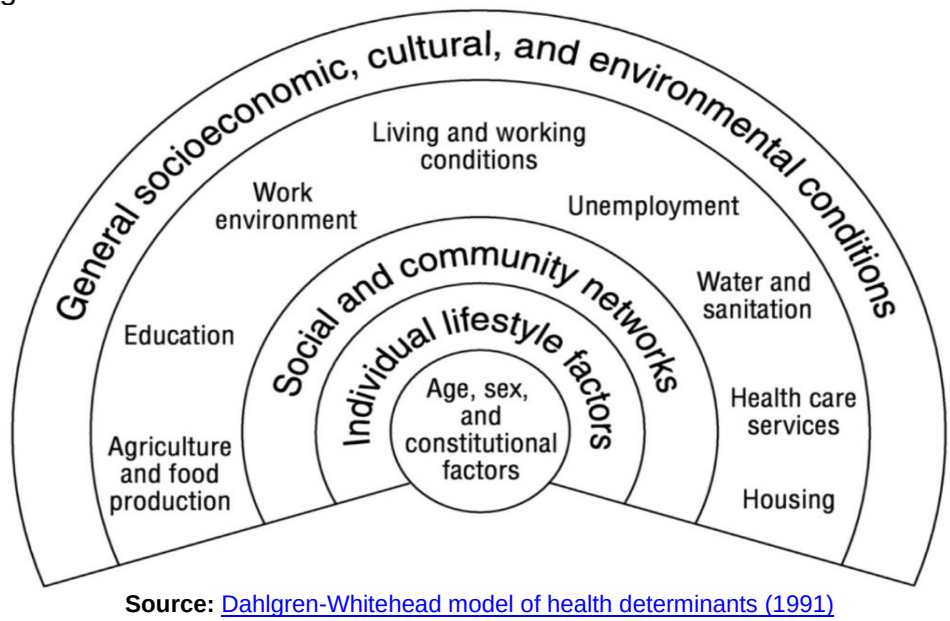
Currently Wirral has only one monitor recording $PM_{2.5}$ levels, located at an urban background site. $PM_{2.5}$ has the strongest evidence-base of negative impacts on health globally (Landrigan 2017). It is therefore important that $PM_{2.5}$ continues to be represented within the Council's work programme. The Department for Environment, Food and Rural Affairs (DEFRA) guidance states that action to address $PM_{2.5}$ should be specifically discussed with Public Health teams and addressed in the Air Quality Annual Status Report.

The 2017 Lancet Commission on Pollution and Health stressed the need for collaboration between departments to tackle the global issue of air pollution (Landrigan 2017). Evidence suggests that local action should be focused on co-benefit strategies, which not only improve air quality, but also generate sustainable improvements in wider health and social outcomes. For example, through changing transportation infrastructure we can promote active travel, thereby reducing harmful emissions, increasing physical activity and enabling healthy weight.

Groups most at risk

Air pollution does not influence health outcomes in isolation, but interacts with other health determinants, including socio-economic status, diet and climate (Royal College of Physicians, 2016) (Figure 9). Globally, negative health impacts of air pollution are disproportionately experienced by marginalised and low income communities (Landrigan 2017).

Figure 9: Dahlgren and Whitehead's model of the wider determinants of health.



Source: Dahlgren-Whitehead model of health determinants (1991)

A 2016 report from the Royal College of Physicians on impacts of air pollution across the life course identified three groups most vulnerable to the effects of air pollution:

1. **Individuals at extremes of age or with pre-existing cardiovascular or respiratory illnesses:** While exposure to air pollution can have health impacts across the life-course, evidence suggests that the elderly people and those with pre-existing diseases are more sensitive to the effects of poor air quality (Pye et al, 2006). The Marmot Review (2010) highlighted that individuals in deprived areas experience more adverse health effects at the time level of exposure compared to those from less deprived areas and that this was due, in part, to the higher prevalence of underlying cardio-respiratory diseases including Chronic Obstructive Pulmonary Disease (COPD), bronchitis, emphysema and asthma. These conditions may be exacerbated by poor air quality in certain geographical areas.

2. **Individuals living or working in close proximity to main roads**: Given that traffic emissions are the greatest source of nitrogen dioxide (NO2) in the UK, it is no surprise that individuals living or working close to major traffic thoroughfares are exposed to higher levels of air pollution (DEFRA, 2017).

3. **Individuals living in more deprived regions:** An examination of the links between air quality and social deprivation in the UK on behalf of DEFRA (Pye et al, 2006) suggested that NO2 concentrations are higher in more deprived areas, largely due to the road transport sources. Further analysis has been undertaken which shows that in deprived areas there was lower car ownership, however such areas still experience high pollution levels, suggesting that deprived areas are suffering further through the actions of the population of car owners. Whilst the research does not further examine this matter in relation to car ownership, it would be fair to assume that car owners are travelling through more deprived areas to access employment, retail etc.

Key inequalities

Deprived communities are more likely to be located in close proximity to busy roads, congested areas and traffic hotspots; this would indicate that people who live in built-up areas are more likely to suffer negative health effects of air pollution.

Similarly, previous work in Wirral has shown that those living in the most deprived communities are more likely to live more years in ill health than individuals from comparatively wealthier areas (Director of Public Health Annual Report, 2017).

Individuals most susceptible to negative health impacts of air pollution exposure are likely to be among the most vulnerable people in society, in some cases with limited social power to alter social circumstances or individual-level risk, for example to move to a new house or make changes to their home to limit exposure to air pollution.

In recognition of these inequalities, current NO_2 air quality monitor placement in Wirral is clustered around East Wirral, recording air quality in some of the most deprived areas of the borough, with the highest concentration of main roads and the poorest air quality (**Map 3**).

Key issues and challenges

Though there is some movement towards ultra-low emission vehicles, diesel and petrol cars currently remain an integral part of our transportation infrastructure. Accurately measuring emissions from vehicles is critical to inform strategies to minimise harmful exposures. Accurate measurement of real-world emissions to identify the worst sources of emissions has proven challenging. In some instances, this challenge was driven by the presence of devices in motor vehicles, which deliberately and artificially reduced emission readings when tested under laboratory conditions.

Even in vehicles not fitted with such devices, real-world emissions appear to be in excess of those reported in test conditions, resulting in inaccurate readings and excesses above EU objectives. In response to this challenge, on 1st September 2017, the European Commission introduced a more sensitive “real driving emissions” test and more accurate tests under laboratory conditions ("World Harmonised Light Vehicle Test Procedure") (European Commission, 2017). It is hoped that these improved tests will result in a more reliable measure of emissions and improve the ability to mitigate the impact of motor vehicle emissions on air quality.

Strategies to improve air quality must be holistic in their scope to ensure changes are sustainable. Previous national recommendations for improving air quality have been largely focussed on nitrogen dioxide (NO_2) and roadside emissions (DEFRA, 2017). Monitoring coverage and air quality strategies must not overlook the importance of $PM_{2.5}$ as a significant threat to public health.

A 2019 report from the Government’s Air Quality Expert Group has cautioned that, even if exhaust emissions from petrol and diesel cars are removed with the widespread uptake of electric vehicles, particulate matter will continue to be released from wear to roads, tyres and brakes, negatively impacting air quality. The report called for improved efforts to measure and control particulate emissions (Air Quality Expert Group, 2019).

National guidance from the Department for Environment, Food and Rural Affairs (DEFRA) has outlined the key role of local authorities in demonstrating local leadership and innovation in tackling air pollution (DEFRA, 2017).

However, mobilising the magnitude of change required in the fields of transportation and planning require significant funding commitments, which is challenging to obtain in the current economic climate.

As previously discussed, accurately measuring the health impact of air pollution presents challenges. Modelled data of key air pollutants are often applied in circumstances where monitoring points providing precise readings are lacking. While modelling is a useful tool, it lacks the accuracy of readings from diffusion monitors, and may be prone to error.

The combined health impact of exposure to all pollutants is difficult to quantify using routinely available health indicators. Furthermore, exposure to air pollution is not currently listed as a cause of death on death certification.

There are also challenges unpicking the historical influence of exposure to air pollution in earlier decades, when air quality was worse, and monitoring and control of air quality were less rigorous. Regular monitoring of emerging health information will be required to better assess the health impact of air pollution on the health of local communities.

What are we doing and why?

Current activity and services

National recommendations emphasise the need for local leadership and local knowledge to tackle issues of air pollution, setting local authorities at the centre of the air quality improvement initiatives (DEFRA, 2017).

As part of its obligations for Local Air Quality Management, Wirral Council produces an annual air quality monitoring report. The report demonstrates that the authority has made suitable arrangements for local air quality management in the borough and has no AQMAs (Annual Status Report, 2019).

There are a number of interventions being prioritised within Council Departments that have potential to impact upon local air quality.

Local Air Quality Leadership

On 20th June 2019, Wirral Council launched 'Be the Key' Clean Air Campaign, to raise awareness locally and promote individual-level behaviour change. This campaign seeks to raise awareness of anti-idling legislation, with additional priorities driven by intelligence and air quality complaints in the region.

Wirral Council Air Quality Group

As previously referenced, representatives of this group work across the Council to identify opportunities to improve air quality and to link Liverpool City Region initiatives including key local and national strategies.

The Wirral Air Quality Group continues to review and revise air quality monitor placement in the borough, drawing on traffic data and information from the Merseyside Emission Inventory. Increasing the coverage and improving the placement of air quality monitors in Wirral ensures more accurate capture of air quality issues within communities most at risk of negative impacts of air pollution. By measuring the right pollutants in the right places, the Council can create an accurate picture of Air Quality in the Borough, with sufficient baseline data to assist in the consideration of Planning Applications.

Additionally, the Air Quality Group led a host of public engagement and education efforts on National Clean Air Day on 20th June 2019 as a mechanism of increasing public awareness around air quality in the local area.

Liverpool City Region (LCR) Air Quality Task Force

In November 2018, the Task Force was established to identify priorities and recommendations to improve air quality at a City Region level. Merseytravel and LCR commissioned the company AECOM to produce a Liverpool City Region Preliminary Air Quality Options Study, outlining interventions for, and benefits of, improving local air quality, which is currently being reviewed by the Task Force.

Air Quality Technical Group (AQTECH)

Wirral is a member of the AQTECH, which discusses relevant regional air quality issues. The AQTECH was awarded funding to develop an educational website to raise public awareness and engagement with air quality issues within the region. This site is due to be launched towards the end of 2019.

Environmental Permitting

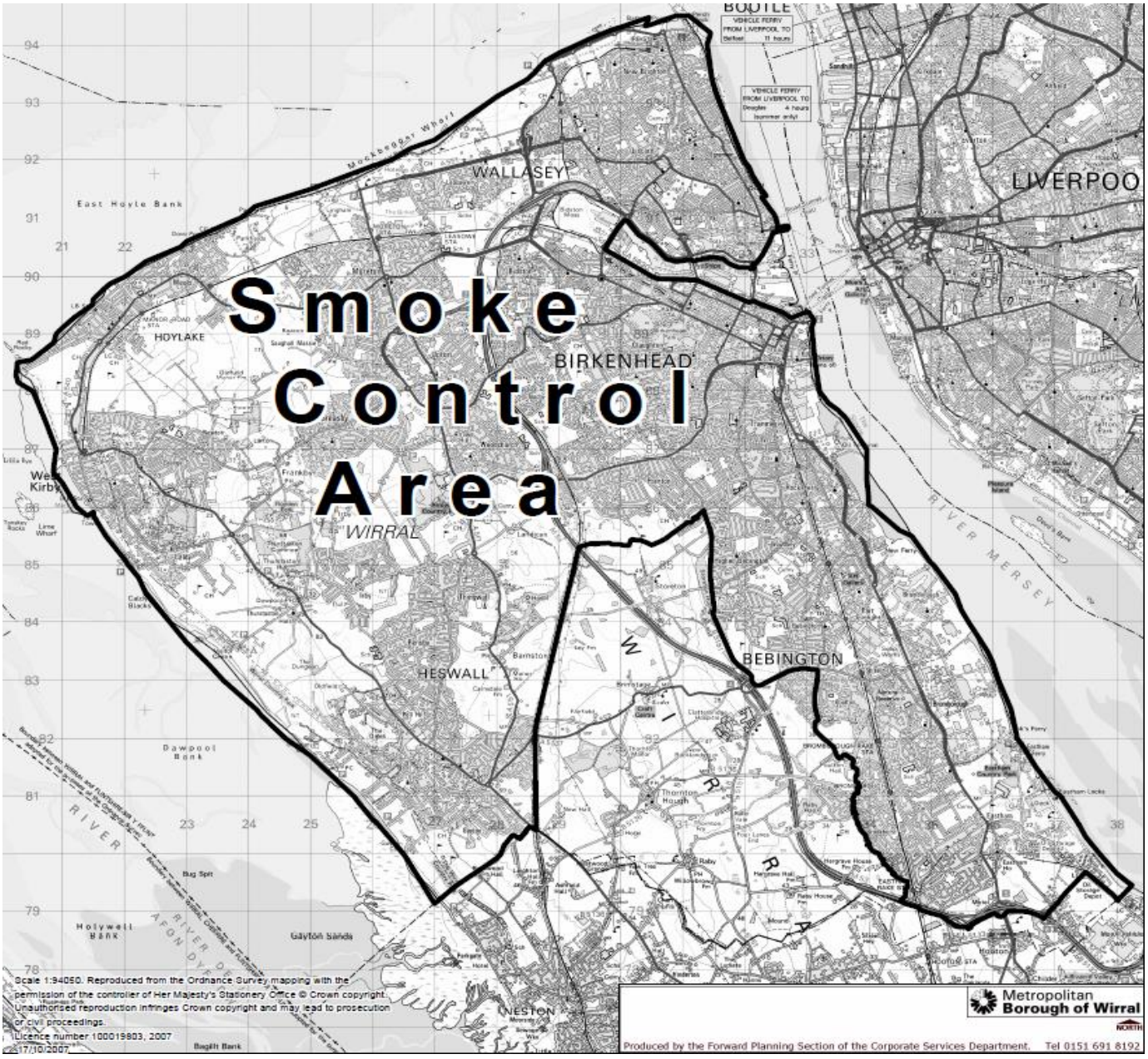
Environmental Health and the Environment Agency (EA) play a significant role in controlling point sources of pollution nationally. Certain industrial processes whose activities emit pollutants, including dust, into the environment are required to operate under an Environment Permit, granted by Environmental Health and the EA. Under the Environmental Permitting Regulations 2010, Wirral Council has issued and monitors more than 50 permits for industrial activities across the Borough.

Environmental Health and the EA ensure that the operators of the permitted processes ensure that their undertakings are done so in accordance with the conditions as described in the Environmental Permit, this includes permitted levels of certain pollutants.

Smoke Control Areas

Smoke control areas have been established across the majority of Wirral **(Map 4)**. In these areas it is illegal to generate smoke from a chimney, fixed boiler or furnace. Only authorised fuels are permitted to be used in smoke control areas, or residents could face fines of up to £1000.

Map 4: Wirral Council Smoke Control Area



Source: https://www.wirral.gov.uk/environmental-problems/pollution-control/smoke-control-areas

Planning

Planning for both residential and industrial developments have a significant impact in air quality. Parts of Wirral are densely built up and this has led to increasing congestion at some junctions. By being involved at the pre planning stages of development, Environmental Health Officers can scrutinise Environmental Impact Assessments to ensure that the impact of development on Local Air Quality Management Objectives is considered.

The National Planning Policy Framework (NPPF) provides guidance to local planning authorities on how to assess the impact of proposed developments. The guidance suggests that the planning system should "contribute to and enhance the natural and local environment", it goes on to state that planning authorities should do this by: *"preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability".*

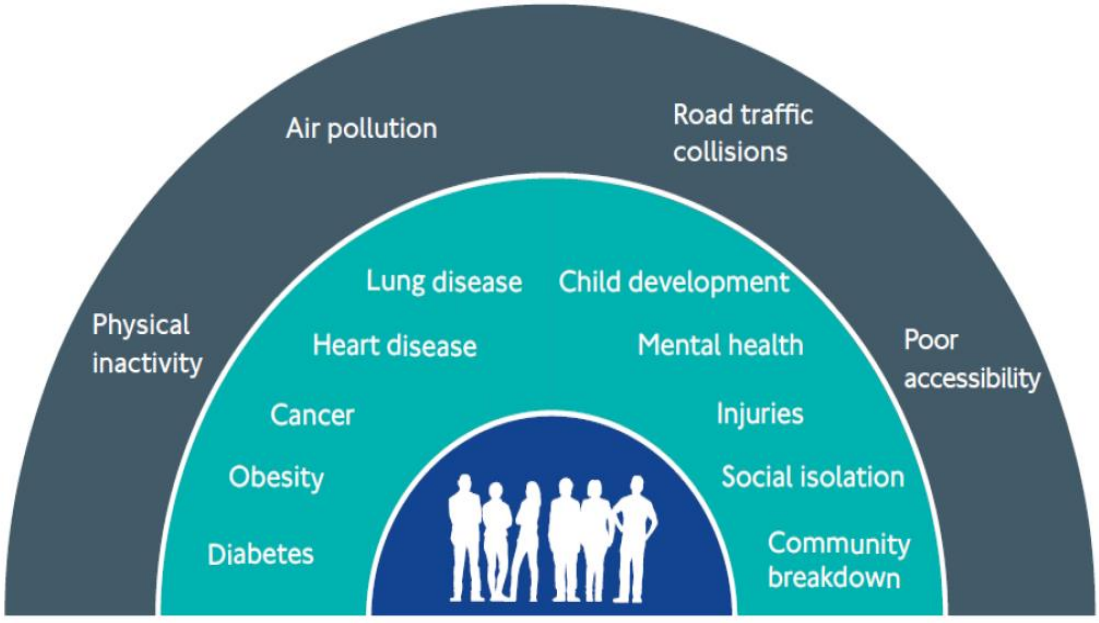
The NPPF also reiterates the importance of compliance with the European Union (EU) limits values for pollutants and the cumulative impacts on air quality from individual sites in local areas.
To assist on the implementation of this framework there is a series of Planning Practice Guidance Documents, including one specifically on Air Quality. As the Council's Core Strategy is developed there are also opportunities to encourage, support and promote actions that will protect or improve Air Quality.

Under the Environmental Permitting (England and Wales) Regulations 2016, Wirral Council has issued and monitors 55 permits for industrial activities regionally, including storage terminals, cement & lime, other minerals, combustion & incineration, tar & bitumen, coating, animal and plant treatment, petroleum and solvents sector.

Transport

With the creation of the Liverpool City Region (LCR) there was a need to harmonise existing transport plans, this lead to the development of 'A Transport Plan for Growth'. Whilst the plan focuses on transport priories, such as growth and access to opportunity, the wider strategic priorities include health and wellbeing and air quality, taking into account the wider impacts of road transport on health (**Figure 10**).

Figure 10: Adverse links between road transport and health



Source: Mayor of London & Transport for London 'Valuing the health benefits of transport schemes' Transport for London, 2015

The plan details action already taken to reduce carbon and improve air quality, including investments in emission reducing and fuel saving devices. The Liverpool City Region (LCR) also has produced a Low Emission Strategy, prioritising the use of low emission fuels and technologies. Wirral Council was awarded a grant from LCR in March 2017 to support sustainable transport initiatives under the umbrella of the Sustainable Transport Enhancement Programme (STEP).

Electric Vehicles

The Electric Vehicle Strategy for the LCR is aimed at speeding up the uptake of electric vehicles across Merseyside. Locally, Wirral is part of the 'Recharge' Scheme, the charging point network. Wirral has three public electric charging points, located at Birkenhead North Train Station Park and Ride, Seacombe Ferry Terminal and Elgin Way Car Park (near to Birkenhead Hamilton Square Train Station). Wirral Council has also incorporated charging facilities at its own facilities, including the Cleveland Street Depot, the Treasury Building and Wallasey Town Hall. A consultation on electric vehicle charging points was conducted in 2018. Results from 500 survey responses are currently under analysis, but it is hoped the consultation will support a bid for government funding to trial on-street residential charging facilities.

Non-Electric Vehicles

To reduce vehicle emissions among taxis, the Licensing Team at Wirral Council mandate compulsory 6-monthly MOTs for private taxi cabs aged over six years old and Hackney Carriages over 10 years old. Vehicles emissions tests must be satisfied during the MOT for a license to be granted. The Air Quality (Taxis and Private Hire Vehicles Database, England and Wales) Regulations 2019 were introduced on 1 May 2019, which requires licensing authorities to regularly send information on licensed taxis and private hire vehicles to a central portal.

Anti-idling legislation has been adopted in Wirral, with enforcement focussed around evidence-based hotspots, including roads around schools and taxi ranks. This change will help to reduce Nitrogen dioxide (NO_2) concentrations at the Liscard site, which has exceeded European Union NO_2 objectives in recent years. In concert with this legislation, the Environmental Health team is leading an educational campaign to raise awareness of the adverse impacts of idling on air quality.

Wirral Council has introduced an in-house anti-idling policy for all Council fleet vehicle users, with anti-idling conditions in place for Council and school transport providers. In addition, Wirral Council's fleet vehicles are fuelled with unleaded petrol or bio diesel, with regular emission tests conducted during servicing. Wirral Council currently has three electric courier vans in its fleet. Gritter trucks and waste collection vehicles are also committed to taking measures to ensure emissions are reduced, such as fitting diesel particulate filters or upgrading to electric vehicles.

Sustainable Transportation for Employees

Wirral Council aims to improve air quality and staff wellbeing through enabling sustainable transport among employees. This is achieved by facilitating working from home, promoting car sharing among employees, encouraging use of public transport via the transport pass loan scheme, and supporting uptake of cycling via the bike loan scheme. Locally, 74 businesses have signed up to the Liverpool City Region Employers Network, which provides access to consultancy support to improve travel options for staff and visitors, promoting health, wellbeing and productivity. In 2018, three companies were awarded funding to install electric vehicle charging points at the workplace.

Public Transportation

MerseyTravel currently has 44 hybrid buses in operation and was awarded £2.5 million funding to retrofit emissions reduction technology to a further 16 buses to reduce NO_2 emissions. Once complete, 19% of the total 86 vehicles in the Laird Street fleet will be retrofitted. Free park and ride schemes are operational at 13 train stations in the borough, in addition to Seacombe Ferry Terminal.

Merseytravel and Merseyrail promote public transportation across the region through targeted campaigns and their website. The LCR received £460 million in December 2016 for public rail improvements, which is being used to upgrade the 40-year-old train fleet. This is accompanied by a public campaign to promote the improvements to the rail network. Similarly, bus providers in the LCR have collaborated to improve network provision, affordability and investment, and to promote bus travel in the region.

Active transportation

Wirral Council is working to improve its cycling infrastructure. £1.2 million of sustainable urban development funding awarded by the European Union, with matched funding from Liverpool City Region (LCR) transforming cities fund, will be used to improve existing cycle and walking paths along the River Birket, and to create new cycle paths within the Wirral Waters Development in 2019. Secure bicycle storage facilities are in situ at 22 train stations in Wirral to encourage people to cycle to work under the 'Go Cycle' scheme. Wirral also supports the national Bike and Go scheme, with bicycles available to hire at six train stations and Seacombe Ferry Terminal in the borough, with 48 bicycles available to hire.

Ten Wirral schools are currently involved in the Living Streets WOW Walk to School project, which seeks to promote active transport among school children. New funding has been awarded to continue this project in 2020 across the LCR.

Community Engagement

Efforts are underway to improve community engagement around air quality. For example, the Public Health team at Wirral Council engaged with researchers at Liverpool John Moores University (LJMU) to promote primary school community engagement in air quality issues through the award-winning Green Air Schools Project (GASP). Local schools were recruited, and pupils measured levels of particulate matter ($PM_{2.5}$) at key points around the school perimeter to determine whether alternative commuting routes to school influenced exposure to air pollution.

In cases where air quality could be improved, Mersey Forrest supported the children to plant vegetation to act as a 'bio-barrier' at key points around the school perimeter. This project has supported 22 schools locally, reporting considerable engagement and interest from staff and pupils. GASP was awarded the Echo Environmental "Healthy Living Award" in 2019.

Wirral Climate Change Strategy

There has been a growing recognition of our local and national responsibilities in mitigating climate change, demonstrated through large organised protests throughout summer 2019. Nationally, the UK government became the first major economy to legislate targets to tackle climate change by introducing a zero emissions target in June 2019, to be reached by 2050 (Press Release, 2019). Locally, there has been an increased focus on climate change, with the creation of a new cabinet position of Environment and Climate Minister in Wirral.

In July 2019, local cabinet members unanimously passed a motion to declare a climate emergency, in line with the UK government and other local authorities nationally (Wirral View, 2019). This signals the council's commitment to tackling climate change locally, with efforts currently underway to update the current climate change strategy. Wirral Council has also pledged its support for the UN Paris Agreement on Climate Change and has signed the Local Government Association's Climate Local initiative (Wirral Council, 2018).

Climate change and air pollution are closely linked, and strategies to mitigate the impacts of climate change have co-benefits of reducing air pollution and improving public health.
The Wirral Climate Change Strategy attempts to reduce pollution associated with climate change and to ensure Wirral is adapted to cope with issues of climate change.

This strategy prioritises the use of active transportation and renewable fuels, and increased community partnerships, engagement and education. Current priorities in the Climate Change Strategy that will benefit air pollution include an on-street residential e-vehicle charging pilot and improved cycle parking. The Wirral Climate Change Strategy is currently being updated for 2020.

What are the challenges?

Key gaps in knowledge and services

The key legislation in Air Quality Management for Air Quality remains the Environment Act 1995. However, the implications of Brexit are not yet clear as long term changes in legislation remain undefined.

What is coming on the horizon?

A £220 million Clean Air Fund was revealed with the Autumn 2017 budget (DEFRA, 2018), with local authorities encouraged to apply for a portion of the fund between 2018/19 and 2020/21 to manage air pollution challenges locally. In July 2017, government plans to terminate the sale of new diesel and petrol vehicles by 2040 were published (DEFRA, 2017). Furthermore, 20th May 2018 saw the introduction of stricter emission limits for diesel vehicles undergoing MOTs, and diesel vehicles registered after 1 April 2018 that fail to meet the real driving emission standard will face a diesel supplement on vehicle excise duty. As such, we may start to see fewer diesel vehicles on the road. However, in a 2018 publication responding to the results of a public consultation on local air quality measures, DEFRA confirmed that they would not be moving forward with a national diesel scrappage scheme.

More locally, the Mayor of Liverpool announced a campaign to ban diesel vehicles in Liverpool city centre by 2022. In his 100 day plan vision for the Liverpool City Region, the Metro Mayor has incorporated “green” as a key theme (Liverpool City Region, 2017). Planned initiatives supported in this strategy include submitting a response to the National Air Quality Consultation, encouraging active transport within the region, awarding funding for electric car charging points, introducing more low emission buses, committing to the Global Covenant of Mayors for Climate & Energy, and initiating the Merseyside Tidal Commission to oversee issues related to the Mersey Tidal Barrage.

The Air Quality Technical Group (AQTECH) has been awarded a grant to develop an educational website to raise awareness around air quality issues in the region. The website is under construction and due to be launched in late 2019.

Collaboration between environmental health, public health, transportation, and sustainability departments will be necessary to ensure that air quality remains a central consideration throughout the regeneration of urban areas in Wirral, including Wirral Waters (http://www.wirralwaters.co.uk) and redevelopment of New Ferry town centre.

A current priority for Wirral Council is to develop a new Local Plan. This document will detail proposals for land use in the region to meet housing demands between 2020-2035. The Sustainability Appraisal will consider the impact of any building proposals on air quality.

Managing future housing demand and the resulting impact on air quality will be an important consideration within this plan. A Health Impact Assessment (HIA) of the Local Plan, which is currently underway, will also provide recommendations relating to health impact.

What does the research suggest as further actions?

Wirral's Air Quality Annual Status Report (ASR) (2019) and the Liverpool City Region's (LCR) Low Emission Strategy and 100 day plan vision (LCR, 2017) emphasise local commitment to investing in the issue of air quality. With air quality established as a global public health priority, there is a call for increased community engagement in this field to inform priority areas for intervention. Engaging with populations most vulnerable to the impacts of air pollution is of particular value to identify ways to mitigate the impact of air pollution in the worst affected communities. Targeting public education and community empowerment around the issues of air quality may help to promote public awareness and support of local air quality initiatives.

In 2019 Public Health England (PHE) published a review of interventions recommended to improve air quality and health in local authorities. An internal audit of action being taken by Wirral Council to improve air quality against PHE's recommendations for local government to improve air quality and health (PHE, 2019) was conducted in September 2019 to identify key areas for improvement.

The audit identified the following recommendations:

1. Air pollutants (specifically NO_2 and $PM_{2.5}$) continue to be strategically monitored across Wirral to identify long term trends and areas for action locally.

2. Continue to annually review and update the Outdoor Air Quality Joint Strategic Needs Assessment.

3. Wirral Council maintains its current commitment to air quality, evidenced by the absence of Air Quality Management Areas, and considers extending membership of the Wirral Air Quality Group to include health partners and other anchor organisations.

4. NHS partners use their Sustainable Development Management Plans to deliver on the air quality goals in the NHS Long Term Plan and share how they are supporting patients and staff to reduce the health impacts of air pollution.

5. Prioritisation of air quality activities is based on the hierarchy of interventions (prioritising prevention of emissions over reducing/avoiding exposure).

6. Air quality initiatives continue to employ a focus on vulnerable populations and foster collaborations with internal/external stakeholders and the wider community.

7. Embed actions related to air quality emerging from the Health Impact Assessment of the Wirral Council Local Plan.

8. Local air quality interventions are formally evaluated to identify/share good practice.

9. The Wirral Air Quality Group drafts a dedicated local air quality plan to clearly and comprehensively define local air quality commitments, priorities and monitoring/evaluation over the next five to ten years, aligned to LCR and national air quality strategies.

10. Key strategic plans for the borough embed air quality considerations across all actions, prioritising initiatives that deliver a net health gain within the local population.

PHE have published an air quality tool, which will be used to characterise economic and health costs of air pollution on a local scale within Wirral over the next decade (PHE, 2018).

Key content

Links

- **Wirral Council – Planning Policy (based on the unitary plan).** Available at: https://www.wirral.gov.uk/sites/default/files/all/planning%20and%20building/Local%20plans%20and%20planning%20policy/Local%20plans/Unitary%20Development%20Plan/UDP%20Written%20Statement%20Sections/19.%20Pollution%20and%20Hazards.pdf [cited 20/02/18].

- **Department of Health (2011). An Outcomes Strategy for Chronic Obstructive Pulmonary Disease (COPD) and Asthma in England.** Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216139/dh_128428.pdf [cited 20/02/18].

- **European Commission (2018). Clean Air.** Available at: http://ec.europa.eu/environment/air/index_en.htm [cited 20/02/18].

- **Liverpool City Region. Mayoral Combined Authority 100 Day Plan.** Available at: http://liverpoolcityregion-ca.gov.uk/100-day-plan [cited 20/02/18].

- **Diesel Vehicle Emission Limits (2018).** Available at: https://www.gov.uk/government/publications/mot-changes-from-may-2018-guidance-for-mot-testers/diesel-vehicle-emission-limits#how-to-find-the-manufacturers-plate-value [cited 01/05/2018]

- **Press Release (2019). PM Theresa May: we will end UK contribution to climate change by 2050.** Available at: https://www.gov.uk/government/news/pm-theresa-may-we-will-end-uk-contribution-to-climate-change-by-2050 [cited 22/07/19]

- **Wirral View (2019). Cabinet Member declares climate emergency**. Available at: https://wirralview.com/news/cabinet-member-declares-climate-emergency [cited 22/07/19]

Relevant and related national and local strategies

- **Liverpool City Region Low Emission Strategy** http://www.merseytravel.gov.uk/about-us/local-transport-delivery/Documents/LTP3/Annexe%2013%20-%20The%20Low%20Emission%20Strategy.pdf [cited 20/02/18].

- **Wirral Council – Wirral Climate Change Strategy 2014-2019** https://www.wirral.gov.uk/sites/default/files/all/About%20the%20council/climate%20change/Wirral%20Climate%20Change%20Strategy%202014-2019.pdf [cited 20/02/18].

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Contact details

For further details please contact:

- Sophie Patterson, Specialty Registrar in Public Health at sophiepatterson@wirral.gov.uk
- Rachael Musgrave, Consultant in Public Health at rachaelmusgrave@wirral.gov.uk
- John Highton, JSNA Programme Lead at johnhighton@wirral.gov.uk

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