Toxic air at the door of the NHS

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Contents

Summary

New analysis by the British Lung Foundation (BLF), and Cambridge Environmental Research Consultants (CERC), has revealed that more than 2,000 health centres in Great Britain, including major teaching hospitals, children's hospitals, clinics and GP surgeries are in areas which exceed safe air pollution limits[1].

What we're calling for

The Government urgently needs to put in place the right measures to ensure that no one breathes dirty air, and adopt the World Health Organisation's recommended limit into UK law through the upcoming Environment Bill. No patient, doctor, nurse or GP should be exposed to such a preventable cause of ill health and early death.

What have we found?

2,220 **GP practices** + **248** **hospitals**

are in areas which exceed safe pollution limits.

This included major teaching hospitals, GP surgeries, clinics and **two of the biggest children's hospitals** in the country, Great Ormond Street Hospital and Birmingham's Children Hospital

2,220 GP practices and 248 hospitals are in areas with average levels of fine particulate matter (PM2.5), one of the most dangerous air pollutants, that are above the limit recommended by the World Health Organisation (WHO) (10µg/m^3 for the annual average).

Many large and medium-sized cities including **Birmingham, Cardiff, Leeds, Leicester, London, Nottingham, Hull, Chelmsford** and **Southampton** have at least one large NHS trust that is located in an area with unsafe levels of pollution. However, smaller towns such as **Ipswich, Westcliff-on-Sea, Gillingham, Worthing, Kettering, Basingstoke and Colchester,** to name but a few, also have their main hospital located in an area with unsafe levels of pollution. Many more cities and towns have small hospitals, clinics and GP surgeries that are located in areas exceeding the WHO's limit.

This is not a problem which affects only London and other big cities. The analysis has showed that the most polluted GP surgery locations in Great Britain are not in **London**, but in **Barrow-in-Furness**. **London** comes tenth after **Lowestoft** and **Ipswich** in Suffolk, **Penzance** in Cornwall, **Portsmouth** and **Bedhampton** in Hampshire, **Great Yarmouth** in Norfolk, **Plymouth** in Devon and **Blackpool** in Lancashire. Individual GP surgeries in these areas have levels of PM2.5 which are in some cases 50% higher than the recommended limit.

What does this mean?

Millions of people visit these hospitals, clinics, and GP surgeries every year, and some of them need ongoing hospital treatment, and may have to stay in hospital for several days. It is unacceptable that hospital staff and GPs have to care for children, people with heart and lung problems, and elderly patients, in environments that could aggravate existing conditions and significantly worsen acute illnesses. Like passive smoking, most of us have very little choice about the levels of toxins in the air we are breathing.

Air pollution is an urgent threat for the twelve million people in the UK who live with a lung condition, such as asthma, COPD and bronchiectasis[2]. Dirty air has a very real effect on their health as breathing can become more difficult and symptoms become worse[3]. Breathing polluted air is particularly dangerous for children and can cause irreversible damage to their growing lungs and hearts[4].

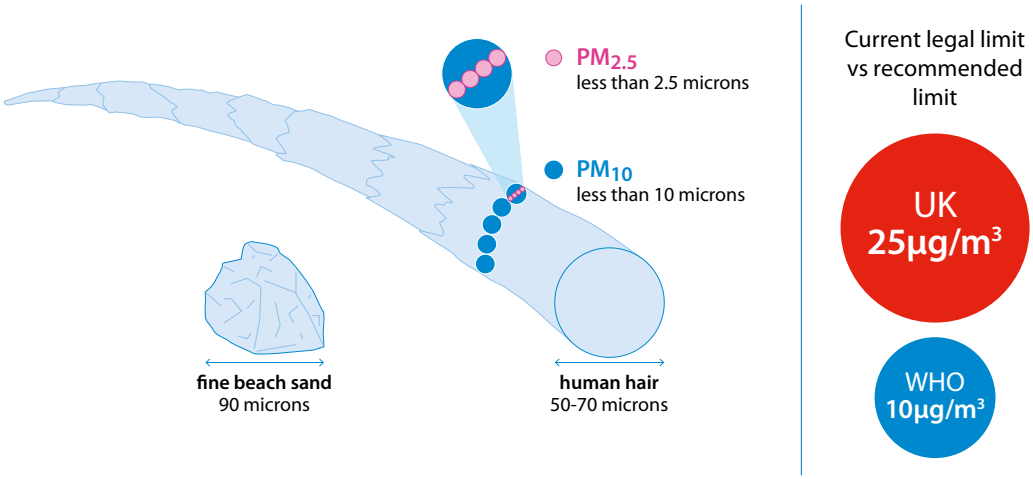
This analysis should not put people off seeking medical help when they need it, and hospitals and GP surgeries should not be blamed for these high pollution levels.

The problem is the pollution created around these health centres, by vehicle emissions, wood burning, shipping, farming or industry. The evidence couldn't be clearer that air pollution is a clear and present danger to our health, and an immediate risk to the health of the most vulnerable. This analysis reaffirms the need for strong and ambitious policies at local and national levels that are enforced to protect us all from what is the biggest environmental threat to public health[5].

What are we recommending?

- **Adopt the World Health Organisation's limit for PM2.5 into UK law through the upcoming Environment Bill to guarantee that the highest health standards are incorporated into future legislation.**
- **Implement a network of charging Clean Air Zones in cities and towns with the highest levels of air pollution across the UK. Where possible, these zones should include hospitals and other health centres.**
- **Provide greater investment in air quality monitoring for places where vulnerable groups gather, including hospitals and health centres, so that where appropriate, people can make an informed choice about where they receive care.**

Fine particulate matter ($PM_{2.5}$)



What is PM2.5 and where does it come from?

PM2.5 refers to particles with a diameter smaller than 2.5µm – 30 times smaller than the average human hair. PM2.5 is particularly harmful as the small particles can easily and quickly penetrate deep into the lungs, and enter the bloodstream[6].

PM2.5 can come from a variety of sources including industrial, commercial and residential emissions, transport, and agriculture. However, the biggest contributor to urban pollution hotspots remains road transport[7].

What are the health effects?

Exposure to PM2.5 has been linked to a plethora of poor health outcomes from diseases including asthma, COPD, coronary heart disease, stroke, and lung cancer, with emerging evidence showing impacts on low birth weight, diabetes and neurodegenerative diseases such as Alzheimer's and Parkinson's[8].

What is the current situation?

The UK is currently meeting legal limits for PM2.5. However, this is only because our legal limit is more lenient than the limit recommended by the international health community. Indeed, the UK legal limit for PM2.5, which is derived from EU regulation, is more than twice as high as the World Health Organisation (WHO) recommendation – 25µg/m^3 instead of 10 µg/m^3 for the annual average. PM2.5 levels have decreased over recent years, but they haven't dropped fast enough, and scientists have not been able to identify a level of PM2.5 that is harmless to breathe. As such, the WHO advocates an annual limit of 10µg/m^3 as a starting point to encourage progressive reductions[9]. **Given there is no safe level, the objective should be to aim for levels as low as possible, and to achieve the WHO's limits at the earliest possible time**.

The long-term objective should be to have levels as low as possible. Every small reduction can deliver substantial health benefits and result in savings in treatment and social care expenditure. For instance, it has been found that reducing PM2.5 levels by just 1µg/m^3 across England in one year would save the NHS and social care budgets £1.38 billion by 2035. This would also avoid 40,312 cases of COPD, 9,253 cases of asthma, and 4,171 cases of lung cancer between 2017 and 2035 in England[10]. As such, sites found to be below the WHO's limit can still benefit from reductions in PM2.5 levels.

Scope and methodology

What is the geographical scope?

The research covers England, Scotland and Wales*. Postcodes for hospitals and GP surgeries were extracted from the NHS digital database. In total, 9,988 health centres – 1,457 hospitals and 8,532 GP practices – were included. Any missing hospital or GP surgery in this analysis means that they weren't available on the NHS digital website.

This report focuses on six case studies, with cities of different sizes, and from different regions, to cover a wide variety of air quality profiles:

- Birmingham, London, Nottingham, and Worthing for England (pages 7–11)
- Aberdeen for Scotland (page 11–13)
- Cardiff for Wales (page 13–15)

What is the methodology?

CERC used existing modelled PM2.5 data published by the UK Government as part of their responsibilities under the Environment Act 1995[11]. CERC used predicted annual average PM2.5 data for 2018. These data have a spatial resolution of 1km x 1km, and therefore represent 'background' levels of PM2.5. These data give a representative indication of expected PM2.5 levels across the whole of the UK at sufficient resolution to provide good evidence.

However, they represent the annual average, and do not capture hyperlocal spatial variations in PM2.5 levels caused by road traffic – so-called 'road side' levels – which fluctuate and sometimes exceed the 10µg/m^3 WHO limit in a short space of time. As such, any variation in pollution levels within that area is smoothed out, and individual institutions which are close to busy roads may experience PM2.5 levels higher than the background concentration. The sites that have been found to be below the WHO's limit can still experience unsafe levels of pollution that are not captured by background concentrations, for example short-term exposure to high levels of PM2.5 by the side of the road. As the data only predicts representations of background, **it is likely that levels at some surgeries and hospitals are even higher than the figures suggest**.

* Northern Ireland was excluded from the scope of this research as NHS Digital does not contain postcodes for hospitals in Northern Ireland

Findings by area

England

Key findings

1 in 3 GP surgeries and 1 in 4 hospitals in England are located in areas that exceed the level of PM2.5 deemed safe by the World Health Organisation. This represents 2,408 health centres – 2,164 GP practices and 244 hospitals. **Two of the biggest children's hospitals in the country, Great Ormond Street Hospital and Birmingham's Children Hospital, are located in areas with unsafe levels of pollution**.

Air pollution in England

If air pollution levels have dropped over the last 50 years, it doesn't mean that the air we breathe is harmless. The smoke from coal-fired plants has now been replaced with invisible fumes, and new pollutants, such as nitrogen oxide and particulate matter, are now of concern.

The UK Government has recently taken steps to tackle all sources of pollution, and will soon publish a comprehensive Clean Air Strategy to reduce levels of many pollutants, including PM2.5. However, a clear commitment to enshrine the WHO's limit into UK law is currently missing from Government's strategies.

One big city (Birmingham), the capital (London), one medium-sized city (Nottingham), and a small coastal town (Worthing) were chosen as case studies to depict the variety of air pollution problems across England. These examples demonstrate the need to have both ambitious national targets, and specific interventions to tackle local air pollution problems.

Birmingham

Key findings

Two major hospitals in Birmingham – Birmingham Children's Hospital, and Birmingham City Hospital – are in areas with unsafe levels of pollution. Sandwell General Hospital is also above the WHO's limit. In addition, 41% of the GP surgeries in Birmingham exceed the WHO's limit.

Hospital profiles

Birmingham Children's Hospital is one of the UK's leading specialist paediatric centres, caring for sick children and young people up to the age of 16 from Birmingham, the West Midlands and beyond. The trust provides a range of specialist services, including the treatment of complex heart conditions and cystic fibrosis. More than 270,600 patients visit the hospital each year[12].

Birmingham City Hospital is a major hospital operated by the Sandwell and West Birmingham Hospitals NHS Trust, serving a population of around half a million people[13].

Local air pollution problems

Nitrogen dioxide (NO_2) and PM2.5 pollution in Birmingham can be linked to 900 deaths per year[14]. It is estimated that up to 80% of the pollution in Birmingham comes from motor vehicles. Birmingham is currently in breach of legal limits for NO_2 and has the second highest levels of NO_2 in England, after London.

New measures and recommendations

Birmingham City Council has announced proposals for a charging Clean Air Zone (CAZ) that includes private cars (class D) for the city centre, which is a very positive step towards tackling road transport pollution. Expanding the scope of the CAZ, especially to roads such as the A4540 which is located close to Birmingham City Hospital, would further reduce air pollution and could contribute to meeting the WHO's limit in Birmingham.

London

Key findings

All major NHS trusts in central London are located in areas exceeding safe air pollution limits. Thirteen out of fourteen teaching hospitals in Greater London have levels of PM2.5 above the WHO's limit – Great Ormond Street Hospital, University College London, St Bartholomew's Hospital, The Royal London Hospital, Guy's Hospital, St Thomas' Hospital, Chelsea and Westminster Hospital, Royal Brompton Hospital, King's College Hospital, The Royal Free Hospital, Charing Cross Hospital, Hammersmith Hospital and St George's Hospital.

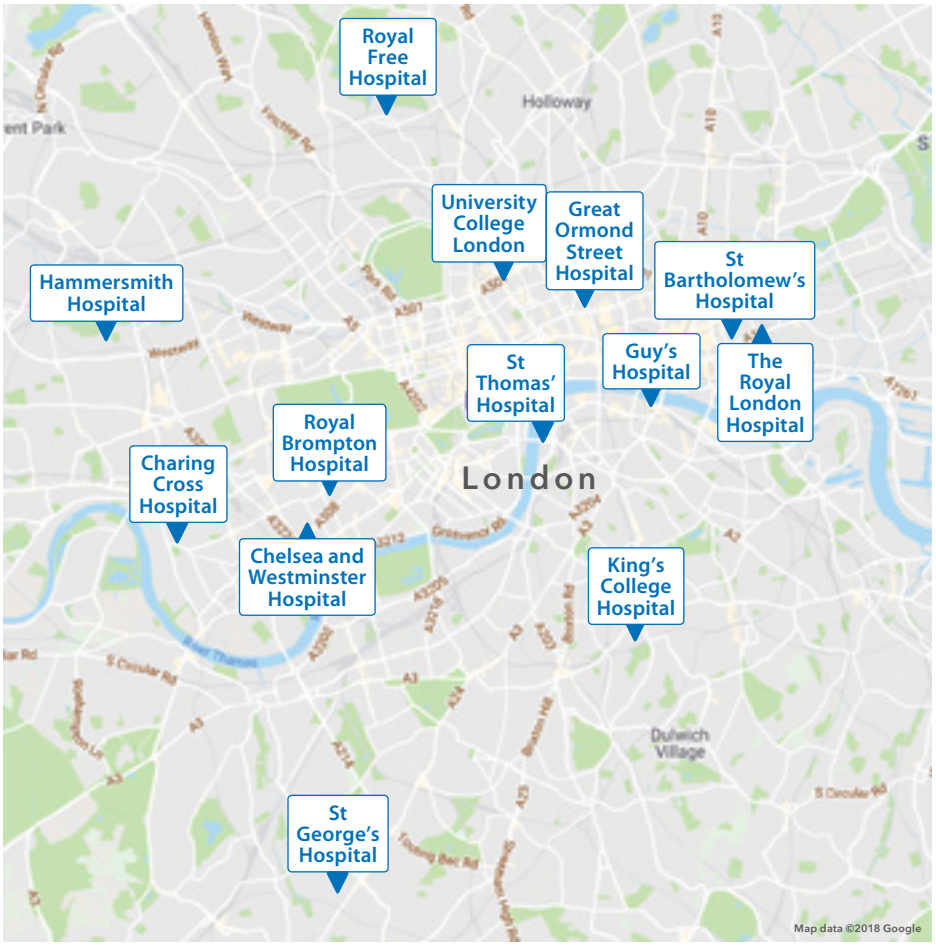
St Mary's Hospital, Great Ormond Street Hospital (GOSH), The National Hospital for Neurology and Neurosurgery, Moorfields Eye Hospital, and University College Hospital are the five most polluted large NHS trusts in London and in the country.

Hospital profiles

St Mary's Hospital is the major acute hospital for North West London, as well as a maternity centre with consultant and midwife-led services. It is also one of four major trauma centres in London[15].

Great Ormond Street Hospital (GOSH) is the largest paediatric centre in the UK for intensive care, cardiac surgery, neurosurgery and cancer services. Great Ormond Street Hospital received 252,389 outpatient visits and 43,778 inpatient visits in 2016–17[16].

Royal Brompton Hospital, the leading heart and lung hospital in the country, is the 12th most polluted large hospital in the capital and in the country.



Map of the 13 teaching hospitals in London located in areas above the WHO's limit

Local air pollution problems

London is one of the most polluted places in the UK, and breaches both legal limits for NO_2, and the WHO's limit for PM2.5. Road transport, of which diesel vehicles are the most polluting, is now the biggest contributor to poor air quality in the capital. Another growing concern in the capital is the use of wood-burning stoves that can make a significant contribution to high pollution episodes.

New measures and recommendations

The Ultra-Low Emission Zone (ULEZ) will begin in central London from 8 April 2019, and will be expanded up to the North and South Circular boundary in 2021. Our research confirms the need to expand the ULEZ beyond central London, as many hospitals and GP practices exposed to unsafe pollution levels are outside the city centre.

Nottingham

Key findings

Two of Nottingham's major hospitals, Nottingham University Hospitals NHS Trust – Queen's Medical Centre Campus, and Circle Nottingham NHS Treatment Centre, as well as 21 out of 53 of GP surgeries analysed, are located in areas with unsafe levels of pollution.

Hospital profiles

The Queen's Medical Centre has 1,700 beds, and is part of one of the busiest NHS trusts in the UK, with annual combined admissions exceeding 214,000[17]. The hospital contains an outpatient respiratory service and a severe asthma service.

A children's hospital that cares for 40,000 children a year is also located on the site. The Queen's Medical Centre is located at the intersection of two busy roads (A52 – Clifton Boulevard and A6200 – Derby Road).

Circle Nottingham NHS Treatment Centre sits on the QMC campus and sees over 12,000 patients a month (both private and NHS)[18].

Local air pollution problems

The city of Nottingham has one of the highest levels of NO_2 in England. It is also the fifth most congested city in the UK. PM2.5 pollution alone is estimated to be linked to 6.4% of adult deaths in the city[19]. Transport remains an important contributor to poor air quality, and, in 2020, petrol and diesel cars will still be one of the main contributors to poor air quality[20].

New measures and recommendations

Nottingham City Council has been mandated to produce a local plan to reduce NO_2 levels, but has announced that it will not be implementing a Clean Air Zone. The focus will be on electrifying the bus fleet.

Nottingham needs to follow the examples of Birmingham and London and implement a class D Clean Air Zone to reduce NO_2 and PM2.5 levels as much as possible. However, the roads near the QMC campus are under the jurisdiction of Highways England (HE), and, as such, HE needs to engage with local councils to discuss local solutions for reducing the use of motorways and trunk roads.

Worthing

Key findings

Worthing is a traditional seaside town, and one of the twenty most polluted areas. One major hospital, Worthing General Hospital, and four in eight GP surgeries in Worthing were found to have above the WHO's limit for PM2.5.

Hospital profile

Worthing Hospital, which is part of the Western Sussex Hospitals Foundation NHS Trust, provides a full range of general acute hospital services including A&E, maternity, outpatients, day surgery and intensive care. Worthing Hospital provides comprehensive care for both in- and out-patients with acute or chronic respiratory diseases, such as asthma and pneumonia[21]. It also recorded 2,381 births in 2016[22].

Local air pollution problems

Worthing is one of the very few UK areas, as defined in Defra's NO_2 plan[23], that is not breaching legal limits for NO_2. However, according to Public Health England, PM2.5 is responsible for 4.9% of deaths in Worthing, the equivalent of 577 years of life lost[24]. Worthing's pollution is partly linked to its location near the sea, as some of the pollution comes from the sea itself, and transboundary continental sources, as well as from local transport and shipping, domestic combustion, and industrial emissions.

New measures and recommendations

Adur & Worthing Councils have established two Air Quality Management Areas (AQMA), but neither of them is in Worthing[25]. This is because PM2.5 levels have always been below the legal limit, and the possibility that levels are above the WHO's limit was probably not considered. Our analysis highlights the need to investigate the reasons why coastal towns like Worthing are experiencing unsafe levels of PM2.5, and put in place more comprehensive air quality plans that cover wider areas than the current AQMA model allows.

Scotland

Key findings

In contrast to other areas of the UK, hospitals and GP practices in Scotland have recorded comparatively lower annual mean levels of PM2.5.

However, this does not mean that the air is safe to breathe. As explained, the WHO is clear that there is no entirely safe limit for PM2.5 levels, and this analysis does not cover other pollutants of concern such as NO_2 and PM10.

Nevertheless, in Scotland, three health care sites have been identified as exceeding the WHO's limit: Aberdeen Community Health and Care Village, Camelon Medical Practice in Falkirk and Merse Medical Practice in Berwickshire.

Air pollution in Scotland

Air pollution is still a big problem in towns and cities across Scotland, and it is estimated that that between 2,500–3,500 deaths in Scotland are attributable to air pollution exposure[26]. Several Scottish towns are still breaching legal limits for NO_2.

Low emissions zones (LEZs) are being introduced across Scotland through the Transport (Scotland) Bill, which is currently being considered by the Scottish Parliament. The Bill intends to give powers to local authorities to introduce LEZs, and Scotland's four largest cities – Aberdeen, Dundee, Edinburgh and Glasgow – are committed to introducing plans for low emissions zones by 2020. It is critical that LEZs are ambitious enough, and consider introducing congestion charging.

Aberdeen

Key findings

Aberdeen Community Health and Care Village has been identified as exceeding the WHO's limit. A further nine sites in Aberdeen have been identified as exceeding an annual mean average of 8µg/m^3 of PM2.5, just below the limit and still presenting risks to people with a lung condition. These include eight GP practices and one hospital (City Hospital).

Hospital profile

Aberdeen Community Health and Care Village is operated by NHS Grampian, which is responsible for delivering health care to approximately 500,000 people in Aberdeen and the wider Grampian area. When operating at full capacity, Aberdeen Community Health and Care Village is expected to deal with 700 patients a day[27]. The hospital is located in King Street in central Aberdeen, which is a known pollution hotspot and is within the Aberdeen City Centre Air Quality Management Area.

Local air pollution problems

The main pollutants of concern according to Aberdeen City Council are NO_2, and particulate matter (PM10), related to road traffic emissions[28]. Regarding fine particulate matter, Aberdeen City Council published an Air Quality Monitoring Progress Report in July 2018, which stated that: "There were no exceedances of the PM2.5 annual mean objective"[29].

New measures and recommendations

A feasibility study for a LEZ has been approved, but scepticism has been expressed that a LEZ is needed for Aberdeen[30]. Our data contradicts the assertions made by the Aberdeen City Council report, as the annual average for PM2.5 was breached at Aberdeen Community Health and Care Village. The latter is located close to King Street, suggesting that existing monitoring equipment is failing to capture a full picture of the impact of air pollution in Aberdeen city centre.

Aberdeen City Council should produce proposals for a city centre LEZ at the earliest possible opportunity, and set up better monitoring systems to capture real world information on levels of air pollution across the city, especially where vulnerable groups are affected.

Wales

Key findings

More than 57 health centres – 54 GP practices and 3 hospitals – are above the WHO's limit for PM2.5. Our data shows that PM2.5 levels are highest in Cardiff.

Air pollution in Wales

It is estimated that air pollution contributes to 2,000 early deaths a year in Wales, or 6% of total deaths. Public Health Wales describes air pollution as second only to smoking as a public health priority.

The Welsh Government will publish a Clean Air Plan for Wales in early 2019, and has recently consulted on Clean Air Zones guidelines. At the same time, a £20m Clean Air Fund was made available to Cardiff and Caerphilly to undertake feasibility studies.

Cardiff

Key findings

Two hospitals in Cardiff – Cardiff Royal Infirmary and St David's Community Hospital – are in areas of unsafe levels of air pollution. In addition, more than half of all GP surgeries in Cardiff report particulate matter levels above the WHO guidelines.

A further three centres on the Heath Hospital site – Wales' largest hospital – report an annual exceedance of more than 9µg/m^3.

Hospital profiles

St David's Community Hospital is part of Cardiff and the Vale University Health Board, which serves a population of 494,446[31], of whom 91,036 are between the ages of 0 to 15. There are a number of children's services provided from St David's Hospital.

The Royal Infirmary provides 119 beds for stroke, orthopaedic and rehabilitation treatment; as well as a community mental health team among others.

GP surgery profiles

More than half of Cardiff's GP surgeries – 26 surgeries – report unsafe levels of air pollution. The table below details the number of registered patients for each of the GP practices reporting levels of PM2.5 above 12µg/m^3, significantly above the WHO guidelines.

GP surgeries reporting exceedances above 12µg/m^3 [32]

Surgery	PM2.5 annual mean	Registered patients
Roathwell Surgery	12.874688	6,443
Clifton Surgery	12.874688	6,130
Cathays Surgery	12.033074	6,940
Meddygfa Albany Surgery	12.033074	6,107
The City Surgery	12.033074	8,041

Local air pollution problems

Public Health Wales estimates that the equivalent of over 220 deaths each year among people aged 30 and over in the Cardiff and Vale area can be attributed to air pollution, of which 196 are due to PM2.5 pollution[33]. It is expected that non-compliance with NO_2 limits will continue beyond 2023 if no additional improvement measures are implemented. The main source of air pollution in Cardiff is road transport, accounting for more than 50% along the A4232 and the A48 of which the A48 runs along the University Hospital Wales site[34].

New measures and recommendations

The Welsh Government directed Cardiff Council to undertake a feasibility study to identify the options which will deliver compliance with legal limits for NO_2 in the shortest time possible. This will be published in late 2018. Cardiff Council published its Transport and Clean Air Green Paper for public consultation in summer 2018, and a charging Clean Air Zone is one of the measures under consideration.

The Welsh Government should adopt the World Health Organisation's annual mean limit for particulate matter into law as soon as possible, and make sure that new air quality plans incorporate the need to reduce air pollution levels around health centres.

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