MIDDLEWICH TOWN COUNCIL

AIR QUALITY WORKING GROUP

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Structure Of Presentation

- Introduction and context
- History UK's air pollution.
- Vehicle exhaust emissions
- Health effects of air pollution
- The Law
- Cheshire East Council Environmental (CEC) methodology and monitoring of Air Quality in Middlewich
- Conclusions
- Next Steps
- Open discussions

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Introduction and context

As a then member of the public I attended a CEC Air Quality Drop in Session, September 2019 to research the CEC methodology and monitoring carried out.

Completed report findings and produced through Town Council

Decision by Council to re-establish Air Quality Working Group to include members of the community.

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Introduction and context

Middlewich has two designated Air Quality Management Areas (AQMA's)

- ***Lewin Street and Chester Road***

Should there be more ?

If so, how do we determine where.

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Vehicle exhaust emissions

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The most significant harmful products are

Carbon monoxide (CO)

Carbon monoxide results from the incomplete combustion where the oxidation process does not occur completely.

Hydrocarbons (HC)

Hydrocarbon emissions are composed of unburned fuels as a result of insufficient temperature which occurs near the cylinder wall

Particulate matter (PM)

Particulate matter emissions in the exhaust gas are resulted from combustion process. Most particulate matters are resulted from incomplete combustion of the hydrocarbons in the fuel and lube oil.

Nitrogen oxides (NOx)

Diesel engines use highly compressed hot air to ignite the fuel. Air, mainly composed of oxygen and nitrogen, is initially drawn into the combustion chamber.

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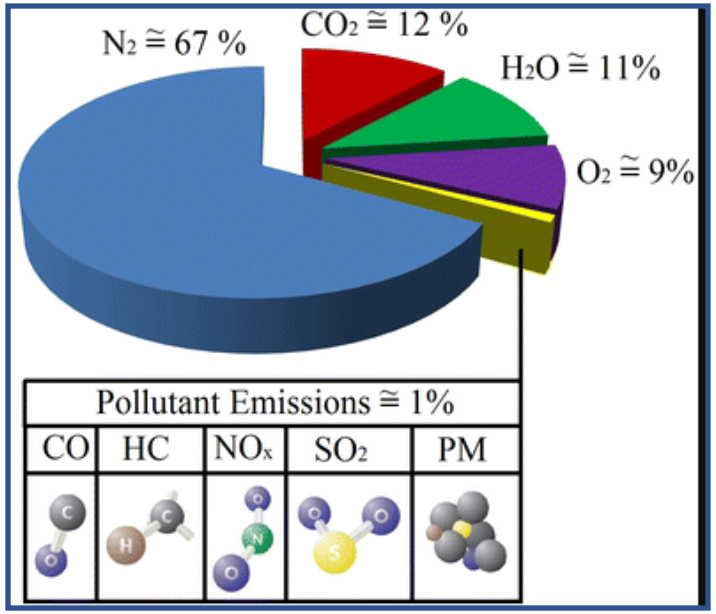

Carbon and hydrogen construct the origin of diesel fuel like most fossil fuels.

For ideal complete combustion of diesel fuel would only generate CO_2 and H_2O in combustion chambers of engine (Prasad and Bella 2010).

However, many reasons

(the air–fuel ratio, ignition timing, turbulence in the combustion chamber, combustion form, air–fuel concentration, combustion temperature, etc.)

make this out of question, and a number of harmful products are generated during combustion.

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Pollutant: ***Particulate Matter (PM-PM10 and PM2.5)***

Particulate Matter is generally categorised on the basis of the size of the particles (for example PM2.5 is particles with a diameter of less than 2.5µm).

PM is made up of a wide range of materials and arise from a variety of sources.

Concentrations of PM comprise primary particles emitted directly into the atmosphere ***from combustion sources*** and secondary particles formed by chemical reactions in the air.

PM derives from both humanmade and natural sources (such as sea spray and Saharan dust).

In the UK the ***biggest human-made sources are stationary fuel combustion and transport.***

Road transport gives rise to ***primary particles from engine emissions, tyre and brake wear and other non-exhaust emissions.***

Other primary sources include quarrying, construction and non-road mobile sources.

Secondary PM is formed from emissions of ammonia, sulphur dioxide and oxides of nitrogen as well as from emissions of organic compounds from both combustion sources and vegetation.

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Source: DEFRA

Pollutant: ***Oxides of nitrogen (NOX)***

All combustion processes in air produce oxides of nitrogen (NOX). Nitrogen dioxide (NO2) and nitric oxide (NO) are both oxides of nitrogen and together are referred to as NOX.

Road transport is the main source, followed by the electricity supply industry and other industrial and commercial sectors.

Pollutant: Ozone (O3)

Ozone is not emitted directly from any humanmade source.

It arises from chemical reactions between various air pollutants, primarily NOX and Volatile Organic Compounds (VOCs), initiated by strong sunlight.

Formation can take place over several hours or days and may have arisen from emissions many hundreds, or even thousands of kilometres away.

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Source: DEFRA

Pollutant:* *Sulphur dioxide (SO2)

UK emissions are dominated by combustion of fuels containing sulphur, such as coal and heavy oils by power stations and refineries.

In some parts of the UK, notably Northern Ireland, coal for domestic use is a significant source.

Pollutant:* *Polycyclic aromatic hydrocarbons (PAHs)

There are many different PAHs emanating from a variety of sources. This strategy uses benzo[a]pyrene (B[a]P) as a marker for the most hazardous PAHs.

The main sources of B[a]P in the UK are domestic coal and wood burning, fires (eg accidental fires, bonfires, forest fires, etc), and industrial processes such as coke production.

Road transport is the largest source for total PAHs, but this source is dominated by species thought to be less hazardous than B[a]P

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Source: DEFRA

Pollutant:* *Benzene

Has a variety of sources, but primarily arises from domestic and industrial combustion and road transport.

Pollutant:* *1,3-butadiene

Mainly from combustion of petrol. Motor vehicles and other machinery are the dominant sources, but it is also emitted from some processes, such as production of synthetic rubber for tyres.

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Pollutant:* *Carbon monoxide (CO)

Formed from incomplete combustion of carbon containing fuels.

The largest source is road transport, with residential and industrial combustion making significant contributions.

Source: DEFRA

Pollutant:* *Lead

Emitted from the combustion of coal and also the iron and steel combustion and nonferrous metals.

Pollutant:* *Ammonia

Mainly derived from agriculture, primarily livestock manure/slurry management and fertilisers.

Small proportion derived from variety of sources ***including transport and waste disposal***.

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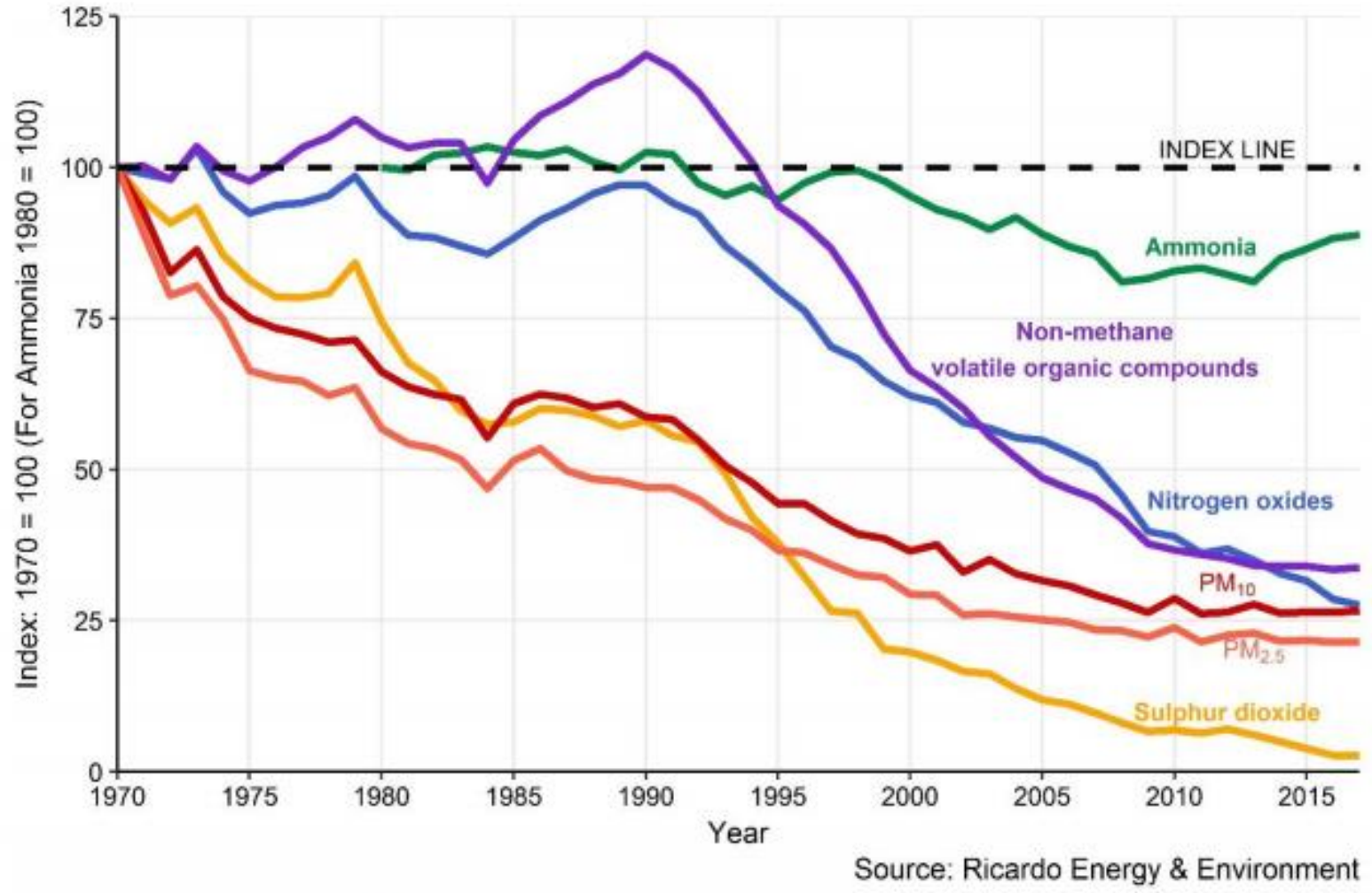
Source: DEFRA

Figure 1: Trends in annual emissions of sulphur dioxide, nitrogen oxides, non-methane volatile organic compounds, ammonia and particulate matter (PM_{10}, $PM_{2.5}$) in the UK: 1970 – 2017



The index line is a comparator that shows the level of emissions if they had remained constant from the beginning of the time series.

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History of UK Air Pollution

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Accounts date back to the 13th century. Early occurrences resulted from

- *rapid population growth,*
- *urbanisation and changes in fuel use – in particular the medieval switch from wood to coal, especially in brick kilns and domestic fireplaces.*

Main source of air pollution until the 1950s, then smoke and sulphur dioxide (SO2) the main pollutants.

- *Coal combustion in industrial furnaces, boilers*
- *domestic fireplaces,*

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Source: Parliamentary Office of Science and Technology

During calm, cold winter weather, pollutant concentrations could cause severe pollution episodes, termed *smogs (smoke + fog),* where the combination of smoke and SO2 emissions forms a thick fog, *leading to serious health problems*.

Such pollution episodes occurred as early as the 17th century but, with rapid industrialisation, became more frequent and more severe towards the end of the 19th century.

Legislation at this time focused only on smoke abatement from industry, and difficulties in implementation led to little improvement in air quality until the early 20th century.

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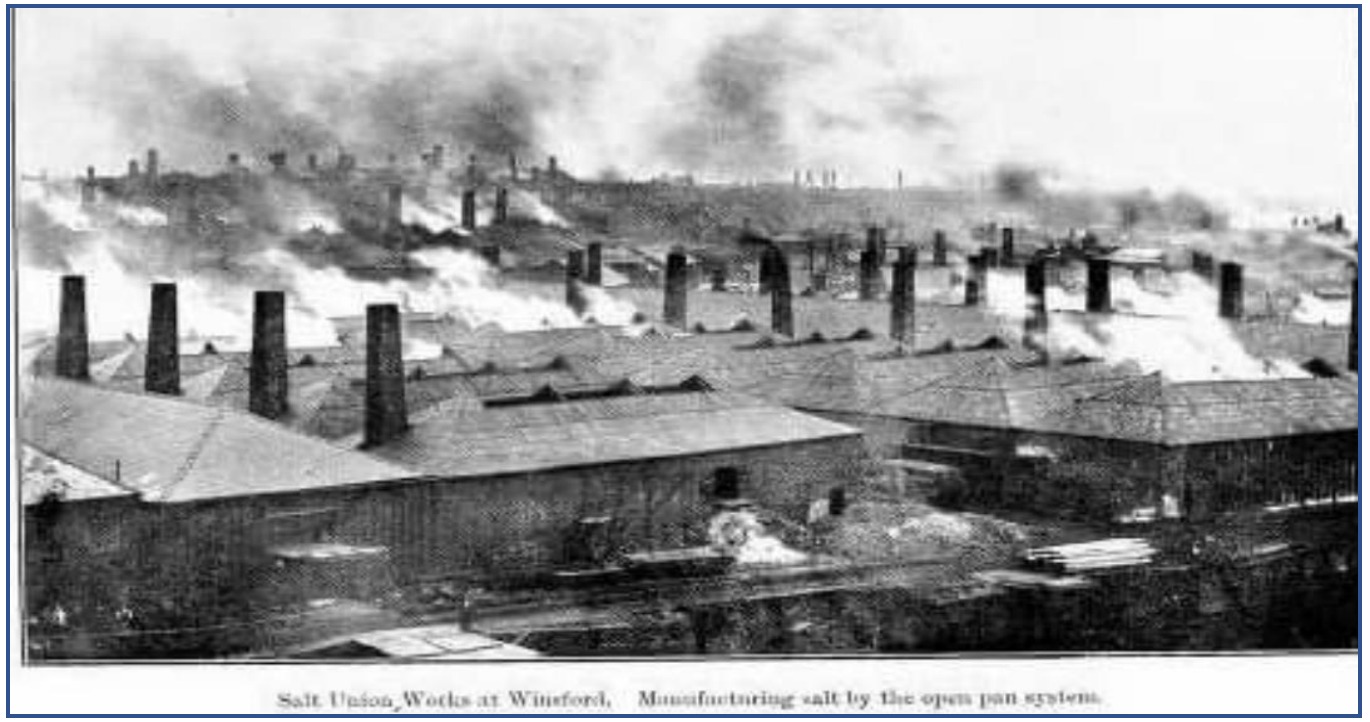
Source: Parliamentary Office of Science and Technology


Salt Union Works at Winsford. Manufacturing salt by the open pan system.

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Across the UK, episodes of extremely poor urban air quality occurred less frequent from around 1900, as industry and residential areas moved from the centre of cities.

A trend towards using town gas and electricity also contributed although the use of coal in their production inevitably involved emissions somewhere.

However, pollution episodes such as the Great Smog still occurred, and not only in London.

This caused severe and widespread health impacts and great public concern leading to the ***Clean Air Acts of 1956 and 1968***. These acts regulated domestic sources for the first time and introduced ***'smoke control areas'.***

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Source: Parliamentary Office of Science and Technology

The focus was purely on smoke from coal; SO2 emissions were not directly regulated, although subsequently, these dropped in parallel with smoke levels.

Since the 1960s,

- the burning of cleaner fuels (especially natural gas),
- the decline in heavy industry and the location of power stations with high stacks outside cities

has led to an over 90% decrease in national average smoke and SO2 levels.

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Source: Parliamentary Office of Science and Technology

The 1952 London major smog event led to approximately ***12500 deaths and substantial increases in respiratory illness.***

This public health toll was the ***most significant*** amongst the many reported smog events in London's history that stretch back over many centuries.

Its impacts on health were profound and such was the public response to the problem that ***political action*** to ensure it could not be repeated was inevitable.

Private members bill, ***Beaver Committee*** whose recommendations ultimately resulted in the ***Clean Air Act, 1956***

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Source: University of West England; Bristol

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Catastrophe drives action.

Creates a willingness to act

However Good intentions fall foul of vested interests

Source: University of West England; Bristol

The Clean Air Act demonstrated that substantial air quality improvements could be produced when ***concerted and sustained governmental*** action was directed at ***an environmental and public health problem.***

The Act banned dark smoke emissions from

- chimneys,
- railway engines and vessels,
- required new furnaces to be smokeless, required the emissions of grit and dust from furnaces to be minimised,

and ***gave local council's powers to introduce smokeless zones.***

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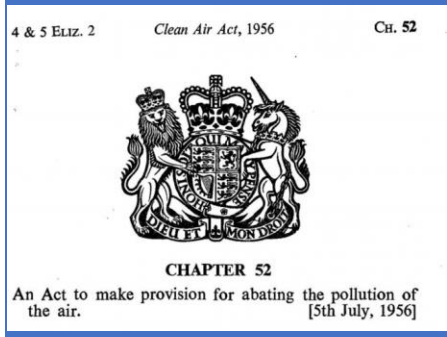
4 & 5 Eliz. 2 *Clean Air Act*, 1956 Ch. 52

CHAPTER 52

An Act to make provision for abating the pollution of the air. [5th July, 1956]

Source: University of West England; Bristol

- The Clean Air Act helped the UK achieve a world leading position in the battle against air pollution.

- However, the importance of sustained interest became apparent later on as elimination of “pea soupers” created a ***prevailing ideology*** that air pollution had been conquered.

- Resources were directed towards other problems as ***governmental priorities*** changed.

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Source: University of West England; Bristol

Late 1980s and early 1990s - a ***growing public health concern related to childhood asthma*** and an ***association with traffic emissions***.

The ***Environment Act of 1995*** and the ***National Air Quality Strategy, 1997*** provide the foundations for what promised to be a sustained and concerted attempt to manage air pollution and to reduce it below levels considered to be a risk to public health.

The onset of ***health based*** concerns about the impacts of the ***growth of road traffic*** in the 1980s and 1990s left the UK woefully ill prepared to tackle a ***new form of air pollution***.

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Source: University of West England; Bristol

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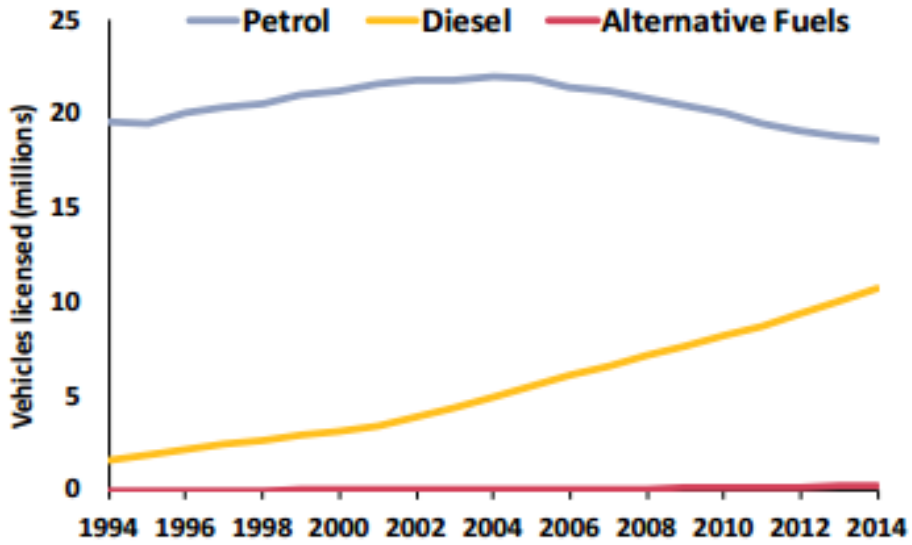
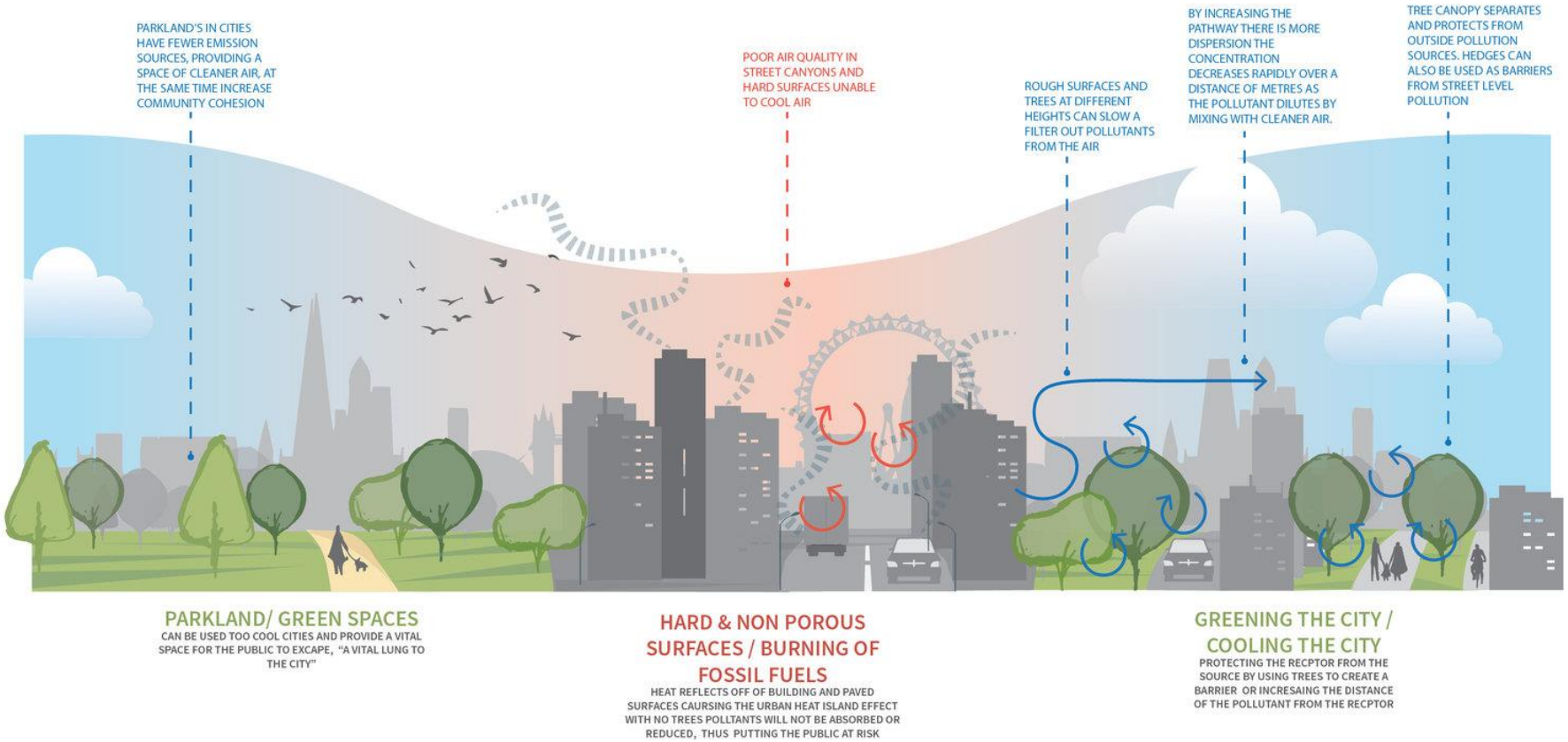
Licensed cars by propulsion type, GB 1994 - 2014



Source: University of West England; Bristol



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Source: University of West England; Bristol

Health effects of air pollution

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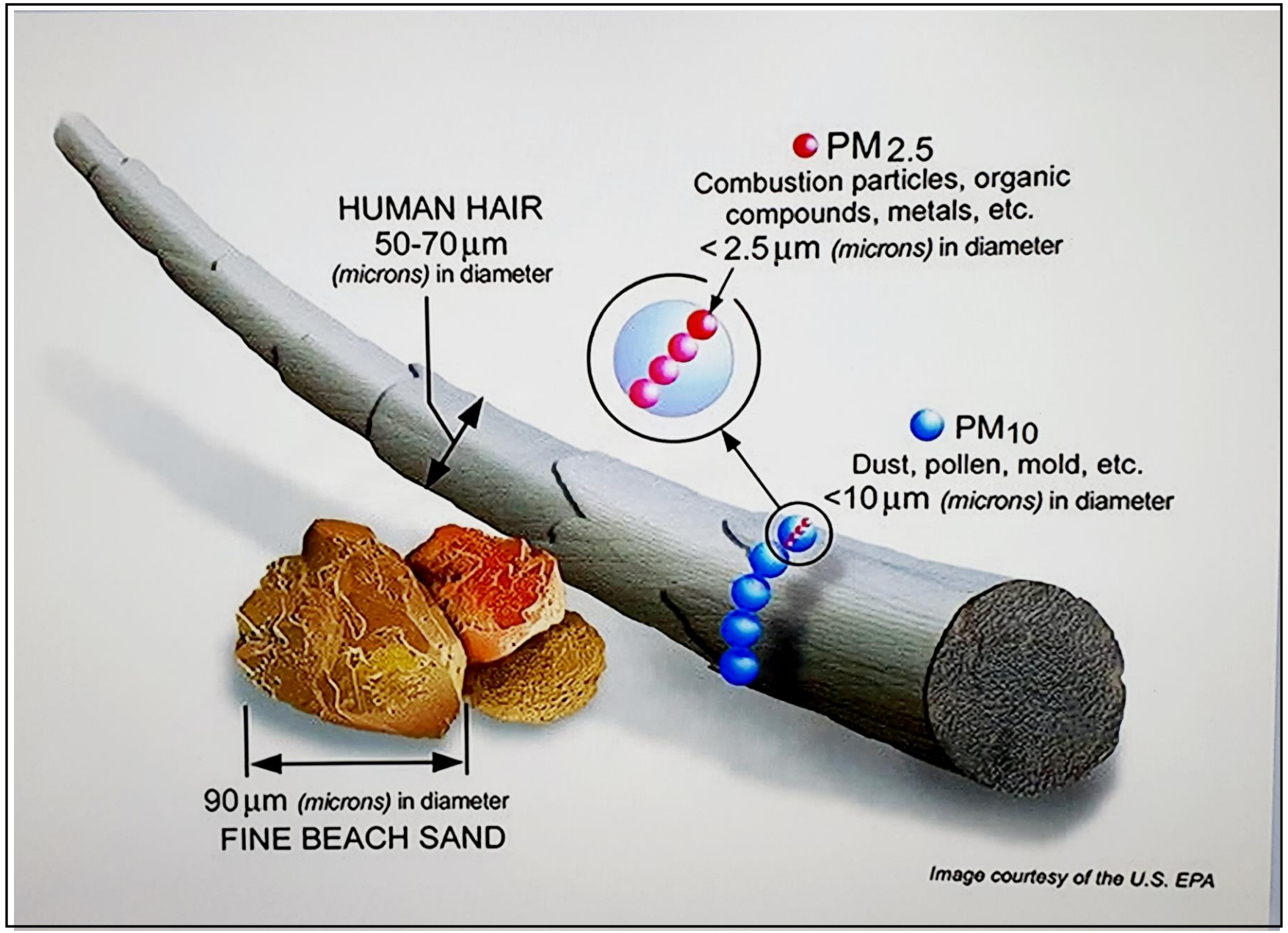
Particulate size



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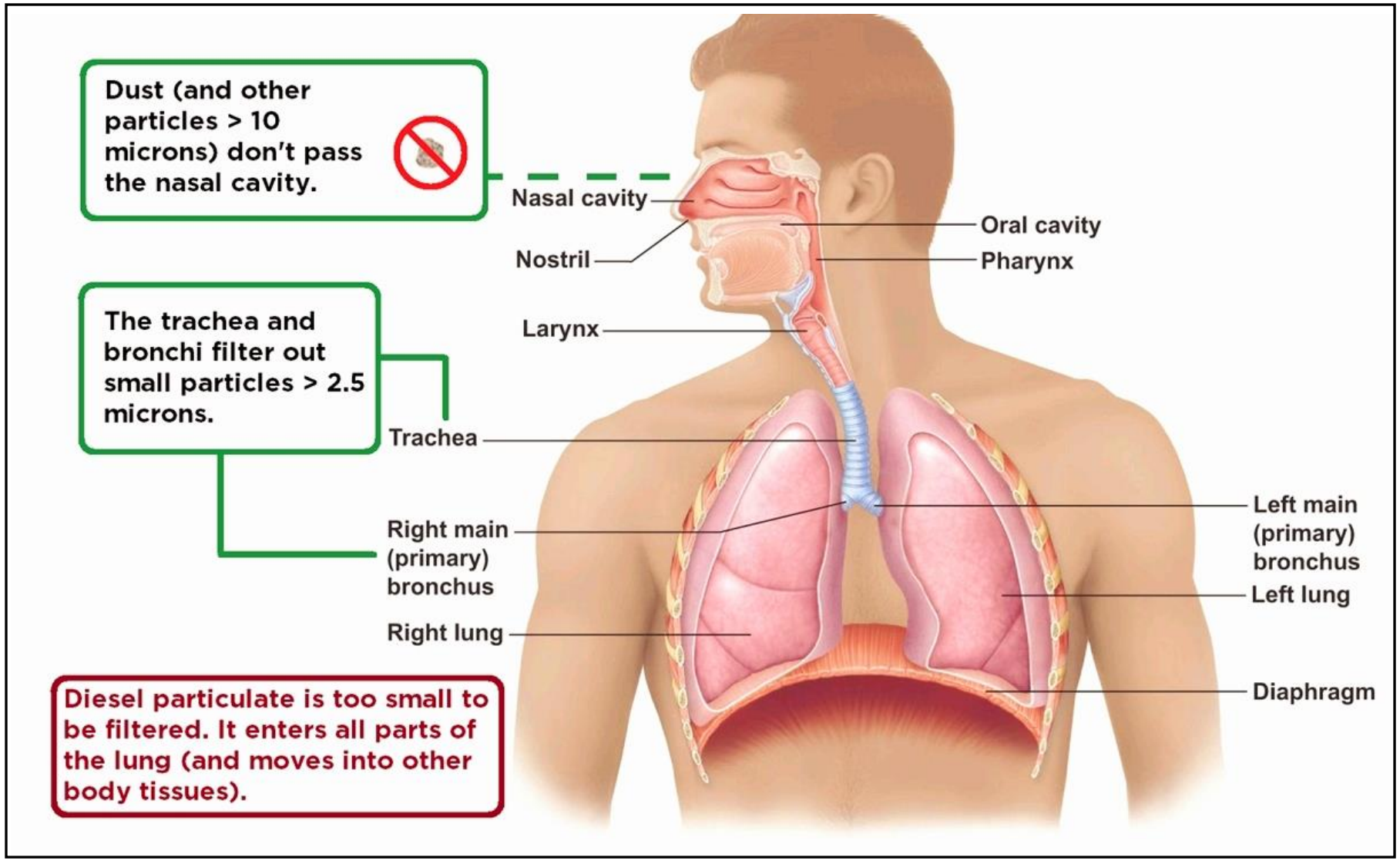
How do particles enter the body?



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In the UK about 29000 deaths per year are associated with exposure to fine particles, (PM2.5), ca. 5-6% of total deaths.

In cities PM2.5 primarily comes from cars, lorries and buses but they are also produced by the burning of wood, heating oil or coal for domestic or industrial purposes.

In Europe, the WHO estimates about 500,000 people die prematurely as a result of air pollution every year.

These estimates do not include any contribution from NO_2.

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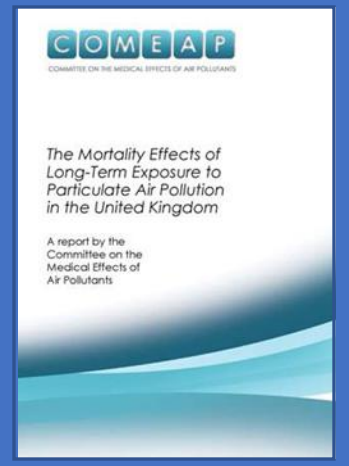

Source: Committee on the Medical Effects of Air Pollutants (COMEAP)

x(but heavily caveated).

Many of the sources of NOx (NO_2 and NO) are also sources of particulate matter (PM).

The combined impact of these two pollutants maybe as much as 52 000 deaths per year and represents a significant public health challenge.

The response to this burden is inadequate to say the least.

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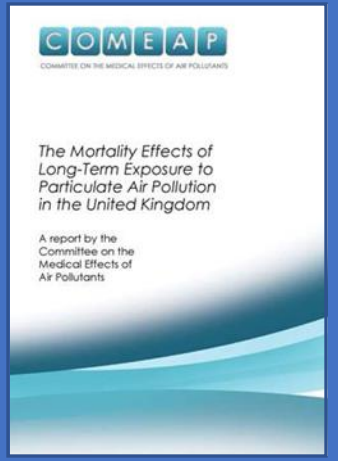

Source: Committee on the Medical Effects of Air Pollutants (COMEAP)

Focus on health impacts of continuous exposure to chronic air pollution over a lifetime, with specific reference to:

- Pregnancy ,children and adults
- indoor and outdoor exposure
- the influence of local, regional and national policy relating to pollution control measures
- examining the influences of climate change
- socio-economic impacts of air pollution.

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Estimate 40000 premature deaths annually from PM and NO_2 in the UK, this is slightly less than other estimates.

Source: RCP/RCPH Report (Feb 2016)

Middlewich Health Issues

CEC publish a spreadsheet called the ‘Health Profiles for Electoral Wards plus Primary Health and Social Care Areas’. Quantile 1being highest 20% of wards nationally to Quantile 5 being Lowest 20% of wards nationally. *(Commonly named as the Tartan Rug)*

- *Emergency admissions for respiratory is Quantile 2*
- *New cases lung cancer is Quantile 1*
- *Heart deaths under 75 is Quantile 1*
- *Deaths from respiratory disease is Quantile 2”*

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It was last updated 2017 and I know there has been a request to CEC for updated info, we have had a response, (I was copied in) but not an update.

Source: RCP/RCPH Report (Feb 2016)

The Law

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CLEAN AIR STRATERGY

- The new strategy was published in January 2019.
- The foreword by the Secretary of State for Environment, Food and Rural affairs (Defra) identifies ***air pollution as the top environmental risk to human health in the UK.***
- The Clean Air Strategy sets out the case for action to improve UK air quality.
- The strategy is focused on tackling air pollution in England but also highlights action being taken in Northern Ireland, Scotland and Wales.

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Source: University of West England; Bristol

The Clean Air Strategy should be seen as part of a suite of policy documents including

- The 25 Year Environment Plan,
- 25 Year Environment Plan progress report: January 2018 to March 2019
- The Industrial Strategy, November 2017 updated June 2018
- Clean Growth Strategy, October 2017
- The Road to Zero, July 2018

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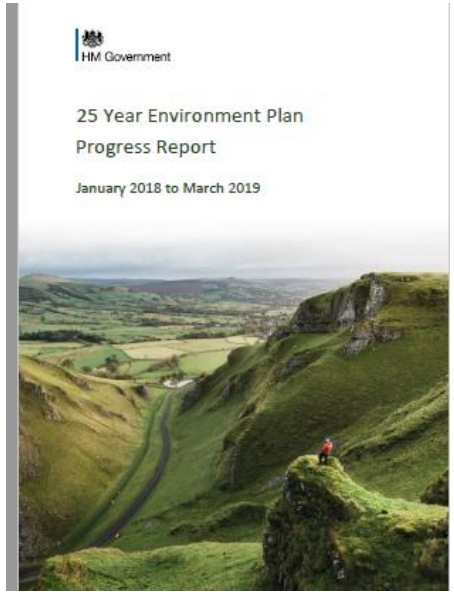
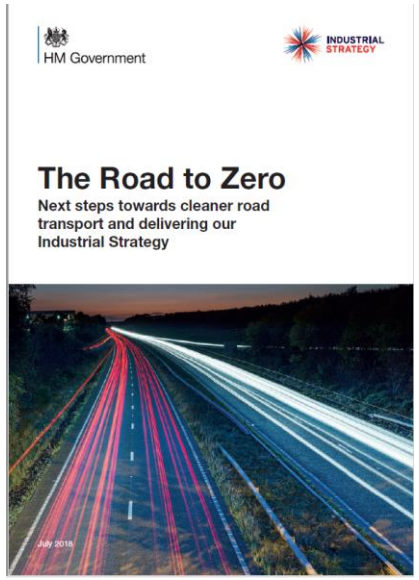
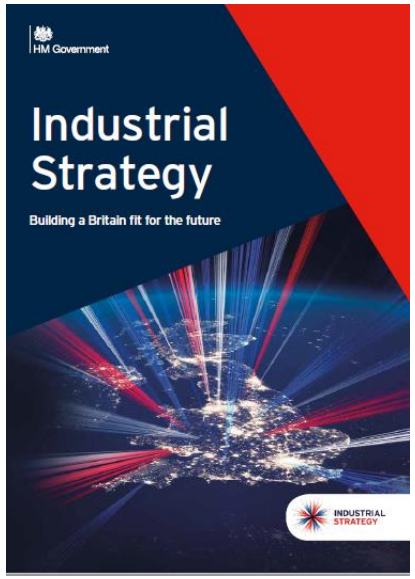
Source: University of West England; Bristol







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We have had plenty of guidance, but *has it been effective* in delivering cleaner air?

Undoubtedly it has helped us to identify where poor air quality exists, *but has it led to cleaner air?*

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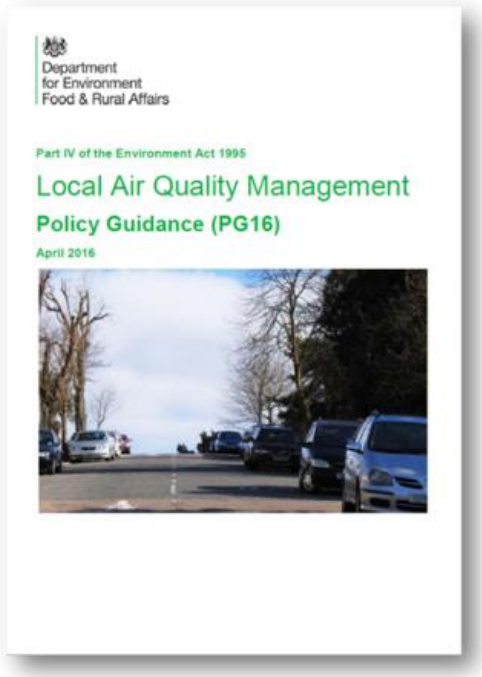
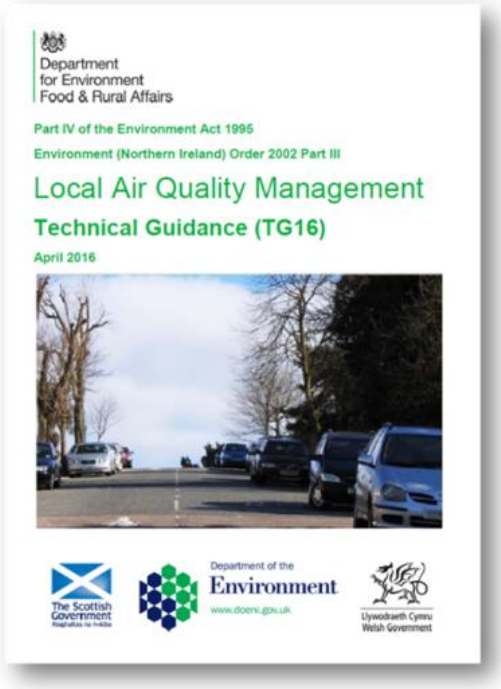
Source: University of West England; Bristol





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Source: University of West England; Bristol