



Department  
for Environment  
Food & Rural Affairs

# CLEAN AIR STRATEGY 2018





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# Foreword from the Secretary of State

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At the most fundamental level, our health and prosperity depend on the health of the planet on which we live. From the air we breathe to the water we drink, the food we eat and the energy that powers our homes and businesses, we need to protect and sustain the health of the natural environment.

Nowhere is this more true than in the case of air quality. Air pollution is the top environmental risk to human health in the UK, and the fourth greatest threat to public health after cancer, heart disease and obesity. It makes us more susceptible to respiratory infections and other illnesses, and the latest research estimates that the actions outlined in this document could cut the costs of air pollution to society by £1 billion every year by 2020, rising to £2.5 billion every year from 2030.

This Clean Air Strategy sets out the case for action and demonstrates this government's determination to improve our air quality. In some cases the goals that we have set are even more ambitious than EU requirements because we want to do all that we can to reduce people's exposure to toxic pollutants like nitrogen oxides, ammonia, particulate matter, non-methane volatile organic compounds and sulphur dioxide.

We often think of air pollution as a problem caused by road transport and industrial level burning of fossil fuels. These are two of the central sources of pollution, but industry and government have worked together to remedy many of the worst culprits by incentivising clean fuels and investing in new technology. We have already secured a significant reduction in emissions since the 1970s, but now this trajectory has slowed.

Now we need to tackle other sources of air pollutants that damage human health and the environment. Air pollution can be caused by intensive agricultural food production, heating our homes or even cleaning with certain solvents.

We therefore need comprehensive action to safeguard our health.

For example, a recent rise in the popularity of wood burning stoves and open fires is making a significant contribution to particulate matter - tiny particles that get into the lungs and blood and are transported around the body becoming lodged in the heart, brain and other organs. Like many other pollutants, particulate matter can have a short term impact over a single, highly polluted day or long-term impacts from low-level exposure over a long period of time. This strategy sets out our aim to reduce particulate matter emissions by 30% by 2020, and by 46% by 2030.

Ammonia emissions from agriculture are also increasing, and the widespread use of volatile organic compounds in many everyday cleaning and toiletry products poses a serious indoor exposure risk. Indeed, Public Health England attributed the 2014 smog in London, in part, to agricultural ammonia emissions.

Armed with increased awareness and improved scientific measurements, we must tackle these problems with a new goal that takes into account the World Health Organisations guidelines. We plan to set out our ambitions in primary legislation, last updated by a Conservative government in the Clean Air Act 1993. This strategy sets out new enforcement powers at a national and local level, across all sectors of society.

I am confident that industry, environmental NGOs, the health sector and the public will respond to this consultation with the constructive and challenging responses that ensure government does its duty to protect public health and enhance the natural environment.

We will continue to work with the devolved administrations to deliver our international air quality commitments. This consultation is focused on tackling air pollution in England, but the United Kingdom has a shared goal to protect our natural heritage. This strategy highlights action being taken across the country, not just in England, but also in Northern Ireland, Scotland and Wales.

Leaving the EU marks a new chapter for the UK. We have an opportunity to set world-leading standards on everything from marine conservation to clean air strategies, and to set a gold standard for environmental protection. We will be able to set out a new direction for our environment, based on rigorous scientific research and underpinned by the legal principles that have done so much to improve our environment in the past. It is my profound hope that we will use the opportunity presented by leaving the EU to become a world leader in environmental excellence.



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**Rt Hon Michael Gove MP**  
Secretary of State for Environment,  
Food and Rural Affairs

# Executive summary

**This Clean Air Strategy shows how we will tackle all sources of air pollution, making our air healthier to breathe, protecting nature and boosting the economy.** It sets out a wide range of actions on which the UK government is consulting and also shows how devolved administrations intend to make their share of emissions reductions. This consultation will inform the final Clean Air Strategy and detailed National Air Pollution Control Programme, to be published by March 2019. It complements three other UK government strategies: the Industrial Strategy, the Clean Growth Strategy and the 25 Year Environment Plan. **We want to hear from all interested parties to help us shape our final strategy for publication later this year.**

Since the middle of the 20th century we have addressed many of the worst impacts of air pollution through regulatory frameworks, investment by industry in cleaner processes and a shift in the fuel mix towards cleaner forms of energy. However, exposure to the pollution still present in our atmosphere is one of the UK's biggest public health challenges, shortening lifespans and damaging quality of life for many people. It also harms the natural environment, affecting our waterways, biodiversity and crop yields.

Clean air is essential for life, health, the environment and the economy. Government must act to tackle air pollution which shortens lives. We have already acted to reduce concentrations of nitrogen dioxide (NO<sub>2</sub>) around roads from cars. But vehicles are not the only source of harmful emissions. Air pollution is a result of the way we currently generate power, heat our homes, produce food, manufacture consumer goods and power transport. Better, cleaner technologies and simple changes in behaviour will tackle the pollution that claims lives.

In the past, the priority was to tackle the biggest individual sources of pollution. As these major sources of emissions have decreased, the relative contribution of smaller and more diffuse sources of air pollution, like smaller industrial sites, product use, open fires in homes and spreading manure on farms, has increased. That requires new action.

We have already adopted **ambitious, legally-binding international targets to reduce emissions of five of the most damaging air pollutants** (fine particulate matter, ammonia, nitrogen oxides, sulphur dioxide, non-methane volatile organic compounds) by 2020 and 2030. We are now also proposing **tough new goals to cut public exposure to particulate matter pollution, as suggested by the World Health Organisation.**

This draft Strategy sets out the comprehensive action that is required from across all parts of government and society to meet these goals. **New legislation will create a stronger and more coherent framework for action to tackle air pollution.** This will be underpinned by **new England-wide powers** to control major sources of air pollution, in line with the risk they pose to public health and the environment, **plus new local powers** to take action in areas with an air pollution problem. These will support the creation of **Clean Air Zones to lower emissions from all sources of air pollution**, backed up with clear enforcement mechanisms.



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## CHAPTER 1 - Understanding the problem

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Air pollution comes from many sources. Pollutants can travel long distances and combine with each other to create different pollutants. Emissions from distant and local sources can build up into high local concentrations of pollution. The UK has set stringent targets to cut emissions by 2020 and 2030. The goal is to reduce the harm to human health from air pollution by half. A robust evidence base, backed by the most up to date science is essential to help us achieve this.

**We are investing £10m in improving our modelling, data and analytical tools to give a more precise picture of current air quality and the impact of policies on it in future.**

**We will increase transparency by bringing local and national monitoring data together into a single accessible portal for information on air quality monitoring and modelling, catalysing public engagement through citizen science.**

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## CHAPTER 2 - Protecting the nation's health

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Air quality is the largest environmental health risk in the UK. It shortens lives and contributes to chronic illness. Health can be affected both by short-term, high-pollution episodes and by long-term exposure to lower levels of pollution. There are small things we can all do that will make a big difference to emissions locally and nationally. Effective communication of health messages about air pollution can save lives and improve quality of life for many.

**We will progressively cut public exposure to particulate matter pollution as suggested by the World Health Organisation. We will halve the population living in areas with concentrations of fine particulate matter above WHO guideline levels (10 µg/m<sup>3</sup>) by 2025.**

**We will provide a personal air quality messaging system to inform the public, particularly those who are vulnerable to air pollution, about the air quality forecast, providing clearer information on air pollution episodes and accessible health advice.**

**We will work with media outlets to improve public access to the air quality forecast.**

**We will work to improve air quality by helping individuals and organisations understand how they could reduce their contribution to air pollution, showing how this can help them protect their families, colleagues and neighbours.**

**We will publish updated appraisal tools and accompanying guidance this summer to enable the health impacts of air pollution to be considered in every relevant policy decision that is made.**



## CHAPTER 3 - Protecting the environment

This strategy is a key part of delivering our 25 Year Environment Plan. Air pollution has direct impacts on the natural environment, contributing to climate change, reducing crop yields and polluting oceans. Cleaner air will directly benefit animals and habitats as well as creating a better environment for everyone to live, work and thrive in.

**We will monitor the impacts of air pollution on natural habitats and report annually so that we can chart progress as we reduce the harm air pollution does to the environment.**

**Later this year we will provide guidance for local authorities explaining how cumulative impacts of nitrogen deposition on natural habitats should be mitigated and assessed through the planning system.**

## CHAPTER 4 - Securing clean growth and innovation

This strategy contributes to the Government's action on clean growth. Action to clean up the air will boost productivity and economic growth. We will make the UK a world leader in the development, use and export of goods and services focused on tackling air pollution.

**In partnership with UKRI, we will seek ways to support further investment in Clean Air innovation to enable the development of novel technologies and solutions that tackle emissions from industry, vehicles, products, combustion and agriculture and support both improvements in air quality and decarbonisation.**

**We will make the UK a world leader in goods and services focused on tackling air pollution.**

**Future energy, heat and industrial policies will together improve air quality and tackle climate change. Phasing out coal-fired power stations, improving energy efficiency, and shifting to cleaner power sources will reduce emissions of air pollution as well as carbon. As we phase out oil and coal heating, we will ensure this transition improves air quality wherever possible and cost effective to do so. In addition, the government will conduct a cross-departmental review into the role of biomass in future policy for low carbon electricity and heat, focusing on the air quality impacts. The proposed way forward will be set out in the final Clean Air Strategy.**

**We will minimise the air quality impacts of the Renewable Heat Incentive Scheme, for example by tackling non-compliance and consulting on excluding biomass from the RHI if installed in urban areas which are on the gas grid. We will work across central and local government to put a plan in place. In addition, we will consult on making coal to biomass conversions ineligible for future allocation rounds of the contracts for difference scheme.**

**We are seeking evidence on the uses of non-road diesel, mainly in urban areas, considering the air quality impacts and the potential for market distortion. The Treasury has also announced it will review how alternative fuel rates line up with rates of petrol and diesel ahead of Budget 2018.**

**We will cut emissions from non-road mobile machinery and give local authorities tough new powers to control the use of such machinery where it is causing an air pollution problem.**

**Green Great Britain Week, starting in autumn 2018, will engage the public on air quality, alongside climate change, and highlight the economic opportunities it offers for the UK.**



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## CHAPTER 5 - Action to reduce emissions from transport

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Transport is a significant source of emissions of air pollution. The immediate air quality challenge is to reduce emissions of nitrogen oxides in the areas where concentrations of these harmful gases currently exceed legal limits. The government has already committed £3.5bn to tackle poor air quality through cleaner road transport and is working closely with local authorities and Local Economic Partnerships to make progress. Alongside this, the government is committed to cutting air pollution from all forms of transport.

**In 2018, we will set out our ambitious plans to drive down emissions from shipping and aviation.**

**We will end the sale of new conventional petrol and diesel cars and vans by 2040. We will position the UK as the best place in the world to develop, manufacture and use zero exhaust emissions vehicles and, during the transition, we will ensure that the cleanest conventional vehicles are driven on our roads.**

**We will work with international partners to research and develop new standards for tyres and brakes to enable us to address toxic non-exhaust emissions of micro plastics from vehicles which can pollute air and water.**

**New legislation will enable the Transport Secretary to compel manufacturers to recall vehicles and machinery for any failures in their emissions control system, and make tampering with an emissions control system a legal offence.**

**We will reduce emissions from rail and reduce passenger and worker exposure to air pollution. By the autumn, the rail industry will produce plans to phase out diesel-only trains by 2040.**

**All major English ports should produce air quality strategies setting out their plans to reduce emissions. These plans will be reviewed periodically to establish if the measures are effective or whether government action is required.**

**We will review policy on aviation-related emissions to improve air quality.**

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## CHAPTER 6 - Action to reduce emissions at home

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Many people are unaware that emissions in the home increase personal exposure to pollutants and contribute significantly to our overall national emissions. Burning solid fuel in open fires and stoves makes up 38% of the UK's primary emissions of fine particulate matter<sup>1</sup> (PM<sub>2.5</sub>). Harmful sulphur dioxide (SO<sub>2</sub>) is emitted by coal burned in open fires. Non-methane volatile organic compounds (NMVOCs) from a wide variety of chemicals that are found in carpets, upholstery, paint, cleaning, fragrance, and personal care products are another significant source of pollution.

**We will legislate to prohibit the sale of the most polluting fuels.**

**We will ensure only the cleanest stoves are available for sale by 2022.**

**We will update outmoded legislation on 'dark smoke' from chimneys and underused provisions on Smoke Control Areas to bring these into the 21st century with more flexible, proportionate enforcement powers for local government.**

**The government will work with industry, retailers, health experts and consumer groups to reduce emissions of NMVOCs from consumer products, develop options to promote product innovation and encourage the use of low emissions alternatives.**

## CHAPTER 7 - Action to reduce emissions from farming

The agriculture sector accounts for 88%<sup>2</sup> of UK emissions of ammonia, which is emitted during storage and spreading of manures, slurries and from application of inorganic fertilisers. Ammonia damages sensitive natural habitats and contributes to smog in urban areas. Action by farmers can make a big difference to ammonia emissions. The government is already acting to help farmers by funding the necessary equipment.

**We will provide a national code of good agricultural practice to control ammonia emissions.**

**We will require and support farmers to make investments in the farm infrastructure and equipment that will reduce emissions.**

**A future environmental land management system will fund targeted action to protect habitats impacted by ammonia.**

**We will continue to work with the agriculture sector to ensure the ammonia inventory reflects existing farming practice and the latest evidence on emissions.**

**We will regulate to reduce ammonia emissions from farming and are seeking views on 3 possible approaches to regulation.**

## CHAPTER 8 - Action to reduce emissions from industry

Industrial processes, including energy generation to power our businesses and homes and the manufacture of goods and food, can all create pollution. For many decades, the UK has been at the forefront of reducing industrial pollution, and significant progress has already been made. We will continue to build on that progress by increasing standards to reflect international best practice.

**We will maintain our longstanding policy of continuous improvement in relation to industrial emissions, building on existing good practice to deliver a stable and predictable regulatory environment for business as part of a world-leading clean green economy.**

**We will work with industrial sectors to review improvements to date, and to explore opportunities to go further through a series of sector roadmaps that set ambitious standards – moving beyond a focus on minimum standards to make UK industry world leaders in clean technology and secure further emissions reductions.**

**We will close the regulatory gap between the current Ecodesign and medium combustion plant regulations to tackle emissions from plants in the 500kW to 1MW thermal input range. As legislation on medium combustion plants and generators comes into force, we will consider the case for tighter emissions standards on this source of emissions.**

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## CHAPTER 9 - Leadership at all levels

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Emissions from abroad, across the UK and local sources all contribute to the pollution that people and the environment are exposed to. Effective action is needed at all levels to clean up our air. This strategy sets out our commitment to cut our national emissions to reduce population exposure. As part of this we will make it easier to take action at local level. Alongside this, the UK will continue to play an active, leading role in international action to improve air quality.

**We are consulting on a new, independent statutory body to hold government to account on environmental commitments following EU exit. Ensuring that there is transparency and accountability in how we achieve our clean air ambitions will be a priority in this work.**

**We will bring forward new clean air legislation at the earliest opportunity. This will bring long-standing frameworks for local and national action on air pollution into the 21st century with stronger powers and clearer accountability.**

**To ensure that local action to reduce air pollution remains robust and relevant, we will transform existing structures to increase transparency and back this up with stronger statutory powers to tackle local air pollution.**

Our international air quality commitments have been agreed at a UK level. However, air quality is a substantially devolved policy area. Scotland and Northern Ireland have both already produced their own Air Quality Strategies and Wales is currently in the process of producing one (further details of these are set out in Chapter 9).

**The UK government will work in partnership with the governments of Scotland, Wales and Northern Ireland to develop a detailed National Air Pollution Control Programme as required under the National Emissions Ceilings Directive for publication in 2019.**

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## CHAPTER 10 - Progress towards our goals

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Analysis shows that the actions set out in this strategy can meet our ambitious emissions reduction targets, if they are implemented with the necessary pace and determination.

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### Consultation

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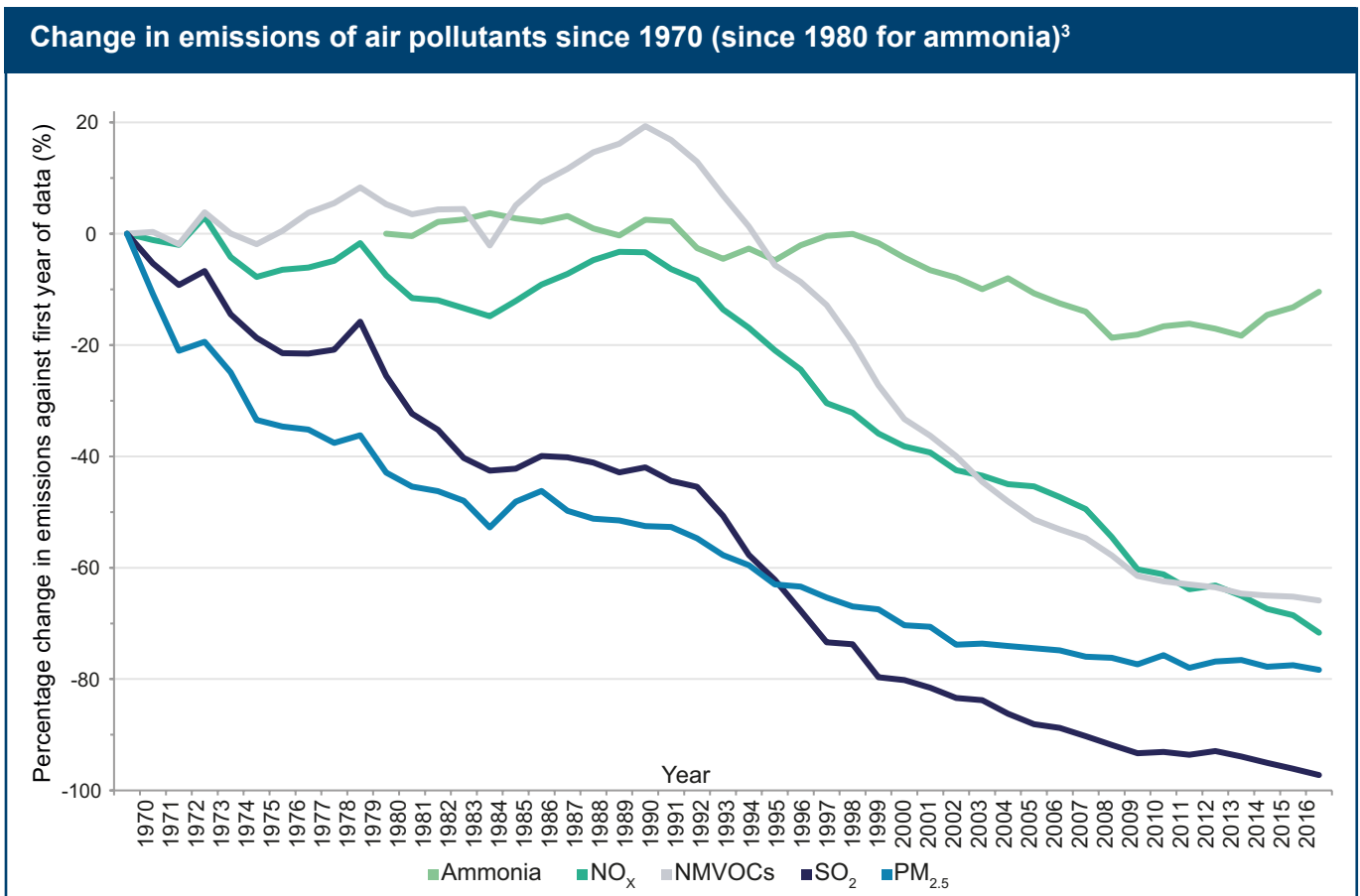
We are consulting here on a draft strategy developed by the UK government, setting out how we will work towards meeting these ambitious reductions in England. The consultation period for this strategy runs until 14 August 2018. We look forward to input from a wide range of partners on the measures set out here and what more is possible (See Annex A for details).

# 1. Understanding the problem

## 1.1 Background

Many substances can pollute the air. Some of these are very harmful and their sale and use is strictly regulated. Others are not immediately harmful, but are released in thousands or millions of tonnes per year nationally as by-products of transport, energy production, chemicals manufacture, domestic combustion and farming. When released into the air these substances have gradual but significant impacts on health and the environment. We maintain an award winning National Atmospheric Emissions Inventory (NAEI), to keep track of such emissions, which is updated annually.

Once released, air pollution is dispersed by the weather and can travel significant distances within and between countries. Pollutants mix and interact in the atmosphere, forming new compounds, and can be deposited on land and water. For example, UK sulphur dioxide emissions from coal burning power stations caused considerable “acid rain” damage in Scandinavia during the 1970s and 1980s. Dust frequently blows into the UK from as far away as the Sahara, and UK air quality can be affected by distant volcanoes. Pollution episodes in London and the southeast often arise when the weather transports pollution from continental Europe and elsewhere, exacerbating the impacts of our own urban pollution.



# 1.2 Air pollution: emissions, concentrations and exposure

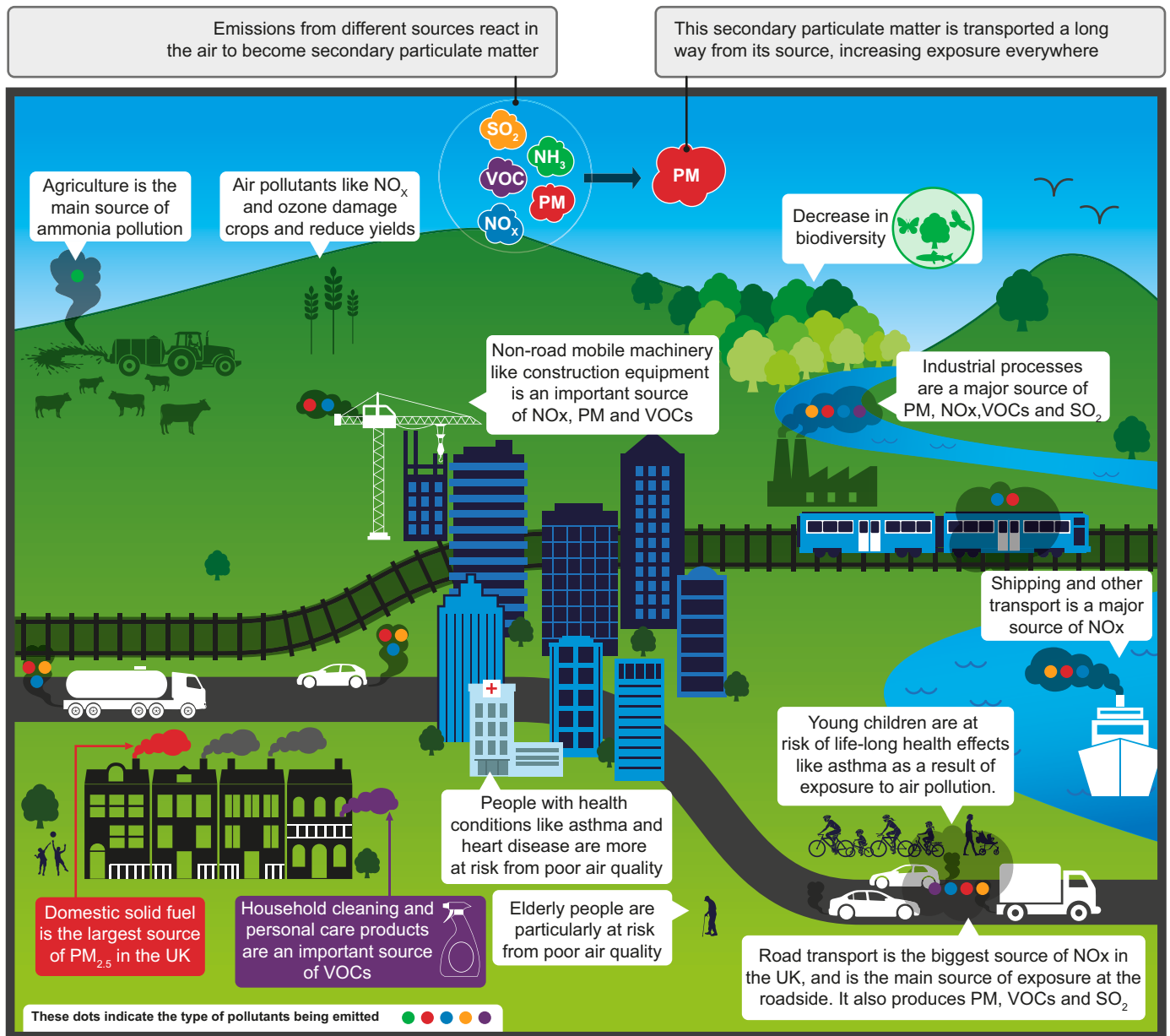
The impact of pollution depends on **how much** is emitted, **how harmful** it is and how it interacts with other substances in the air. It also depends on where it is emitted and how sensitive the exposed population or environment is.

Vulnerable individuals and sensitive habitats are at particular risk. In monitoring and controlling pollutants we are concerned with the total volumes that are released (**our national emissions**).

These emissions contribute to **local concentrations** of pollutants, which occur where pollutants build up in significant quantities in particular locations, for example near busy roads, industrial installations or large intensive farming operations.

It is **exposure** to high concentrations of pollutants that is most likely to directly result in adverse impacts. These impacts are cumulative, so we need to think about reducing exposure at all stages of life, at home, when travelling, at school and at work.

## The sources of air pollutants and their effects



<b>Types of pollution</b>	<b>Ammonia (NH<sub>3</sub>)</b>	<b>Primary Particulate Matter (PM<sub>2.5</sub>)</b>
<b>Nitrogen oxides (NO<sub>x</sub>)</b>	<b>Sulphur dioxide (SO<sub>2</sub>)</b>	<b>Volatile organic compounds (NMVOCs)</b>

Once emitted, pollutants can build up in the atmosphere contributing to **overall background** pollution. Background pollution can combine with local emissions to create localised high concentrations and exposure.

This is illustrated in the charts on page 25.

Ultimately, our emissions contribute to our neighbours' concentrations. **The aim of this draft strategy is to drive down the national emissions of pollutants, reducing background pollution, and minimising human exposure to harmful concentrations of pollution.**

## 1.3 What pollutants are we focusing on?

We have statutory obligations to keep concentrations of specified pollutants below certain levels<sup>4</sup>. The only area in which we are not currently meeting these limits, in common with many other countries in Europe<sup>5</sup>, is in relation to roadside nitrogen dioxide concentrations. We also have national emission reduction commitments for overall UK emissions of five damaging air pollutants. These are:

- fine particulate matter (PM<sub>2.5</sub>)
- ammonia (NH<sub>3</sub>)
- nitrogen oxides (NO<sub>x</sub>)
- sulphur dioxide (SO<sub>2</sub>)
- and non-methane volatile organic compounds (NMVOCs)

Our national emissions targets set ambitious reduction goals for 2010, 2020 and 2030. The UK has met the current targets since 2011<sup>6</sup>. By comparison, five EU countries (Austria, Germany, Hungary, Spain and Sweden) were still in exceedance of their 2010 ceilings in 2015<sup>7</sup>. The more stringent targets that we have set for 2020 and 2030 aim to cut the harm to human health by half. **This strategy sets out existing policies and a programme of new actions that will help us meet these targets. Information about the individual pollutants and how they interact is set out on the following pages.**

### Pollutants with ambient air quality standards in the UK.

- Nitrogen dioxide (NO<sub>2</sub>) / NO<sub>x</sub> (vegetation)
- Particulate Matter (PM<sub>10</sub>)
- Fine Particulate Matter (PM<sub>2.5</sub>)
- Ozone (O<sub>3</sub>)
- Sulphur dioxide (SO<sub>2</sub>)
- Benzene
- Lead (Pb)
- Carbon monoxide (CO)
- Benzo[a]pyrene (B[a]P)
- Nickel (Ni)
- Cadmium (Cd)
- Arsenic (As)
- 1,3-butadiene



## Primary Particulate Matter (PM<sub>2.5</sub>)

### SOURCES

**Domestic wood & coal burning**  **38%\***

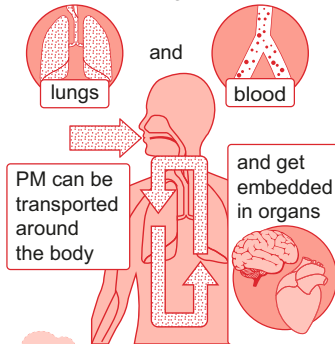
**Industrial combustion**  **16%\***

**Road transport**  **12%\***

**Use of solvents & industrial processes**  **13%\***

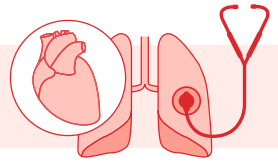
### IMPACTS

These tiny particles from smoke, soot and dust can get into the...



### More likely to be affected are:

those already suffering from lung and heart conditions



elderly people

pregnant woman and their unborn babies

and the very young

**LIFESPAN**  
PM<sub>2.5</sub> can shorten lifespans



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Particulate matter is everything in the air that isn't a gas, a suspension of particles which are solid, liquid or somewhere in between. It can come from natural sources such as pollen, sea spray and desert dust, and human made sources such as smoke from fires, soot from vehicle exhausts, dust from tyres and brakes, as well as emissions from industry. Particles emitted directly from these sources are called primary PM. Secondary PM is formed in the atmosphere through chemical reactions between other air pollutant gases such as nitrogen oxides (NO<sub>x</sub>), ammonia (NH<sub>3</sub>) and sulphur dioxide (SO<sub>2</sub>). Particulates are classified according to size, either as PM<sub>10</sub> (particles of ≤10µm (micrometres) diameter) or PM<sub>2.5</sub> (particles of ≤2.5µm diameter particles which are 200 times smaller than a grain of sand).

The distinction between PM and the other air pollutants considered here is somewhat artificial. PM is not a single pollutant; it is made up from a huge variety of chemical compounds and materials. Both PM and the gases that can form it travel large distances, so impacts may occur far from the original source. Around 15% of UK PM comes from naturally occurring sources, up to a third from other European countries and around half from UK human-made sources.

PM is formed of tiny particles that can get into the lungs and blood and be transported around the body, lodging in the heart, brain and other organs. PM affects health in two ways: by being toxic or by providing a surface for transporting toxic compounds to where they can do harm. PM can have short-term health impacts over a single day when concentrations are elevated, and long-term impacts from lower-level exposure over the life-course. Effects are amplified in vulnerable groups including young children, the elderly, and those suffering from breathing problems like asthma. The Department of Health and Social Care's independent Committee on the Medical Effects of Air Pollutants (COMEAP) quantified the long-term impacts of UK PM concentrations in terms of mortality as equivalent to 340,000 life years lost<sup>8</sup>.

38% of UK primary PM emissions come from burning wood and coal in domestic open fires and solid fuel stoves<sup>9</sup>, 12% comes from road transport (e.g. fuel related emissions and tyre and brake wear)<sup>10</sup> and a further 13% comes from solvent use and industrial processes<sup>11</sup> (e.g. steel making, brick making, quarries, construction). Between 1970 and 2016 primary PM<sub>10</sub> emissions fell by 73%, and primary PM<sub>2.5</sub> emissions fell by 78%. However, emissions of PM<sub>10</sub> and PM<sub>2.5</sub> have been relatively stable since 2009<sup>12</sup>. Our aim is to reduce emissions of PM<sub>2.5</sub> against the 2005 baseline by 30% by 2020, and 46% by 2030.




POLLUTANTS THAT AFFECT AIR QUALITY  
\*percentage of total NH<sub>3</sub> emissions (2016) source: NAEI 2018

## Ammonia (NH<sub>3</sub>)

### SOURCES

**Agriculture**  
(includes anaerobic digestion)




88%\*

### IMPACTS

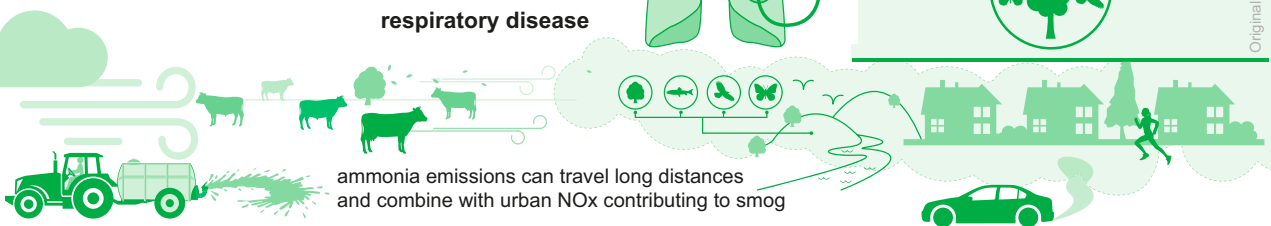
NH<sub>3</sub> REACTS → PM

Ammonia reacts in the atmosphere to produce particulate matter (PM) which has significant health impacts including:




cardiovascular and respiratory disease

ammonia emissions can travel long distances and combine with urban NOx contributing to smog




### The effects of ammonium deposition

acidification of habitats




pH

excessive nitrogen in habitats



N levels

reducing biodiversity



Original design by Defra Digital Comms

Ammonia is a gas that is emitted into the atmosphere and then either deposited back onto land or converted to secondary PM through reactions in the atmosphere. Agriculture is the dominant source of NH<sub>3</sub> emissions (88% in 2016). It is emitted during storage and spreading of manures, slurries and fertilisers. A further 4% of NH<sub>3</sub> emissions come from the waste sector. Remaining ammonia emissions are from a diffuse mix of sources including vehicles, human waste and industry<sup>13</sup>.

The main concerns resulting from ammonia emissions are the contribution to particulate matter and the human health effects described earlier. Ammonia is converted by mixing with nitrogen oxides and sulphur dioxide, producing ammonium compounds that turn into fine particulate matter. This PM is transported large distances and adds to the suspended background levels of particulates in the atmosphere. Public Health England attributed the 2014 smog in London in part to agricultural ammonia emissions.

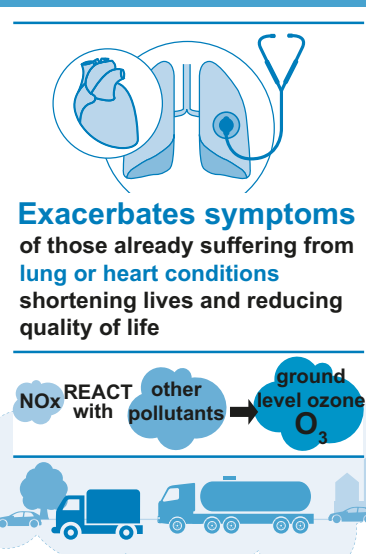
NH<sub>3</sub> stays in the atmosphere for just a few hours as a gas but this extends to several days when converted to PM. In this form it can travel very long distances before being removed from the atmosphere by rain and snow and deposited to land. In this way ammonia can cause significant long-term harm to sensitive habitats, depositing more nitrogen onto soils and plants, and into freshwaters, than they can cope with. This has led to significant changes to plant communities, and also affects the animal species that depend on them.

Emissions of ammonia fell by 13% between 1980 and 2015. However, since then there has been an increase of 3.2% largely as a result of fertiliser use<sup>14</sup>. Our aim is to reduce emissions of ammonia against the 2005 baseline by 8% by 2020 and 16% by 2030.

\*percentage of total NO<sub>x</sub> emissions (2016) source: NAEI 2018

## Nitrogen oxides (NO<sub>x</sub>)

SOURCES	
Road transport	34%*
Near roadsides	80%
Energy generation	22%*
Domestic & Industrial combustion	19%*
Other transport	17%*



NO<sub>x</sub> levels

high levels of NO<sub>x</sub> can change soil chemistry and affects biodiversity in sensitive habitats

Short-term exposure to high concentrations of NO<sub>2</sub> can cause inflammation of the airways

**INCREASES susceptibility:**

- respiratory infections
- allergens

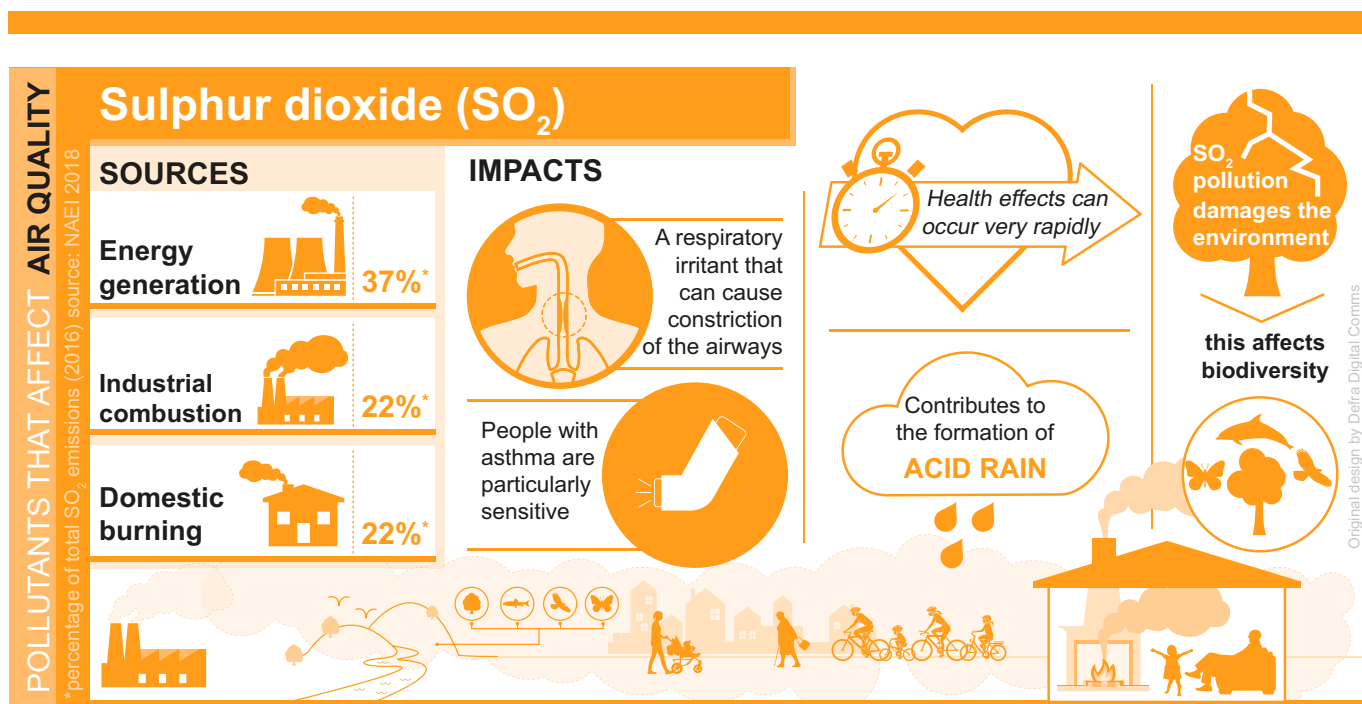


Original design by Defra Digital Comms

Nitrogen oxides (NO<sub>x</sub>) are a group of gases that are predominantly formed during the combustion of fossil fuels. The majority of NO<sub>x</sub> emitted as a result of combustion is in the form of nitric oxide (NO). When NO reacts with other gases present in the air, it can form nitrogen dioxide (NO<sub>2</sub>), which is harmful to health. It is also important in the formation of ozone. NO converts to NO<sub>2</sub> very quickly and vice versa. It is therefore usual scientific practice to refer to the two gases together as NO<sub>x</sub>. For reporting and measurement purposes, we report “NO<sub>x</sub> as NO<sub>2</sub>” because of this very fast interconversion.

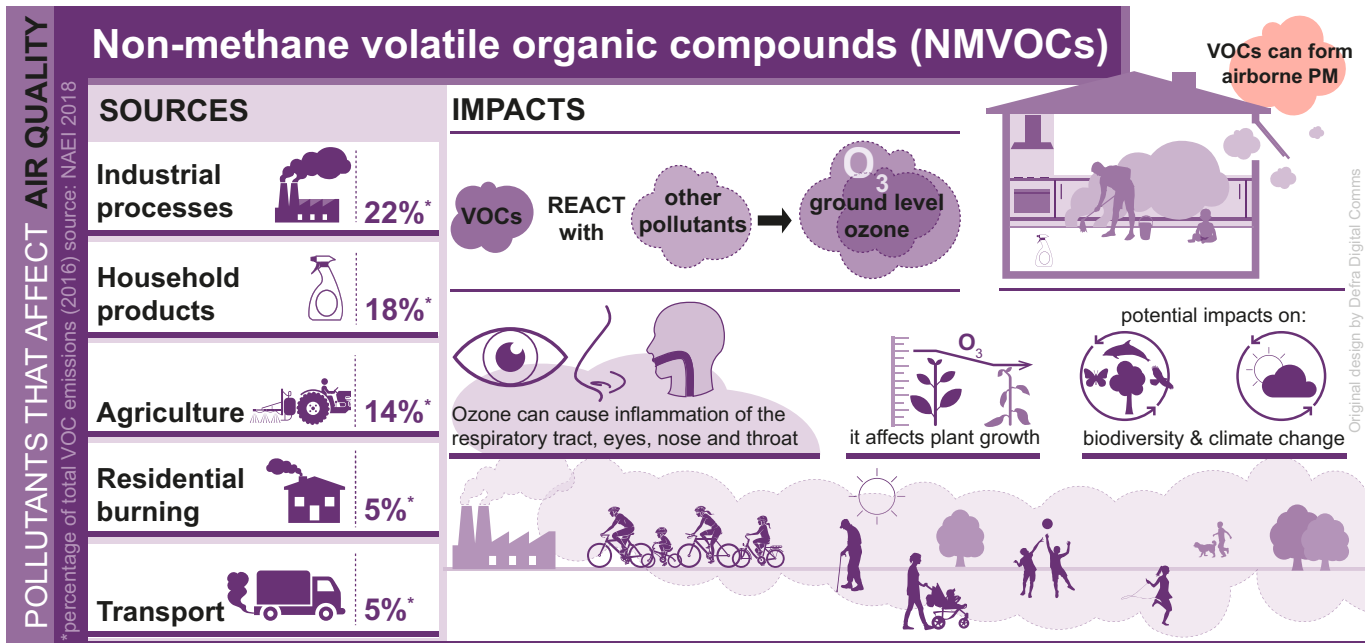
The main sources of NO<sub>x</sub> are road transport (34%), energy generation, for example power stations and refineries (22%), domestic and industrial combustion (19%) and ‘other’ transport such as rail and shipping (17%)<sup>15</sup>. Our aim is to reduce emissions of nitrogen oxides against the 2005 baseline by 55% by 2020, increasing to 73% by 2030.

Short-term exposure to concentrations of NO<sub>2</sub> can cause inflammation of the airways and increase susceptibility to respiratory infections and to allergens. It exacerbates the symptoms of those who are already suffering from lung or heart conditions, shortening their lives.



Sulphur dioxide is a corrosive, acidic gas which is harmful to health and combines with water vapour in the atmosphere to produce acid rain. SO<sub>2</sub> pollution episodes in ambient air are also associated with asthma and chronic bronchitis and can be a significant component of particulate matter. Sulphur in coal played a contributory key role in the health impacts of the London smog in 1952, where estimates of the resulting mortality range between 8,000 and 12,000 deaths. SO<sub>2</sub> emissions caused significant harm to forests and freshwater habitats in the Northern Hemisphere in the 1970s - 80s. Following concerted action to reduce SO<sub>2</sub> emissions, such episodes no longer occur in the UK.

Emissions of SO<sub>2</sub> are primarily from combustion of solid and liquid fuels and have reduced markedly with restrictions on the sulphur content of liquid fuels, as well as a shift away from a reliance on coal for energy generation. However, domestic coal burning can result in significant indoor exposure to SO<sub>2</sub>. Our aim is to reduce emissions of sulphur dioxide against the 2005 baseline by 59% by 2020, increasing to 88% by 2030.



Non-methane volatile organic compounds (NMVOCs) are a very large group of organic compounds, which differ widely in their chemical composition but can display similar behaviour in the atmosphere. NMVOCs are emitted to air as combustion products, as vapour arising from petrol, solvents, air fresheners, cleaning products, perfumes and numerous other sources, often when products are used at work or in the home. The diversity of products and processes which emit NMVOCs is huge, covering not only industrial processes (22% of emissions), but also household products (18%), agriculture (14%), domestic burning and transport (5% each)<sup>16</sup>.

In the outside atmosphere, NMVOCs react with other air pollutants in the presence of sunlight to produce ground level ozone (see below). NMVOC emissions can also form a significant component of indoor air pollution. Indoor reactions are different because ultraviolet light, the main driver of outdoor reactions, is absorbed by glass.

However, there are many other reactions which they can undergo to form other chemicals. A particularly important NMVOC is formaldehyde, which can be released from furniture, finishes and building materials, such as laminate flooring, kitchen cabinets and wood panels, and is also formed in chemical reactions in the air between other NMVOCs and chemicals generated from combustion processes, such as smoking, heating, cooking or candle burning. At low concentrations, exposure to formaldehyde can cause irritation to the eyes and upper airways, and is classified as a human carcinogen.

Other sources of NMVOCs include furnishing, carpets, and upholstery, products for cleaning and polishing, air fresheners, and personal care products, for example fragrance, deodorants, and hair styling products. Our aim is to reduce emissions of NMVOCs against the 2005 baseline by 32% by 2020, increasing to 39% by 2030.

## Ozone (O<sub>3</sub>)

Some pollutants are not directly emitted but formed in the air, such as ozone. Ozone is damaging to both human health and the environment. It is highly reactive, and will react with nitric oxide to form nitrogen dioxide. Modelling suggests that, as we reduce NO<sub>2</sub> concentrations in our towns and cities, we will need to consider how to address the increasing levels of ozone that might result. However, by

tackling all sources of pollution, we will continue to reduce the formation of ozone across the whole of the UK. Ozone travels long distances and can reach high concentrations far from the original sources of pollution. It can cause inflammation of the respiratory tract, eyes, nose and throat. It can trigger asthma attacks and cause chest discomfort whilst breathing. It can also cause damage to crops.

## 1.4 Maintaining a strong evidence base

The atmosphere is a dynamic system in which many human-made and natural substances interact. To understand the total emissions of air pollutants and how these change over time the UK government produces and publishes national inventories of air pollutants each year, measuring and reporting according to agreed international guidelines. These inventories go back to 1970 and provide good evidence of changing trends in air pollution. They are drawn from a combination of sources, including:

- directly measured emissions
- data and our understanding of the activities that produce air pollution
- data and our knowledge of how these activities release pollutants to the atmosphere

We have a national air quality monitoring network consisting of 287<sup>17</sup> sites across the UK which measure ambient concentrations of various air pollutants. This network is operated by the Environment Agency on behalf of the UK Government. Near real-time measurements from 168<sup>18</sup> monitoring sites is made available online and updated hourly.

It is not possible to monitor the air in every location, so modelling enables us to assess air quality in locations without monitoring stations. This helps us to understand how different

sources contribute to local air pollution and provides a consistent framework for making future projections. We model the interaction between total emissions and the resulting local concentrations in order to better understand the impacts of air pollution in terms of human exposure to air pollution. We also make projections of the levels of emissions we expect to see in future, given current trends and regulations, looking forwards to 2030 in order to plan further action to reduce air pollution.

The Meteorological Office makes daily short-term forecasts of air quality. These are produced early each morning for the current day and for the coming days. These forecasts are compared to monitoring information to ensure consistency of assessments.

**We have a strong commitment to both transparency about the methods by which air quality assessments are made and the ease by which the public, industries, researchers and others can access air quality data.** The National Atmospheric Emissions Inventory (NAEI) website contains detailed information on how air quality assessments are made<sup>19</sup>, with easily accessible data on emissions of air pollutants available both via a web-based tool and as downloadable data files<sup>20</sup>.



In 2018 the UK won the international award for the most complete inventory at the annual task force for emissions inventories and projections (TFEIP) conference in Sofia, Bulgaria, ahead of more than 40 countries who report emissions data.



The dedicated [UK-Air website](#)<sup>21</sup> enables everyone to:

- understand how air quality affects their health and the environment<sup>22</sup>
- access data on local concentrations of air pollutants, including datasets on air quality trends and real-time air quality assessments<sup>23</sup>
- access short-term forecasts for air quality<sup>24</sup>
- explore the network of monitoring sites and access information on how these function<sup>25</sup>

We remain strongly committed to a process of continuously improving the evidence base on air quality in the UK and to ensuring this evidence is accessible and transparent to a wide range of audiences from academic experts and school children to health professionals and vulnerable individuals.

The national monitoring and modelling available through UK-AIR is designed to meet our international obligations. In addition to this, local authorities run their own monitoring networks and local models to support them meet their legal obligations at the local level. There is also increasing interest and opportunity for individuals to undertake their own monitoring, using a variety of 'citizen science' sensor equipment. These different data sources require careful interpretation due to variability in data quality, location and technology type.

Historically, the national and local data sources have been managed and published separately, reflecting their different intended uses. This has led to a fragmented data landscape which is not being used to its full potential. Information is needed at all scales because action is needed at all scales to address the air pollution challenges we face. We will, therefore, increase transparency by bringing local and national monitoring data together into a single accessible portal for information on air quality monitoring and modelling, catalysing public engagement and encouraging citizen science initiatives.

Working closely with the government's existing Air Quality Expert Group that provides us with independent advice, we will develop a wider network of inter disciplinary collaborations with the research community to further improve our understanding of air pollution sources and impacts, and to encourage innovative approaches to the many technical challenges in making significant further improvements to our air quality.

## 1.5 Action to improve understanding of the problem and its solutions

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- We are investing £10m in improving our modelling, data and analytical tools to give a more precise picture of current and future air quality and the impact of policies to improve it in future.
  - We will increase transparency by bringing local and national monitoring data together into a single accessible portal for information on air quality monitoring and modelling, catalysing public engagement through citizen science.
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## 1.6 Questions

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- Q1. What do you think about the actions put forward in the understanding the problem chapter? Please provide evidence in support of your answer if possible.
- Q2. How can we improve the accessibility of evidence on air quality, so that it meets the wide-ranging needs of the public and other interested parties?



# 2. Protecting the nation's health

## 2.1 Health evidence

**Air pollution is a major public health risk ranking alongside cancer, heart disease and obesity<sup>26</sup>. It causes more harm than passive smoking.** A review by the World Health Organization concludes that long-term exposure to air pollution reduces life expectancy by increasing deaths from lung, heart and circulatory conditions. That is why we are taking action to accelerate the improvements to air quality that will reduce risks to health for current and future generations.

There is a compelling case for action to reduce public exposure to air pollution in order to save lives and improve quality of life for many.

Conditions caused or exacerbated by air pollution include asthma, chronic bronchitis, chronic heart disease (CHD), and strokes. These conditions significantly reduce quality of life. They also mean that people are less able to work and need more medical care, resulting in higher social costs and burdens to the National Health Service.

Poor air quality can affect health at all stages of life. Those most affected are the young and old. In the womb, maternal exposure to air pollution can result in low birth weight, premature birth, stillbirth or organ damage. In children there is evidence of reduced lung capacity, while impacts in adulthood can include diabetes, heart disease and stroke. In old age, a life-time of exposure to air pollution can result in reduced life-expectancy and reduced wellbeing at end of life. There is also emerging evidence for a link between air pollution and an acceleration of the decline in cognitive function.

Public Health England (PHE), the independent body responsible for protecting the nation from public health hazards, has identified air pollution as a top priority for action.

Deprived communities are more likely to experience adverse health effects from poor air quality because they are more exposed to air pollution, for example, by being close to major roads<sup>27</sup>. They are less likely to live close to well-maintained green spaces associated with lower levels of air pollution, increased physical activity, and improved mental wellbeing. However, air quality can also be poor in areas that are generally considered affluent, such as central London. This is reflected by the overall national distribution of air pollution with highest average levels in South East England and lowest in the North of England, Scotland, Wales, and Northern Ireland<sup>28</sup>.



## Counting the costs of air pollution on health

In order to target action to tackle air pollution we need to understand the costs of the damage caused by emissions and the benefits of intervention. Our economic appraisal tools provide a monetary estimate of the health and environmental impact costs of each tonne of air pollutant still released into the atmosphere. Up to now, these estimates have mostly focused on the value that people place on living longer lives. This is a very important impact, but it's not the only factor: we also know that people have to live with the consequences of conditions brought on by air pollution and that emissions reductions could alleviate this day-to-day suffering. In the past, it has not been possible to quantify these impacts, but a big research effort is now advancing our understanding of these impacts. It is possible to estimate the impacts of air pollution on various conditions, including coronary heart disease, stroke, lung cancer and asthma.

Recent research commissioned by Public Health England has found that the health and social care costs of air pollution (PM<sub>2.5</sub> and NO<sub>2</sub>) in England could reach £5.3 billion by 2035. This is a cumulative cost for diseases where there is a strong association with air pollution: coronary heart disease; stroke; lung cancer; and child asthma.

When diseases with weaker evidence of association are also added, including chronic obstructive pulmonary disease; diabetes, low birth weight, lung cancer, and dementia, the costs could reach to £18.6 billion by 2035. When all diseases are included, air pollution is expected to cause 2.4 million new cases of disease in England between now and 2035. PM<sub>2.5</sub> alone could be responsible for around 350,000 cases of coronary heart disease and 44,000 cases of lung cancer in England over that time. Even small changes can make a big difference – just a 1µg/m<sup>3</sup> reduction in PM<sub>2.5</sub> concentrations this year could prevent 50,000 new cases of coronary heart disease and 9,000 new cases of asthma by 2035.

The government supports a strong and growing evidence base on the effects of pollution through our two independent expert committees - the Department of Health and Social Care's advisory Committee on the Medical Effects of Air Pollutants (COMEAP) and Defra's Air Quality Expert Group (AQEG) that keep emerging evidence under regular review. We work closely with the health science community to further our understanding of the air quality impacts on the whole life cycle from before birth to death and also gain greater understanding on emerging areas of research. Public Health England is undertaking a feasibility study of a system to capture the health impacts resulting from air pollution across England.

## Researching the link between air pollution and cardiovascular disease

British Heart Foundation and the University of Edinburgh

Since 2010, the British Heart Foundation has invested £3.2 million in research into how air pollution, especially fine and ultrafine particulate matter, can make existing heart conditions worse and increase the likelihood of a heart attack or stroke in vulnerable groups.

Research by the University of Edinburgh has shown how particulate matter contributes to cardiovascular disease. Senior Research Scientist Dr Mark Miller used harmless gold nanoparticles to mimic the ultrafine PM found in air pollution. These particles are of a similar size to the nanoparticles that are abundant in diesel exhaust. Volunteers breathed in these nanoparticles for 2 hours, which were then tracked through the body. Within 24 hours, a proportion of nanoparticles had crossed from the lungs into the bloodstream, where they were still detectable three months later. This demonstrates that the health risk from breathing PM could continue long after exposure.

Dr Miller's team also tested how the nanoparticles affected patients who were at high risk of stroke due to a build-up of fatty plaques inside their arteries. The researchers found that the gold nanoparticles accumulated within these plaques. While gold nanoparticles are harmless, if other particulates behaved in the same way it is likely that they would promote heart disease. These findings are hugely important in suggesting how PM from air pollution may cause heart attack or stroke and will help us to shape policies aimed at reducing the risk to people's cardiovascular health.

## 2.2 Health information

Effective communication of health messages about air pollution can save lives and improve quality of life for many. As we build our understanding of how poor air quality affects health in both the short and long term, it is important that we communicate the evidence in a transparent and accessible way.

**Many of the everyday activities that create air pollution also increase personal exposure for ourselves and our families.** For example, there is a common misconception that the air outside a car on a busy road is more polluted than inside. However, studies in London and other UK and European cities show that drivers and passengers inside vehicles are exposed to significantly higher levels of air pollution than those walking or cycling along the same urban routes<sup>29</sup>. This is because cars can suck in emissions from surrounding vehicles, particularly those that are immediately ahead, and recirculate them within a confined space. Walking and cycling, even where there is a lot of traffic, exposes people to less air pollution than driving. Taking the scenic route and walking along quieter roads reduces exposure even further. Fewer cars on the road means less pollution for everyone.

Similarly, most people think that the air inside their home is cleaner than that outside. However, this is rarely the case. Levels of air pollutants in the home can be significantly higher than those outside. For example, NMVOCs and particulates accumulate inside the more confined space in the home, through the multiple use of cleaning products, the installation of new carpets and furniture, and especially where wood burning stoves or open fires are regularly used. Simple actions, like burning cleaner fuels and opening windows to ventilate the home can make a big difference. **There is a need for straightforward, practical information so that people can reduce their own emissions for the benefit of themselves and their neighbours.**

Children, the elderly and individuals with pre-existing cardio and respiratory conditions are particularly vulnerable to the effects of poor air quality, so it is important to provide clear and transparent information and air quality forecasts. Recent work to better understand public perceptions around air quality<sup>30</sup> has shown strong demand among certain groups for more information on air quality, with a third of the general public calling for information on how to minimise their contribution and the same proportion wanting to know more about how to protect themselves.

The government already provides information on local and national air quality. A multi-day air quality forecast service is available to the public on the government's [UK-Air website](#). It provides up-to-date information on air pollution and has a postcode search facility to enable information to be provided at a local level. We will work with media outlets to improve public access to the air quality forecast.

The government also provides health advice to support vulnerable individuals during episodes of poor air quality and we also work closely with a network of key health stakeholders to provide alerts during high pollution episodes. We will improve the quality and accessibility of our air quality information, especially for vulnerable groups and during high pollution episodes.

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## 2.3 Providing decision makers with accurate data

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The health impacts of poor air quality are not currently well represented in the health profession's education and training. So we are working with the Medical Royal Colleges and the General Medical Council to remedy this.

The government is reviewing current evidence to provide recommendations for practical interventions to significantly reduce harm from air pollution from the wide range of sectors covered in this draft strategy. This builds on the Defra UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations and the NICE air quality and health guidelines<sup>31</sup>. Additionally, the National Institute of Health Research will commission further research into action to reduce risks to public health from poor air quality.

Central and local government work closely together to provide support for local authority directors of public health to take action to tackle air pollution at local level and to inform how planning can avoid creating air pollution problems. In March 2017, Defra, PHE and the Local Government Association, jointly published an updated resource 'Air Quality: A briefing for directors of public health'. It provides information, case studies, guidance and communication tools for directors of public health and their teams<sup>32</sup>. This is being supported by a rolling programme of masterclasses with local health professionals to facilitate sharing of good practice and innovation on the ground.

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## 2.4 Leading the way: reducing population exposure to PM<sub>2.5</sub>

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All ambitions to reduce average population exposure will deliver positive health benefits.

**That is why we have already signed up to meet ambitious emissions ceilings by 2020 and 2030 and why we now want to go further by setting a new goal to reduce human exposure to PM<sub>2.5</sub>.**

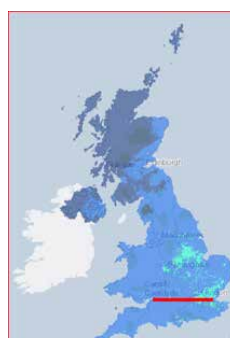
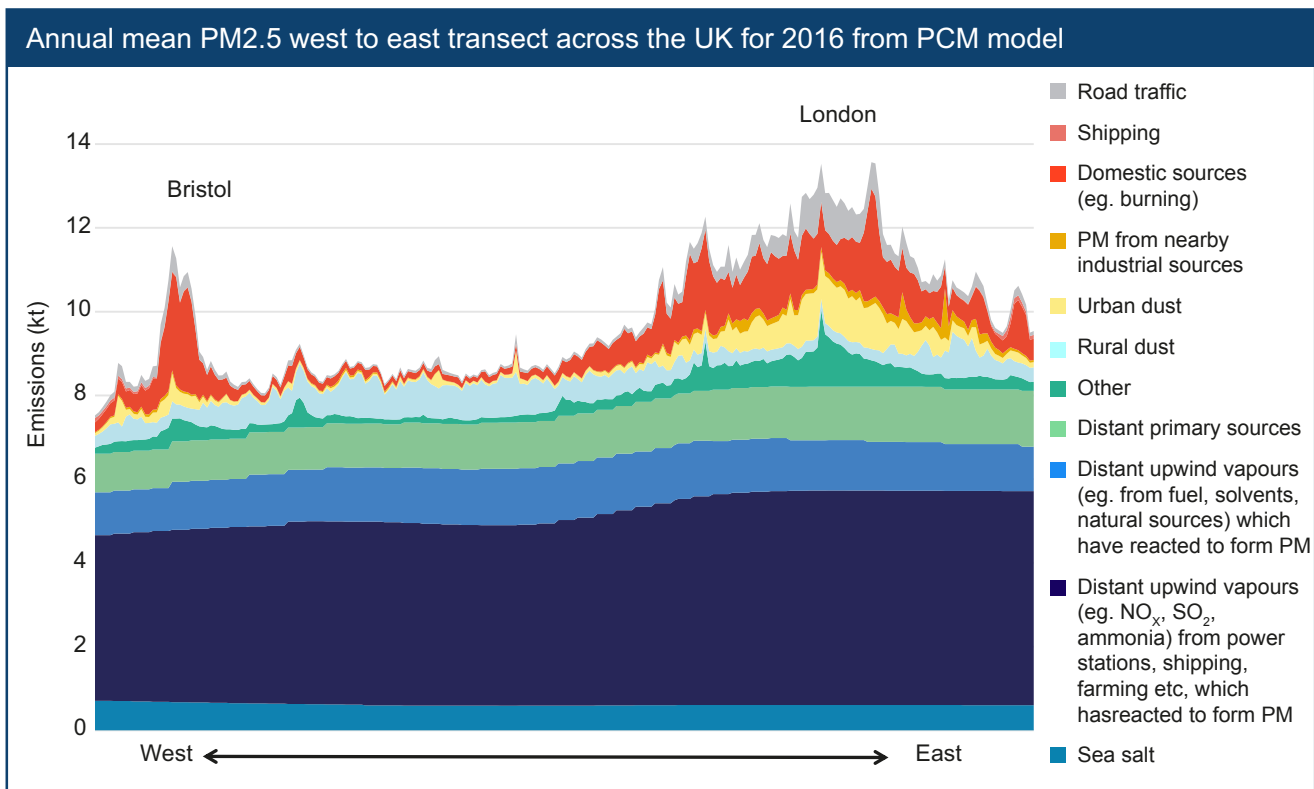
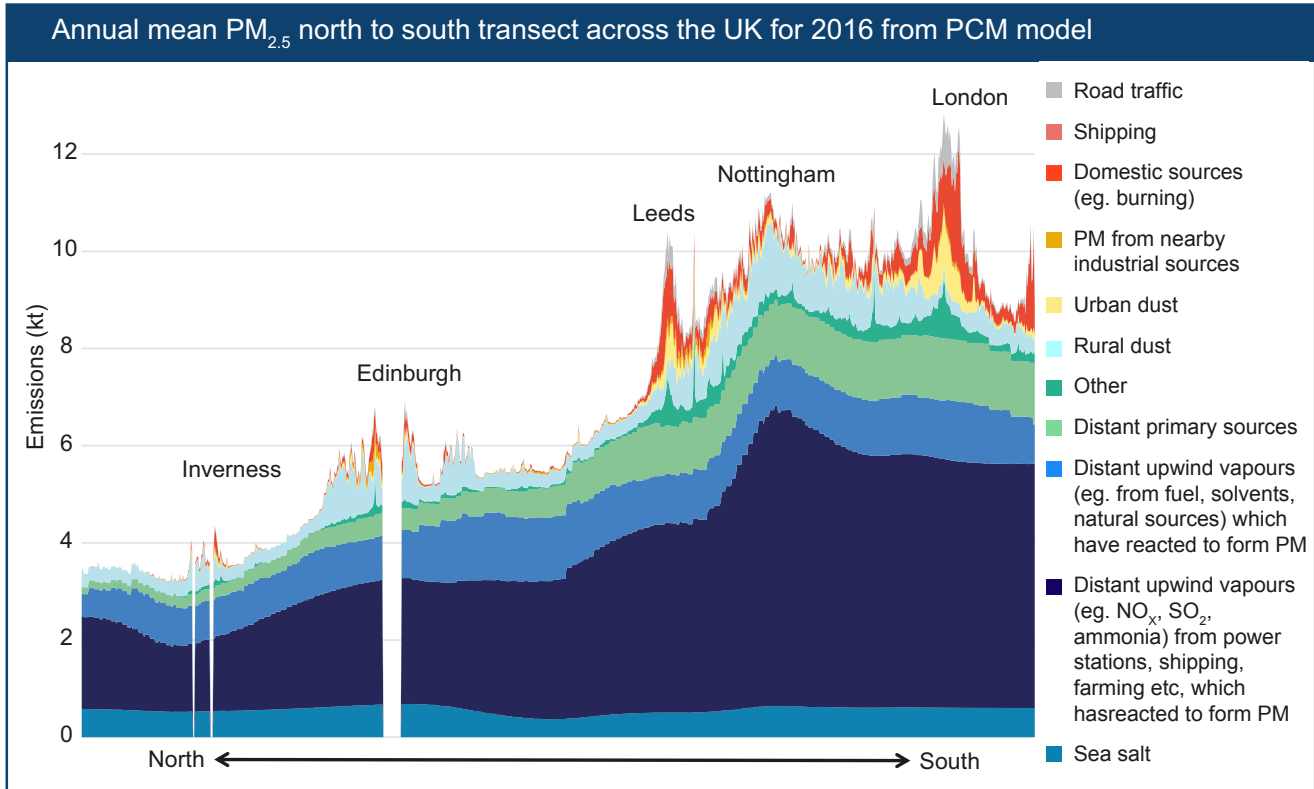
The UK sets air quality goals, informed by evidence from a range of sources. These include the World Health Organisation (WHO) 2008 guidelines, recognised as the international benchmark for setting air quality standards.

The UK's current objectives on PM<sub>2.5</sub> stem from EU legislation. We already meet the EU limit value of 25 µg/m<sup>3</sup> and are on track to meet a second stage limit of 20 µg/m<sup>3</sup> by 2020. In this we are ahead of several European countries who still have exceedances of these limits.



## CLEAN AIR STRATEGY

These images show how particulate matter from across the country can build up in the atmosphere as 'background pollution' and the role that this can play in combination with local sources in areas with a pollution challenge.



Like other pollutants, PM can travel large distances and it is a transboundary problem. Sometimes, depending on wind direction and other circumstances, up to 50% of the UK's PM<sub>2.5</sub> levels (more in South East England than other areas) are from sources outside of the UK (for example, continental Europe). This is why co-ordinated international action is required. PM also moves across the UK and emissions can build up in the atmosphere, far from the source of emissions. This strategy seeks to drive down emissions of PM across the UK and provide stronger powers to tackle it in local areas where there is a problem.

The WHO guidelines recommend an ultimate goal for concentrations of PM<sub>2.5</sub> of 10 µg/m<sup>3</sup>. This is half the current EU limit and the WHO recognises that this represents a significant challenge. 92% of the global population currently live in areas that exceed this goal<sup>33</sup>. The WHO therefore recommend a step-by-step approach to achieve progressive reductions. Reflecting this, we will set a bold new goal to progressively cut public exposure to particulate matter pollution, as suggested by the WHO. **We will reduce PM<sub>2.5</sub> levels in order to halve the number of people living in locations where concentrations of particulate matter are above 10 µg/m<sup>3</sup> by 2025.**

To support this we will set detailed interim objectives and report publically on our progress. **We will review our progress in 2022, and we will consider if we should have more challenging milestones towards WHO goals; the new independent statutory body that we are establishing to hold government to account on environmental objectives may, subject to consultation, have a role in the scrutiny of air quality policy and any other**

**strategies relating to air quality.** This will set a clear national ambition to drive down human exposure to PM<sub>2.5</sub> as rapidly as is feasible.

We will be bold in our ambition but practical in our approach, taking account of the different levels of challenge in different parts of the country (for example in major urban areas, where there are concentrations of industrial activity, traffic, transport networks and people) and the impact of transboundary air pollution which means that around one third of the PM in our atmosphere comes from abroad. **We will back these targets up with a comprehensive set of new powers designed to enable targeted local action in areas with an air pollution problem.**

We will engage with the devolved administrations to explore the potential to develop a shared UK-wide goal, recognising the work that the London Mayor and Scottish Government have already begun in this area. In achieving these targets, we can expect significant long-term reductions in acute and chronic diseases associated with air pollution.

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## 2.5 Actions to reduce people's exposure to air pollution

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- We will set a bold new goal to progressively cut public exposure to particulate matter pollution, as suggested by the World Health Organisation. We will reduce PM<sub>2.5</sub> levels in order to halve the number of people living in locations where concentrations of particulate matter are above 10 µg/m<sup>3</sup> by 2025.
- We will back these goals up with a comprehensive set of new powers designed to enable targeted local action in areas with an air pollution problem.
- We will review our progress in 2022, and we will consider if we should have more challenging milestones towards WHO goals; the new independent statutory body that we are establishing to hold government to account on environmental objectives may, subject to consultation, have a role in the scrutiny of air quality policy and any other strategies relating to air quality.
- We will develop and deliver a personal air quality messaging system to inform the public, particularly those who are vulnerable to air pollution about the air quality forecast and provide clearer information on air pollution episodes and health advice.
- We will improve the information we provide about air pollution, health impacts and the simple actions people can take to reduce their exposure and improve air quality.
- We plan to publish a new set of appraisal tools and accompanying guidance this year to enable the health impacts of air pollution to be considered in every relevant policy decision that is made.



## CLEAN AIR STRATEGY

- We will equip health professionals to play a stronger role by working with the Medical Royal Colleges and the General Medical Council to embed air quality into the health profession's education and training. Work with local authorities and directors of public health to equip and enable them to lead and inform local decision-making to improve air quality more effectively.
- We will work with the NHS, hospitals, emergency departments, GPs and local authorities to gather better information on where, when and how patients report and are treated for air quality related health conditions, to help evaluate the effectiveness of actions to improve air quality. This will help meet the recommendations of the recent Chief Medical Officer report on air pollution<sup>34</sup>.

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## 2.6 Questions

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- Q3. What do you think of the package of actions put forward in the health chapter? Please provide evidence in support of your answer if possible.
- Q4. How can we improve the way we communicate with the public about poor air quality and what people can do?

# 3. Protecting the environment

## 3.1 Clean air and our environment

**Human health and a thriving natural environment are concepts that go hand in hand and clean air is central to this vision.**

19th century social reformers such as Octavia Hill promoted access to natural environments for city dwellers through a network of urban parks and green belt known as 'green lungs'. In the 20th century the idea of fresh air and exercise became synonymous with personal wellbeing. This Clean Air Strategy is part of a wider government vision for creating and maintaining thriving places where people can live, work, bring up families and enjoy their free time.

A Green Future: Our 25 Year Plan to Improve the Environment sets out the government's plans to secure clean air and water, protect our natural heritage, innovate to achieve clean growth and increase resource efficiency. This will provide benefits to both our environment and economy, and help us to keep our pledge to hand over our planet to the next generation in a better condition than we inherited it.

In the past, pollution was sometimes seen as a price we had to pay for progress, but that is outdated thinking. **We now know that clean, green and healthy environments in urban and rural areas are an essential component of progress, not a barrier to economic development.** We have set out our vision for a Green Brexit in which environmental standards are not only maintained but enhanced, and Chapter 9 of this strategy sets this in the context of our leadership role nationally and internationally.

We are consulting on establishing a new world-leading, independent, statutory body to give the environment a voice, championing and upholding environmental standards as we leave the European Union.

## 3.2 Impacts and improvements to date

Air pollution has direct impacts on the environment and is a factor in the poor conservation status of many of our protected sites. Over time, emissions of air pollutants have had negative impacts in plant and animal communities in many habitats. Reducing air pollution will reduce the pressure on natural habitats and animals and allow affected areas to start recovering.

### Case study: tackling acid rain

UK sulphur dioxide emissions from coal burning power stations caused considerable "acid rain" damage in the UK and Scandinavia during the 1970s and 1980s. Sulphur dioxide (SO<sub>2</sub>) is emitted to air from fossil fuel combustion at power plants and other industrial facilities along with mobile sources such as ships. When deposited from the atmosphere SO<sub>2</sub> damages vegetation, soils and watercourses. Acid deposition disrupts delicate nutrient balances and when it enters rivers and lakes can damage or kill fish, aquatic plants, invertebrates and trees.

The damage caused by acid rain demonstrated the transboundary nature of air pollution and prompted the agreement of the first international and prompted the agreement of the UNECE Convention on Long-range Transboundary Air Pollution in 1979, which established a common framework for transboundary cooperation on air pollution. Since then, significant reductions in sulphur emissions have been achieved, partially as a result of moving away from coal as a source of energy generation. Nature has slowly begun to recover, with sensitive species returning to large areas of the country. This success story shows us that appropriate action can make real, lasting environmental improvements.

### 3.3 Effective nitrogen management

Nitrogen is a major component of fertiliser which is why it has an important role to play in food production. However, when excess atmospheric nitrogen spreads into the wider environment it can cause problems. Excess nitrogen from farming practices can be emitted to the air as ammonia ( $\text{NH}_3$ ) and re-deposited onto soils and plants, and into freshwaters. Road transport and combustion are also significant sources, via emissions and subsequent deposition of oxides of nitrogen ( $\text{NO}_x$ ).  $\text{NO}_x$  tends to dominate nitrogen deposition in urban areas and near major roads, whereas in rural areas  $\text{NH}_3$  emissions from livestock production are the primary contributor. Nitrogen pollution can also cause the release of the potent greenhouse gas nitrous oxide ( $\text{N}_2\text{O}$ ) to the atmosphere, contributing to climate change. Most nitrogen is deposited locally but some goes high into the atmosphere and can be transported long distances.

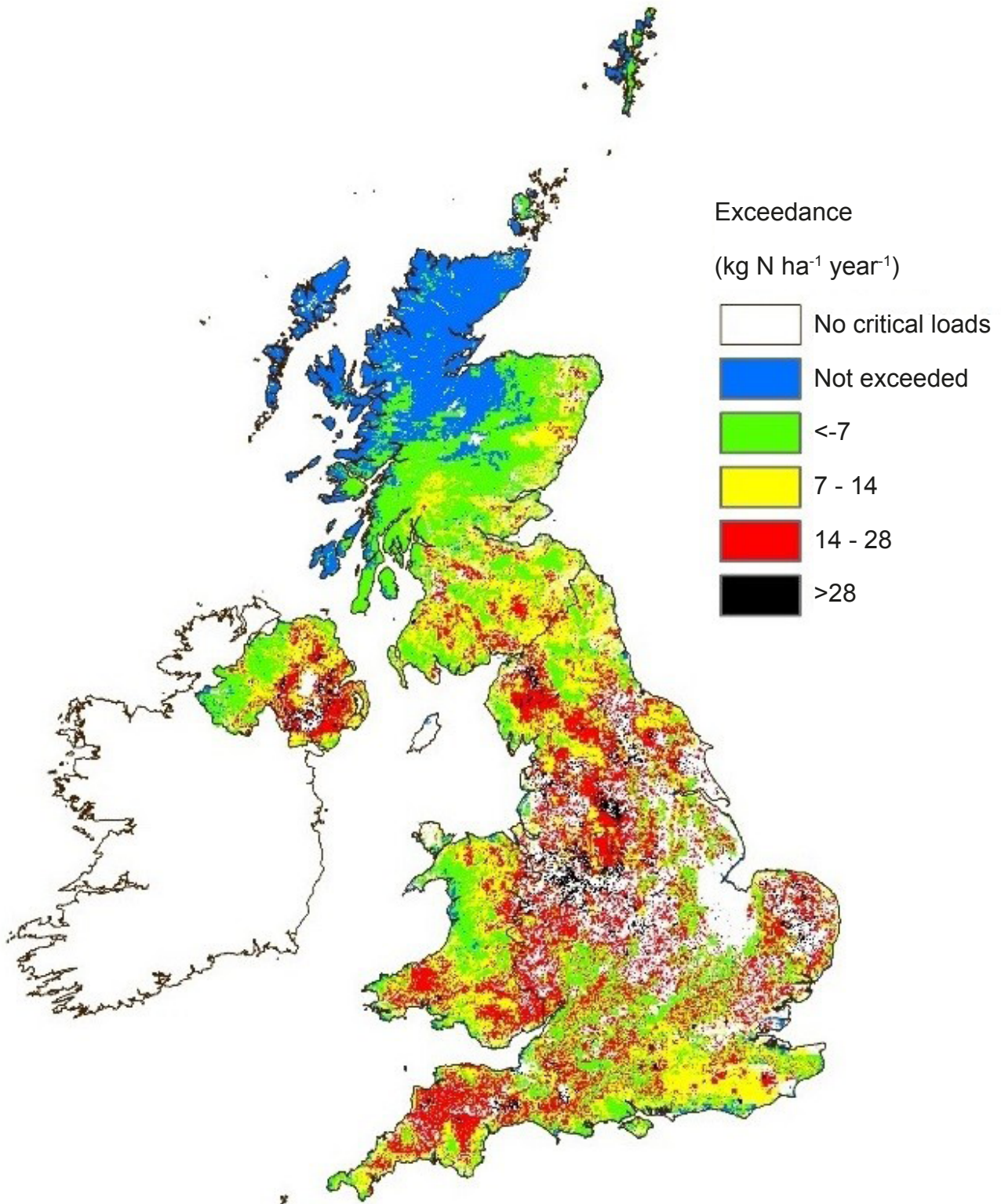
Some plants find reactive nitrogen toxic while others are squeezed out by tougher, nitrogen-loving, species. Most nitrogen-sensitive habitats across the UK receive more nitrogen than they can tolerate. More than two-thirds of our wild flower species, such as harebell and betony, are adapted to low-nutrient conditions and cannot survive in the overly-fertile conditions created by nitrogen deposition. Sensitive habitats have become colonised by more robust nitrogen-loving plants, such as the common nettle and cow parsley, with knock-on effects for other wildlife. There is evidence of population declines of certain species of butterflies and bees and other insects because the sensitive plants on which they depend are in decline or in poor condition<sup>35</sup>



The rare Cistus Forager moth is shown on a Pyramidal Orchid in Great Orme, Wales. Its larvae feed on Common Rockrose – the yellow flowers in the background. Both these plants require very low levels of nitrogen to grow.

Photo: Trevor Dines/Plantlife.

The figure below shows that in 2014 63% of the area of sensitive habitat in the UK had more nitrogen deposition than it can cope with effectively<sup>37</sup>. This was a 12% improvement on 1996 levels but has shown no further positive change since 2009. Around 80% of Special Areas of Conservation in England by area are estimated to receive damaging amounts of atmospheric nitrogen. Once soil quality and the balance of species is changed, recovery is slow and costly to achieve.





### 3.4 Ground level ozone (O<sub>3</sub>) - impacts on the environment

Ground level ozone (O<sub>3</sub>) reduces plant growth, flowering and crop yields, affecting nature, agriculture, and horticulture. Damage to crops can include leaf damage that directly affects economic value particularly for spinach, lettuce and spring onions. It has been estimated that in a typical year in the UK, ozone reduces yields of wheat, potato and oilseed rape by 5%<sup>38</sup>.



Ozone-induced leaf injury on wheat

Photo: ICP Vegetation Programme Coordination Centre, Centre for Ecology & Hydrology



Green-winged Orchid, classified as near-threatened

Photo: Natural England/Graham Earl

## 3.5 Particulate matter (PM) - impacts on the environment

Much of our focus has been on the reduction of emissions from vehicle exhausts but friction during driving also generates fine particles from brakes, tyres and the road surface. They add to the concentrations of PM<sub>2.5</sub> and PM<sub>10</sub> people are exposed to and also have an impact on the environment. In particular, abrasion of tyres and road paints produce tiny microplastic particles, which enter rivers and lakes mainly from road run-off and can eventually be deposited into the sea. Microplastic particles originate from many sources and their generation has increased in line with the global production of plastics (1.5m tonnes in 1950s to more than 300m tonnes in 2015<sup>39</sup>). Studies estimate that micro particles from tyres make up 5-10% of microplastics deposited in the oceans<sup>40</sup>, with well documented impacts for marine wildlife and the food chain.

The government is investing £200,000 in research by the University of Plymouth to improve scientific understanding of how tiny particles of microplastics from car tyre friction on roads make their way into the sea through sewers. This Defra-funded research will close current gaps in the evidence; looking at how microplastics from a variety of sources end up in marine environment and what we can do to tackle this problem in the future. The government's independent scientific advisory body on air pollution the Air Quality Experts Group (AQEG) is also reviewing research into how particulates from tyres and brakes impact on air quality in order to inform advice to government.



### Tackling other human-made pollutants

Human activity results in a range of pollution emissions to air and we are continuing to tackle these emissions as new evidence emerges.

Heavy metals accumulate in the environment, especially in lake and marine sediments, and are toxic to many species at low concentrations. Airborne lead (Pb) emissions have decreased by 98%<sup>41</sup> since 1990, achieved mainly by phasing out the widespread use of leaded petrol.

Work is continuing to reduce other pollutants. Levels of airborne nickel (Ni) can exceed health-based standards in some parts of the UK, particularly in the vicinity of steel processing plants. We are working with the regulators and industries to ensure emissions are lowered so that these standards are not exceeded.

Polycyclic aromatic hydrocarbons (PAH) are toxic, persistent<sup>42</sup> and accumulate through food chains<sup>43</sup>, where they can affect animal reproduction, development and immune systems<sup>44</sup>. PAHs are released into the air by the incomplete burning of fuels, particularly solid fuels such as wood and coal. One specific PAH, benzo[a]pyrene (BaP) is a common component of combustion products and is a known carcinogen. Regulation has helped to decrease emissions of PAHs by 98% since 1990<sup>45</sup>. However, the use of wood as a domestic fuel has increased markedly over the last 20 years, and is calculated to produce 78% of total national BaP emissions<sup>46</sup>. Government action to tackle these emissions is outlined in Chapter 2.



## 3.6 Leadership to reduce environmental damage by air pollution

The UK has long recognised the importance of international coordinated action to reduce the environmental damage caused by air pollution. In 1987 the UK instigated the International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops<sup>47</sup>. This programme sets international standards to report the impacts of ozone, heavy metals and nitrogen, so that progress can be assessed across countries over time.

We also contribute to another of the International Cooperative Programmes (ICPs), on Modelling and Mapping<sup>48</sup>. This programme models the amount of sulphur dioxide, oxides of nitrogen and ammonia deposited on land throughout the UK and the concentrations of these pollutants plants are exposed to annually. This work defines the impacts of air pollution emissions and the effect of emissions reductions. These programmes have become pivotal to an international requirement to report the monitoring of air quality impacts on terrestrial and freshwater ecosystems in the revised National Emissions Ceiling Directive. The first report will be issued in 2018 and will inform action to protect the environment.

We are planning comprehensive action to control ammonia emissions from agriculture, detailed in Chapter 7 of this strategy. **These measures are expected to protect an additional 200,000 hectares of natural habitat (an area the size of Warwickshire) from excessive nitrogen deposition.**

In addition to these regulatory controls we are taking action to improve the way that cumulative impact of nitrogen deposition on natural habitats is controlled. Later this year we will provide guidance for local authorities explaining how cumulative impacts of nitrogen deposition on natural habitats should be mitigated and assessed through the planning system. Consistent application of this guidance will improve protection of important natural habitats while providing greater certainty for applicants to planning and permitting processes.

### Case Study: focus on the Sherwood Shared Nitrogen Action Plan

Natural England's Shared Nitrogen Action Plan (SNAPS) pilots have been developed by bringing together local authorities, NGOs and agricultural and energy sector representatives to encourage shared responsibility for restoring habitats whilst maximising local economic benefits.

Sherwood Forest Focus Area has many air pollution sensitive habitats and species across its 11 Sites of Special Scientific Interest (SSSI). Air pollution sources in the area range from large farms and biomass and waste gas plants to main road traffic.

Local land owners and industries are working to develop innovative solutions to reduce emissions. Opportunities to use Countryside Stewardship & Productivity schemes are available to support actions such as installation of slurry covers and shelter belts along roadsides and around farmyards, together with advice on the impacts of fertiliser use. This will aid the recovery of over 1,500 hectares of SSSI.

Nottinghamshire County Council, Royal Society for the Protection of Birds, Nottinghamshire Wildlife Trust and Natural England have regular input on these plans to manage new emission sources to minimise the potential effects on protected habitats.

We will continue to work with the research community to make the best use of the available evidence and research to understand the mechanisms of ecosystem damage and recovery to underpin proportionate and targeted action. Defra is also working in partnership with stakeholders such as Plantlife and the National Farmers Union. They help us to understand how to improve farming practice and productivity. This has a variety of benefits including reduced greenhouse gas emissions through reduced fertiliser wastage and by achieving healthier soils, allowing communities to see other benefits such as reduced congestion and the services healthy ecosystems provide.



## 3.7 Action to reduce environmental damage from air pollution

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- Our programme of actions to reduce ammonia emissions from agriculture is set out in Chapter 7.
- We will monitor the impacts of air pollution on natural habitats and report annually so that we can chart progress as we reduce the harm air pollution does to the environment.
- Later this year we will provide guidance for local authorities explaining how cumulative impacts of nitrogen deposition on natural habitats should be mitigated and assessed through the planning system.



Heather, Moss and Lichen are all sensitive to excess nitrogen  
Photo: Natural England/Peter Wakely

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## 3.8 Questions

- Q5. What do you think of the actions put forward in the environment chapter? Please provide evidence in support of your answer if possible.
- Q6. What further action do you think should be taken to reduce the impact of air pollution on the natural environment? Where possible, please include evidence of the potential effectiveness of suggestions.

# 4. Securing clean growth and driving innovation

## 4.1 Clean growth

Clean growth means growing our national income whilst tackling air pollution, protecting the natural environment, and cutting greenhouse gas emissions. **It is about boosting productivity by improving air quality, using resources efficiently and making the shift to a low carbon economy.**

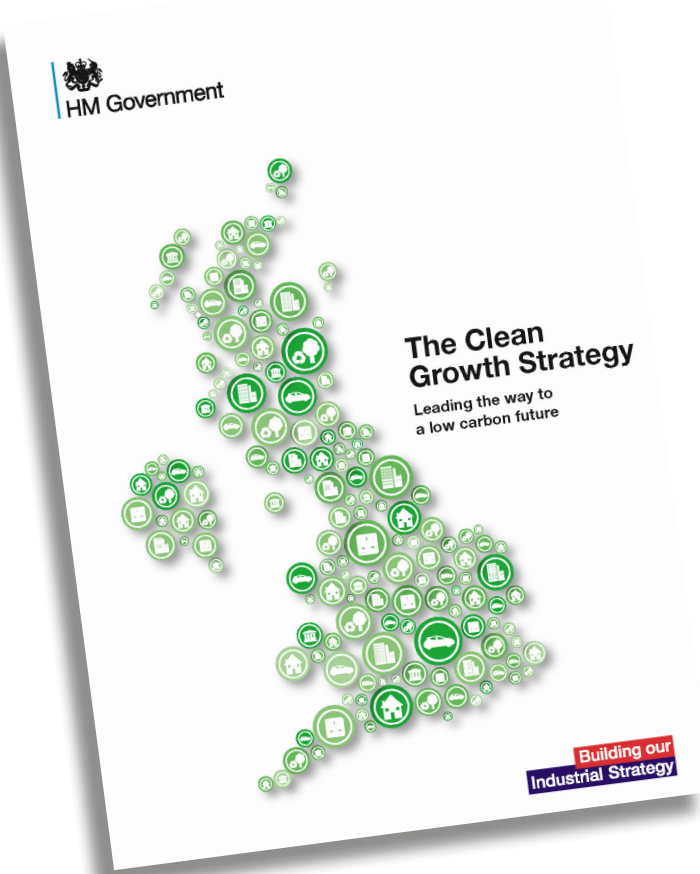
The government is taking action to accelerate clean growth on a number of fronts. The Clean Growth Strategy<sup>49</sup> is our plan for continuing to decarbonise the UK economy through the 2020s. The Clean Growth Strategy sets out the government's commitment to comprehensive action on climate change, air quality and the environment. A Green Future: Our [25 Year Plan](#) to Improve the Environment, a sister document to the Clean Growth Strategy, provides another essential component, setting out our long-term plan for nature's recovery and good health. This Clean Air Strategy provides a comprehensive part of the picture, setting out actions to improve air quality to improve public health, protect the environment and boost the economy.

Cleaner air leads to increased productivity through improvements in public health, leading to reduced workplace absence, and through the creation of an environment that is appealing to businesses and the public alike. For example, particulate matter, nitrogen dioxide and ozone were estimated to be responsible for total productivity losses of up to £2.7bn in 2012<sup>50</sup>.

There are significant opportunities for UK industries to become global leaders in clean, green technologies. The UK low carbon economy has the potential to grow by an estimated 11% per year between 2015 and 2030 – four times faster than the rest of the economy<sup>51</sup> – and

could deliver between £60 billion and £170 billion of export sales of goods and services by 2030<sup>52</sup>. By showing leadership and supporting the development of technologies and solutions that can clean up our air, we can achieve our air quality goals more quickly, as well as increase the UK's competitiveness and opportunities for trade as we leave the EU.

To help realise these opportunities, the Industrial Strategy<sup>53</sup> announced a Clean Growth Grand Challenge, focused on maximising the advantages for UK industry from the global shift to clean growth. As part of this, we want to make the UK a world leader in the goods and services focused on tackling air pollution, such as abatement technology, monitoring equipment and modelling skills.



## 4.2 Innovation

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A variety of actions are needed to fill the gap between where we are now and what we want the quality of our air to be like in 10 years' time and beyond. Many technologies and solutions already exist to support the move towards a clean economy, for example, electric vehicles, increasingly energy-efficient products and abatement technologies. However, in some cases these readily available technologies and solutions to air quality challenges are not yet taken up at scale. In these cases, levers such as incentives, disincentives, behavioural change and regulation may help overcome barriers such as a lack of information or awareness, or access to finance.

Additionally, there are several sources of air pollution for which we do not yet have market-ready solutions available. Innovation can play a key role in both the development of novel solutions and improvements in the efficiency, cost or effectiveness of existing technologies. Through discussion with academics, industry and NGOs we have identified a number of priority areas where innovation funding will support us to achieve our air quality goals:

- particulate matter emissions from industrial combustion, tyre, brake and road wear, industrial processes and domestic burning
- zero or ultra-low emission heavy goods vehicles
- volatile organic compounds from industrial processes; and product formulation
- low and zero-emission options for non-road mobile machinery
- ammonia emissions from agriculture

A number of these areas can be investigated through existing avenues for innovation funding, such as the Innovate UK open funding competition<sup>54</sup> which is open to any business sector and allows businesses with disruptive innovations in air quality to access grant funding. Many of the Industrial Strategy Challenge

Fund<sup>55</sup> programmes also have objectives that are beneficial to air quality. In particular, the £90m Transforming Food Production and the Transforming Construction Industrial Strategy Challenge Funds. We encourage innovators to pursue these.

UK Research and Innovation has also recently announced a £50 million pilot programme of loans for small and medium enterprises (SMEs) to be delivered over the next two years to the end of 2019<sup>56</sup>, aiming to increase both the uptake of innovative technologies and the availability of testing grounds for innovators. The government is also taking action in a number of other relevant areas, including:

- spending nearly £1.5 billion supporting the take-up of ultra-low emission vehicles
- investing up to £246 million in the design, development and manufacture of electric batteries through the Faraday Challenge
- supporting new energy technologies, including £177 million to further reduce the cost of renewables such as offshore wind, and £265 million for smart electricity systems and storage

The Clean Growth Strategy also announced the formation of a Green Finance Taskforce to develop ambitious proposals to further accelerate investment that supports clean growth. One of the key themes in their report *Accelerating Green Finance*<sup>57</sup> focuses on how to improve capital availability to support the commercialisation of innovative clean technologies and solutions.

However, we still need to do more. **In addition, in partnership with UKRI, we will seek ways to support further investment in Clean Air innovation to enable the development of novel technologies and solutions that tackle emissions from industry, vehicles, products, combustion and agriculture and support both improvements in air quality and decarbonisation.**

### Case study: taking a joined-up approach to innovation

Industrial processes and power generation can contribute to air pollution, global warming and land contamination. EarthSave, a project funded by the Energy Catalyst, aims to both reduce the environmental impact and increase the performance efficiency of existing coal and anaerobic digestion plants, biomass boilers and industrial processes across many energy-intensive sectors.

The project aims to develop a prototype heat recovery system using a novel 'wet scrubbing' system. This could provide cooling, power generation and hot water services, whilst reducing air pollutants and carbon dioxide emissions.

Members of the research consortium have previously tested the 'wet scrubbing' system and found it reduced particulate matter emissions by up to 90% and nitrogen oxide emissions by over 80%. This is alongside carbon dioxide emission reductions of up to 20% and the production of clean water for recycling and use in the wet scrubbing system.

## 4.3 Tackling climate change and improving air quality

Many technologies and solutions support multiple aspects of clean growth. For example, the move towards electric vehicles supports both decarbonisation and air quality. However, there are some technologies which can create tension. For example, biomass burning can support decarbonisation but, without appropriate abatement, it will increase levels of air pollution, unless it involves a switch away from a dirtier fuel such as coal. This is particularly problematic when the burning takes place in or close to urban areas.

We will realise the opportunities for mitigating climate change and improving air quality together. For example, we will ensure industrial sector roadmaps for reducing air pollution are well aligned with those for decarbonisation. Where tensions exist, we will ensure that a balanced approach is taken which supports clean growth as a whole. In practice, this means integrating both air quality and climate change considerations into government policies such as energy and agriculture. It also means ensuring that innovation funds are focused jointly on air quality and decarbonisation wherever appropriate, so that we encourage the development of technologies and solutions with multiple benefits and avoid unintended consequences.

For example, the [Renewable Heat Incentive \(RHI\)](#) is a government subsidy scheme for eligible renewable heating technology, including biomass. The RHI has air quality requirements that participants using biomass are required to

meet before they can claim support under the scheme. These air quality requirements set limits on the emissions of particulate matter (PM) and oxides of nitrogen (NO<sub>x</sub>). Participants are also required to use sustainable fuel that is approved for their boiler type. We have recently consulted on changing the RHI rules so that applicants will need to show they have up to date environmental permits before they can be paid. In addition, we will minimise the air quality impacts of the Renewable Heat Incentive scheme, for example by tackling non-compliance and consulting on excluding biomass from the RHI if installed in urban areas which are on the gas grid. We will work across central and local government to put a plan in place. In addition, we will consult on making coal to biomass conversions ineligible for future allocation rounds of the contracts for difference scheme.

Future energy, heat and industrial policies will together improve air quality and tackle climate change. Phasing out coal-fired power stations, improving energy efficiency, and shifting to cleaner power sources will reduce emissions of air pollution, as well as carbon. As we phase out oil and coal heating, we will ensure this transition improves air quality wherever possible and cost effective to do so. In addition, the government will conduct a cross-departmental review into the role of biomass in future policy for low carbon electricity and heat, focusing on the air quality impacts. The proposed way forward will be set out in the final Clean Air Strategy.



## Case study: low emissions refrigeration

Sainsbury's has become the first company in the world to introduce a refrigerated delivery truck cooled by a liquid nitrogen powered engine, which will eliminate all emissions associated with refrigeration. Supplied by cooling technology specialists Dearman and its partners, the zero-emission cooling unit replaces the traditional diesel engine used to chill the vehicle and will significantly cut emissions.

Traditionally many refrigerated trucks require two diesel engines, one to power the vehicle and one for the refrigeration unit. The new system harnesses the rapid expansion of liquid nitrogen to deliver zero-emission power and cooling. Dearman believes that a more sustainable solution for refrigeration may soon be widely adopted on Britain's roads.

Dearman have said that during the three-month trial, 37kg of nitrogen oxides and 2kg of particulate matter were saved with a single truck, compared to a similar diesel system.

David Rivington, Director of special projects at Dearman, said; "There was a clear gap in the market for an affordable, zero-emission alternative". Nick Davies, Head of Logistics for Sainsbury's, said: "As one of Britain's biggest retailers we really recognise the importance of reducing emissions, which is why we're working hard to cut carbon emissions by 30% between 2005 and 2020."

## 4.4 Incentives for clean growth

### Call for evidence on non-road diesel duty rebate usage and non-road mobile machinery: air quality impact and lower emission alternatives

15% of diesel used in the UK is used by non-road machinery at a reduced rate of tax (less than one fifth of the tax for road diesel)<sup>58</sup>. In 2016 this accounted for 21% of emissions of nitrogen oxides and 7% of fine particulate matter<sup>59</sup>.

Non-road mobile machinery (NRMM) is largely diesel-powered and can also be a significant contributor to hotspots of air pollution in urban areas where Clean Air Zones are being put in place to discourage the use of the most polluting road vehicles. For example, NRMM makes up 7% of NO<sub>x</sub> emissions in London<sup>60</sup>, the part of the UK facing the biggest challenge in reducing NO<sub>2</sub> concentrations.

Although it is often thought that rebated diesel is mainly used in the agricultural sector, 75% of it is used across a range of non-farming sectors, including rail, shipping, watercraft, stationary combustion sources (such as generators and boilers), and a range of non-road mobile machinery (including construction, mining, and airport support vehicles).

The current non-road diesel tax rebate makes diesel a low cost option for running such equipment, and this is impacting the market for lower emission technologies which are now becoming available, such as for transport refrigeration, lower emission fuels and technologies for heating and power generation. The non-road diesel rebate also costs the public purse £2.4 billion each year, compared to if duty was charged at the main rate.

The government will review whether the existing fuel duty rates for alternatives to petrol and diesel are appropriate, ahead of decisions at Budget 2018. **The government has launched a call for evidence on non-road mobile machinery usage, its impact on air quality, and the interaction between the availability of red diesel and uptake of cleaner technologies, especially in urban areas.**

## 4.5 Actions to drive clean growth and innovation

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- We will maximise the advantages for UK industry from the global shift to clean growth – through leading the world in the development, manufacture and use of technologies, systems and services that tackle air pollution.
- In partnership with UKRI, we will seek ways to support further investment in Clean Air innovation to enable the development of novel technologies and solutions that tackle emissions from industry, vehicles, products, combustion and agriculture and support both improvements in air quality and decarbonisation.
- Future energy, heat and industrial policies will together improve air quality and tackle climate change. Phasing out coal-fired power stations, improving energy efficiency, and shifting to cleaner power sources will reduce emissions of air pollution as well as carbon dioxide. As we phase out oil and coal heating, we will ensure this transition improves air quality wherever possible and cost effective to do so. In addition, the government will conduct a cross-departmental review into the role of biomass in future policy for low carbon electricity and heat, focusing on the air quality impacts. The proposed way forward will be set out in the final Clean Air Strategy.
- We will minimise the air quality impacts of the Renewable Heat Incentive Scheme, for example by tackling non-compliance and consulting on excluding biomass from the RHI if installed in urban areas which are on the gas grid. We will work across central and local government to put a plan in place. In addition, we will consult on making coal to biomass conversions ineligible for future allocation rounds of the contracts for difference scheme.
- We will hold an annual Green Great Britain Week, starting in autumn 2018, as announced in the Clean Growth Strategy. It will consist of events, public engagement and media activity focused on climate and air quality issues across the UK.
- We are seeking evidence on the uses of non-road diesel, mainly in urban areas, considering the air quality impacts and the potential for market distortion. The Treasury has also announced it will review how alternative fuel rates line up with rates of petrol and diesel ahead of Budget 2018.

## 4.6 Consultation questions

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- Q.7. What do you think of the package of actions put forward in the clean growth and innovation chapter? Please provide evidence in support of your answer if possible.
- Q.8. In what areas of the air quality industry is there potential for UK leadership?
- Q.9. In your view, what are the barriers to the take-up of existing technologies which can help tackle air pollution? How can these barriers be overcome?
- Q.10. In your view, are the priorities identified for innovation funding the right ones?



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# 5. Action to reduce emissions from transport

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## 5.1 Transport's importance for clean air

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An efficient transport system is an essential part of modern life and a healthy economy. Average levels of nitrogen dioxide at the roadside are at their lowest level since the government first started to collect these statistics. Emissions of nitrogen oxides have fallen by almost 27% between 2010 and 2016 and are also at their lowest level since records began. However road transport, shipping, aviation and rail are responsible for a significant proportion of air pollutant emissions: 50% of nitrogen oxides, 16% PM<sub>2.5</sub> and 5% of NMVOCs<sup>61</sup>.

**Transport therefore has a key role to play in reducing emissions and meeting the government's objectives on the environment and public health.** Emissions from road transport have been in the spotlight because of their impact on local air quality, but Government is committed to cutting air pollution from all forms of transport. In 2017, government published the UK plan for tackling roadside nitrogen dioxide concentrations and is already investing £3.5bn to reduce emissions from transport, cleaning up the air.

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## 5.2 Setting strategic direction for transport

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The Clean Growth Strategy published in 2017 includes measures which will reduce both CO<sub>2</sub> emissions and air pollutant emissions from the transport sector by supporting a shift to lower emission road vehicles and more active forms of travel (walking and cycling) for short journeys; and by accelerating the shift of freight from road to rail.

Delivering the significant air pollutant emission reductions we require demands transformational change for our transport network and how we use it. The tools and technologies that will help achieve this are becoming available. Many deliver broader benefits as well as improving air quality, such as greater energy security and reduced congestion. The Industrial Strategy, published in 2017, set the 'Future of Mobility' Grand Challenge for the UK to become a world leader in mobility. The Challenge is supported by the £1.7bn Transforming Cities Fund which aims to invest in new local transport infrastructure to boost productivity by improving public and sustainable transport connectivity.

We will shortly publish Road to Zero, our strategy for reducing exhaust emissions from road vehicles. This, together with the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations, sets out our approach to addressing exhaust emissions from road transport. These are not part of this consultation.

In this Clean Air Strategy we are also **setting out ambitious plans to drive down emissions in each major transport sector, including the announcement of forthcoming strategies for shipping and aviation.**

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## 5.3 Road transport

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### 5.3.1 Action to date

#### Exhaust emissions

Our most immediate air quality challenge is to reduce emissions of nitrogen oxides in the areas where concentrations of these harmful gases currently exceed legal limits. The UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations identifies 28 local authorities in England that are required to develop local plans to address exceedances on their roads in the shortest possible time. It also sets out the measures that the Mayor is taking forward in London. On 23 March 2018, government directed an additional 33 local authorities to conduct feasibility studies to identify measures that could bring forward NO<sub>2</sub> concentration compliance within the shortest possible time.

We are also laying new Regulations that will enhance our existing powers concerning vehicles with a prohibited defeat device. We expect to have these in place for cars, vans, motorcycles, tractors and non-road mobile machinery before the summer.

We will shortly publish Road to Zero, our strategy for reducing exhaust emissions from road vehicles. This, together with the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations, sets out our approach to addressing exhaust emissions from road transport. These are not part of this consultation.

We are also considering the impact that road infrastructure has on air pollution. The Road Investment Strategy (RIS) includes a £100m designated fund for work to tackle air quality concerns associated with existing and new road infrastructure.



## 5.3.2 Taking Further Action

### Non-exhaust emissions

Particulate emissions from non-exhaust sources are a result of the friction required for braking and maintaining traction on the road, which are essential for road safety. However, these particles are harmful to human health and the environment – and a source of microplastics in our oceans. The proportion of total emissions from non-exhaust sources has increased because of action to reduce emissions from other sources, including vehicle exhaust emission standards. We will undertake a call for evidence on tyre and brake wear. **Building on this, we will work with international partners seeking to develop new international regulations for particulate emissions from tyres and brakes through the United Nations Economic Commission for Europe.**

## 5.4 Maritime

The government is committed to driving down emissions from ships and reducing the impact of emissions from the maritime sector on the environment and public health. In 2016, domestic shipping (ships that start and end their journey in the UK) accounted for 11% of the UK's total domestic NO<sub>x</sub> emissions, 2% of PM<sub>2.5</sub> and 7% of SO<sub>2</sub><sup>62</sup>. In addition, international shipping (ships that go to or come from international destinations) emissions have a significant impact on air quality in the UK due to shipping lanes and engine operation while at UK ports.

### 5.4.1 Action to date

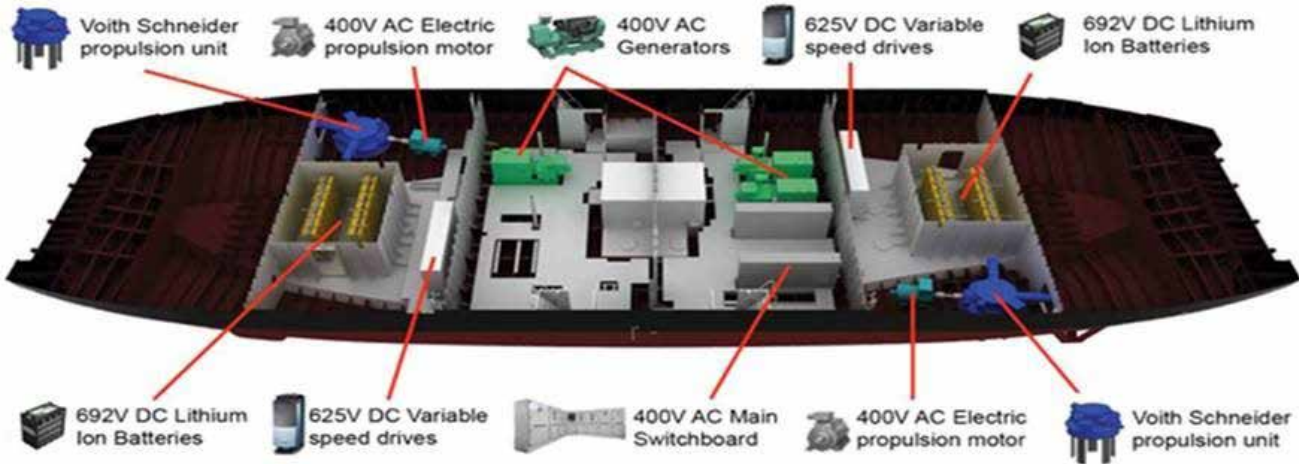
To date, the UK's main priority in tackling ship emissions has been exerting influence at an international level. We have played a leading role in negotiating international limits to pollutant emissions from shipping, e.g. through the North Sea Emissions Control Area (ECA) where a sulphur cap of 0.1% was introduced in 2015 (a ten-fold reduction from the 1% limit introduced in

2010). The International Maritime Organisation (IMO) has recently agreed a 0.5% sulphur limit for global shipping outside ECAs from 2020, a reduction of 3% from the current limit. The IMO has also agreed to the introduction of a NO<sub>x</sub> emissions control area for the North Sea from 2021 which will reduce the limit on NO<sub>x</sub> emissions from new ships operating in this area by around three-quarters.

The UK has been at the forefront of pushing for an ambitious strategy to reduce greenhouse gases (GHGs) from shipping at the IMO, where in April member states committed to phasing out GHG emissions from shipping as soon as possible in this century and by at least 50% by 2050. This sends a very clear message that a switch to zero emission technologies is now imminent, and will deliver benefits for air quality.



## Hallaig Hybrid Ferry Technical Layout



Environment will be a key theme of the Maritime 2050 Vision. As part of the vision, we will work with stakeholders to develop by spring 2019, the first UK Clean Maritime Plan setting out a number of policies to reduce greenhouse gases and pollutant emissions from shipping in parallel, and to underpin the long-term vision of zero emissions shipping.

This section focuses on actions to reduce the overall impact of shipping emissions on UK air quality in the short and medium term. It focuses on opportunities to reduce emissions from domestic shipping and ports activities.

We are improving our evidence base to produce a comprehensive body of data on emissions from all ships operating in UK waters.





## Case study 1: the port of London's green tariff

On the 1st January 2017, the Port of London Authority (PLA) introduced a discount on port charges for vessels with lower emissions, where the vessels meet an Environmental Shipping Index (ESI) score of 30 or above.

The ESI, developed by the World Ports Climate Initiative (WPCI), ranks ships' environmental performance based on factors including emissions of nitrogen oxide, sulphur oxide, and carbon dioxide. It provides a rating for ships that outperform the current International Maritime Organisation emission standards. On the Thames, qualifying vessels have the potential to receive a 5% discount on Thames Vessel Conservancy Charges. To qualify, a vessel must be registered within the ESI scheme and have an ESI score of 30 points or greater.

PLA has also developed an Air Quality Strategy to address air quality on the tidal Thames. This strategy which was published for consultation in December last year, aims to reduce river-based air pollution on the tidal Thames between Teddington and Southend and will be delivered through a five year action plan covering 2018 to 2022. The final version of the PLA AQ Strategy will be published in May 2018. Further details on the PLA's activities on air quality can be found on the [PLA website](#).

## Case Study 2: Government Support For The Uptake Of Cleaner Fuels/ Technologies Hydrogen-Fuelled Vessels On The Isle Of Man

In 2016, the UK government's Innovate UK part funded a project led by Cheetah Marine, an Isle of Man Company, which built and successfully tested a hydrogen-powered 9.95m catamaran. The catamaran was the first marine example of hydrogen internal combustion energy (HICE) technology, concluding with a 100km round the island voyage.

The consortium had 10 partners including ITM Power, specialists in hydrogen production facility, IBM, which were developing user interface software for the refuelling process and Arcola who produced a schools programme to involve children and raise awareness of hydrogen as a potential fuel for the future. The project has sparked significant interest and has highlighted the potential of zero emissions technology in the marine industry.

### 5.4.2. Taking further action on shipping

Using the comprehensive evidence base on maritime emissions, we will:

- By March 2019, consult on options for new domestic regulations to reduce pollutant emissions from domestic ships. This could be through the application of international emission standards.
- By March 2019 - we will consult on options for extending the current Emissions Control Areas (ECAs) in UK waters.
- By May 2019, all major English ports should produce Air Quality Strategies setting out their plans to reduce emissions across the port estate including ship and shore activities. These plans will be reviewed periodically to establish if the measures implemented are effective or further government action is required.
- By summer 2018, we will introduce a new government-led Clean Maritime Council to bring together different parts of the maritime sector to drive uptake of cleaner technologies and greener fuels.

## 5.5 Rail

Rail transport is generally considered to be a cleaner form of transport which makes a relatively small contribution to poor air quality (4 percent of NO<sub>x</sub> emissions and 1 percent of PM<sub>2.5</sub> emissions<sup>63</sup>, nationally) with overall emissions both less per passenger mile and tonne per km for freight when compared to other transport modes. It is clear, however, that more can and should be done to drive down emissions and improve air quality throughout the whole rail sector, not least as rail emissions have risen overall in absolute terms.

### 5.5.1 Action to date

Government has asked the industry to set up a taskforce that will look at how to decarbonise the rail industry and improve air quality through reducing harmful emissions produced by the rail industry. The approach of this task force will be holistic and examine the industry in the wider sense including for example, the impact of taxi traffic in and around stations. The industry task force will report back in autumn 2018.

As part of this, government has also challenged the taskforce to set out how the industry will meet the ambition of removing all diesel only trains by 2040 (encompassing both freight and passenger traction). This will be both stretching and challenging and will require an embracing of new technologies and innovation, including the possibilities of alternative fuels such as batteries and hydrogen

We have introduced progressively more stringent emission standards to drive down emissions from new rail engines since 1999 and have started implementation of Stage 5 standards, which will be introduced in 2020 and require a reduction in PM and NOx emissions of over 90% compared with a pre-1999 train.

We set carbon targets for rail franchises to reduce their greenhouse gas emissions which requires the replacement of the older diesel trains with new trains which are either electric, bi-mode or diesel compliant with more stringent emission limits.



Birmingham Midland Metro tram. Photo: DfT



## Change is already underway

- since 2017, the new Bi-Mode Class 800 – Intercity Express trains have been replacing Class 43 trains, delivering a reduction in emissions by complying with latest emission standards and by switching to electric mode where lines and stations are electrified
- there are examples of lower emission alternatives in use on the rail network, for example, in Birmingham there are light rail and tram alternatives which are helping to improve local air quality
- there are also bi-mode rail freight locomotives in service, including the new Class 88s which provide an environmental benefit as they are predominantly designed for electric mode but retain the ability to use diesel on non-electrified lines
- after poor air quality issues were identified at Birmingham New Street, industry introduced measures including reduced idling time to reduce air pollution

## 5.5.2 Taking further action to reduce emissions from rail

- we are developing the evidence and testing alternatives to conventional fuels. In particular we are looking at the viability of using alternative fuels including hydrogen fuel cells through research conducted by the Transport Systems Catapult project amongst others. This technology is already in use in Germany and is being developed for use in the UK within the next few years
- government will work closely with the decarbonisation task force and industry throughout 2018 and early 2019 to develop a range of measures to tackle decarbonisation and air quality within the wider rail industry including in stations
- we will develop options to reduce emissions from freight informed, among other sources, by the National Infrastructure Commission's Freight Study
- government is sponsoring the independent assessment of air quality at a range of stations to identify if there is a more widespread problem. This assessment will be completed in early 2019

## 5.6 Aviation

Aircraft contribute to air pollution while in the air, during take-off and on the ground. The biggest domestic impact of aircraft is during take-off and landing (1% of total NO<sub>x</sub> and SO<sub>2</sub> national emissions<sup>64</sup>). In addition, airports are large, complex sites with a range of emission sources and so can be of concern for local air quality. They also generate significant land journeys by passengers, workers and freight transport.

### 5.6.1 Action to date

The government works to improve international standards on emissions from aircraft and to challenge airports and local authorities (as appropriate) to improve local air quality.

The industry is taking action to cut airport-related emissions by operating aircraft more efficiently, introducing new lower emission technologies and practices, reducing vehicle emissions within the airport boundary, and improving public transport links to airports.

The government published a call for evidence for a new aviation strategy in July 2017 and, building on this, will consult on a new Aviation Strategy later this year.

### 5.6.2 Taking further action

- Government will consult on an Aviation Strategy in 2018 which will include measures to improve air quality.



## 5.7 Reducing emissions by modal shift

In addition to the actions for reducing emissions from each transport sector identified above, modal shift to lower emission modes of travel still plays a central role in reducing transport emissions. We remain committed to encouraging more sustainable modes of transport like cycling, walking and public transport, and shifting freight from road to rail.

### 5.7.1 Freight

Over three times as much freight is moved by road as by rail and water combined; so we recognise that in the short-to-medium term it would not be possible for that traffic to be accommodated on other modes. Nonetheless, our freight mode-shift grants<sup>65</sup> help remove in excess of 800,000 lorry journeys a year from Britain's roads.

Taking further action to reduce freight emissions, we will support industry research:

- We will support industry research into rail freight emissions and air quality to enable better comparisons with HGV emissions, to understand how a shift from road to rail can best be used to deliver a reduction in emissions of air pollutants
- developing and deploying cost-effective options for shifting more freight from road to rail, including low emission rail freight for delivery into urban areas with zero emission last mile deliveries

### 5.7.2 Active Travel

Encouraging an increase in cycling and walking for short journeys delivers a reduction in traffic congestion and emissions from road transport, as well as health benefits from more active lifestyles. Our Cycling and Walking Investment Strategy announced that £1.2 billion will be invested in cycling and walking from 2016-21 to double the level of cycling by 2025 and to reverse the decline in walking. This has included investing £101m through the Cycle City Ambition programme to improve and expand cycle routes between the city centres, local communities, and key employment and retail sites in eight cities to get more people cycling, as well as £80m to support local projects including training and resources to make cycling and walking safer and more convenient.

### 5.7.3 Public Transport

In 2017, we introduced the Bus Services Act which includes a range of measures to improve bus services through franchising and better partnership working. We have also announced the £1.7bn Transforming Cities Fund, which will drive productivity through improving public transport connectivity in some of England's largest cities. It aims to tackle congestion through increased public transport in major cities, which will have an impact on exhaust and non-exhaust emissions. £840m has already been allocated to the six mayoral combined authorities on a devolved basis and a Call for Proposals for access to the remaining £840m of funding was launched for non-mayoral city regions on 13 March 2018.

Modal shift to rail, particularly on electrified lines, can help to reduce road traffic congestion and emissions. The Department for Transport (DfT) has been working closely with the railway industry to reduce their emissions. Franchising has encouraged an increase in both the length of trains and the frequency of services to encourage passengers to travel by rail.

## 5.8 Non-Road Mobile Machinery

Non-road mobile machinery (NRMM) covers a wide range of machinery which moves or is intended to move (whether self-propelled or not) and contains a combustion engine. It includes agricultural machinery, construction equipment, non-sea faring boats, watercraft and a range of industrial equipment such as off road trucks, road resurfacing machines, mobile crushers and smaller household machinery such as lawn mowers and generators.

The sector is responsible for emissions of NO<sub>x</sub>, PM, SO<sub>2</sub> and VOCs. Emissions of SO<sub>2</sub> are controlled by setting the maximum sulphur content of the fuel, with the remaining key pollutants being subject to regulations setting the maximum emissions levels - which are enforced at the point where the engine (or the product into which the engine is installed) is placed on the market in the UK. As discussed in the Clean Growth section above, many types of NRMM are eligible to use red diesel, which attracts a lower rate of tax than road diesel.

We have already implemented more stringent emission standards, which are consistently applied across the wide range of engines used in NRMM. They will drive a reduction in emissions with the turnover of the NRMM fleet – however, we need better data to understand how quickly emissions will be reduced and what further action may be needed.

### 5.8.1 Taking further action to tackle emissions from NRMM

We will, as appropriate for the type of machinery:

- Grant LAs powers to impose minimum emission standards where required to tackle serious air pollution problems;

- introduce compliance checks, to ensure that the equipment has emissions within a specified tolerance of the regulated maximum emissions levels enforced when it was placed on the market

We have also launched last week a call for evidence on the use of NRMM, emissions from NRMM, use of red diesel and the availability of lower emission options. Informed by the responses to the call for evidence, we will take further action to reduce emissions from this source with options that may include but are not limited to:

- introducing a requirement for in-service compliance checks, to ensure that NRMM equipment emissions remain within agreed levels for their whole lifetime
- introducing controls over in-service operations to deter and penalise tampering to intentionally reduce the effectiveness of emission control devices
- establishing of a register of NRMM to enable local enforcement including, where appropriate, information of retrofitted equipment and compliance checks
- introducing an emissions labelling scheme where it can encourage uptake of lower emission equipment
- ensuring that emission standards continue to reflect what is technically achievable as new technologies develop, and drive down emissions of new equipment

## 5.9 Questions

- Q11. What do you think of the package of actions put forward in the transport chapter? Please provide evidence in support of your answer if possible.
- Q12. Do you feel that the approaches proposed for reducing emissions from Non-Road Mobile Machinery are appropriate or not? Why?

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# 6. Action to reduce emissions at home

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## 6.1 Emissions at home

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Up to now the public debate about air pollution has been focused on outdoor sources of air pollution. In recent years, this has been concentrated particularly on emissions from cars and other vehicles. **One aim of this strategy is to raise awareness of the breadth of everyday activities that contribute to air pollution.** Many of these activities take place in and around the home. This is important because, alongside our strong commitment to meeting our legally binding targets to reduce the amount of pollution in our atmosphere, the government's priority is to minimise human exposure to air pollution.

The principal forms of indoor air pollution are particulate matter (PM) and Non-Methane Volatile Organic Compounds (NMVOCs). PM is produced by many forms of cooking and home heating, most notably from combustion in open fires and stoves. NMVOCs are emitted by a wide variety of chemicals that are found in carpets, upholstery, paint, cleaning, fragrance, and personal care products. Sulphur dioxide (SO<sub>2</sub>) is emitted by coal burned in open fires.

Indoor air pollution both increases personal exposure and contributes to our overall national emissions as most of these indoor emissions end up in the atmosphere. There are simple, practical steps that we can all take to reduce our exposure such as ensuring homes are adequately ventilated, and making informed choices about the products we use.

These indoor emissions can have a significant impact for some people and add to everyone's incremental exposure over the life course. Studies have found that as much as 90% of the day is spent indoors where the levels of some air pollutants are often far higher than outside<sup>66</sup>. Awareness of the exposure that takes place in the home is currently very low. **The government's objective is to raise awareness of the potential impacts of air pollution at home and ensure that consumers are armed with reliable information enabling them to make informed choices to protect themselves, their families and their neighbours.**

## 6.2 Domestic burning

Open fires and wood-burning stoves have risen in popularity over recent years. They are now an additional form of heating for many households in both urban and rural areas; for a minority they may be the sole heat source. In addition, we have seen the growth of biomass boilers for home heating. This increase in burning solid fuels in our homes is having an impact on our air quality and now makes up the single largest contributor to our national PM emissions at 38%<sup>67</sup>. This compares with industrial combustion (16%) and road transport (12%). What people burn and the appliance they use will have a significant impact on emissions. A recent report by King’s College London<sup>68</sup>, measuring local concentrations, found that wood burning accounts for up to 31% of the urban derived PM<sub>2.5</sub> in London. This change in behaviour means that the boundaries of smoke control areas (where it is illegal to allow smoke emissions from the chimney of your building) that were established in the 1950s, no longer necessarily align with those areas with high levels

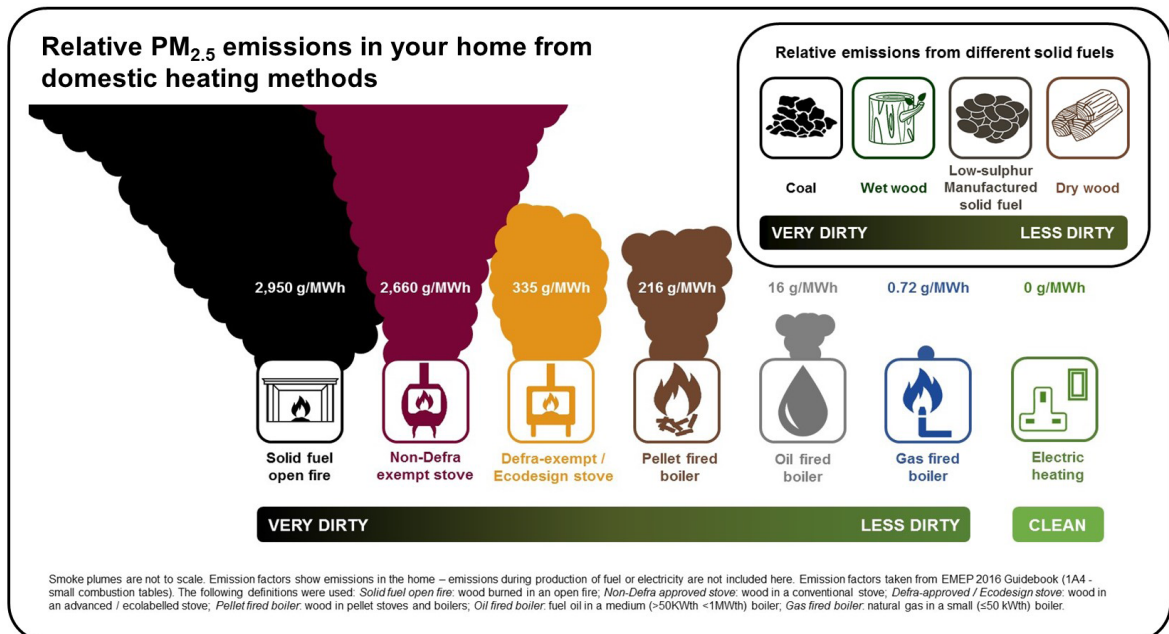
of domestic burning. Whilst this legislation is still helpful to reduce the impact of burning in those areas, a more widespread solution is needed.

While emissions from domestic burning and other sources have reduced significantly since the 1950s, the evidence on the adverse health impacts from air pollution has also grown during that time, showing that, even at today’s lower levels, significant harm can be caused. We are more aware of the impacts of indoor air pollution and how it can affect people with open fires and stoves in their homes. We also have a better understanding of how pollution travels through the atmosphere, meaning that pollution emitted in one area can have an effect far away. It is therefore more appropriate to consider a nationwide approach to reduce the impact of domestic burning on air quality and the health of all citizens.

## 6.3 Reducing the impact of domestic burning

Not all forms of domestic burning are equally polluting. The appliance (e.g. stove or fireplace), how well it is used and maintained and what fuels are burnt in it, all make a big difference to how much pollution is produced. Significant air quality benefits can be realised through a new efficient appliance as compared with an old stove or open fire. There are simple steps that households can

take to limit emissions both indoors and out. Using cleaner fuels, in a cleaner appliance which is installed by a competent person, knowing how to operate it efficiently, and ensuring that chimneys are regularly swept, will all make a big difference. Defra has developed [simple guidance](#) for all local authorities to share with residents on these simple steps.





### **6.3.1 New powers for local government**

Smoke control areas are specific areas, designated by local councils, where it is illegal to allow smoke emissions from the chimney of your building. In these areas you can only burn authorised fuels or use an appliance (e.g. a stove) which has been exempted for use in the area. Local authorities have advised that awareness of, and compliance with, smoke control area legislation is low and that few people make the link between domestic burning and air pollution. Some local authorities are working to raise awareness of smoke control areas and to re-assess their boundaries. However, they have told us that smoke control areas can be hard to enforce.

That is why in future we will focus on a nationwide approach to smoke control which can be built upon as appropriate by local authorities. We will give local authorities powers to go further in areas of high pollution, for example exploring what further steps government can take to enable local authorities to encourage 'no burn days' during high-pollution episodes.

### **6.3.2 Ensuring only the very cleanest stoves can be bought and installed**

In 2022 new, tougher emissions standards<sup>69</sup> will come into effect for all new domestic stoves. This will raise the standard of appliances across the whole country.

These more stringent emission limit requirements for solid fuel appliances will need to be coupled with a more effective approach to testing. The government is consulting with UK industry and test houses on an approach that will better reflect the way appliances are used in people's homes.

### **6.3.3 Ensuring only the cleanest fuels are available for sale**

We will simplify and update legislation to protect consumers so that only the cleanest fuels are available for sale. In January this year, government issued a Call for Evidence on domestic burning of house coal, smokeless coal, manufactured solid fuel and wet wood sold in small quantities for immediate use. The purpose was to identify appropriate action on wood which would enable people who buy wood in large quantities and season it at home to continue to do so, but to reduce the sale of wood that has not been seasoned or dried, which is highly polluting when burned. In addition, we wished to understand the impact of phasing out the sale of the most polluting mineral fuels, such as bituminous house coal or high-sulphur smokeless fuels. We will be taking the evidence and views submitted to develop a final proposal for legislative changes, and potential exemptions, which will be consulted upon in the summer.

High sulphur content fuels are harmful to human health and the environment. They also cause damage to stoves and chimneys. At present the sulphur content of solid fuels is limited to 2% in smoke control areas but not elsewhere. It is hard for consumers to identify at point of sale whether a product is high sulphur or not. Government intends to extend this 2% sulphur limit nationwide to ensure that consumers are protected against cheaper, dirtier alternatives.

In addition, new fuels are now entering the market made from a variety of wastes and recycled products. The government wishes to encourage innovation, but it is essential that all products are safe to use and that consumers understand what they are buying. Government will work with industry to identify an appropriate test standard for new solid fuels entering the market.

## Responses to our call for evidence

In response to our Call for Evidence, we received evidence from a wide range of respondents, some of whom called for a total ban on domestic burning, primarily due to personal experience of nuisance or health impacts. Others felt that there should be no restrictions at all or were concerned about the impact on those in fuel poverty.

Some suggested that more should be done to help inform consumers; many are unaware of the impacts of burning waste or cheaper fuels, and some unscrupulous suppliers market wood as seasoned, when it is not. Many chimney sweeps highlighted the point that how a stove is used can have a significant impact on emissions.

Most wood fuel businesses which responded indicated that they would be able to adjust to any proposed regulations on fuel standards. However, most coal businesses felt less able to adjust and were concerned about the impact. This feedback will be taken on board and inform policy. We will consult carefully on the appropriate phase in periods for wood and coal.

### 6.3.4 Voluntary industry initiatives

The stove, fuel and chimney sweep industries have been proactive in recognising the benefits to them and their customers from promoting those fuels, stoves and actions which will reduce air quality impacts. This is making it easier for consumers to understand the benefits of cleaner fuels, appliances and chimneys.

**Woodsure's** 'Ready to Burn' scheme, backed by government, enables consumers to easily recognise which wood is dry, and ready to take home and burn, instead of wood which is wet and must be seasoned for up to 2 years prior to burning. This can reduce emissions by 50% and in some cases is better value for money.

#### Case study particulate matter – 'Ready to Burn'

Particulate matter (PM) emissions are increasing, which has a significant impact on human health. It is widely recognised that domestic wood burning is the primary single contributor, accounting for 34% of PM<sub>2.5</sub> emissions in 2016<sup>70</sup>.

Defra met fuel industry representatives in January 2017 to discuss and identify ways to reduce emissions from wood fuel. This led to the wood fuel industry launching the 'Ready to Burn' scheme in September 2017. It aims to raise consumer awareness and educate wood-burning stove owners about the importance of burning clean, dry, quality logs to help reduce air pollution.

The scheme sets a benchmark for logs and other wood fuels in the UK to help consumers to identify wood that has been carefully chosen and is 'Ready to Burn' for the benefit of their appliance and the environment. The initiative is being led by Woodsure, the UK's only wood fuel quality assurance scheme, and supported by Defra. Suppliers signing up to the scheme provide a guarantee that the fuel they sell as 'Ready to Burn' has a moisture content of 20% or less, meaning that it can be burned without the need for further drying out. To date, 70% of major UK suppliers have signed up to the scheme.



A 1kg freshly cut log can contain around a pint of water. Burning off all that water takes a lot of energy from the fire and creates a lot of smoke!

The Stove Industry Alliance has introduced the Ecodesign Ready brand ahead of the implementation of the ecodesign provisions due to be introduced in 2022. This shows consumers which stoves are already compliant with the key components of the new legislation and therefore can have up to 90% lower emissions than an open fire or old stove.



We have worked with chimney sweep organisations to provide advice to chimney sweeps and householders. They have developed an [informative website](#) and guide which provides clear advice on how to save money and reduce pollution by following certain simple rules.



We are working with industry bodies such as HETAS<sup>71</sup> and the Stove Industry Alliance<sup>72</sup> on a dedicated campaign to inform retailers of Ready to Burn and Ecodesign Ready, providing free point of sale information for consumers and technical bulletins for industry and trade. This is alongside updated training and work with education providers to ensure that stove retailers and installers understand their role in educating the consumer on the benefits of buying the right stove and using an accredited installer, using the correct fuels, and ensuring regular servicing/ chimney sweeping. Together, these actions can safeguard consumers and will have a big impact on the level of emissions from domestic burning.

The way in which we use our stoves can have a big impact on air quality and how long the chimney and stove will last. A local professional sweep can help consumers get it right, ensuring that they get the most from their stoves and provide advice on optimum operation. This can help save money and avoid chimney fires. It is recommended that a chimney is swept twice a year.

## 6.4 Biomass boilers

Around 2% of households burning biomass have biomass boilers to heat their homes. In general the air quality impacts of these installations are much lower than open fires and stoves, although they could have local impacts. However, like stoves, the emissions can vary depending upon the quality of the installation, the fuel used and how it is maintained. Government will raise awareness of these factors through working with

industry and developing clear guidance for local authorities, regulators and households to reduce the air quality impacts from biomass installations. In addition, as set out in chapter 4, we are committed to reducing the air quality impacts of the Renewable Heat Incentive.





## 6.5 Actions to reduce emissions from domestic burning

- We will legislate to prohibit sale of the most polluting fuels.
- We will ensure that only the cleanest stoves are available for sale by 2022.
- We will give new powers to local authorities to take action in areas of high pollution, bringing legislation into the 21st century with more flexible, proportionate enforcement powers.
- We will work with industry to identify an appropriate test standard for new solid fuels entering the market.
- We will ensure that consumers understand what they can do to reduce their impact from burning.

## 6.6 Non-methane volatile organic compounds (NMVOCs)

Volatile organic compounds (VOCs) are chemicals which evaporate into the air at room temperature. They are emitted from many sources, including production processes, household chemicals, solvent use and different kinds of combustion. Non-methane volatile organic compounds (NMVOCs) are VOCs with the exclusion of methane (natural gas). Methane is already subject to emission controls as a greenhouse gas, so we have not duplicated these in our national emissions ceilings.

Fossil fuels produce NMVOCs either directly as products (for example, vapour from petrol) or indirectly as by-products (for example, vehicle exhaust gas). NMVOCs are also commonly found in paints, carpeting, furniture, adhesives, cleaning products, personal care products and a range of other building and interior materials. If a product has a strong smell, there is a good chance it contains NMVOCs.

In the past most NMVOC emissions came primarily from larger point sources such as refineries and fuel pipelines. However, as these have become increasingly well-regulated, the scientific community is becoming more aware of the significant proportion that arise from diffuse sources, such as the use of products in the home. Many NMVOCs have low levels of toxicity in isolation but may react to form chemicals which are much more harmful.

When products containing NMVOCs are used, concentrations within the home can often exceed ambient outdoor concentrations, particularly if ventilation is poor. How well a home is ventilated is down to a mixture of occupant behaviour, the ventilation system provided, and the natural leakiness of the home. We therefore encourage people to regularly ventilate their homes. Indoor concentrations of NMVOCs also contribute to the overall level of UK NMVOC emissions.



## NMVOCs outdoors

Outdoors, NMVOCs react with other pollutants in the air in the presence of sunlight to cause ground level ozone and particulates. Ozone can cause short term physical symptoms such as inflammation of the mouth, eyes, nose, throat and lungs, in addition to causing damage to ecosystems. Industrial NMVOC emissions are subject to a range of controls. By requiring producers and users to apply for environmental permits, we limit VOC emissions from a wide range of industrial solvent activities, including printing, surface cleaning, vehicle coating, dry cleaning and the manufacture of footwear and pharmaceutical products. These set strict emission limits and can require reductions in emissions over time. These permits require regulated businesses to use the Best Available Techniques as agreed by industry, regulators, health and environmental groups.

VOC emissions into the atmosphere from petrol during storage, distribution to service stations, and refuelling of petrol cars at service stations are controlled via the requirement to install petrol vapour recovery systems. Since the early 1990s standards on VOC emissions from new cars sold in Europe have been in place, requiring the fitting of three-way catalysts to all new petrol cars to significantly reduce emissions of CO, NO<sub>x</sub> and VOCs. A significant reduction of VOC emissions has been achieved by systems to collect fuel vapour from petrol pumps as vehicles are refuelled – the systems suck up vapours which would otherwise evaporate into the atmosphere. This is why petrol stations no longer smell as strongly of fuel as they used to.

The VOC content of paint products is limited through the Paints Regulations to minimise VOC emissions during use. There may be opportunities to improve awareness and enforcement of these limits, especially in sectors where they are under-recognised.

There is also a range of emerging approaches and alternatives that may reduce VOC emissions further over time. These include replacement of solvent-based adhesives with alternatives, including solid or reactive adhesives which do not release solvents, or with water-based adhesives which generally contain much lower concentrations of VOCs. These will not be suitable for all applications, but there is scope for wider take-up.

Abatement techniques are already applied in certain sectors and could potentially be taken up more widely. There are also emerging opportunities for switching to low or no VOC alternatives to existing products and processes. For example, new agrochemicals products have been developed with lower solvent contents. There are also emerging VOC-free dry cleaning options, including wet cleaning and CO<sub>2</sub>, although none of these are yet as effective as the most commonly used solvent, perchloroethylene, and they can be more expensive.



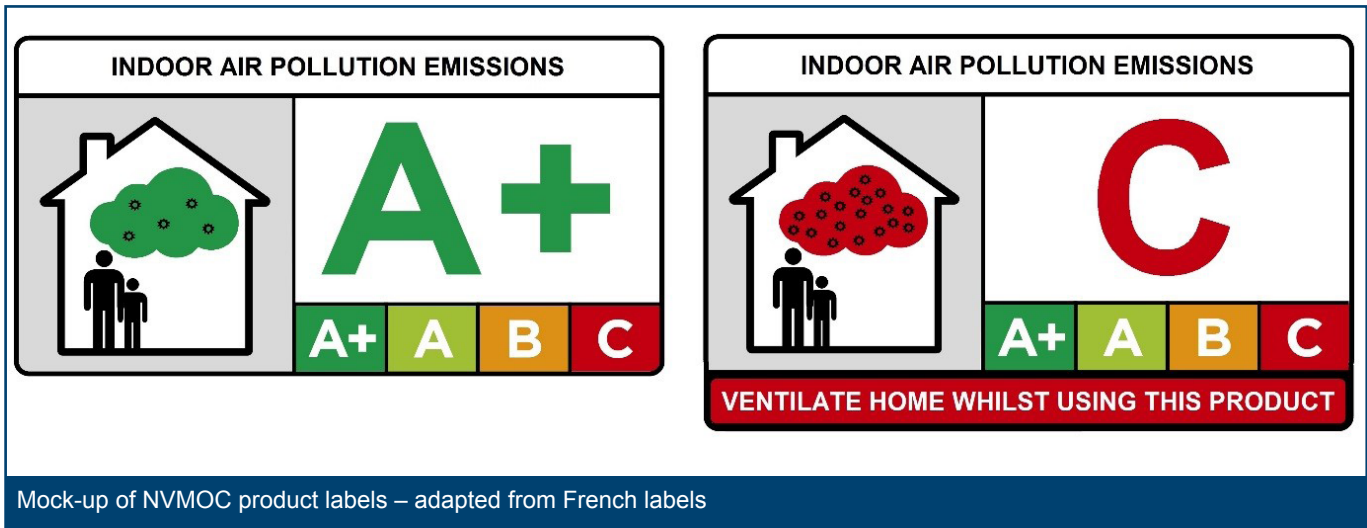
### 6.6.1 Reducing exposure to NMVOCs at home

Indoors, while NMVOCs do not react with sunlight in the same way as they do outdoors, they do still react in the air to form other chemicals. For example, many fragrances in common household and personal care products include limonene and alpha pinene (responsible for citrus and pine scents). These have a low level of toxicity, but once released into the air indoors they can react to form new chemicals. These include harmful substances such as formaldehyde, a well understood secondary product of fragrance chemicals.

There are a number of practical ways to reduce indoor air pollution from VOCs, which can be as simple as switching to lower VOC alternatives, such as unperfumed cleaning products, and ensuring that homes are well ventilated to avoid an accumulation of emissions from multiple sources.

Currently, with the exception of the Paints Regulations, there are few provisions limiting the VOC content of products used in the home. We will improve understanding of exposure to VOCs within the home, working with industry, academia and health organisations. Recognising the impact of high-VOC products, both in the home and once ventilated outdoors, we would like a wider range of low-VOC alternatives to many household products. Many products contain VOCs to enable their function, for example, propellant in aerosol cans, but many other products contain VOCs as an added extra, for example, fragrance in soap. The government will work with industry on how best to enable consumers to make informed choices about what they use in their homes, and to switch to low-VOC content products wherever possible. Options include the development of a voluntary labelling scheme for NMVOC-containing products; example mock-ups of these labels are given below.

The science about the impacts of indoor use of products containing VOCs is developing rapidly. The government will work with industry to take account of this emerging evidence base. We want to develop voluntary approaches wherever possible and will look at regulation where necessary.





### 6.6.2 Actions to reduce emissions of NMVOCs in the home

- We will work with consumer groups, health organisations and industry to improve awareness of NMVOC build-up in the home, and the importance of effective ventilation to reduce exposure.
- We will work with consumer groups, health organisations, industry and retailers to better inform consumers about the VOC content of everyday products. We will explore a range of options including the development of a voluntary labelling scheme for NMVOC-containing products, and assess its potential effectiveness.
- We will work with consumer groups, health organisations, industry and retailers to promote development of lower VOC-content products and to reduce emissions from this sector.

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## 6.7 Questions

- Q13. What do you think of the package of actions put forward to reduce the impact of domestic combustion? Please provide evidence in support of your answer if possible.
- Q14. Which of the following measures to provide information on a product's non-methane volatile organic compound content would you find most helpful for informing your choice of household and personal care products, and please would you briefly explain your answer?
  - information on manufacturer website
  - leaflet at the point of sale
  - inclusion in advertising campaigns
  - other option
- Q15. What further actions do you think can be taken to reduce human exposure from indoor air pollution?

# 7. Action to reduce emissions from farming

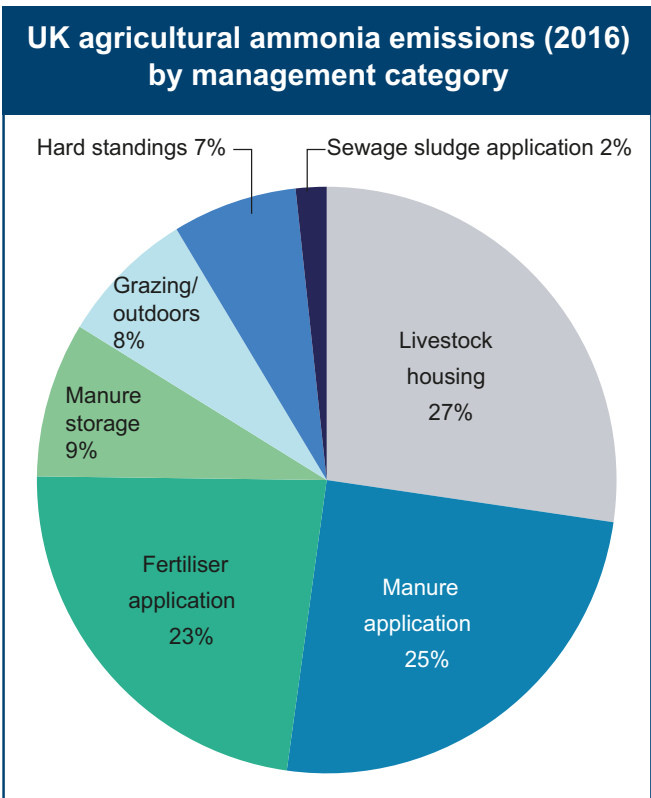
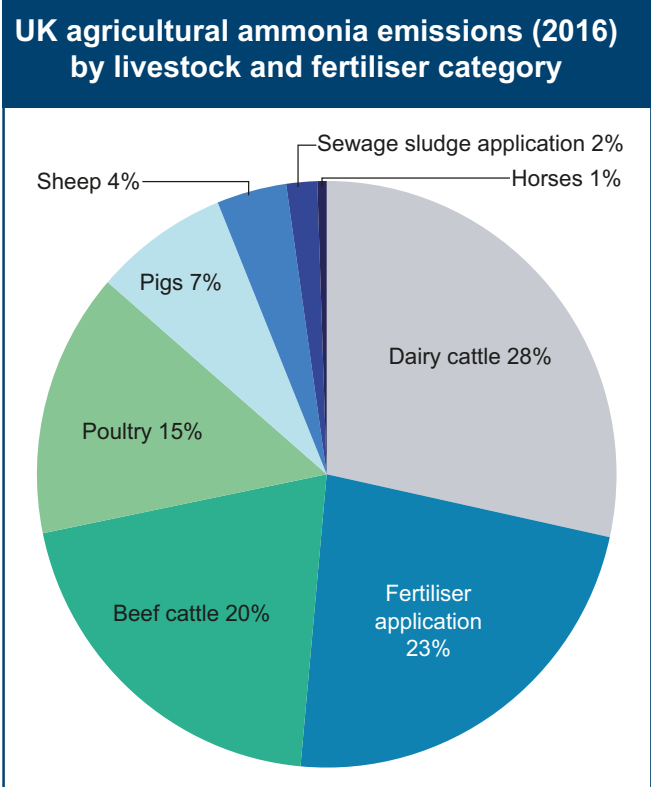
## 7.1 Agriculture and air quality

Agriculture is at the heart of our rural communities, producing high quality food and creating and maintaining the beautiful landscapes we all enjoy. Farming has a role to play in protecting our environment by keeping our air and rivers clean, improving our soils, and providing habitats for our wildlife. As set out in the 25 Year Environment Plan, we will support farmers and land managers to provide public goods and enable them to meet rules to control pollution.

Ammonia is emitted during storage, land-spreading and deposition of manures and slurries, and from application of inorganic fertilisers. The agriculture sector is the main source of ammonia, accounting for 88% of UK emissions in 2016<sup>73</sup>. Ammonia reacts with nitrogen oxides and sulphur dioxide to form secondary particulate matter which significantly impacts on human health. Most notably, ammonia contributes to smogs in urban areas. Ammonia also damages sensitive habitats as described in Chapter 3.

Agriculture also accounts for around 51%<sup>74</sup> of methane emissions and 14%<sup>75</sup> of NMVOC emissions. These contribute to ozone formation, which can cause harm to human health and to key agricultural crops and flowering plants as detailed in Chapter 3. In a typical year, ozone damage is estimated to reduce yields of wheat, potato and oilseed rape by around 5%<sup>76</sup> in the UK. Ozone also damages horticultural crops such as spinach, lettuce and spring onions. Many of the farm practices that can be used to reduce ammonia emissions also reduce emissions of NMVOCs.

The pie charts (right) give a breakdown of agricultural ammonia emissions by source. Cattle farming, particularly dairy farming, accounts for a substantial proportion of ammonia emissions whereas extensively grazed livestock, which are not housed, make a small contribution to ammonia emissions.



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## 7.2 Existing regulation and policies affecting ammonia emissions

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A number of existing frameworks are in place to limit ammonia emissions from agriculture. Intensive pig and poultry farms are point sources of ammonia emissions and those over a certain size are regulated under the Environmental Permitting Regulations in England. Operators of intensive farms over specified thresholds must hold an environmental permit which requires adoption of Best Available Techniques for their production processes to reduce emissions to

air, water and land. The use of these techniques reduces emissions from these facilities by around 30%. At present, around 1,260 English pig and poultry farms hold permits. The planning regime plays an important role in protecting habitats that are sensitive to nitrogen deposition from sources of ammonia emissions, such as animal houses and slurry stores. Policies such as Farming Rules for Water, the Nitrates Regulations and measures within existing agri-environment and farm advice schemes also help to reduce ammonia emissions.

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## 7.3 Reducing Ammonia Emissions

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Farmers can take practical action to reduce ammonia emissions.

### **Key measures to control ammonia emissions from farming**

- covering slurry and digestate stores and manure heaps or using slurry bags
- using low emissions techniques for spreading slurries and digestate on land (for example, by injection, trailing shoe or trailing hose)
- incorporating manures into soils rapidly after spreading (at least within 12 hours)
- washing down animal collection points soon after use
- ensuring that levels of protein in livestock diets are well matched to nutritional needs
- switching from urea based fertilisers to ammonium nitrate, which has lower emissions, injecting urea into soil or applying it alongside a urease inhibitor

The sources of ammonia emissions (slurries, manures, etc.) also cause nitrate and phosphate pollution to our surface waters and groundwaters. Across England and Wales, agriculture is estimated to account for up to 60% of nitrate losses to the water environment, and also nationally, 25% phosphate, of 75% sediment loadings in rivers, and 80% of nitrate pollution to groundwaters. These actions to reduce ammonia emissions will help to improve nitrogen use efficiency, which can improve water quality and reduce greenhouse gas emissions. Some of these practices will also save farmers money on inorganic fertilisers.

Widespread implementation of these kinds of measures across the farming sector is expected to reduce ammonia emissions in line with our 2030 targets. In addition to these measures, there is a need for specific localised action on ammonia to help deliver our nature objectives.

### 7.3.1 Learning from international experience

Action in other European countries has already effectively reduced ammonia emissions in this way.

#### Netherlands

The Netherlands reduced ammonia emissions by 64% between 1990 to 2016<sup>77</sup> through actions including:

- regulating to ensure manure is applied using low-emission spreading equipment
- regulating to ensure slurry stores are covered
- funding for manure banks to supply arable farms with excess manure and reduce over-application on livestock farms
- providing financial support for a voluntary industry strategy to develop and install low-emission animal housing
- regulating to ensure that all new housing since 2007 meets low-emission criteria; suitable housing is recognised by the government through a certification scheme

- providing grants for research into innovative manure management techniques and subsidies, and tax breaks to support investment in the new technologies
- establishing farmer networks for knowledge transfer and peer-to-peer support

The overall improvement in nutrient management in the Netherlands has been estimated to cost €500 million annually, but resulted in annual societal benefits of €900-3,700 million, including €150 million in fertiliser savings for farmers.

#### Denmark

Denmark reduced ammonia emissions by 40%<sup>78</sup> between 1990- and 2016 through actions including:

- regulating to ensure manure is applied using low-emission spreading equipment (band spreaders or injection), and spreading in winter is limited to certain crops
- regulating to ensure slurry stores are covered
- regulating to ensure solid manure must be incorporated into bare soil within 6 hours
- permitting most farms, requiring a fertiliser plan and adherence to nitrogen application limits; small farms do not require a permit, but are incentivised to create a fertiliser plan by a tax relief on mineral fertiliser
- allocating the majority of their EU funded rural development programme to tackling pollution
- setting nitrogen limits at up to 18% below the economic optimum level; this was raised in 2015 to the economic optimum level
- limiting the amount of mineral fertiliser available for purchase; all purchases are recorded automatically on a farm's online fertiliser plan



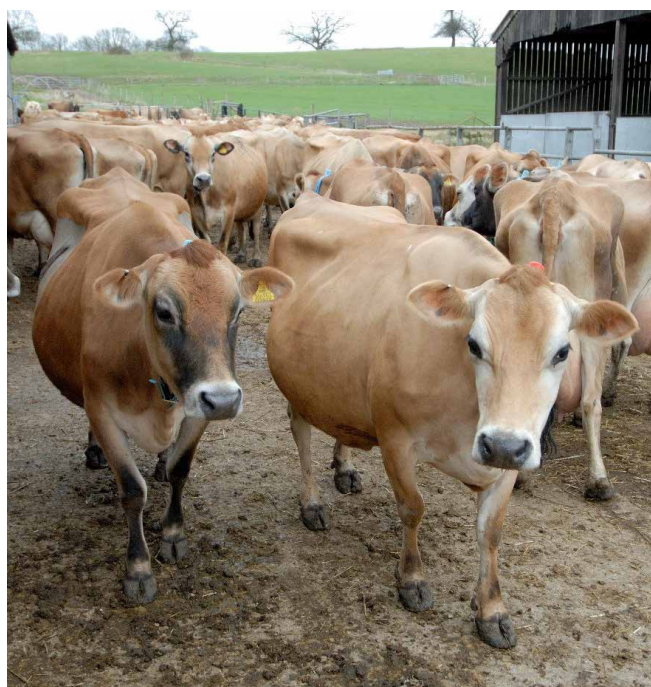
### 7.3.2 Current action

The government is already acting to help farmers to reduce ammonia emissions. The focus of action so far has been on enabling farmers to invest in the equipment that will help to achieve this objective. As a first step, we provided practical help for farmers through the Farming Ammonia Reduction Grant Scheme which funded slurry store covers, and on-farm advice. Funding is now available through the Countryside Productivity Scheme to help farmers purchase manure management equipment including low-emission spreaders and through the Countryside Stewardship Scheme for slurry tank and lagoon covers for farmers in priority water catchments.

We are also working with farming organisations to increase the uptake of best practice and signpost available grant funding for low emissions farm equipment and infrastructure through a number of routes. We are supporting industry action, led by the Campaign for the Farmed Environment which has run workshops on reducing ammonia emissions and improving nutrient use efficiency this spring. We are also delivering a £3m programme of support to farmers over the next 3 years. This will start with demonstration events across the country in autumn 2018, showcasing low-emission spreading equipment and providing advice on other practical mitigation methods, such as slurry and manure storage, housing, animal feed and fertiliser use. Practical help to reduce

ammonia emissions will be available to farmers in high priority water catchment areas through their catchment sensitive farming officer by the end of the year.

We are developing a national advisory code of good agricultural practice to reduce ammonia emissions in collaboration with farming organisations, which will be published later this year. We will explore whether the code could form the basis of a clean air standard within a wider gold standard for farmers.



## 7.4 Cutting ammonia emissions from farming

More still needs to be done to reduce emissions of ammonia in line with our targets. To achieve this, we will introduce clear, proportionate regulations. We are seeking views on 3 possible approaches to regulation (see Section 7.4.2). The government has recently consulted on the future of agriculture policy in England. In future, financial support for the farming sector will be focused on delivering improvements to the environment, including air quality and protection of the habitats impacted by it. For most farmers, changing practice to reduce emissions will incur some costs. Therefore, we will require and support farmers to make investments in the farm infrastructure and equipment that will reduce emissions.

A future environmental land management system will fund targeted action to protect habitats impacted by poor air quality. Achievement of our 2030 air quality targets will reduce the pressure of emissions on semi-natural habitats. However, despite projected improvements, some vulnerable habitats will still be exposed to nitrogen deposition and atmospheric levels of ammonia that are greater than they can tolerate. Natural England is currently examining options to improve the effectiveness of incentive schemes for mitigating ammonia emissions to air and protecting natural ecosystems. In addition, we will commission further work to determine how these habitats might be protected most effectively through new environmental land management schemes.

## 7.4.1 Improving the evidence base

The UK's ammonia inventory compares favourably to those compiled in other countries and UK academics have actively shaped the guidance used internationally for compiling agricultural emissions inventories. A lot of work is being done by farming organisations and advisers to improve uptake of best practice to reduce ammonia emissions. We will continue to work with the agriculture sector to ensure the ammonia inventory reflects existing farming practice and the latest evidence on emissions.

## 7.4.2 We will regulate to reduce ammonia emissions from farming

The three approaches proposed below could be introduced separately or in combination; we welcome views on these.

### 1. Introduction of nitrogen (or fertiliser) limits

The 25 Year Environment Plan sets out our commitment to work with farmers to improve fertiliser use efficiency. The plan states that we will “put in place a robust framework to limit inputs of nitrogen-rich fertilisers such as manures, slurries and chemicals to economically efficient levels backed up by clear rules, advice and, where appropriate, financial support”.

Fertiliser recommendations for different crops are published by the Agriculture and Horticulture Development Board in the fertiliser manual (RB209). The recommendations advocate application of fertilisers in accordance with the economic optimum to the farmer for that crop, taking into account both fertiliser price and crop prices.

In order to determine nitrogen limits which would effectively reduce ammonia emissions to meet ammonia targets, it would be necessary to set them at a level which reflects the costs of fertiliser application to the environment either at the farm, local, regional or national level. Given the impact of fertilisers (including organic fertilisers such as manures and digestates) on water quality and on greenhouse gas emissions, we propose that the limits should take an integrated approach, considering all these impacts.

We will task a group of independent specialists to make recommendations by November 2019 on the maximum limits that should be applied for (organic and inorganic) fertiliser application, taking account of economic efficiency and commitments to reduce ammonia and greenhouse gas emissions from agriculture and to protect sensitive habitats and water bodies.

The advantage of setting limits is that farmers would have the freedom to choose how to optimise the use of nitrogen to best suit their chosen method of production. It may also encourage the farming sector and its suppliers to develop and adopt innovative approaches.

### 2. Extension of environmental permitting to large dairy farms by 2025

Ammonia emissions arising from dairy cattle accounted for around 28%<sup>79</sup> of UK agricultural ammonia emissions in 2016. However, emissions from the dairy sector are not currently regulated. Given their contribution to ammonia emissions and other pollutants, there may be a case for adopting similar controls for the largest dairy farms to those currently applied to intensive pig and poultry units under the environmental permitting regime. In the UK, around 60% of ammonia emissions from dairy farms are from farm premises with over 150 cows<sup>80</sup>.

This approach would require industry and government to agree appropriate emission limits and Best Available Techniques for the sector, and regulated farms would then be given time to implement the proposals. It is proposed that the requirements should be implemented on the largest dairy farms by 2025.

It is anticipated that other policies would be needed, in addition to the extension of environmental permitting to large dairy farms, in order to meet the ammonia emissions reduction targets.

### 3. Rules on specific emissions-reducing practices

We propose to introduce the following rules through regulation:

- a requirement to spread urea-based fertilisers in conjunction with urease inhibitors, unless applied by injection on appropriate land by 2020



- mandatory design standards for new livestock housing by 2022; we propose that the standards would be developed in conjunction with industry and cover at least poultry, pig and dairy housing
- a requirement for all solid manure and solid digestate spread to bare land to be incorporated rapidly (within 12 hours) by 2022
- a requirement to spread slurries and digestate using low-emission spreading equipment (trailing shoe or trailing hose or injection) by 2027
- the requirement for all slurry and digestate stores and manure heaps to be covered by 2027

This approach provides farmers, farm suppliers and farm service providers with certainty about the investments and farm practice changes needed. Adoption of these measures is likely to deliver the majority of the ammonia emissions reductions needed to meet emissions reduction targets by 2030.



## 7.5 Action to reduce emissions from farming

- we will provide a national code of good agricultural practice to reduce ammonia emissions
- we will regulate to reduce ammonia emissions from farming and are seeking views on 3 possible approaches to regulation
- we propose to require and support farmers to make investments in the farm infrastructure and equipment that will reduce emissions
- we propose that a future environmental land management system should fund targeted action to protect habitats impacted by ammonia
- we will continue to work with the agriculture sector to ensure the ammonia inventory reflects existing farming practice and the latest evidence on emissions
- we will task a group of independent experts to make recommendations by November 2019 on the maximum limits that should be applied for (organic and inorganic) fertiliser application, taking account of economic efficiency and commitments to reduce ammonia and greenhouse gas emissions from agriculture, and to protect sensitive habitats and water bodies

## 7.6 Ammonia emissions from anaerobic digestion

Anaerobic digestion (AD) is an effective treatment for organic waste which produces renewable fuel, heat or energy and a nutrient rich by-product, digestate, which can be used as a fertiliser. AD also helps to avoid greenhouse gas emissions associated with manure storage and waste disposal to landfill.

As well as these positive impacts on the environment, ammonia emissions released during the AD process and during the storage and spreading of digestate account for around 3% of UK ammonia emissions<sup>81</sup>. Over recent years the AD industry, and the ammonia emissions associated with it, have grown rapidly in response to incentives to encourage the use of renewable heat and energy. We expect the AD industry to continue to grow in scale while these incentives are offered.

Ammonia emissions from digestate can be reduced by covering stores and using low-emission spreading equipment. Many AD facilities are subject to environmental permits requiring digestate stores to be covered which helps to reduce ammonia emissions. Digestate can give rise to more ammonia emissions than the fertilisers it is likely to replace. The spreading of digestate accounts for the majority of emissions from AD, and it is therefore important that it is spread in accordance with good practice guidance.

We are considering options for ensuring that, in future, digestate produced through AD incentivised by government is required to be spread using best practice techniques. Introducing rules requiring future AD plants to be certified by schemes to ensure best practice is followed is one way this could be done.

## 7.7 Questions

- Q16. What do you think of the package of actions put forward in the farming chapter? Please provide evidence in support of your answer if possible.
- Q17. What are your preferences in relation to the 3 regulatory approaches outlined and the timeframe for their implementation: (1) introduction of nitrogen (or fertiliser) limits; (2) extension of permitting to large dairy farms; (3) rules on specific emissions-reducing practices? Please provide evidence in support of your views if possible.
- Q18. Should future anaerobic digestion (AD) supported by government schemes be required to use best practice low emissions spreading techniques through certification? If not, what other short-term strategies to reduce ammonia emissions from AD should be implemented? Please provide any evidence you have to support your suggestions.

# 8. Action to reduce emissions from industry

## 8.1 Industry and air quality

Industrial processes, including energy generation to power our businesses and homes, and the manufacture of goods and food can all create pollution. These processes are carefully managed to avoid potentially significant impacts on our health and environment and this has already made a significant contribution to reductions in air pollution. However, emissions from industrial sources still contribute to background levels of pollution throughout the UK. Reducing these emissions further, alongside action on

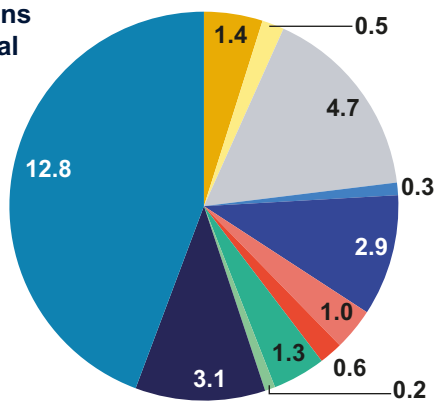
other sources, will have a direct impact on the concentration of air pollutants in those places where people live and work.

Chapter 4 set out how businesses can increase productivity and achieve air quality improvements by harnessing the opportunities for innovation and investment in clean growth. The government's Industrial Strategy: Building a Britain Fit for the Future<sup>82</sup> and Clean Growth Strategy<sup>83</sup>, set out how we will maximise the advantages for UK industry of the global shift to clean growth.

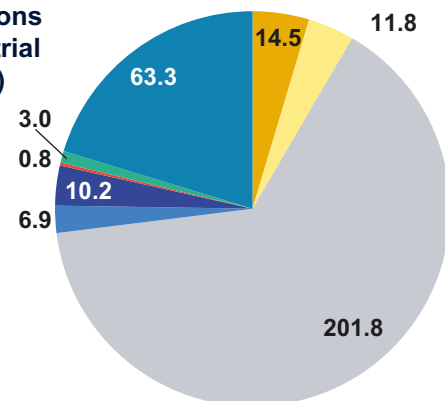
### A sectoral breakdown of the UK's industrial emissions of air pollutants

The following charts show the contribution of individual sectors to the UK's total industrial emissions for 2016. Source: NAEI (2018)

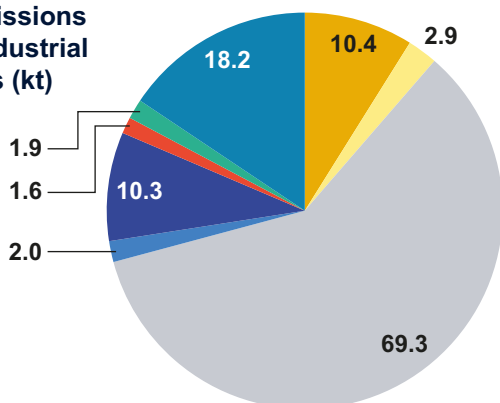
**PM<sub>2.5</sub> emissions from industrial sources (kt)**



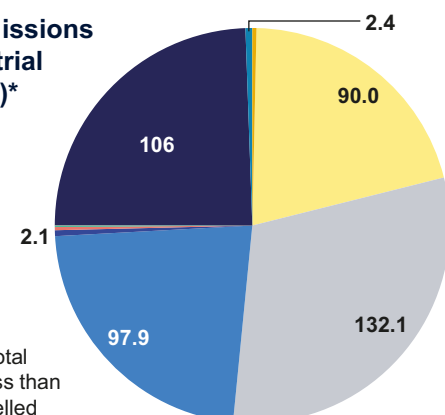
**NO<sub>x</sub> emissions from industrial sources (kt)**



**SO<sub>2</sub> emissions from industrial sources (kt)**



**NMVOC emissions from industrial sources (kt)\***



\* Sectors with total emissions of less than 2 kt are not labelled

- Cement and lime production
- Pulp paper and wood production
- Chemical industry
- Mining and quarrying
- Food and drink
- Other industrial combustion
- Iron and steel
- Glass production
- Non-ferrous metal production
- Solvent and other product use
- Energy industry





## 8.2 A strong existing framework

The UK has been at the forefront of reducing industrial pollution, using a proportionate framework of regulation to require industry to improve their environmental performance, and industry has responded with investment and innovation to meet these standards. For example, we have set limits on the emission of NO<sub>x</sub> from power stations, reduced the amount of sulphur allowed in liquid fuels and redesigned fuel pumps to recover petrol vapour. Industry will need to continue to progressively drive down emissions of all pollutants, looking at more diffuse sources such as product use, as well as the larger point sources of emissions.

The UK introduced an integrated approach to controlling pollution to air, water and land as a result of the 1990 Environment Act, as well as the concept of Best Available Techniques. These approaches have subsequently been adopted and applied across the EU through the Industrial Emissions Directive, which sets challenging industry standards for the most polluting industries.

### Best available techniques

The Industrial Emissions Directive (IED) aims to prevent and reduce harmful industrial emissions across the EU, while promoting the use of techniques that reduce pollutant emissions and that are energy and resource efficient.

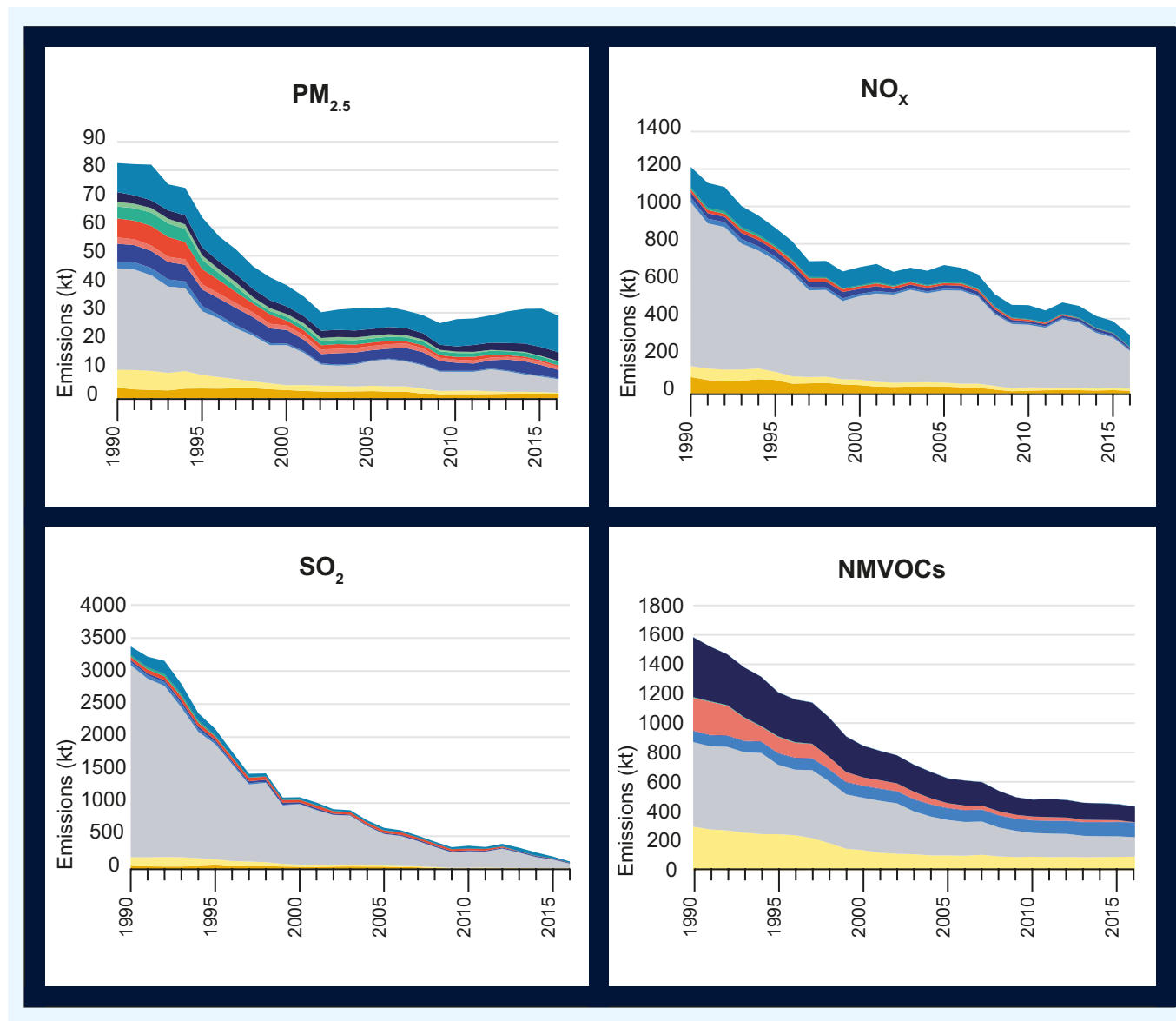
Larger industrial facilities undertaking specific types of activity are required to use Best Available Techniques (BAT) to reduce emissions to air, water and land. BAT means the available techniques which are the best for preventing or minimising emissions and impacts on the environment. 'Techniques' include both the technology used and the way your installation is designed, built, maintained, operated and decommissioned.

The European Commission produces BAT reference documents (BREFs). For example, there's a BREF for intensive agriculture which contains BAT for housing for pig rearing units and a BREF for the textiles industry which contains BAT for selecting materials for textile manufacture. BREFs include BAT conclusion documents that contain emission limits associated with BAT, which must be complied with.

The UK is committed to maintaining high standards and good practice and will continue to apply the existing successful model of integrated pollution control as we exit the EU. As a direct result of these actions, the level of pollution from industry has decreased significantly over recent decades.

## Industrial emissions trends

Since 1990, industrial emissions of nitrogen oxides to air have reduced by 74%, emissions of sulphur dioxide have reduced by 97% and emissions of volatile organic compounds have reduced by 73%. However, industrial emissions are still responsible for a significant proportion of total UK emissions - 35% of nitrogen oxides, 65% of sulphur dioxides, 27% of particulate matter and 53% of volatile organic compounds in 2016<sup>84</sup>.



- |                                |                                  |                     |                        |
|--------------------------------|----------------------------------|---------------------|------------------------|
| ■ Cement and lime production   | ■ Pulp paper and wood production | ■ Chemical industry | ■ Mining and quarrying |
| ■ Food and drink               | ■ Other industrial combustion    | ■ Iron and steel    | ■ Glass production     |
| ■ Non-ferrous metal production | ■ Solvent and other product use  | ■ Energy industry   |                        |

The Industrial Emissions Directive is mainly focused on larger plants (those over 50MW thermal input). Emissions from smaller plants used by industry, as well as from offices, large buildings, schools and hospitals will also need to be controlled, if we are to make further progress in cutting air pollution. That is why we have recently introduced legislation to reduce emissions from a significant and previously unregulated source of air pollution: medium-sized combustion plants and generators<sup>85</sup>.

## 8.3 A commitment to continuous improvement

We recognise the importance of maintaining policy stability for industry in order to send a clear, long-term signal, to provide the certainty they need to make investment decisions. Many of these businesses have long-term plans and investment cycles, so any changes to the regulatory framework need to be signalled well in advance. That is why we are making clear our commitment to the existing successful model of integrated pollution control as we leave the EU. In order to meet our challenging 2030 targets and to maintain our ambitious industrial emissions policy, we will look to all sectors to make appropriate contributions, recognising both their efforts to date and the potential to do more. And, while tackling big point sources of emissions remains a priority, we will also need to address increasingly diffuse sources of emissions in order to reduce background levels of pollution.

As a part of our commitment to better regulation, we also want to explore potential opportunities to evolve this framework. We will develop a system for determining BAT that maintains a consistent approach with the Industrial Emissions Directive. We will ensure this helps deliver our overall commitment of improving the environment within a generation.

Working in close collaboration with industry we will also explore further opportunities for emissions reductions by developing a series of sector roadmaps to set ambitious, achievable standards aimed at making UK industry world leaders in clean technology. The roadmaps will identify where additional measures can be implemented within industrial sectors, focusing on the most polluting industries and those with the greatest potential to drive improvements in air quality.

We will establish a series of workshops with the most significant polluting industrial sectors, including energy and refineries, iron and steel, manufacturing, solvents, chemicals, and other industrial sectors such as cement production. Through this, we will begin to explore the emissions reduction contributions from industry to date, the potential to make further commitments to improving air quality, and the technical and financial feasibility of doing so. As we leave the EU, we are provided with an opportunity to consider our longer-term framework for industrial emissions regulation, and the government is seeking views on how best to evolve this framework and whether to consider approaches such as market-based measures. We will also explore whether standards for smaller industrial sites could be improved and identify actions to reduce NMVOCs indoors and out.

With respect to smaller plants, we will assess the evidence and consider whether additional measures are required to further reduce emissions from medium combustion plants and generators in future.

We also plan to continue to take a proportionate approach. That is why we are planning to amend the recently implemented generator controls to ensure generators used for research and development are exempt. This small change will ensure a consistent approach with the Medium Combustion Plant Directive and Industrial Emissions Directive without a significant impact on air pollution. We plan to make this amendment in autumn 2018 and welcome any views on this approach.



Diesel generators  
Photo: John Henderson at Environment Agency



## 8.4 Action to tackle emissions from industry

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- We will maintain our longstanding policy of continuous improvement in relation to industrial emissions, building on existing good practice to deliver a stable and predictable regulatory environment for business as part of a world-leading clean green economy. This means that we will maintain the existing successful model of integrated pollution control as we leave the EU. But we also want to explore how to evolve this framework over time, for instance, by exploring the use of market-oriented approaches to further reducing industrial emissions.
- We will consult on how to improve the current framework to make it work better for both the environment, the public and UK industry.
  - We will work with industrial sectors to review improvements to date, and to explore opportunities to go further through a series of sector roadmaps that set ambitious standards – moving beyond a focus on minimum standards – to make UK industry world leaders in clean technology and to secure further emissions reductions from industry between 2018 and 2030.
- We will develop a UK approach to determine Best Available Techniques for industrial sectors. We will review existing guidance, in conjunction with devolved administrations, regulators, industry and other interested stakeholders.
- We will review existing guidance to support effective emission controls at smaller industrial sites and consider whether further action is needed to strengthen the current regulatory framework.
- As legislation on medium combustion plants and generators comes into force, we will consider the case for tighter emissions standards on this source of emissions.
- We will close the regulatory gap between the current ecodesign and medium combustion plant regulations to tackle emissions from plants in the 500kW to 1MW thermal input range.

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## 8.5 Consultation Questions

- Q19. What do you think of the package of actions put forward in the industry chapter? Please provide evidence in support of your answer if possible.
- Q20. We have committed to applying Best Available Techniques to drive continuous improvement in reducing emissions from industrial sites. What other actions would be effective in promoting industrial emission reductions?
- Q21. Is there scope to strengthen the current regulatory framework in a proportionate manner for smaller industrial sites to further reduce emissions? If so, how?
- Q22. What further action, if any, should Government take to tackle emissions from medium combustion plants and generators? Please provide evidence in support of your suggestions where possible.
- Q23. How should we tackle emissions from combustion plants in the 500kW-1MW thermal input range? Please provide evidence you might have to support your proposals if possible.
- Q24. Do you agree or disagree with the proposal to exempt generators used for research and development from emission controls? Please provide evidence where possible.



# 9. Leadership at all levels

## 9.1 International leadership on clean air

Air pollution does not stop at national borders and we know that emissions produced across the country, the continent and the globe can all impact on air quality in the UK. Similarly, the emissions we produce in the UK can have health and environmental impacts on our neighbours. As one of the original signatories to the 1979 UNECE Convention on Long-range Transboundary Air Pollution, the UK has long been at the forefront of international action to tackle transboundary air pollution, and formal ratification of the three most recently amended Convention Protocols in the coming months will signal our ongoing commitment to its objectives.

Under this UN Convention, the UK supports international programmes to drive forward scientific understanding of air pollution emissions and their impacts, and engages constructively to agree ambitious standards and emission reduction commitments that encourage action across the Northern Hemisphere and serve

as a model for a global response. As we work towards our 2020 and 2030 emission reduction commitments, the Convention will continue to be the cornerstone of the UK's international engagement on air quality. It will be a key forum for cooperation on long term and cross-cutting challenges, for example action to tackle short-lived climate pollutants. The UK will also continue to support bodies such as UN Environment and the World Health Organisation in raising the issue of transboundary air pollution up the global agenda.

The action we are taking to develop and implement policies to achieve our ambitious 2020 and 2030 commitments sits alongside similar action in other countries. We will continue to actively engage with our neighbours, sharing experience and best practice. We will continue to be reliable partners, willing allies and close friends with countries in Europe and around the world, as we work to achieve cleaner air for all of our citizens.

## 9.2 National leadership on clean air

This government is committed to be the first generation to leave the environment in a better state than we inherited it. One of our top environmental priorities is to drive down overall emissions of air pollutants and reduce human exposure to local concentrations of pollutants. This strategy sets out next steps to achieve our challenging national emissions reduction targets. These were transposed into UK legislation in February 2018. In April 2019, we will produce our National Air Pollution Control Programme as required under this legislation. This programme will set out a detailed pathway to achieving the required emissions reductions and show how these will impact on local concentrations and human exposure to pollution. We will continue to monitor and report on air quality across the UK within this internationally recognised framework.

### 9.2.1 Securing a green Brexit

Leaving the EU means we will take back control of environmental legislation. This presents a unique opportunity to design policies to drive environmental improvement that are specifically tailored to the needs of our country. Our vision is for a green Brexit in which environmental standards are not only maintained, but enhanced. The EU Withdrawal Bill will ensure existing EU environmental law continues to have effect in UK law after we leave the EU, providing businesses and stakeholders with maximum certainty. Currently, emission reduction commitments in the UK are overseen by the European Commission, which has powers to take action to enforce compliance. They are also overseen by the UNECE Convention on Long-range Transboundary Air Pollution and will continue to be in future.



The government recognises that some of the scrutiny mechanisms currently provided by the European Commission will no longer exist once we leave the EU. In order to ensure that there is no governance gap, the government is consulting on a new, independent statutory body to hold government to account on environmental commitments following EU exit; backed up by a new policy statement on environmental principles. Ensuring that there is transparency and accountability in how we achieve our clean air ambitions will be a priority in this work.

## 9.2.2 The legislative framework

The UK government will bring forward legislation at the earliest opportunity in order to secure a more coherent legislative framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem.

New clean air legislation will enable the Transport Secretary to **compel manufacturers to recall vehicles and machinery for any failures in their emissions control system**, and make tampering with an emissions control system a legal offence. It will also replace the existing patchwork with **single coherent legislative framework for local authorities** to tackle air quality and bring the law up to date with the evolution of structures at sub-national level so that accountability for air quality sits in the right place. It will update **outmoded legislation on 'dark smoke' from chimneys** and underused provisions on Smoke Control Areas to bring them into the 21st century with more flexible, proportionate enforcement powers. Finally, it will create a new **statutory framework for Clean Air Zones (CAZ)** to simplify current overlapping frameworks of CAZ, AQMA and Smoke Control Areas to create a single approach covering all sources of air pollution.

In addition we will **legislate to ensure that major sources of air pollution are subject to proportionate controls that reflect the risk they pose to public health and the environment**. This will strengthen powers at both national and local level. We will take England-wide action to:

- prohibit the sale of polluting fuels and inefficient stoves for domestic use
- limit emissions of ammonia from farming
- consider the case for setting tighter emission controls for biomass installations to reduce PM pollution from energy generation
- close regulatory gap to apply limits to medium combustion plants between 500kw - 1MW and consider the case for increasing stringency of limits for plants above 1MW
- drive-up emissions standards for diesel-powered non-road mobile machinery before and after sale

## 9.2.3 Action to improve the legislative framework

- The UK government will bring forward primary legislation at the earliest opportunity in order to secure a more coherent legislative framework for action to tackle air pollution.

## 9.3 Greening government commitments

Achieving our legally binding emissions targets at an international level will require action across society, and it is the UK government's ambition to lead by example. With the wider environment in mind, our commitment to improving air quality extends to improving how we are running our buildings and estates, as well as the sustainable procurement of vehicles, services and cleaning products through our Government Buying Standards.

### Case study: PHE/NHS England Sustainable Development Unit (SDU)

Health related travel makes up over 3% of all road miles. In 2017, the Sustainable Development Unit (SDU) for Public Health England and NHS England published the Health Outcomes Transport Tool (HOTT). This tool helps NHS organisations measure the impact their travel has in environmental, financial and health terms, allowing valuation of improvements in these same terms. HOTT measures impacts (such as air and noise pollution, road traffic incidents and greenhouse gases) and sources (such as staff commute, patient and visitor travel, fleet and supply chain travel). Manchester University NHS Foundation Trust recently used HOTT to evidence that their work on sustainable travel had avoided over £870K in economic costs. This tool is designed to be used by a wide range of health organisations and their supply chains, and has the potential to be adopted on a much wider scale.

Defra is already encouraging sustainable travel of our employees by developing a Sustainable Travel Plan. The plan sets out to reduce air miles and private car miles, encourage active travel with bike schemes, provide incentives to cycle and walk to meetings, and remove the need to travel by encouraging remote working.

There are plans to go much further on incorporating air quality emissions into sustainable procurement across government. The Government Buying Standards for vehicle procurement published in December 2017 demonstrated our ambition to accelerate a move to zero or ultra-low exhaust emission vehicles, thus improving our health and quality of life by making the air cleaner in our towns and cities.

### 9.3.1 Action to improve coverage of air quality in the greening government commitments

- the government will be taking further robust action to reduce emissions across the government estate
- the Environment Agency are evaluating the use of more stringent emissions requirements from their suppliers under their Next Generation Supplier Arrangements (NGSA)
- while government departments already report greenhouse gas emissions from their estate and operations, we intend to extend this to reporting and achieving reductions of air pollutant emissions

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## 9.4 Local action on clean air

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Local government has been the main agent for cleaning up local air since before the first Clean Air Act of 1956. This Clean Air Strategy sets out the case for tackling air pollution from activities which form an essential part of 21st century life. The impacts of air pollution and the action required to address it are highly relevant to local government priorities: health, housing, transport, education, local economies, greenspace and quality of life. As air quality continues to improve, the focus on local hotspots will continue to increase and local action will remain essential.

Local authorities have long had specific legal powers to tackle air pollution locally, where there is evidence from either the local or national assessment regimes that it exceeds legal limits. They also have long-standing powers to tackle emissions from domestic chimneys and industrial sources. Alongside these specific obligations, strategic decisions on transport, planning and public health taken by local government all contribute to the quality of the air that people breathe in local communities. We will give local government new legal powers to take decisive action in the most polluted areas through **local Clean Air Zones that can lower emissions from a wider range of sources than transport alone**, including:

- new powers to **control the use of diesel-powered machinery** where it is causing an air pollution problem
- new powers to **ensure cleaner domestic burning** especially where it is causing an air pollution problem
- new powers to **control biomass** and other forms of combustion for energy generation where it is causing an air pollution problem

### 9.4.1 Local government tackling NO<sub>2</sub> hotspots around roads

The most immediate and urgent air quality challenge faced by local authorities is to tackle the problem of NO<sub>2</sub> concentrations around roads. This is most acute in towns and cities which should be healthy places to live, work and relax. The Clean Air Zone (CAZ) framework sets out principles for local government to define an area where targeted action is taken to improve air quality, and resources are prioritised and coordinated in order to shape the urban environment in a way that delivers improved health benefits and supports economic growth. 28 local authorities have been directed to produce local plans to reduce NO<sub>2</sub> levels in the shortest time possible, which includes benchmarking proposals against the possible introduction of a Clean Air Zone, where this is appropriate. We are undertaking further work with another 33 local authorities which have shorter-term exceedances to assess whether there are actions they could take to meet NO<sub>2</sub> concentration limits earlier.

CAZs are available to all local authorities and may address all sources of pollution, including particulate matter, to reduce public exposure using a range of measures appropriate to the particular location. The CAZ framework offers a creative, total emissions tool for local authorities to clean up local air, but awareness of its potential is low. We will look to the 28 local authorities taking accelerated action under the Air Quality Plan to help other local authorities learn from their activities.

## Local action to tackle NO<sub>2</sub> exceedances

The UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations launched in July 2017 announced £255m for 28 local authorities to accelerate their air quality plans to achieve legal compliance in the shortest possible time. A further £220m was announced in the November 2017 Budget for a new Clean Air Fund (CAF) available to local authorities to support individuals and businesses impacted by local plans to improve air quality. Possible measures the CAF funding could be used to support the 28 local authorities were consulted on from 22nd November 2017 to 5th January 2018. The summary of responses and guidance was published in March 2018. In total, the government has committed £3.5bn for tackling poor air quality and promoting cleaner transport.

We are working with local authorities at all levels to tackle the challenge of roadside NO<sub>2</sub>. The Joint Air Quality Unit provides the 28 local authorities with comprehensive technical support and guidance specifically for the development and implementation of local plans and measures to improve air quality. Each local authority has a dedicated account manager who supports co-ordination and communication with the relevant local authorities, and keeps track of progress. We provide guidance and workshop style support, and signpost to funding streams across government.

In addition, 33 local authorities that have NO<sub>2</sub> exceedances (2018 to 2021) have been required by government to assess if there are measures they could take to bring forward the point when they comply with NO<sub>2</sub> concentration limits. These 33 local authorities will also have the support of JAQU workshops and access to funding, and can also access support from Defra as part of the Local Air Quality Management (LAQM) framework.

## 9.4.2 Local leadership to improve air quality

We know good work is taking place across the country at local level. For example:

- the county-wide Surrey Air Alliance will deliver a programme to primary and secondary schools across Surrey to raise awareness about the impacts of air quality, encourage behaviour change and reduce idling outside schools
- City of Bradford Council has been leading work in collaboration with other West Yorkshire local authorities and Public Health England to develop a regional Low Emissions Strategy; it includes measures to tackle transport emissions to deliver significant and rapid improvements, encouraging uptake of ULEVs, including development of an air quality and planning technical guidance and a low emissions procurement guide
- the Sussex Air Quality Partnership will deliver a targeted schools and businesses campaign to reduce idling, increase walking and cycling and reduce emissions from plant
- London Boroughs of Hackney, Islington and Tower Hamlets have established a Zero Emissions Network, with over 1,100 residents and businesses committing to cleaner air
- Leicester City Council and London Borough of Islington are both making it easier for residents to understand and comply with Smoke Control Area rules by consolidating all their Smoke Control Areas
- Westminster City Council worked with a hard-to-reach group of businesses to provide concrete advice on what actions they can take to reduce their air quality impact, this resulted in being nominated for a Transport Award

We want these types of good practice to showcase what is possible and what can be achieved when local government shows commitment and leadership to tackle air pollution. We will continue to support local government to build on the good practice demonstrated by many local authorities and ensure that the long-standing framework for local action on air pollution remains robust and relevant.

### 9.4.3 Keeping the system under review

The current Local Air Quality Management framework (LAQM) was established over 20 years ago. Lifestyles have changed since then, with more private and public transport in everyday use, and an increase in the popularity of open fires and wood-burning stoves. Now is a good time to assess whether the LAQM framework continues to be an effective tool for delivering the scale or pace of change needed at the local level.

Local government structures have evolved in recent decades and vary across the country. Across the 353 local authorities in England, there are two-tier district and county authorities, as well as single-tier unitary authorities, plus metropolitan and London boroughs. In six regions' combined authorities, mayors elected in 2017 have budgets, powers and responsibilities delegated by national government to enable groups of local councils to collaborate and make decisions across boundaries. Public health and transport decisions are made at upper or regional level, as are strategic decisions on investment, growth, job creation and home building. These policies can drive real change in improving local air; however, policy responsibility for local air quality remains at district level in two-tier authorities.

242 local authorities in England have one or more Air Quality Management Areas (AQMAs). These are designated where local air quality monitoring identifies a problem. Once an AQMA is in place, the local authority is expected to produce a plan to tackle the issue. Some AQMAs are for more than one pollutant, and many local authorities have more than one AQMA. There are 556 AQMAs in England and some were declared as long ago as 2001. Only 166 AQMAs have been revoked<sup>86</sup>, suggesting that problems once identified may not be being resolved. Differences between the LAQM framework and national compliance assessment approaches required by the EU Ambient Air Quality Directive often create confusion for local authorities and citizens.

Furthermore, LAQM does not currently effectively encourage all local authorities to work collaboratively across departmental or structural boundaries, or to take a total emissions approach to tackling local air quality. Nor does it always focus attention on the most significant issues. For example, under the existing system few local authorities consider themselves to have a problem or need to take action on domestic wood and coal burning even though nationally this source accounts for 38% of PM<sub>2.5</sub> emissions.

### 9.4.4 Action on local clean air

- We will give Local Government new legal powers to take decisive action in the most polluted areas through local Clean Air Zones that can lower emissions from a wider range of sources than transport alone.
- We will consult on transformative changes to the LAQM system to minimise bureaucracy and reporting burdens, shifting the focus to taking action to clean up local air through strong collaborative local partnerships, and driving stronger local action on reducing PM emissions.
- We will encourage greater public transparency about local air quality to empower local citizens and the air quality decision-makers in their local communities, and provide stronger incentives for local authorities to use their tools and powers.
- We will develop a single, straightforward clean air designation covering Air Quality Management Areas, Clean Air Zones and Smoke Control Areas.
- We will strengthen statutory planning guidance on air quality and help share good practice where it is already happening.
- We will facilitate the sharing of best practice and knowledge between local authorities through webinars and other digital media.



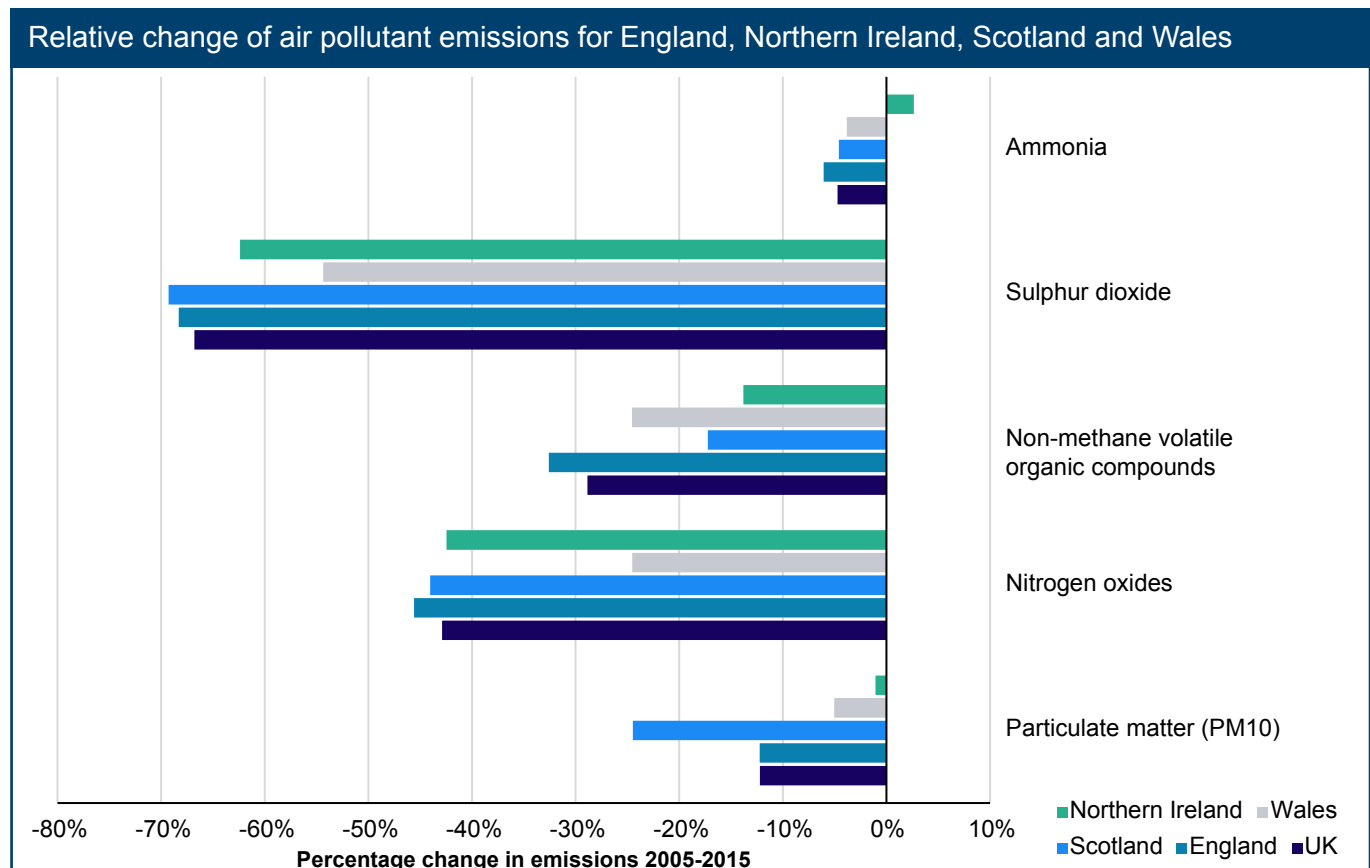
## 9.5 Questions

- Q25. What do you think of the package of actions put forward in the leadership chapter? Please provide evidence in support of your answer if possible.
- Q26. Do you feel that the England-wide legislative package set out in 9.2.2 is appropriate? Why/why not?
- Q27. Are there gaps in the powers available to local government for tackling local air problems? If so, what are they?
- Q28. What are the benefits of making changes to the balance of responsibility for clean local air between lower and upper tier authorities? What are the risks?
- Q29. What improvements should be made to the Local Air Quality Management (LAQM) system? How can we minimise the bureaucracy and reporting burdens associated with LAQM?

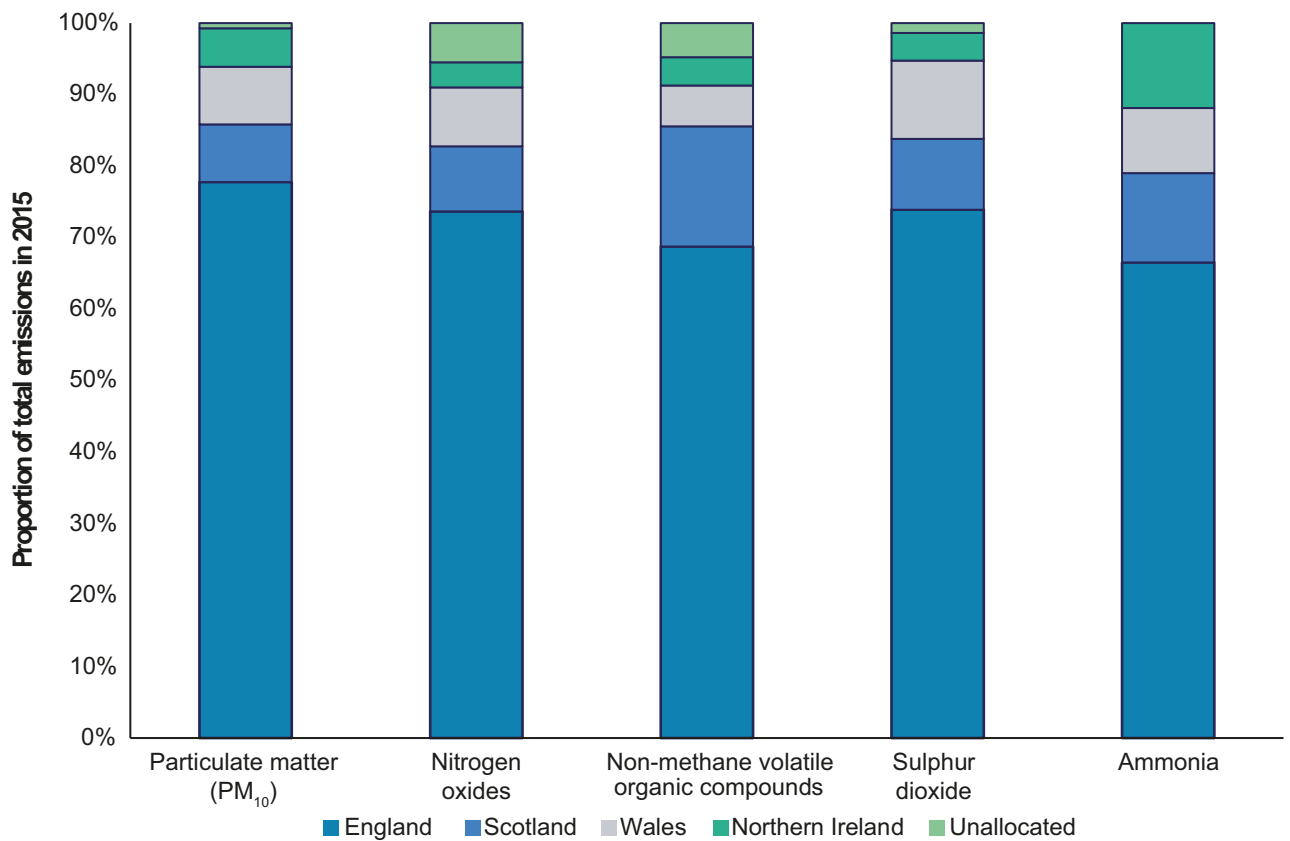
## 9.6 Action on clean air across the UK

Our international emission reduction commitments, under the National Emission Ceilings Directive and Gothenburg Protocol under the Convention, have been agreed at a UK level. The UK Government annually prepares a national atmospheric emissions inventory in line with internationally recognised standards and is required to report on their achievement. Nevertheless, air quality is a devolved policy area: Scotland, Northern Ireland, and Wales lead on policy within their own territories. Given the transboundary nature of air pollution, close partnership-working between the nations of the UK is essential. The UK government and the devolved administrations are working together to manage transboundary air pollution and improve air quality right across the UK.

Each administration faces different challenges in reducing emissions. Therefore different approaches are required across the UK to meet these challenges and address the specific sources of pollution and emission patterns. The chart below show the relative change of air pollutant emissions for England, Northern Ireland, Scotland and Wales as compared to the overall UK change, and the proportion of UK emissions that each nation produced in 2015.



## Proportion of UK emissions that each nation produced in 2015



The following sections set out a summary of air quality data for each country of the UK and showcase actions taken already, which have led to considerable improvements.

## 9.7 Action to tackle air pollution in Northern Ireland

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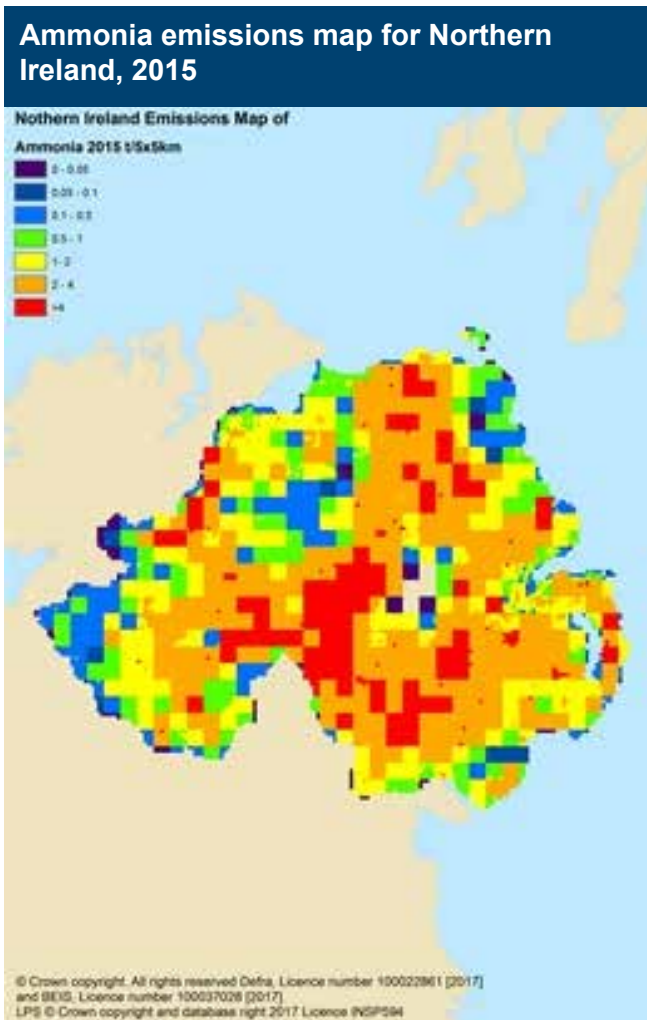
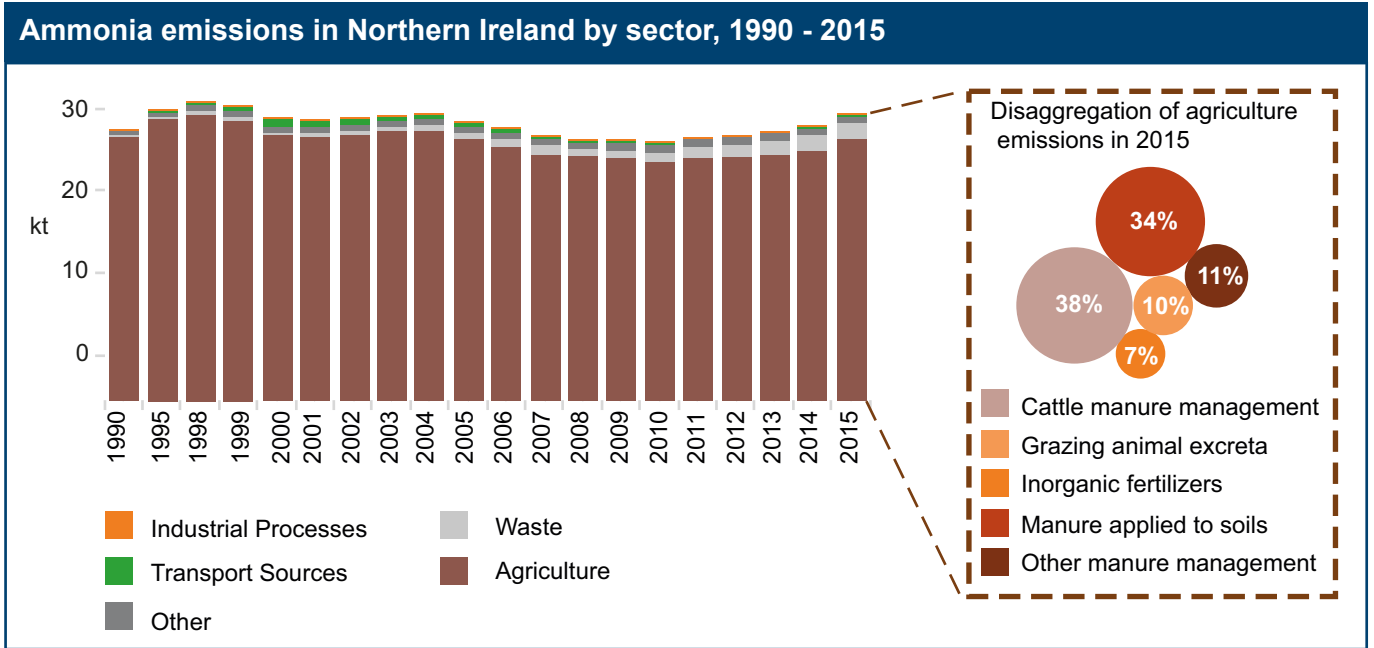
Air pollution in Northern Ireland is dominated by three main sources: nitrogen oxides from road traffic emissions, in particular those from diesel vehicles; particulate matter from residential burning of solid fuels, in particular coal; and ammonia emissions from agricultural activities such as manure storage, handling and spreading.

Northern Ireland has largely seen reductions in emissions in recent years similar to those for the UK as a whole for nitrogen oxides, sulphur dioxide and volatile organic compounds. Emissions of ammonia and particulate matter have reduced at a slower rate in Northern Ireland than for the UK as a whole and emissions of these pollutants in Northern Ireland represent a significant proportion of the UK total; this reflects the nature of land use in Northern Ireland, and the relative importance of the agricultural sector to the Northern Ireland economy.

Northern Ireland's geography and maritime position ensure it has a steady supply of good air; however, NO<sub>2</sub> pollution from road traffic is a significant problem, whilst the proportion of journeys made by public transport and active travel is fairly stable over time. However, generally concentrations of nitrogen dioxide have been falling in recent years and except for Belfast, Northern Ireland is compliant with the limit values for nitrogen dioxide concentrations set out by the Air Quality Directive. Further action to reduce these concentrations was announced in the UK plan for tackling nitrogen dioxide concentrations. Since 1994, there has been a 36% drop in the annual mean concentration of nitrogen dioxide at the Belfast Centre station.

The Northern Ireland Department of Agriculture, Environment and Rural Affairs (DAERA) recognises the contribution of emissions of nitrogen oxides from road transport to non-compliance in Belfast with the limit value and suggests a number of initiatives that have been taken forward to address this including investment in infrastructure and public transport.

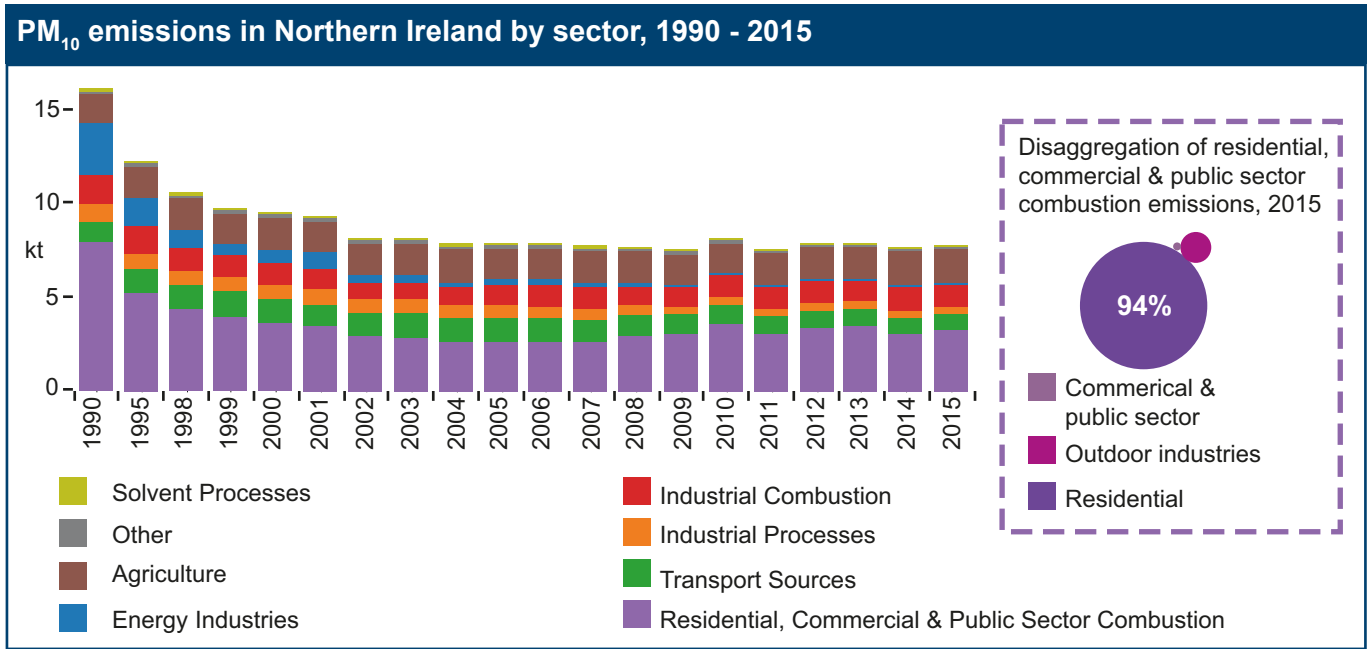
The trend in ammonia emissions for Northern Ireland by sector is shown in the figure below; which shows that a large proportion of ammonia emissions come from manure management and manure applied to soils. Emissions of ammonia in Northern Ireland have increased by 5% since 2005. An increase in the cattle population in the last few years (a 6% increase between June 2014 and June 2016, although cattle numbers are down compared with 2005), a large increase in the pig population over the last decade (48% increase between June 2005 and June 2016<sup>87</sup>), along with spreading of animal manure to agricultural soils are responsible for the increase in ammonia emissions. The spatial distribution of emissions in Northern Ireland is determined by the distribution of farms across the administration.



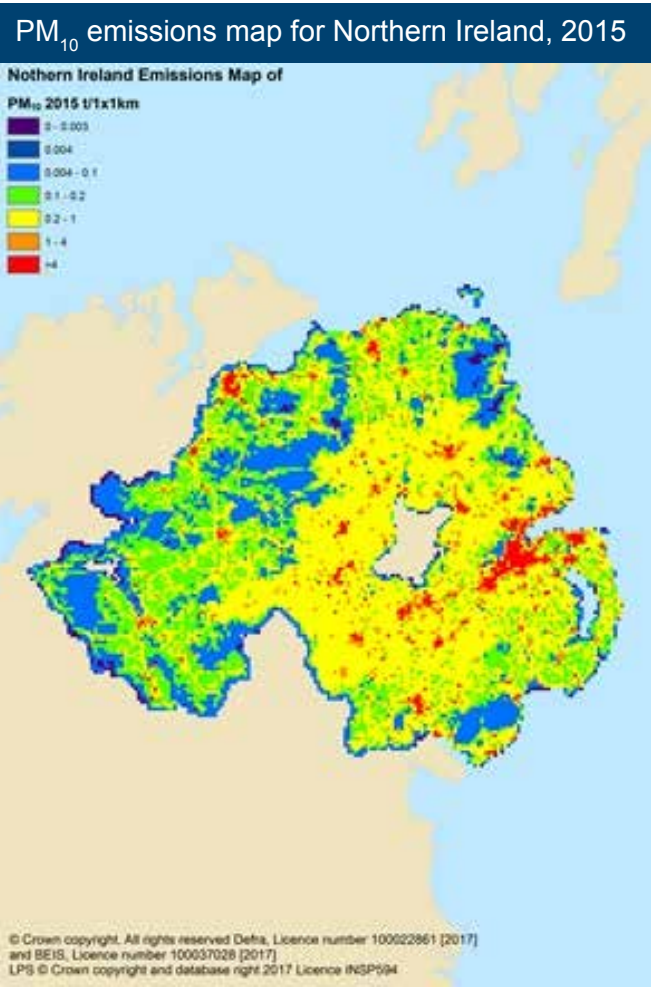


**CLEAN AIR STRATEGY**

The trend in particulate matter (PM<sub>10</sub>) emissions for Northern Ireland by sector is shown in the figure below; which shows that PM<sub>10</sub> emissions have a number of sources, but residential combustion activity contributes a large proportion of emissions in Northern Ireland.



Similar to the rest of the UK, the use of wood-burning stoves and open fires in residential homes is on the rise in Northern Ireland. Domestic combustion is a particular issue for Northern Ireland due to the relatively high proportion of homes that do not have gas or electrical heating. At least 66% of households in the 2011 census did not have gas or electric central heating; the majority of these households have oil-based central heating. This represents a much larger proportion of the population dependent on solid fuels or oil for their heating needs compared to England (at least 9% of households), Scotland (at least 10% of households), and Wales (at least 14% of households). The spatial distribution of emissions in Northern Ireland is determined by the distribution of the population (domestic combustion).



### 9.7.1 Northern Ireland's plans for cleaner air

A specific Air Quality Strategy for Northern Ireland is due for consultation in the first half of 2018. The strategy will look at air pollution on a sectoral basis, focusing on pollution from road traffic, household emissions and agricultural activities. It will put forward policy proposals for reducing air pollution from each of these sectors. It also looks at the existing Local Air Quality Management (LAQM) system to see how it should be improved, and makes recommendations regarding raising awareness of air pollution and its impacts, and how communication may be used to promote behaviour change.

The Northern Ireland Executive has a draft Programme for Government which contains an indicator on air quality (monitored levels of nitrogen dioxide). The indicator has a delivery plan that sets out a range of measures, including those focusing on transport, which are aimed at reducing congestion and promoting modal shift away from private car use. Following consultation on the draft Air Quality Strategy for Northern Ireland, a finalised strategy will be published in late 2018/early 2019. Measures contained in the Programme for Government Delivery Plan for the air quality indicator will also come on line in the future.

Northern Ireland is signed up to the UK Air Quality Strategy. The Department for Agriculture, Environment and Rural Affairs (DAERA) funds local authorities to enable them to monitor air quality, declare Air Quality Management Areas, and produce Action Plans to deal with air pollution. DAERA will revise Northern Ireland's air quality policy and legislation and devise an Air Quality Action Plan. This will include a specific action plan for tackling emissions of ammonia, based on the findings by the Expert Working Group on Sustainable Agricultural Land Management.

The Belfast Rapid Transit (BRT) ('Glider') project is a £90m investment, which will bring a new kind of high quality public transport system to Belfast and is due to become operational in September 2018. BRT is a key element in the delivery of a step-change in the quality of public transport in Belfast and is one of the key supporting drivers for regeneration throughout the city, providing high quality access to, and linkages between, jobs, hospitals, schools and colleges across

the city. It is hoped that BRT will contribute to a reduction in the number of short journeys made by car in the city and will lead to an improvement in air quality.

A Northern Ireland Expert Working Group on Sustainable Agricultural Land Management has examined the issue of ammonia in an annex to their original Strategy. This group had membership from across the spectrum of stakeholders with an interest in land, including farmers, the environment sector, the supply chain and government. Its report on ammonia is entitled [Making Ammonia Visible](#). The report made a number of key recommendations to government and farmers: a partnership approach to address ammonia; improved communication and education on ammonia; scientific research to address significant evidence gaps; adoption of guiding principles for planning applications; the implementation of ammonia mitigation measures on farms, including an end to the use of both splashplates for slurry-spreading and non-stabilised urea fertiliser; and the establishment of an Agri Emissions Partnership.

DAERA has established a Project Board on Ammonia to develop and implement a DAERA Action Plan on Ammonia. This action plan will set out an approach which aims to:

- achieve tangible and sustained reductions in ammonia emissions from Northern Ireland farms
- reduce the impact of ammonia via nitrogen deposition on nature and habitats, and in particular, designated sites
- respond to each of the recommendations of the Expert Working Group in their Ammonia Annex
- encourage uptake of on-farm ammonia mitigation measures
- highlight the impact of ammonia on human health, while noting the relevant uncertainties

DAERA has also commissioned research into pollution from solid fuel burning and is taking measures to reduce emissions from domestic combustion sources, particularly from wet wood and coal burning.

## 9.8 Action to tackle air pollution in Scotland

In November 2015, the Scottish Government published *Cleaner Air for Scotland – The Road to a Healthier Future (CAFS)*<sup>88</sup>, Scotland's first separate air quality strategy. CAFS sets out in detail how Scotland intends to deliver further air quality improvements over the coming years.

CAFS sets out a national approach to improving air quality. The strategy contains 40 key actions within six policy areas – transport, health, climate change, legislation, placemaking and communications. CAFS also introduces two important new policy initiatives, the National Modelling Framework (NMF) and the National Low Emission Framework (NLEF).

The NMF promotes a standard approach to evaluating and assessing air quality, providing evidence to support the actions and decision making process around land use and traffic management to improve local air quality. The NMF consists of two elements, a local modelling approach and a regional modelling approach. The local approach involves building detailed air quality and traffic models for Scotland's four largest cities – Aberdeen, Dundee, Edinburgh and Glasgow. The regional approach draws on air quality modelling methodology adopted in the Netherlands and reflects the fact that land use

and transport planning decisions made across local authority boundaries can have implications for local air quality. The regional approach is focused on the strategic development planning authority areas surrounding the four cities.

The outputs from the NMF will be used to inform the NLEF. This is designed to enable local authorities to appraise, justify the business case for, and implement a range of transport related policy interventions to improve local air quality.

Since CAFS was published, the Scottish Government has announced plans to establish Scotland's first Low Emission Zone (LEZ) by the end of 2018, in Glasgow. This will be followed by further LEZs in Aberdeen, Dundee and Edinburgh by 2020, and in all remaining local Air Quality Management Areas by 2023, where appraisal suggests such an approach would be appropriate.

The first CAFS annual progress report<sup>89</sup> was published in June 2017 and summarises progress on delivering the actions.

Scotland has largely seen reductions in emissions of the five NECD pollutants in recent years that are similar to those for the UK as a whole.

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## 9.9 Clean air Wales

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The Welsh Government is committed to building healthier communities and better environments. Clean air has a central role in creating the right conditions for better health, well-being and greater physical activity in Wales. In September 2017, the Welsh Government published their national strategy: 'Prosperity for All'<sup>90</sup>. This document sets out a cross-Government commitment to reducing emissions and delivering vital improvements in air quality through planning, infrastructure, regulation, and health communication measures<sup>91</sup>.

The Welsh Government provides the strategic direction for air policy in Wales, which is framed within a complex set of regulatory and operational responsibilities.

The Welsh Government has recently strengthened their own legislative framework through the Well-being of Future Generations (Wales) Act 2015 (WFG Act) and the Environment (Wales) Act 2016<sup>92</sup>, which sets a legal target for reducing emissions by a minimum of 80% by 2050 and places a duty on the Welsh Ministers to set a series of interim targets (for 2020, 2030 and 2040) and carbon budgets. These budgets will set limits on the total amount of emissions emitted in Wales over a 5 year period and act as stepping stones to ensure regular progress is being made towards the long term target.

By the end of 2018, the Welsh Government will be setting their interim targets and first two carbon budgets in legislation, providing clarity and certainty to help drive investment. The Welsh Government will also set out how they are going to achieve their first carbon budget through policies and proposals by the end of March 2019. This will inform their Low Carbon Delivery Plan. These actions will cover key sectors such as energy, buildings, agriculture and land use, industry and business, waste and transport.

Air pollution often originates from similar activities that contribute to climate change and there are many co-benefits that can be realised through actions such as promoting low-carbon vehicles, renewable sources of energy and planting trees. In delivering the Low Carbon Delivery Plan, the Welsh Government will look to maximise the opportunities from the transition to a low carbon economy, which not only brings opportunities around clean growth, quality jobs and global market advantages, but also has wider benefits of enhanced places to live and work, with clean air and water and improved health outcomes.

The WFG Act has also established average population exposure to nitrogen dioxide as one of the Welsh Government national indicators which are used to measure progress towards well-being goals in Wales.

The Environment (Wales) Act 2016 sets out the "sustainable management of natural resources" (SMNR). SMNR means using natural resources in a way and at a rate that promotes the achievement of the objective to maintain and enhance the resilience of ecosystems and the benefits they provide, and that, in doing so, meets the needs of present generations without compromising the ability of future generations to meet their needs. The definition of "natural resources" includes air. The Act sets out a framework for the delivery of SMNR, which includes a statutory evidence base: The State of Natural Resources Report published by Natural Resources Wales in 2016<sup>93</sup>, and a statutory Natural Resources Policy which was published in August 2017<sup>94</sup>. The Natural Resources Policy sets out the challenges and opportunities for managing Wales' natural resources sustainably, which includes reducing pollution levels in air and enhancing air quality. Actions for air quality include taking practical steps to improve air quality across Wales, not just in the most polluted hotspots but across Wales. This will require a mix of action to address pollution from traffic and other sources and to improve the ability of the natural environment to absorb pollutants through tree planting and green infrastructure.



## Clean Air Wales Programme

In order to be effective in tackling air quality pollution, it is essential to take a cross-Government approach. To achieve this, the Welsh Government is establishing a cross-Government Clean Air Wales Programme this summer to reduce the burden of poor air quality on human health and the natural environment. In the nearer term, it will support delivery of actions required to comply with our European and domestic legislative air quality obligations.

This programme will consider evidence and develop and implement actions required across Government Departments including environment, decarbonisation, transport, local government, planning, agriculture and industry to achieve Clean Air for Wales.

For example, in order to reduce atmospheric ammonia and fine particulate matter emissions, the Directive requires National Air Pollution Control Programmes to include measures applicable to the agricultural sector. Such measures should be cost-effective and based on specific information and data, taking account of scientific progress and previous measures undertaken by Member States. There is a requirement for a National Action Programme to be published by March 2019.

Draft guidance and reporting format for the National Air Pollution Control Programme required under the Directive is currently being assessed. Member States must take into account an Ammonia Guidance Document and make use of best available techniques. Member States must also establish a national advisory code of good agricultural practice to control ammonia emissions, taking into account the UNECE Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions of 2014, which covers at least the following items:

- nitrogen management, taking into account the whole nitrogen cycle
- livestock feeding strategies
- low-emission manure spreading techniques
- low-emission manure storage systems
- low-emission animal housing systems
- possibilities for limiting ammonia emissions from the use of mineral fertilisers

The Welsh Government is currently assessing how their existing Code of Good Agricultural Practice addresses these requirements and whether the Code, which is currently being reviewed, should be amended.

The principles of Basic Measures were consulted upon as part of the Consultation on the SMNR, which ended in 2017. A Welsh Government working group has been established to consider the need for Basic Measures, including measures to address air pollution caused by agriculture, and whether powers are available or needed for their introduction. The outcome of this work will inform future Clean Air Wales Programme actions.

The Programme will build on existing cross-Government work to reduce air pollution. For example, Planning Policy Wales (PPW), the Welsh Government's main planning policy document, has been completely restructured and rewritten in the context of the Well-being of Future Generations Act.

Air quality and soundscape are addressed in the new PPW as a key component of the natural and built environment, placing the issues on an equal footing with other objectives such as housing, transport and economic development. The revisions to PPW recognise the importance of air quality and appropriate soundscapes to the health and well-being of people and the environment. It is expected that the new PPW will ensure long-term approaches are taken to prevent creation of new problems or worsening of existing issues. It will also seek to encourage integrated solutions which aim to reduce average levels of airborne pollution. The revised PPW was published for public consultation on 12 February with responses required by 18 May<sup>95</sup>.

On 25 April, the Welsh Government published their consultation on a Clean Air Zone Framework for Wales. This provides guidance to local authorities<sup>96</sup> who are considering options to address local air quality issues. It describes what a clean air zone is, under what circumstances it may be applied and the key considerations for local authorities who wish to establish one. The reasons for reducing airborne pollution, through a clean air zone, may be to address the need to reduce emissions to within legal limits, but most importantly, to bring about improvements in the environment and to deliver better health for all. The final version of the Framework will be published, and issued to local authorities, by 31 July 2018.



On 25 April, the Welsh Government also published a consultation on the Welsh Government supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017. The plan sets out how the Welsh Government will reduce concentrations of NO<sub>2</sub> around roads where levels are above legal limits in the shortest possible time.

Welsh Ministers have accepted that the Welsh section of the 2017 plan did not satisfy the requirements of the Ambient Air Quality Directive and associated Welsh Regulations during a judicial review earlier this year. This consultation and the accompanying Plan have been published to meet legal obligations.

The Welsh Government is committed to legal compliance. However, the focus of the plan is taking action to improve the air quality for everyone in Wales for the health improvements that this will deliver and because it's the right thing to do. A final compliant plan will be published by 31 July 2018 in accordance with a court undertaking.

The Welsh Government has committed £20 million for an Air Quality Fund through to 2021 to help accelerate compliance with nitrogen dioxide limits and improve air quality in Wales.

This will be used to provide ongoing support, guidance and finance, enabling Councils to develop and implement plans and take action to achieve compliance in the soonest possible time.

In addition, the Welsh Government issued new statutory policy guidance to local authorities in Wales in June 2017, which ensures that the ways of working enshrined in the WFG Act are applied fully in local authorities' air quality management work. The new guidance stresses the need for transport and planning departments in local authorities to work collaboratively with air quality teams if local air quality management is to succeed. This statutory guidance recognises schools and active travel routes, amongst others, as "sensitive receptor locations".

Addressing air quality in Wales is an urgent issue and local authorities are crucial to achieving the development of a broad range of solutions. The Welsh Government has invited Welsh local authorities to apply for use of their Green Infrastructure funding<sup>97</sup> to secure any monitoring equipment they need for assessing, mapping and targeting appropriate solutions which includes the development and/or enhancement of local green infrastructure.

A key future action for the programme is the development of a Clean Air Plan for Wales, which the Welsh Government intends to publish for consultation by the end of 2018 with a view to publishing in early 2019. The Clean Air Plan for Wales will include a range of measures to support our aspirations for clean air, including:

- identifying key pollutants and their effects on public health and the natural environment in Wales. These will include noise and legally binding targets to reduce emissions of the most damaging pollutants under the National Emissions Ceiling Directive (fine particulate matter, ammonia, nitrogen oxides, sulphur dioxide, non-methane volatile, ozone) by 2020 and 2030
- measures to achieve compliance with the European and domestic legislative requirements
- actions across a range of Welsh Government departments and sectors to achieve clean air in Wales. For example, environment, transport, planning, agriculture and industry
- details about the establishment of an Air Quality Assessment and Monitoring Centre for Wales, to advise local and national government on the extent of poor air quality and the effectiveness of current and future actions
- proposed communications, engagement and education to encourage behavioural change to support air quality improvements
- proposed improvements to local authority reporting on air quality issues in their areas and their plans to deal with them

# 10. Progress towards our clean air goals

## 10.1 Our commitments to improving air quality

The UK has signed up to a number of high-profile international agreements to improve air quality. This is because we recognise that reducing air pollution not only benefits our own citizens, but emissions can travel long distances and impact human and environmental health around the world. Our commitments relate to total emissions<sup>98</sup> and local concentrations<sup>99</sup> of pollutants.

The UK is compliant with the concentration limit values set out in EU legislation, except for NO<sub>2</sub> where we face a significant challenge along with many other EU countries. We have therefore produced an air quality plan for nitrogen dioxide<sup>100</sup>, which will ensure compliance with NO<sub>2</sub> limit values as quickly as possible. We are currently compliant with our ceilings for total emissions for all pollutants. However, we need to ensure that we continue to reduce the total amount of air pollution we produce to both protect the health of the nation and remain compliant with our statutory commitments.

The table below, presents our 2005 baseline emissions of 5 key pollutants and our commitments to reductions by 2020 and 2030<sup>101</sup>.

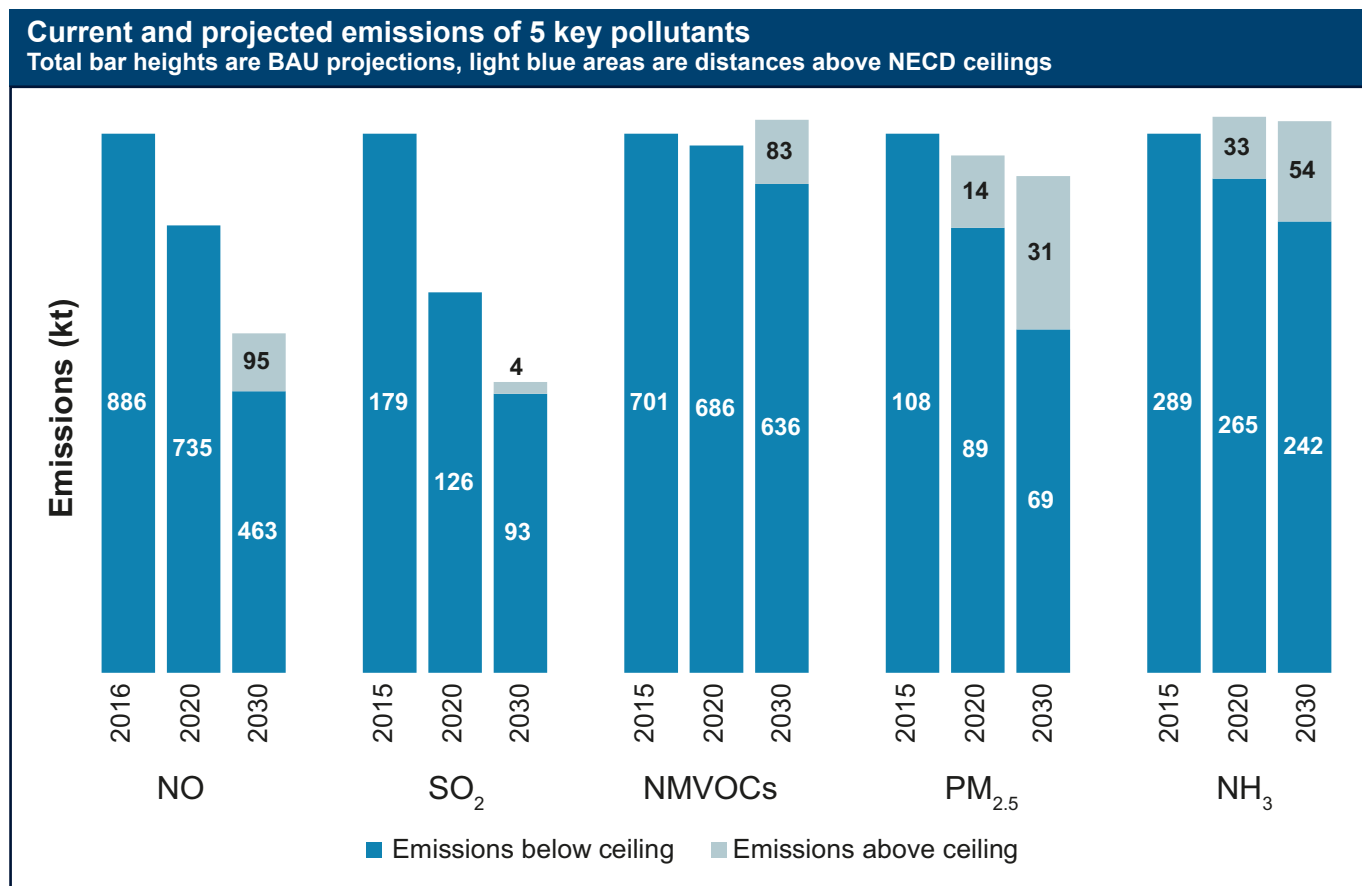
	2005 baseline (kt)	Reduction required by 2020	Reduction required by 2030	2020 ceiling (kt)	2030 ceiling (kt)
NO <sub>x</sub>	1,714	55%	73%	771	463
SO <sub>2</sub>	773	59%	88%	317	93
NMVOCs	1,042	32%	39%	709	636
PM <sub>2.5</sub>	127	30%	46%	89	69
NH <sub>3</sub>	288	8%	16%	265	242

## 10.2 How far will existing action get us?

Measuring our progress towards emission ceilings requires an understanding of future emissions of air pollution based on our best estimates about the likely impacts of our regulatory measures and other actions already in place. Emission projections are produced by Ricardo Energy & Environment on behalf of Defra and are published via the EIONET data repository<sup>102</sup>.

Projections are constructed by using our knowledge and some informed assumptions about how activities that produce air pollution are likely to change over time (for example, the levels and types of industrial production) and how much pollution each activity would produce (for example, the amount of pollution produced per unit of industrial production). These projections are consistent with projections for other government policy priorities, such as those developed for BEIS on future energy use<sup>103</sup>.

The figure below, presents our actual emissions in 2016 and our projected 2020 and 2030 emissions before the new policies and commitments set out in this strategy are taken into account. It shows whether these projections are above or below our emissions ceilings. The total height of each bar (i.e., light blue plus dark blue areas) are current and projected total emissions for each pollutant. The dark blue segments of each bar represent emissions that are up to our ceilings and the light blue segments represent emissions above our ceilings. Where a bar has no light blue segment we are already on track to deliver emissions reductions that will meet a particular emissions ceiling.



This figure shows that, without the new policies and commitments set out in this strategy, we would be likely to breach our emissions ceilings for PM<sub>2.5</sub> and NH<sub>3</sub> in 2020 and all five of our emissions ceilings in 2030. Following a path of no action will have a significant long-term impact on the health of our nation. Using the latest research commissioned by Public Health England, we have made an interim estimate of the population health impacts if we do not achieve our emissions ceilings. We estimate that the population health impacts would be over £1bn per annum by 2020 and nearly £2.5bn per annum by 2030. These costs will continue to be refined and we will publish a new set of impact appraisal tools this year.

## 10.3 Action to meet our emissions ceilings

As discussed in previous chapters, air pollution is produced from a wide range of sources and we have identified a suite of policies across different sectors to reduce our overall emissions. These build on existing policies, such as eco design for domestic stoves and the Medium Combustion Plant Directive. The table below presents how our proposed suite of policies will go further to abate emissions to close the gap to our emissions ceilings.

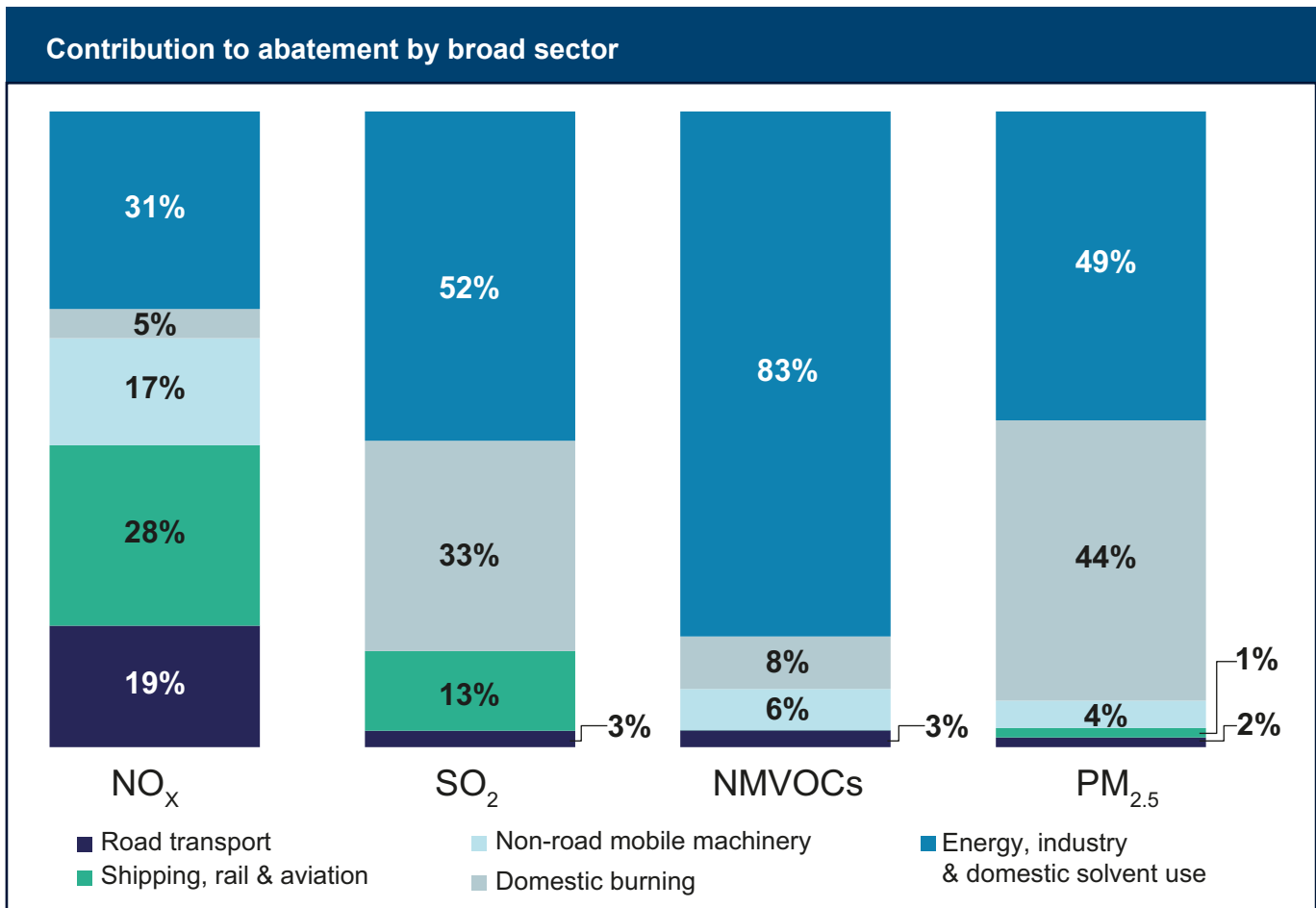
Table showing the impact of Clean Air Strategy policies

	2020 gap to ceiling (kt)	2030 gap to ceiling (kt)	Policy impact (kt)
NO <sub>x</sub>	0	95	up to 110
SO <sub>2</sub>	0	4	up to 25
NMVOCs	0	83	up to 85*
PM <sub>2.5</sub>	14	31	up to 35
NH <sub>3</sub>	33	54	up to 55

\*(of which 55 already set out)

The table indicates that for NO<sub>x</sub>, PM<sub>2.5</sub> and NH<sub>3</sub> we need to deliver at the upper estimates of our policy impacts to meet our emissions ceilings in 2030. For NMVOCs, we will need to identify further reductions to close the gap to our 2030 emission ceiling. SO<sub>2</sub> is less challenging, as actions to reduce NO<sub>x</sub> and PM<sub>2.5</sub> have the co-benefits of reducing SO<sub>2</sub>.

We have also analysed the abatement potential at sector level. The chart below, presents our initial assessment of abatement by broad sector.



The chart indicates how our policies will look for emission reductions across all sectors. For  $\text{NO}_x$ , there is significant potential for abatement in non-road transport. For NMVOCs, the largest opportunities are associated with industrial processes and domestic solvent use. For  $\text{PM}_{2.5}$  we need to look for reductions in the domestic burning and energy and industry sectors. Reductions in  $\text{NH}_3$  emissions are not presented as they are expected to be delivered exclusively in the agricultural sector.

In conclusion, we believe that the commitments set out in the preceding chapters will enable us to meet four of our emissions ceilings. Chapter 6 of this strategy sets out the action that is underway to identify further options to reduce NMVOC emissions in time to meet our 2030 emissions ceiling.

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## 10.4 Questions

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- Q30. What do you think of the package of actions in the strategy as a whole?
- Q31. Do you have any specific suggestions for additional or alternative actions that you think should be considered to achieve our objectives? Please outline briefly, providing evidence of potential effectiveness where possible.
- Q32. If you have any further comments not covered elsewhere, please provide them here.



# Annex A: Clean air strategy consultation questions

## Overview

Last summer, we published our plans for reducing roadside nitrogen dioxide concentrations in the UK, setting out our approach to meeting the statutory limits for NO<sub>2</sub>.

This draft of our Clean Air Strategy outlines our ambitions relating to reducing air pollution in the round, making our air healthier to breathe, protecting nature and boosting the economy. In this draft strategy, we set a clear direction for future air quality policies and goals. The strategy sits alongside three other important UK government strategies: our Industrial Strategy, our Clean Growth Strategy and our 25 Year Environment Plan.

We are consulting here on a draft strategy developed by the UK government, setting out how we will work towards meeting these ambitious reductions in England (and where relevant across the UK). However, air quality is a devolved matter with responsibility also resting with the Scottish Government, Welsh Government and the Northern Ireland Executive. Since air pollution does not respect national boundaries, securing the necessary improvements will require action in all parts of society and across the UK. The strategy, therefore, highlights the importance of effective co-operation with the devolved administrations and Chapter 9 briefly sets out actions already underway in Scotland, Wales and Northern Ireland to cut air pollution right across the UK.

## Why we are consulting

The Clean Air Strategy deals with action to improve air quality by addressing pollution from a wide range of sources. It cuts across a broad range of sectors and touches on the interests of many.

We would like your views on the actions being proposed to tackle air pollution and reduce its impacts, and to hear whether you have any further suggestions.

We are consulting on each of the main themes of the strategy document: our understanding of the problem; protecting the nation's health; protecting the environment; securing clean growth and innovation; reducing emissions from transport; reducing emissions from farming; reducing emissions from industry; and leadership. We also ask for your views on the strategy as a whole in the last chapter on progress against targets.

We understand that many of those wishing to respond to this consultation may have interests pertaining to only some of these areas. We have designed the accompanying survey to enable you to concentrate on the areas that are most relevant to you, as well as providing an opportunity to comment on the strategy as a whole. Click on the link below to start.

If you choose to provide a response separate to the online survey, please outline whether you are an individual or responding on behalf of an organisation (and provide relevant details). Please also let us know whether you would like your response to be treated as confidential.

The responses we receive now are important and will inform the final UK Clean Air Strategy and detailed National Air Pollution Control Programme to be published in March 2019. We want to hear from all interested parties to help us shape our final strategy.

If you have any questions on this consultation please email:  
[cleanair.consultations@defra.gsi.gov.uk](mailto:cleanair.consultations@defra.gsi.gov.uk)

## 1. Understanding the problem

- Q1. What do you think about the actions put forward in the understanding the problem chapter? Please provide evidence in support of your answer if possible.
- Q2. How can we improve the accessibility of evidence on air quality, so that it meets the wide-ranging needs of the public, the science community, and other interested parties?

## 2. Protecting the nation's health

- Q3. What do you think of the package of actions put forward in the health chapter? Please provide evidence in support of your answer if possible.
- Q4. How can we improve the way we communicate with the public about poor air quality and what people can do?

## 3. Protecting the environment

- Q5. What do you think of the actions put forward in the environment chapter? Please provide evidence in support of your answer if possible.
- Q6. What further action do you think can be taken to reduce the impact of air pollution on the natural environment? Where possible, please include evidence of the potential effectiveness of suggestions.

## 4. Securing clean growth and innovation

- Q7. What do you think of the package of actions put forward in the clean growth and innovation chapter? Please provide evidence in support of your answer if possible.
- Q8. In what areas of the air quality industry is there potential for UK leadership?
- Q9. In your view, what are the barriers to the take-up of existing technologies which can help tackle air pollution? How can these barriers be overcome?
- Q10. In your view, are the priorities identified for innovation funding the right ones?

## 5. Action to reduce emissions from transport

- Q11. What do you think of the package of actions put forward in the transport chapter? Please provide evidence in support of your answer if possible.
- Q12. Do you feel that the approaches proposed for reducing emissions from Non-Road Mobile Machinery are appropriate or not? Why?

## 6. Action to reduce emissions at home

- Q13. What do you think of the package of actions put forward to reduce the impact of domestic combustion? Please provide evidence in support of your answer if possible.
- Q14. Which of the following measures to provide information on a product's non-methane volatile organic compound content would you find most helpful for informing your choice of household and personal care products, and please would you briefly explain your answer?
  - "A B C" label on product packaging (a categorised product rating for relevant domestic products, similar to other labels such as food traffic light labels)
  - information on manufacturer website
  - leaflet at the point of sale
  - inclusion in advertising campaigns
  - other option
- Q15. What further actions do you think can be taken to reduce human exposure from indoor air pollution?

## 7. Action to reduce emissions from farming

- Q16. What do you think of the package of actions put forward in the farming chapter? Please provide evidence in support of your answer if possible.
- Q17. What are your preferences in relation to the 3 regulatory approaches outlined and the timeframe for their implementation: (1) introduction of nitrogen (or fertiliser) limits; (2) extension of permitting to large dairy farms; (3) rules on specific emissions-reducing practices? Please provide evidence in support of your views if possible.
- Q18. Should future anaerobic digestion (AD) supported by government schemes be required to use best practice low emissions spreading techniques through certification? If not, what other short-term strategies to reduce ammonia emissions from AD should be implemented? Please provide any evidence you have to support your suggestions.

## 8. Action to reduce emissions from industry

- Q19. What do you think of the package of actions put forward in the industry chapter? Please provide evidence in support of your answer if possible.
- Q20. We have committed to applying Best Available Techniques to drive continuous improvement in reducing emissions from industrial sites. What other actions would be effective in promoting industrial emission reductions?
- Q21. Is there scope to strengthen the current regulatory framework in a proportionate manner for smaller industrial sites to further reduce emissions? If so, how?
- Q22. What further action, if any, should government take to tackle emissions from medium plants and generators? Please provide evidence in support of your suggestions where possible.
- Q23. How should we tackle emissions from combustion plants in the 500kW-1MW thermal input range? Please provide evidence you might have to support your proposals if possible.

- Q24. Do you agree or disagree with the proposal to exempt generators used for research and development from emission controls? Please provide evidence where possible.

## 9. Leadership at all levels (local to international)

- Q25. What do you think of the package of actions put forward in the leadership chapter? Please provide evidence in support of your answer if possible.
- Q26. What are your views on the England-wide legislative package set out in section 9.2.2? Please explain, with evidence where possible.
- Q27. Are there gaps in the powers available to local government for tackling local air problems? If so, what are they?
- Q28. What are the benefits of making changes to the balance of responsibility for clean local air between lower and upper tier authorities? What are the risks?
- Q29. What improvements should be made to the Local Air Quality Management (LAQM) system? How can we minimise the bureaucracy and reporting burdens associated with LAQM?

## 10. Progress against targets

- Q30. What do you think of the package of actions in the strategy as a whole?
- Q31. Do you have any specific suggestions for additional or alternative actions that you think should be considered to achieve our objectives? Please outline briefly, providing evidence of potential effectiveness where possible.
- Q32. If you have any further comments not covered elsewhere, please provide them here.

**Many thanks for sharing your views with us. We will ensure these have been properly considered before the strategy is published.**

## At the end of the consultation

When this consultation ends, we will keep copies securely. Members of the public may ask for a copy of responses under freedom of information legislation.

If you do not want your response - including your name, contact details and any other personal information – to be publicly available, please say so clearly in writing when you send your response to the consultation. Please note, if your computer automatically includes a confidentiality disclaimer, that won't count as a confidentiality request.

Please explain why you need to keep details confidential. We will take your reasons into account if someone asks for this information under freedom of information legislation. But, because of the law, we cannot promise that we will always be able to keep those details confidential.

We will summarise all responses and place this summary on our website at [www.gov.uk/defra](http://www.gov.uk/defra). This summary will include a list of names of organisations that responded but not people's personal names, addresses or other contact details.

Please give us 24 hours' notice if you wish to see consultation responses and summaries. There is a charge for photocopying and postage.

If you have any comments or complaints about the consultation process, please address them to:

Defra Consultation Co-ordinator,

Area 1C Nobel House 17 Smith Square London SW1P 3JR

or email:  
[consultation.coordinator@defra.gsi.gov.uk](mailto:consultation.coordinator@defra.gsi.gov.uk)

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