RCP/RCPH Working Party on Air Pollution

Every breath we take: the lifelong impact of air pollution
Feb 23rd 2016

Professor Stephen Holgate
Chair RCP WP on Air Pollution, MRC
Professor University of Southampton.

The Great Smog of 1952 took hold on London 65 years ago, claiming an estimated 4200 lives.

60 years after the Clean Air Act: the toxic legacy of King Coal.

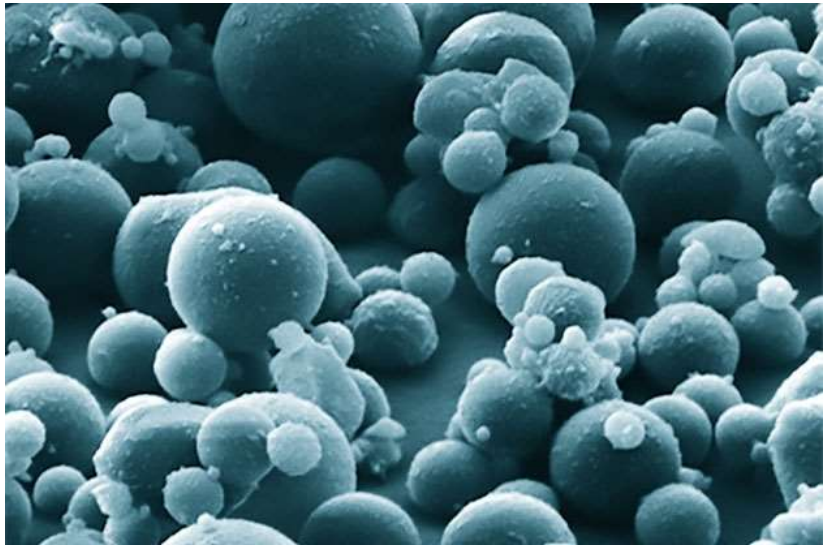
D.I.W. Phillips, C. Osmond, H. Southall, P. Aucott, A. Jones, S. Holgate

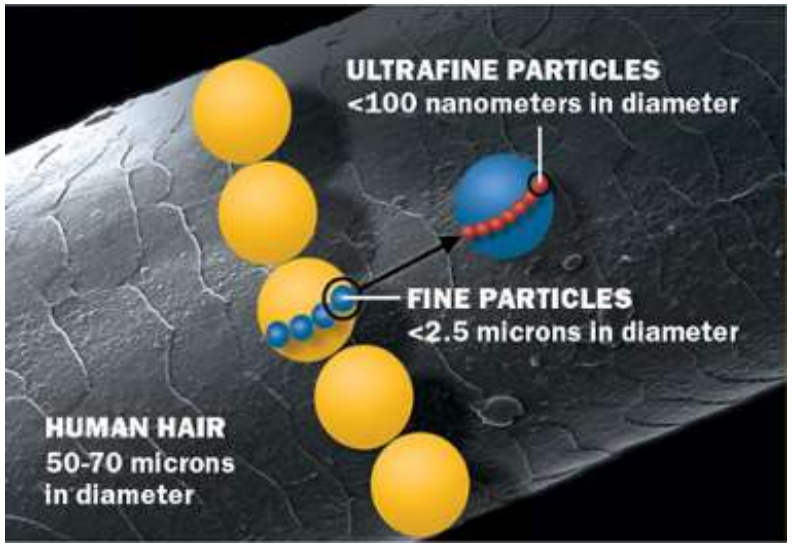
Coal was the major cause of pollution in the UK until the Clean Air Act of 1956 led to a rapid decline in consumption.

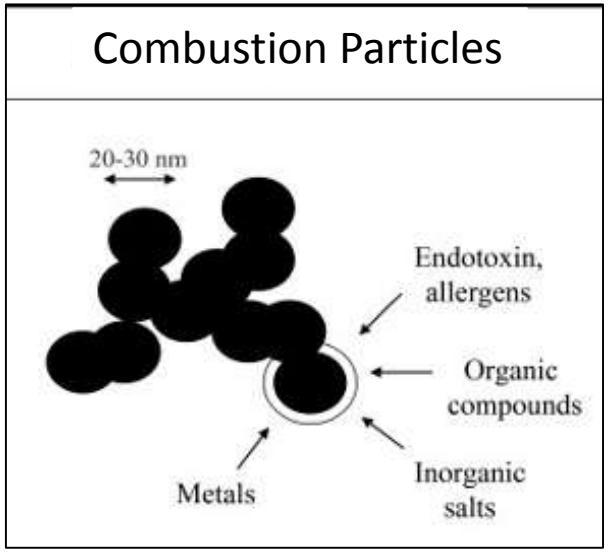
Although based on geographical correlations, our data provide convincing evidence that coal-based pollution, experienced over 60 years ago in young children, affects human health now, by increasing mortality from a wide variety of diseases.

Sources and types of outdoor air pollution

Particulate air pollution remains the greatest concern:
PM_{10} and $PM_{2.5}$



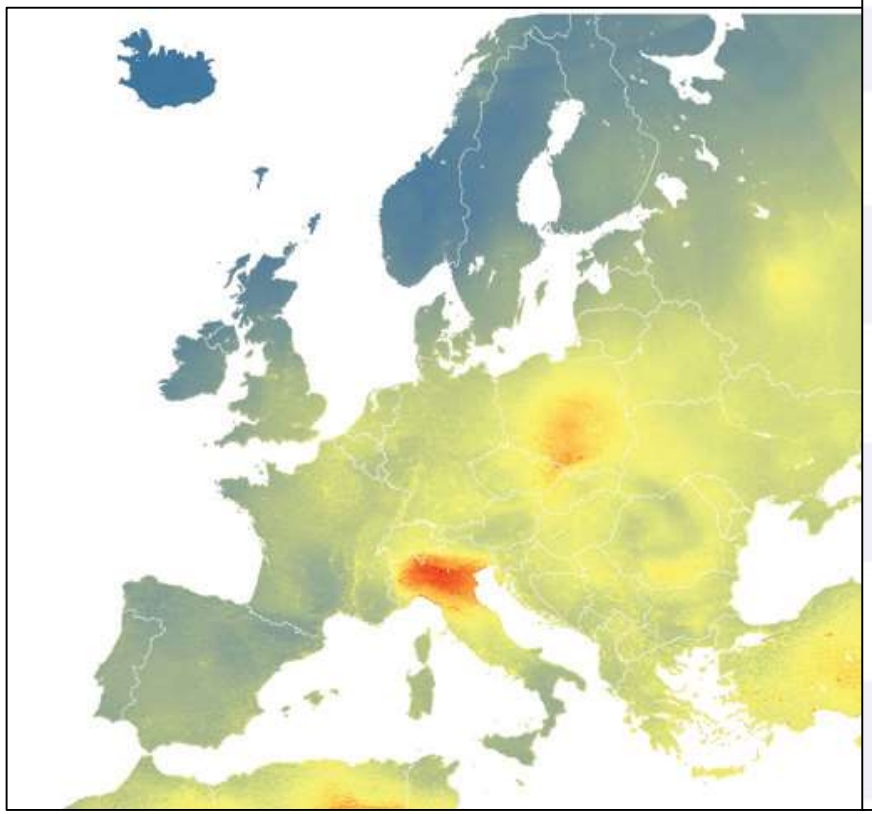




How the 2016 RCP/RCPH report came about

- Great strides made on tobacco control, alcohol and obesity
- Air pollution remains a major public health challenge
- Interactions between air pollution and climate change
- RCP and RCPCH convened working party to discuss evidence and draw up recommendations

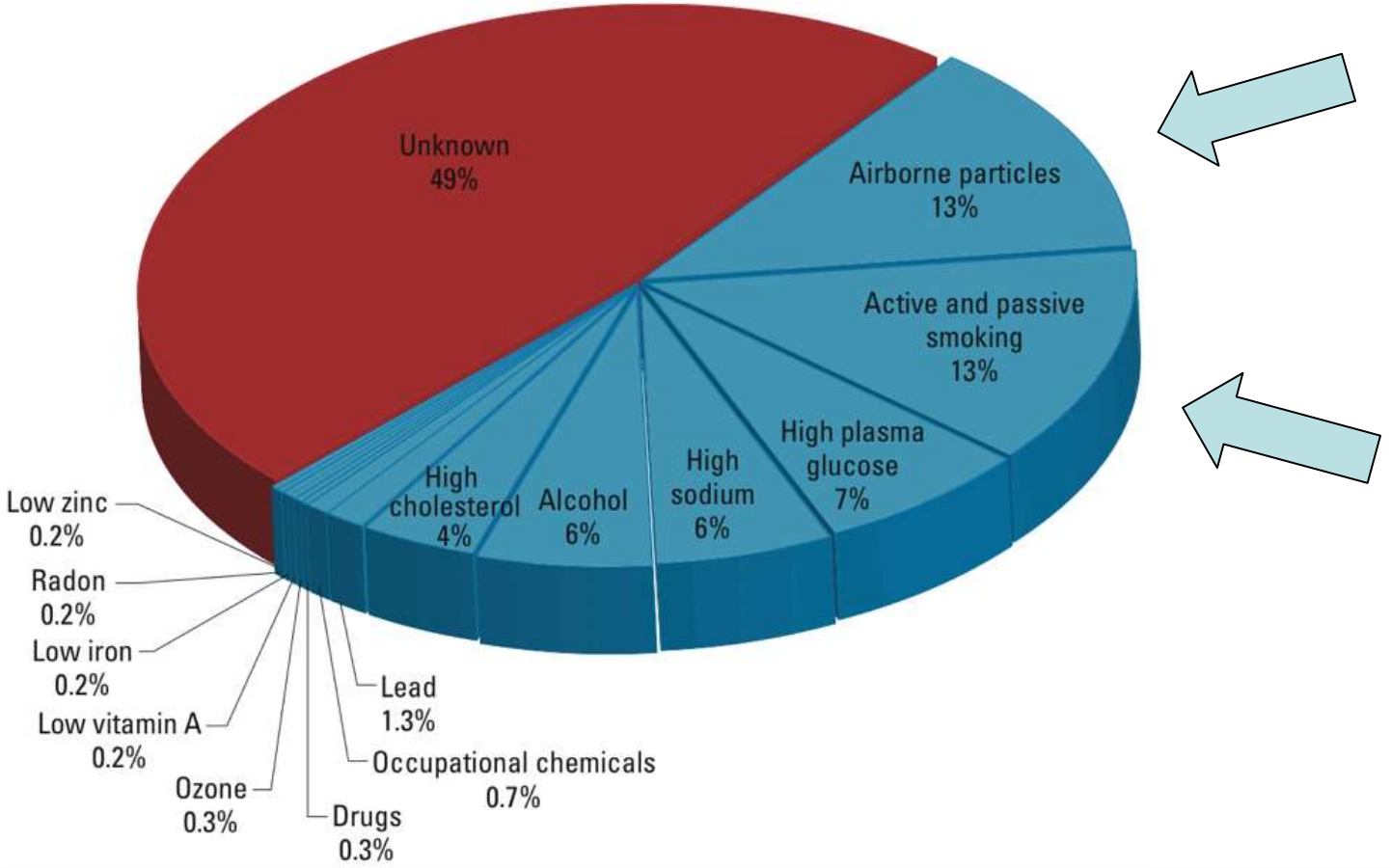
Satellite derived $PM_{2.5}$ level (global annual average), 2012-2014



EU urban population exposed to harmful levels of air pollutant concentrations in 2012–2014, according to:

	EU limits/target values	WHO guidelines
$PM_{2.5}$	8–12 %	85–91 %
PM_{10}	16–21 %	50–63 %
O_3	8–17 %	96–98 %
NO_2	7–9 %	7–9 %
BaP	20–24 %	88–91 %
SO_2	<1 %	35–49 %

Risk factors for exposures that contribute to chronic-disease mortality. The chart was compiled from World Health Organization estimates of exposures affecting 50 million global deaths in 2010



Clear the air for children: The impact of air pollution on children.

unicef

October 2016

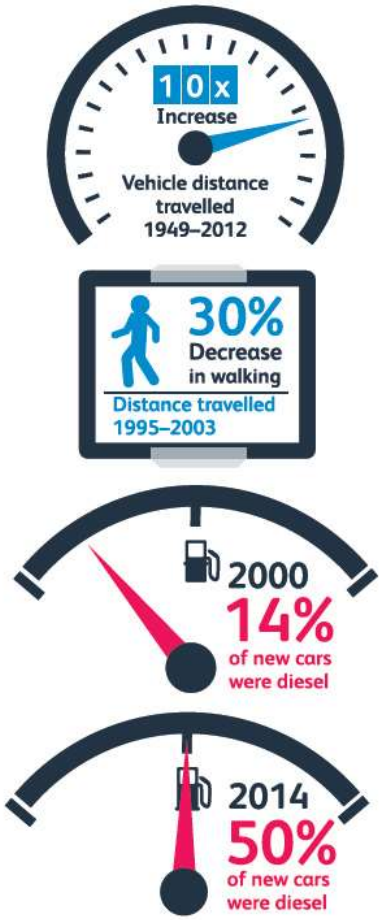
unicef

Together, outdoor and indoor air pollution are directly linked with pneumonia and other respiratory diseases that account for almost one in 10 under-five deaths, making air pollution one of the leading dangers to children's health.

Why the RCP is tackling this issue?

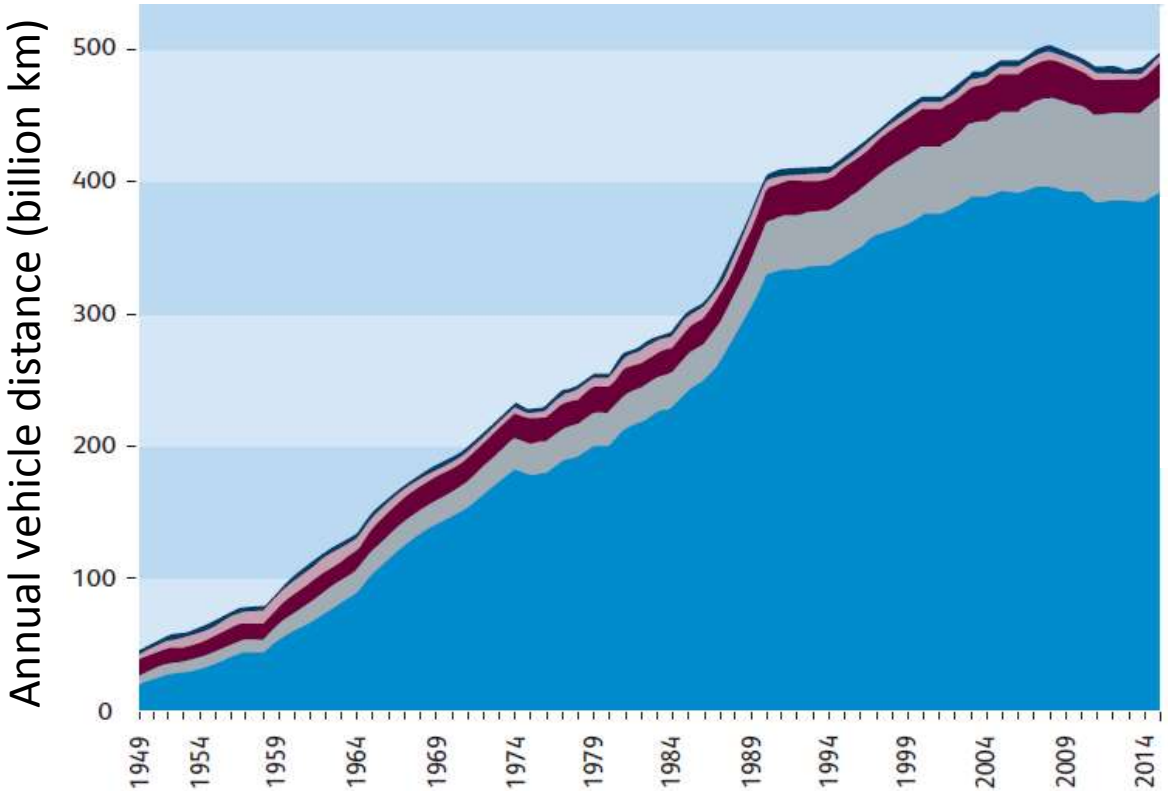
- Air pollution estimated to cause around 40,000 deaths per year in the UK
- Estimated cost of air pollution is £20bn annually in the UK
- Linked to major health challenges of our day such as heart disease, asthma, COPD, lung cancer, diabetes and dementia

Air pollution in our changing world



- Changes in the way we live have changed air we breathe
- Total distance walked each year decreased by 30% between 1995 and 2013
- In 2012, road traffic in the UK was 10x higher than in 1949
- Not just outdoor environment but indoor as well

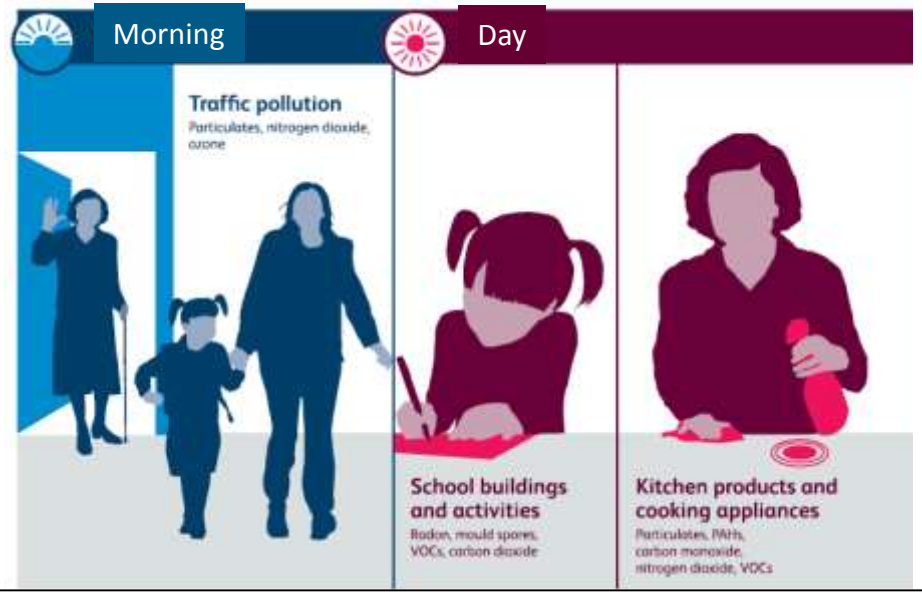
Annual distance travelled by road in the UK

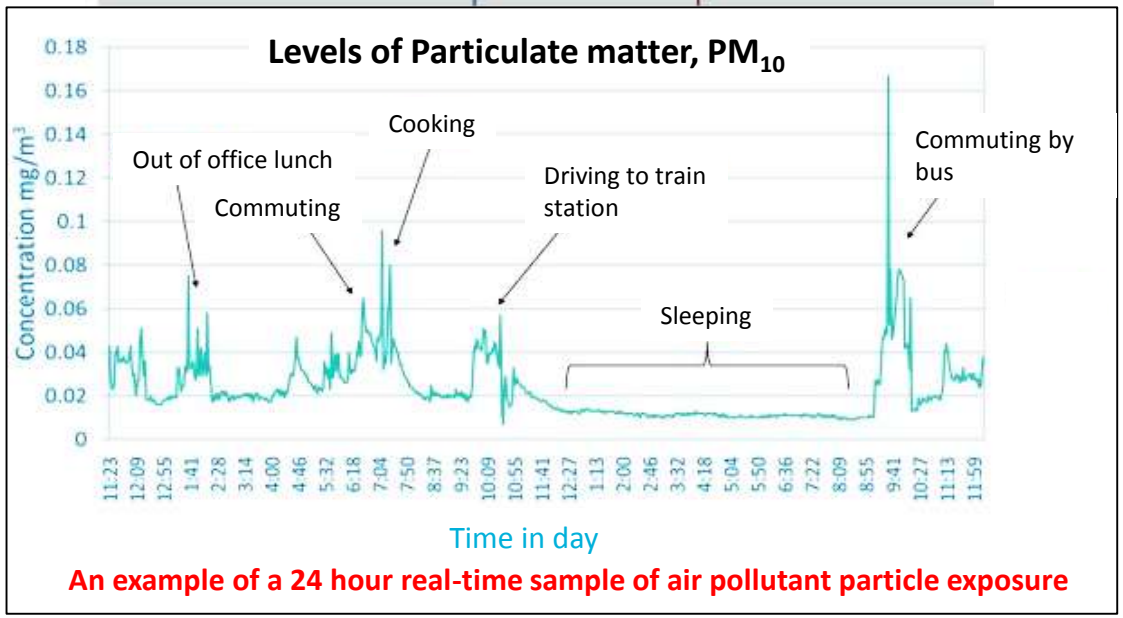


Now, 774,513 diesel cars in London

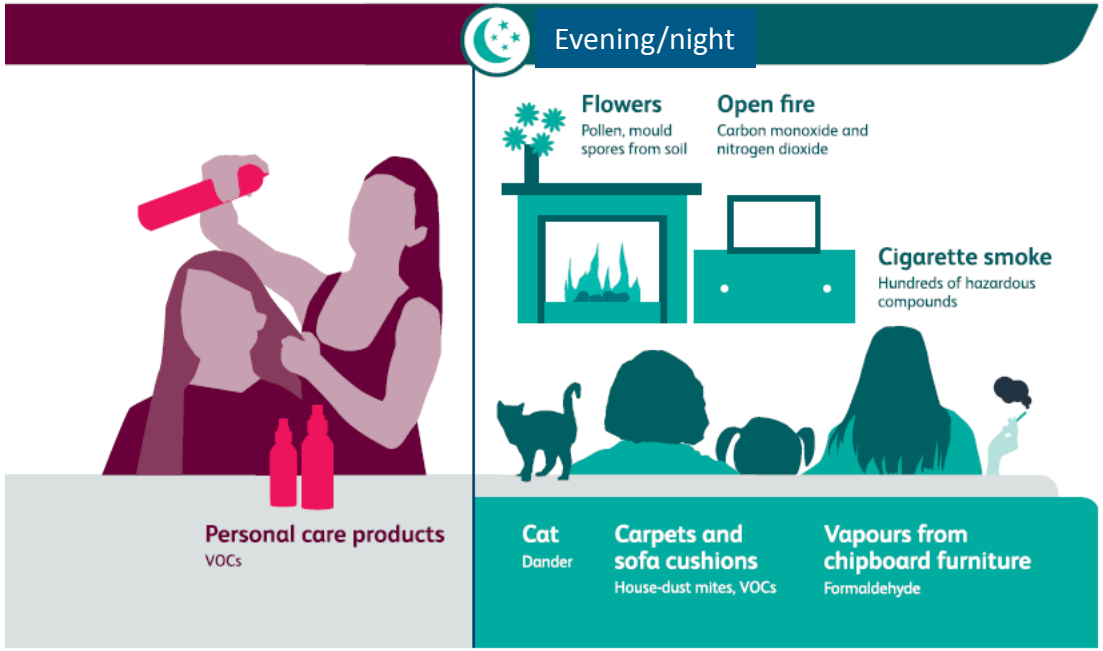
170,000 (30%) increase since 2012

Health effects of pollutants across 24 hours/day of exposures

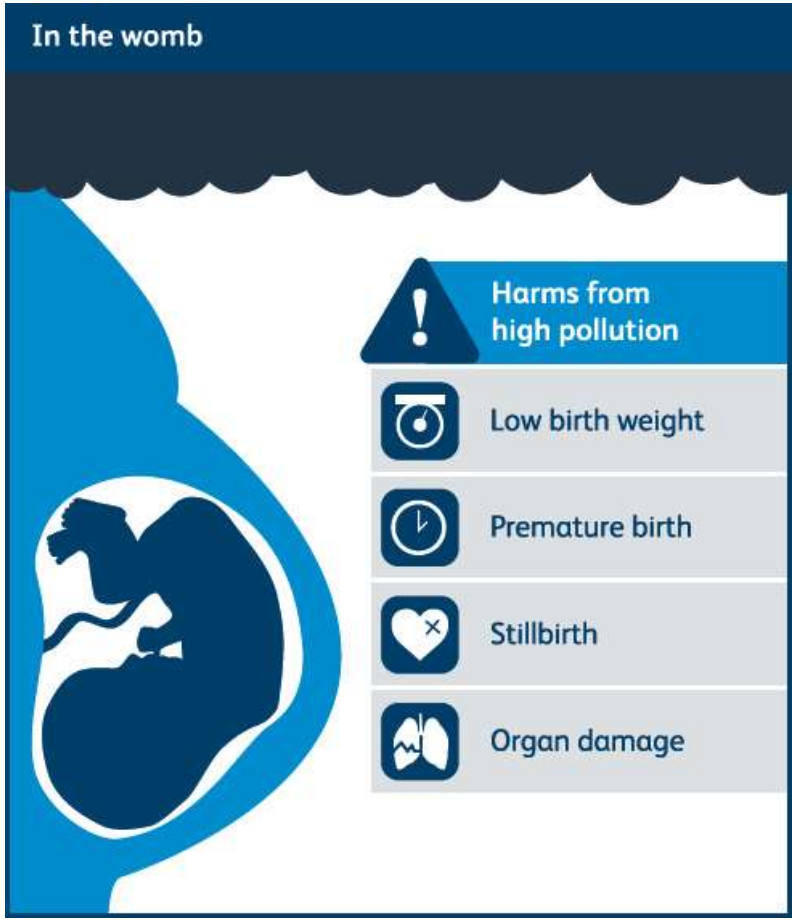




An example of a 24 hour real-time sample of air pollutant particle exposure

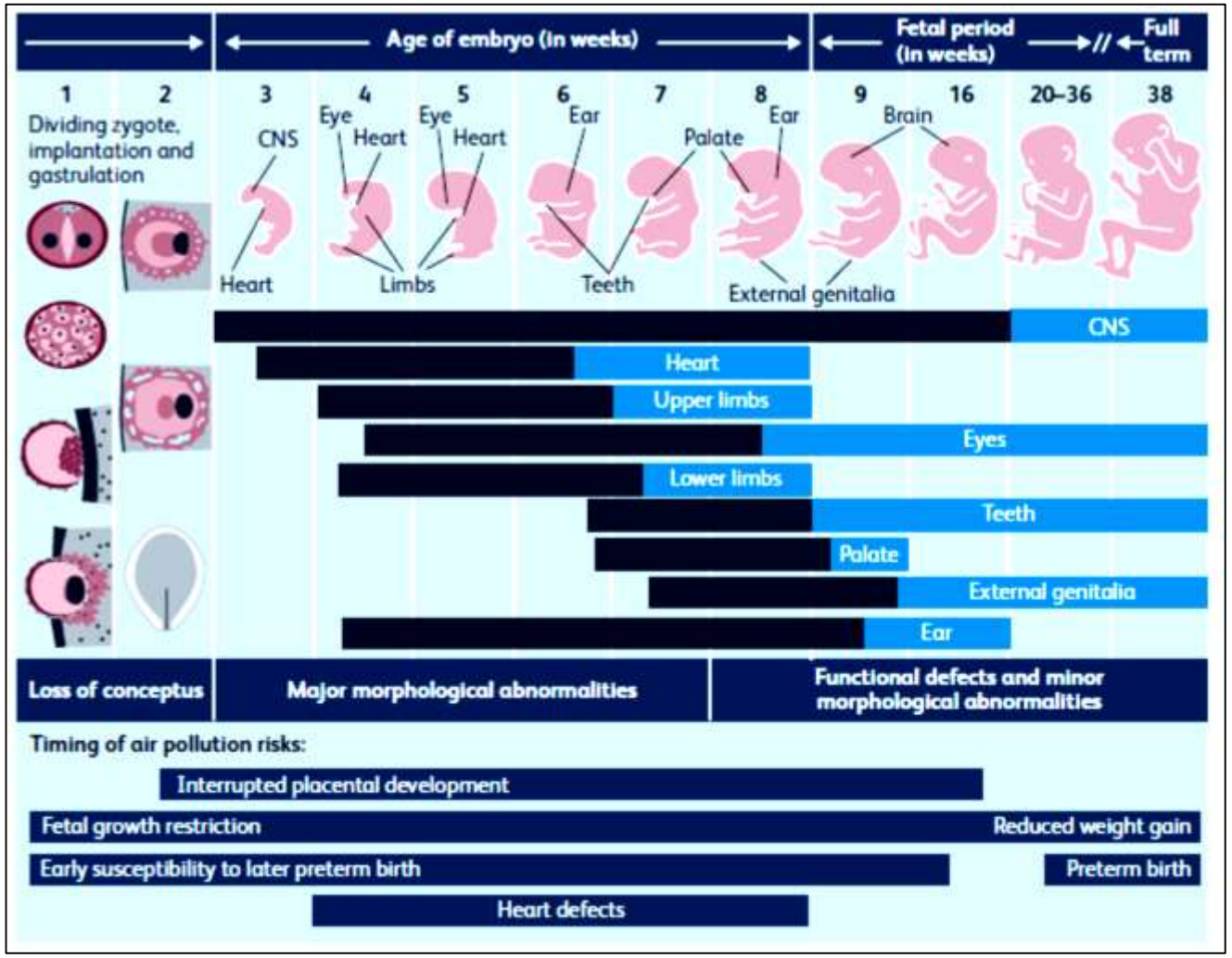


Protecting future generations

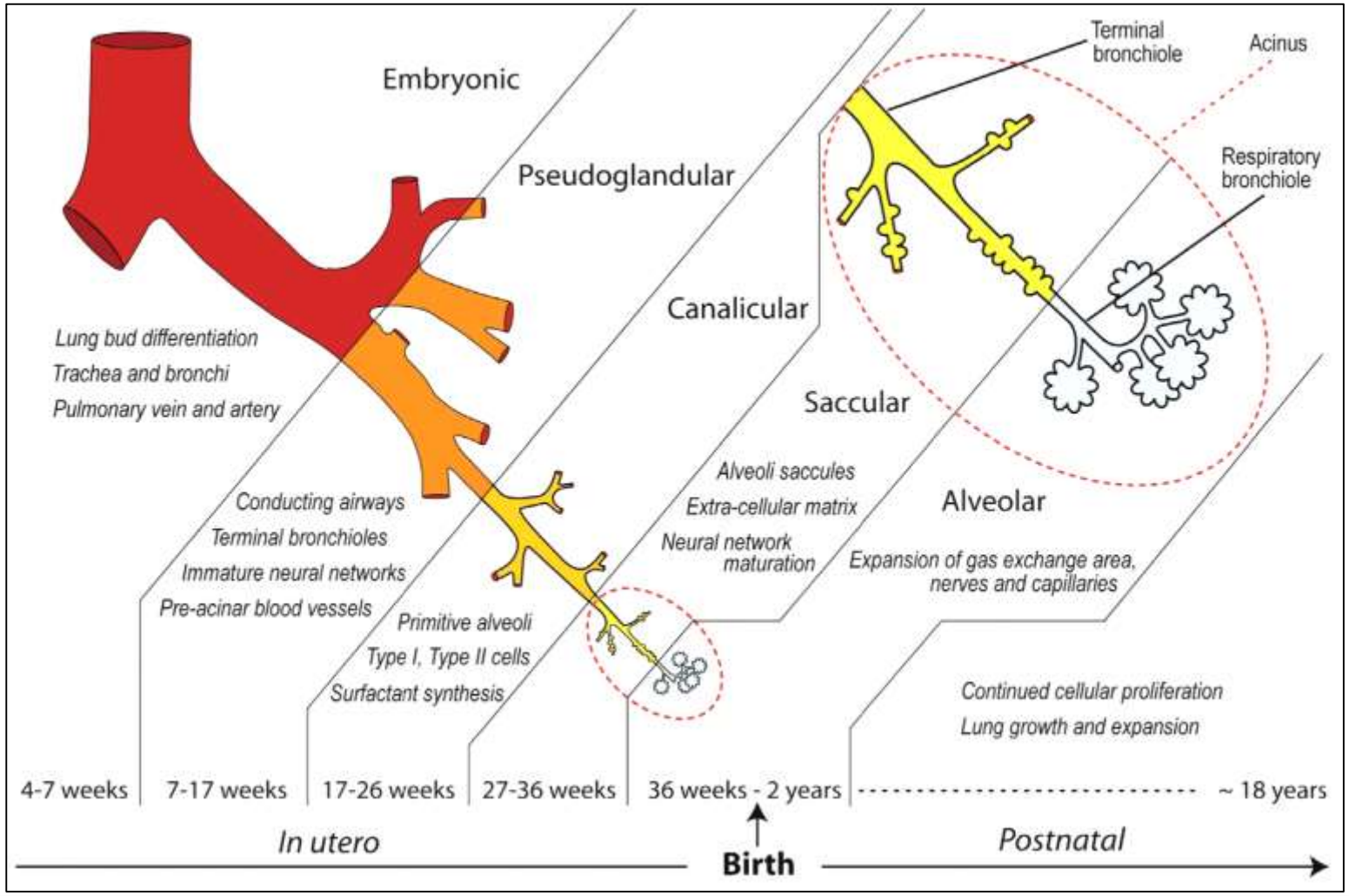


- First report to examine health implications of exposure to air pollution over lifetime
- Developing heart, lung, brain, hormone systems and immunity can all be harmed by pollution
- Effects growth, intelligence, asthma and development of the brain and coordination

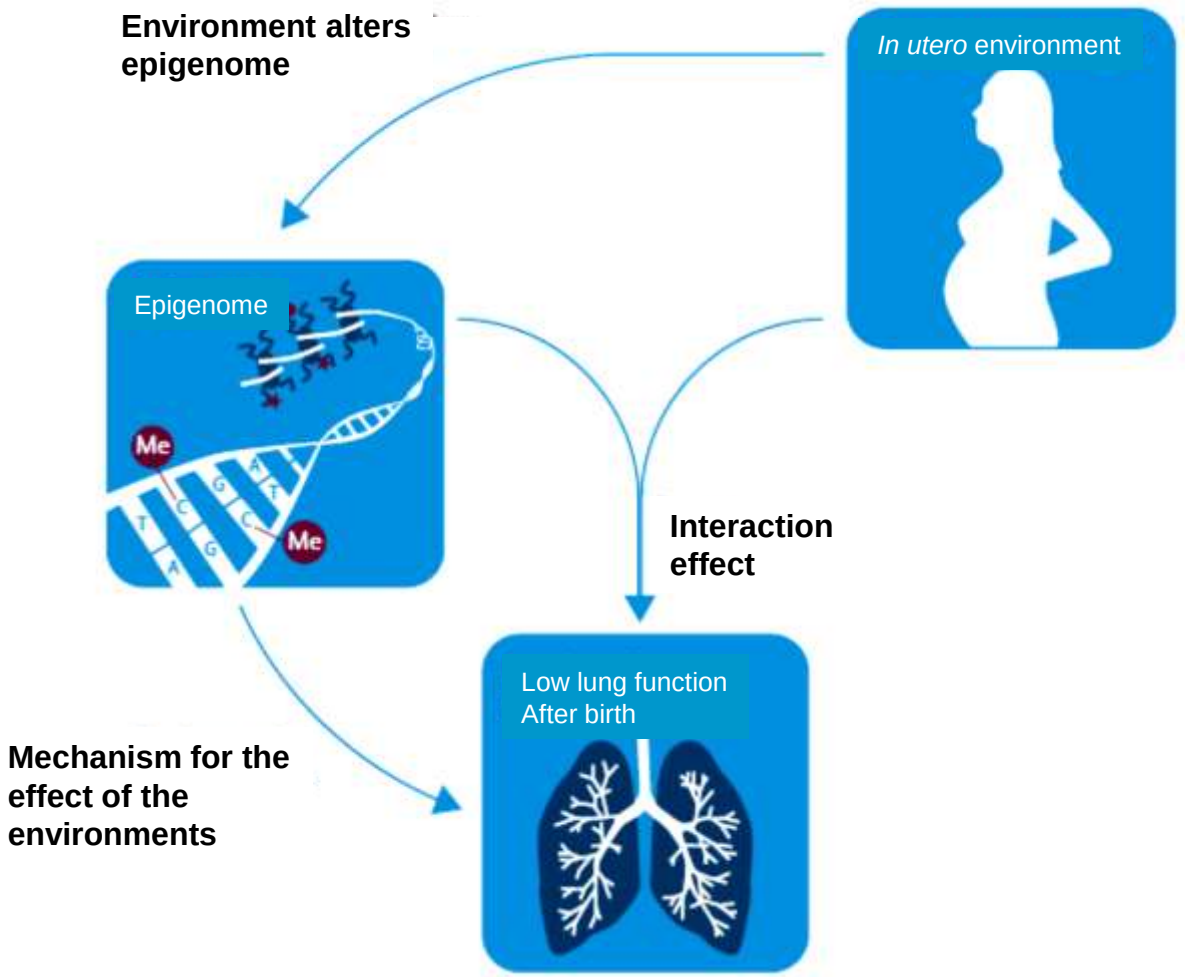
Critical periods of risk from pollution during foetal development

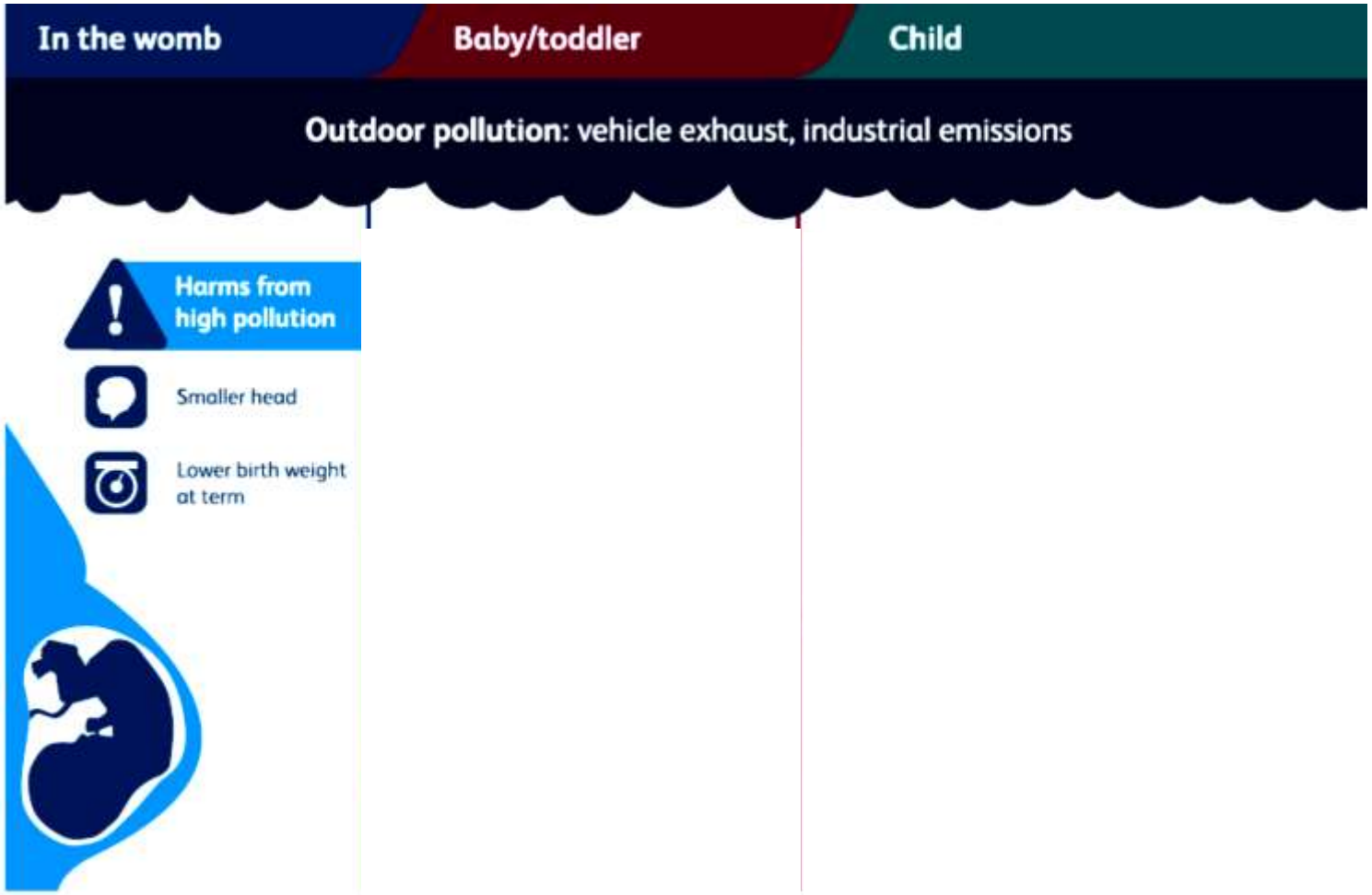


Principle stages of lung development in humans

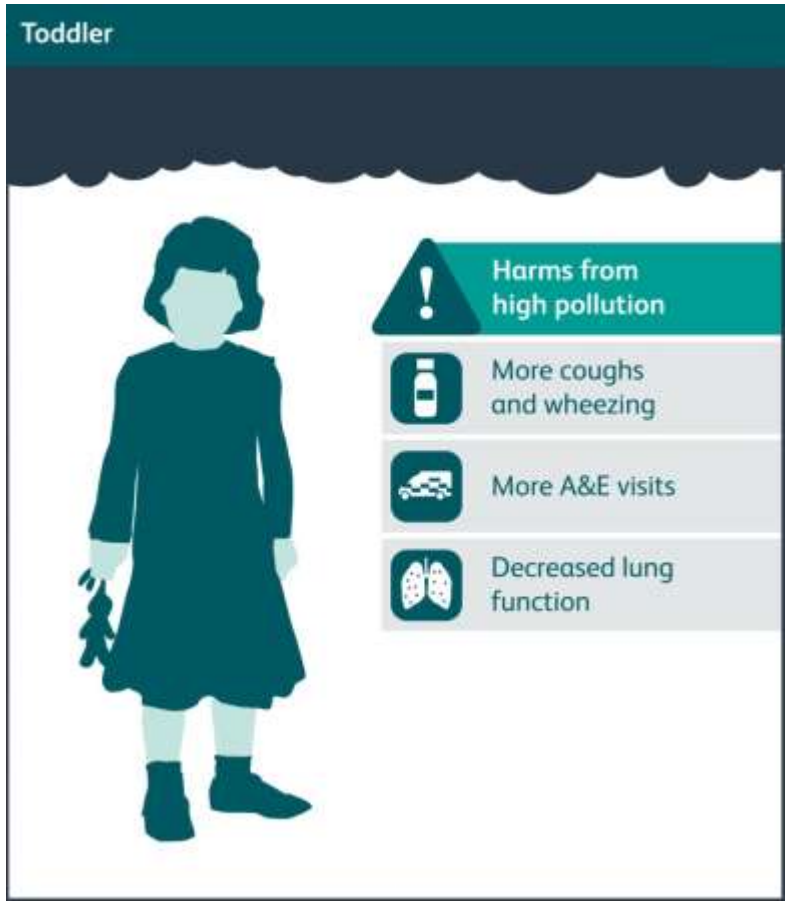


Effect of air pollution in modifying gene expression - epigenetics




In the womb
Baby/toddler
Child
Outdoor pollution: vehicle exhaust, industrial emissions
Harms from high pollution
Smaller head
Lower birth weight at term

Health effects of air pollution over our lifetime



Vulnerable groups

Some people suffer more from exposure to air pollution because they are:

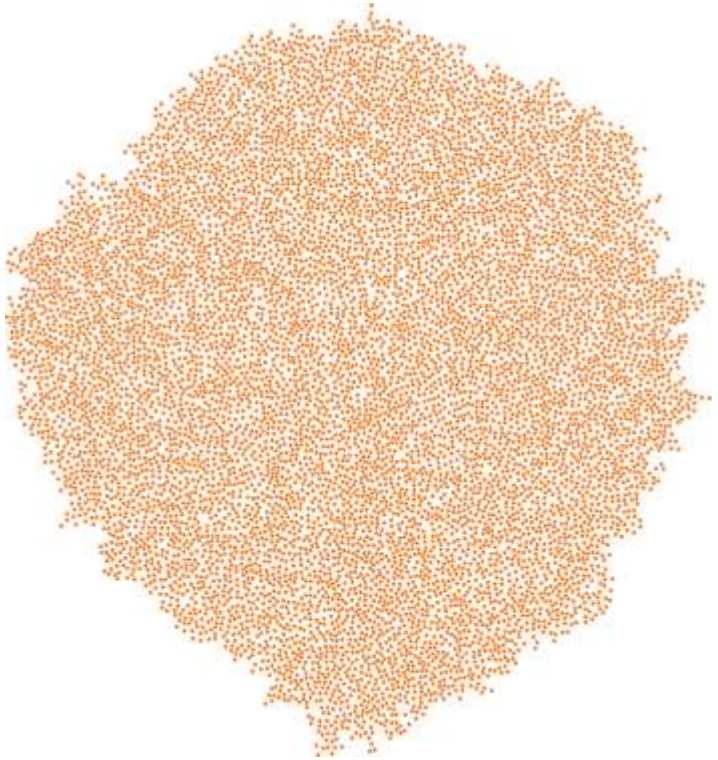
- More likely to live in polluted areas
- Exposed to higher levels of air pollution
- More vulnerable to health problems caused by air pollution

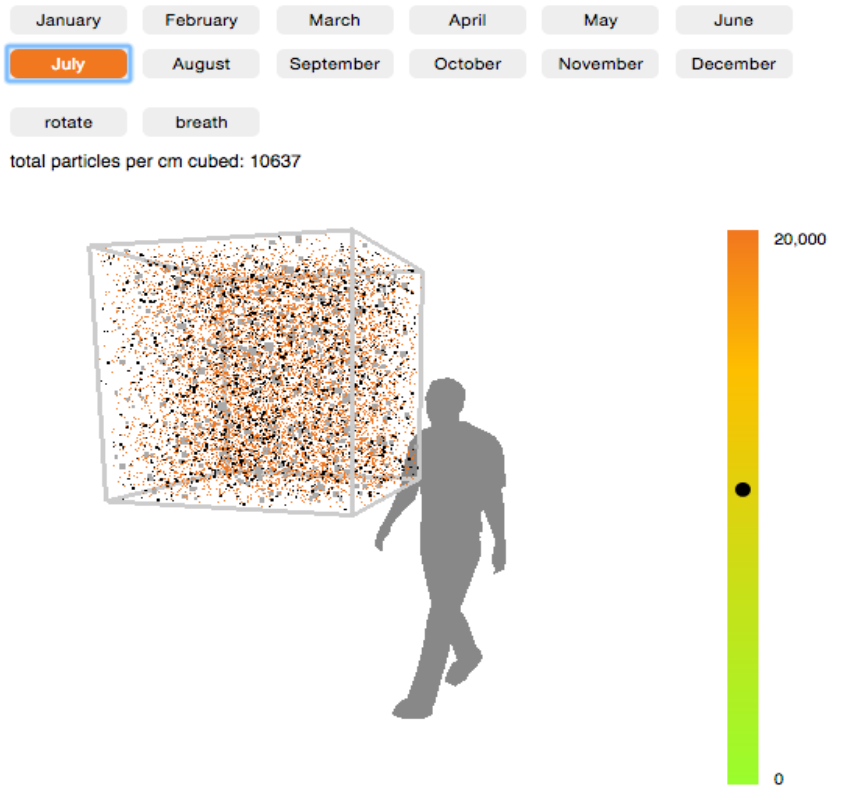
Recommendations for action

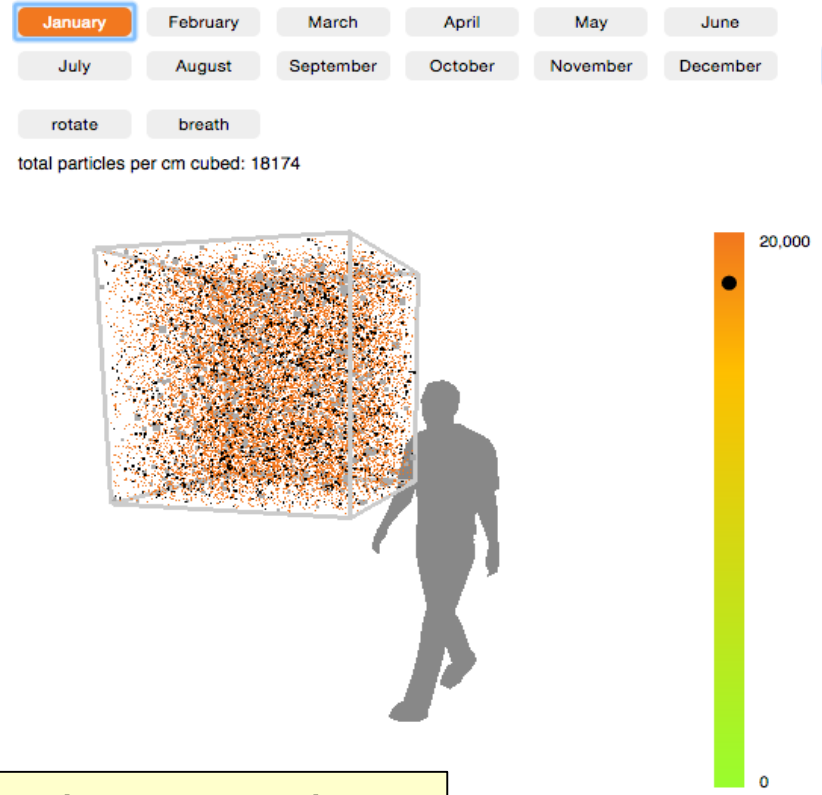
1. **Act now, think long term.** We must act now, and with urgency, to protect the health, wellbeing and economic sustainability of today's communities and future generations. Government must empower local authorities and incentivise industry to plan for the long term.

2. **Educate professionals and the public.** The Health Services and patient charities must educate health professionals, policymakers and the public about the serious harm that air pollution can cause. Health professionals, in particular, have a duty to inform their patients.

Kings College London estimate that air pollution killed 9,416 Londoners in 2010. Each spot represents an individual life lost.



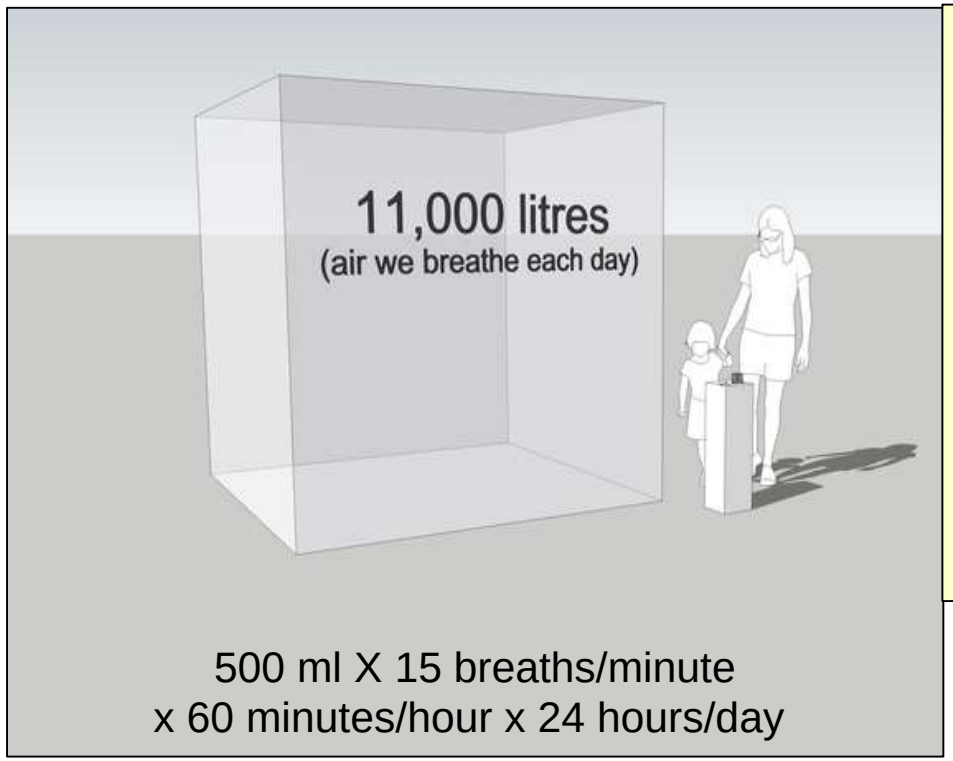




Real $PM_{2.5}$ data from Marylebone Road, London

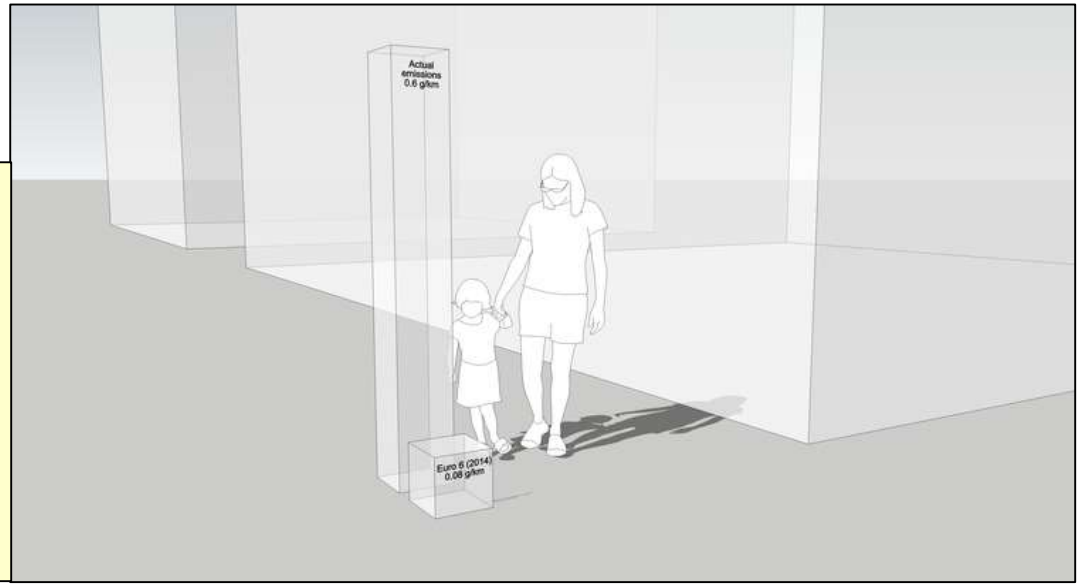
(each particle = 1 million $PM_{2.5}$ particles)

A day's air consumption; EU regulations vs real-world emissions



The problem with invisible pollution is that even when we *know* its real it doesn't *feel* real. We know for instance that Volkswagen have been dishonest but few of us have a feel for how significant their deception was. Does it really affect us? How can we answer that question visually?

Volume of NO_2 that can be emitted per km according to the latest EU regulations (front) and actual emissions of Euro 6 rated cars (back). Average real-world emissions can be more than four times higher than those measured in the laboratory under test conditions.






3) Promote alternatives to cars fuelled by petrol and diesel. Government, employers and schools should encourage and facilitate the use of public transport and active travel options like walking and cycling. Active travel also increases physical activity, which will have major health benefits for everyone. Local Transport Plans, especially in deprived areas, should:

- expand cycle networks
- require cycle training at school,
- promote safe alternatives to the "school run", based on walking, public transport and cycling instead of cars
- encourage employers to support alternatives to commuting by car
- promote leisure cycling
- develop 'islands' of space away from traffic, for safer walking and cycling.

National and local policies should also encourage the use of hybrid, electrical and hydrogen-powered vehicles.

Diesel pollution blamed for 12,000 early deaths a year

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Ben Webster Environment Editor

More people have their lives cut short by diesel pollution in Britain than in any other European country apart from Italy, a study has found.

Almost 12,000 people a year die prematurely in Britain because of exposure to nitrogen dioxide (NO_2), which is largely produced by diesel engines, the European Environment Agency (EEA) said. In Germany, which has 16 million more people, there are 10,600 premature deaths a year from NO_2, according to the agency, which advises the EU on environmental issues.

The High Court ruled this month that the government was failing to tackle NO_2 pollution and ordered ministers to draw up a plan by July to reduce it in cities. Of the 169 council areas in England, 40 per cent had NO_2 levels above EU limits last year.

NO_2 inflames the lung lining and causes respiratory diseases such as asthma. It has also been linked to a raised risk of heart attacks, strokes and cancer. The biggest cause of premature deaths was fine particles, 30 times smaller than a grain of sand, that are inhaled deep into lungs and can enter the bloodstream. They are emitted by burning coal and biomass and from building sites, industry, agriculture and vehicles. In Britain in 2013 these particles, PM 2.5, caused 38,000 deaths.

Hans Bruyninckx, EEA's executive director, said: "We need to tackle the root causes of air pollution, which calls for a fundamental and innovative transformation of our mobility, energy and food systems. This process of change requires action from us all."

The European parliament approved new limits on air pollution yesterday which are projected to halve the number of premature deaths it causes in Europe by 2030.

Alan Andrews, a lawyer for ClientEarth, which brought this month's High Court action against the government, said the new EU limits were due to become part of UK law before Brexit. However, he said it was unclear whether the European Commission would play any role in enforcing the limits in the UK, meaning that they might be breached.

Mr Andrews said: "The UK has a major problem with nitrogen dioxide pollution, with 37 out of 43 UK zones in breach of limits that came into force in 2010. The EEA report demonstrates the grave health effects that result from our government's failure to protect us from deadly diesel fumes.

"We need a national network of clean air zones to keep dirty diesel vehicles out of our town and city centres."

Julie Girling, the Conservative MEP for South West England, who helped to secure approval for the new EU air pollution limits, said: "Air pollution does not recognise national borders and we must work with our EU neighbours to tackle it. The agreement will reduce the health impacts of bad air quality by about 50 per cent by 2030.

"With our national health system we bear the economic consequences of bad air quality directly and we should not allow the progress made in recent years to slip."

Invisible killer

Premature deaths from nitrogen dioxide:

Italy
21,000

United Kingdom
11,900

Germany
10,600

France
8,200

Spain
4,300

Data for 2013, published by the European Environment Agency

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Drivers of toxic diesels must pay to enter cities

Ben Webster Environment Editor
Graeme Paton Transport Correspondent

Drivers of diesel cars face charges to enter city centres across the country after the High Court ruled that the government was failing to tackle air pollution.

Britain has failed to draw up plans to ensure that it meets EU limits on air pollution, which causes more than 40,000 premature deaths a year in the country, a judge found. He concluded that ministers had knowingly based their air-quality plan on forecasts that were too optimistic.

The cabinet had been warned that diesel cars emitted at least four times as much nitrogen dioxide — a toxic gas largely produced by diesel engines — on the road as in official laboratory tests. Ministers still approved a plan exempting diesel cars, which were responsible for up to 40 per cent of pollution, from charging zones for diesel lorries, buses and taxis to be imposed by 2020 in Birmingham, Leeds, Nottingham, Derby and Southampton.

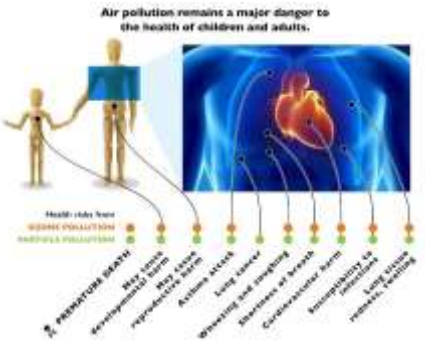
Theresa May accepted the ruling yesterday and admitted that there was "more for the government to do" to cut emissions of nitrogen dioxide.

4. **Put the onus on the polluters.** Polluters must be required to take responsibility for harming our health. Political leaders at a local, national and EU level must introduce tougher regulations, including reliable emissions testing for cars. They must also enforce regulations vigorously, especially in deprived areas where pollution levels are higher and people are more vulnerable.

5. **Monitor air pollution effectively.** Air pollution monitoring by central and local government must track exposure to harmful pollutants in major urban areas and near schools. These results should be proactively communicated to the public, in a clear way that everyone can understand. When levels exceed EU limits or World Health Organization guidelines, local authorities must immediately publish serious incident alerts.

6. **Act to protect the public health when air pollution levels are high.** When these limits are exceeded, local authorities must have the power to close or divert roads to reduce the volume of traffic, especially near schools.

7. **Tackle inequality.** Our most deprived communities are exposed to some of the worst outdoor and indoor air quality, contributing to the gap in life expectancy of nearly 10 years between the most and the least affluent communities. Regulators, local government and NHS organisations must prioritise improvements in air quality in our most deprived areas, setting high standards of emission control across all sectors of industry.



8. **Protect those most at risk.** Children, older people, and people with chronic health problems are among the most vulnerable to air pollution. Public services must take account of this disproportionate harm through local tools such as planning policies for housing and schools, equalities impact assessments, and joint strategic needs assessments. At an individual level, healthcare professionals should help vulnerable patients protect themselves from the worst effects of air pollution.

Information packs developed as part of the Barts Health Cleaner Air Programme developed by the Global Action Plan

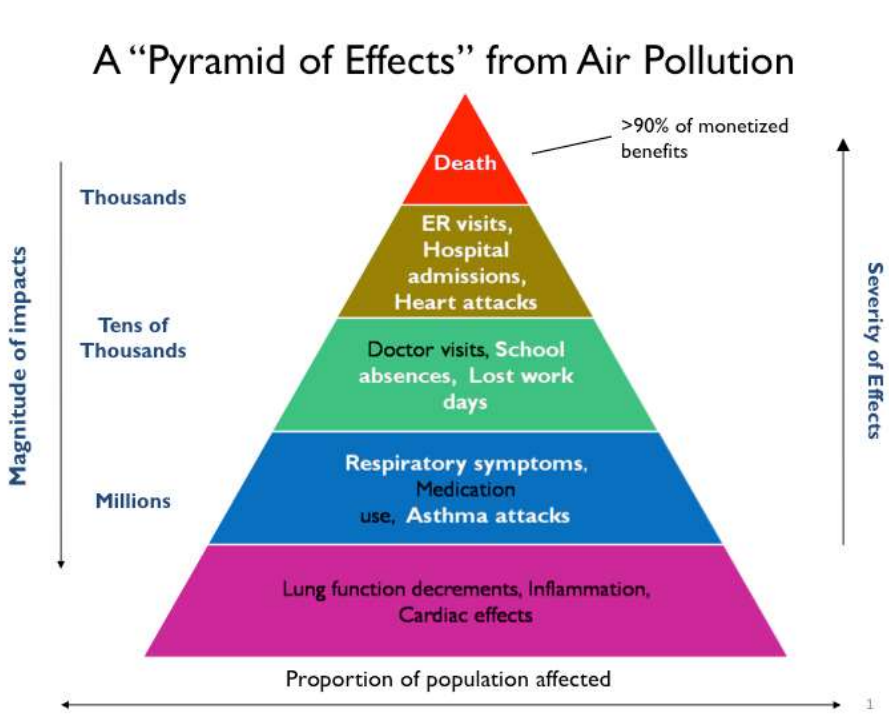
9. **Lead by example in the NHS.** The NHS is one of the largest employers in Europe, contributing 8% of the UK's gross domestic product (GDP). The health service must no longer be a major polluter; it must lead by example and set the benchmark for clean air and safe workplaces. In turn, this action will reduce the burden of air pollution-related illness on the NHS. The Department of Health, NHS England and the devolved administrations must give commissioners and providers incentives to reduce their emissions, and protect their employees and patients from dangerous pollutants.

What can I do?

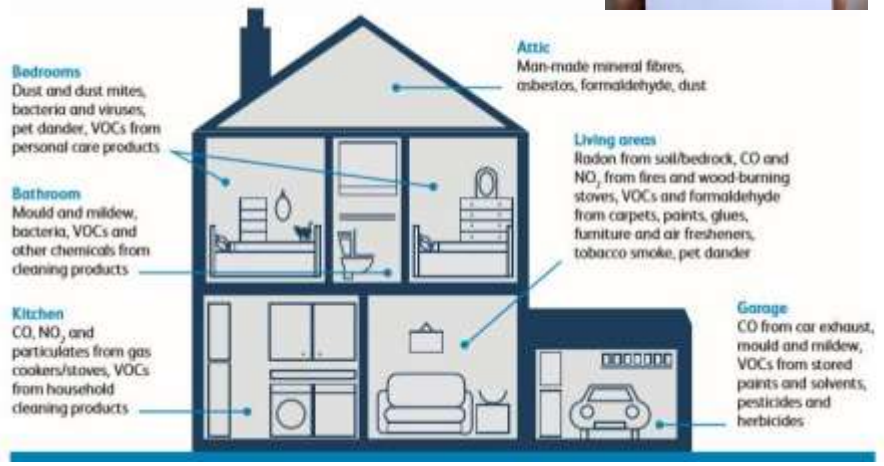
As citizens and members of the public, everyone can help by:

- **trying alternatives to car travel: bus, train, walking and cycling**
- **aiming for energy efficiency in our homes**
- **keeping gas appliances and solid fuel burners in good repair**
- **asking our local council and MPs to take action**
- **learning more about air quality and staying informed.**

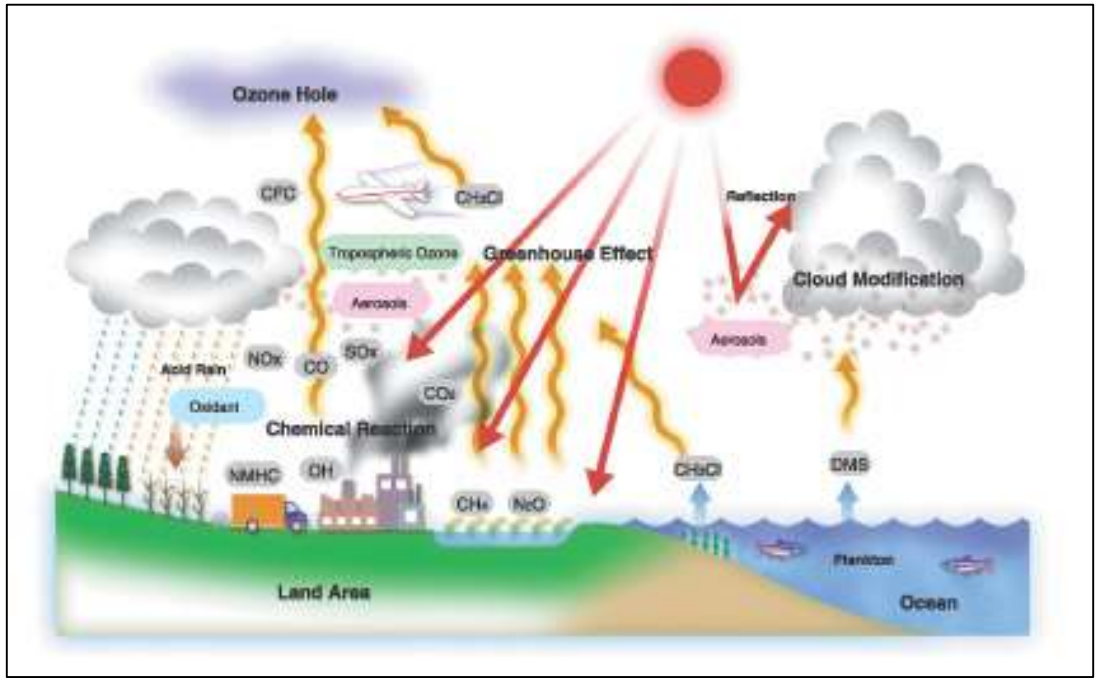
It might seem as if individual actions will not make a difference, but it all adds up, and each one of us must act.

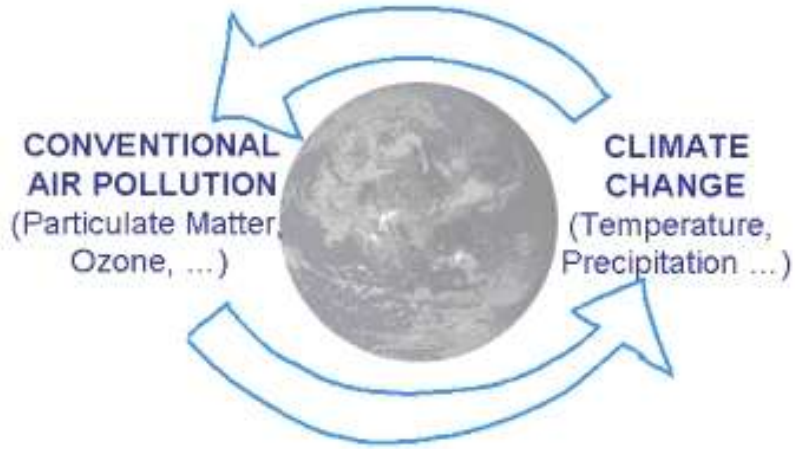


10. Define the economic impact of air pollution. Air pollution damages not only our physical health, but also our economic wellbeing. We need further research into the economic impact of air pollution, and the potential economic benefits of well-designed policies to tackle it.

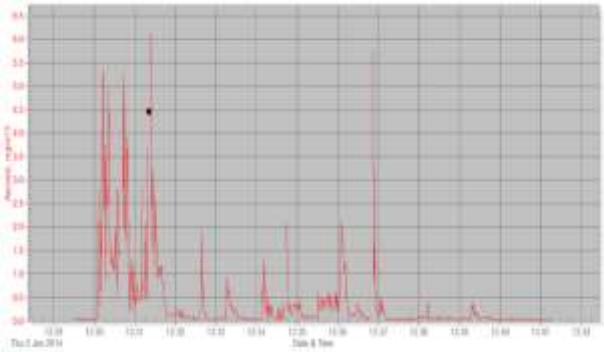


11. **Quantify the relationship between indoor air pollution and health.** We must strengthen our understanding of the relationship between **indoor air pollution** and health, including the key risk factors and effects of poor air quality in our homes, schools and workplaces. A coordinated effort among policymaking bodies will be required to develop and apply any necessary policy changes

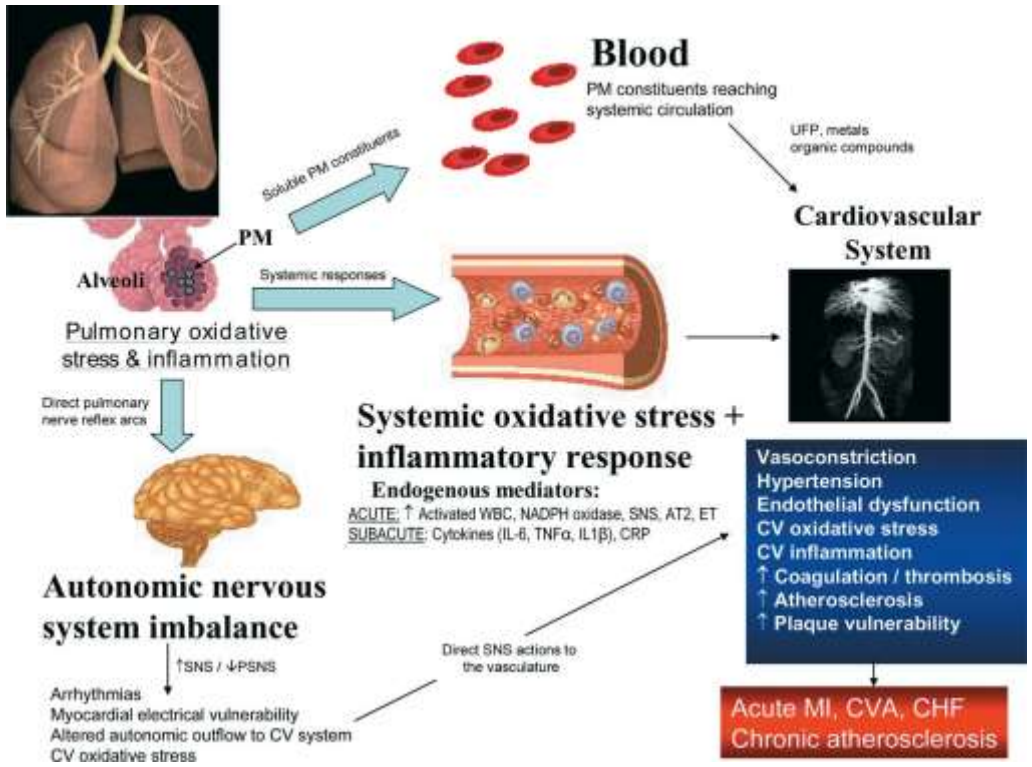




12. **Determine how global trends are affecting air quality.** From increased energy production and consumption to global economic development and urbanisation, we need to improve our understanding of how major social and economic trends are affecting air quality and its twin threat, climate change.



13. **Develop new technologies to improve air pollution monitoring.** We need better, more accurate and wider-ranging monitoring programmes so that we can track population-level exposure to air pollution. We also need to develop adaptable monitoring techniques to measure emerging new pollutants, and known pollutants that occur below current concentration limits. We must develop practical technology – such as wearable 'smart' monitors – that empower individuals to check their exposure and take action to protect their health.



14. **Study the effects of air pollution on health**. To appreciate fully the risk to health, we need further research on air pollution's effects on the body. In addition to lung and cardiovascular disease, research into the adverse health effects of pollution should accommodate systemic effects such as **obesity, diabetes, changes linked to dementia, and cancer**, **as well as effects on the developing fetus and in early childhood.**

The EEA report ‘Air quality in Europe—2016 report’

> **Emission reductions have led to improvements in air quality in Europe, but not enough to avoid unacceptable damage to human health and the environment. We need to tackle the root causes of air pollution, which calls for a fundamental and innovative transformation of our mobility, energy and food systems.**
>
> Hans Bruyninckx, EEA Executive Director

A UK Clean Air Act for the 21st Century

Specific provisions of a new Clean Air Act would include:

1. Retain the objectives under the EU Ambient Air Quality Directive as a minimum safeguard on human health
2. Adopt revised objectives based on WHO guidelines
3. Guarantee the public the right to access the courts to enforce its provisions, in accordance with the Aarhus Convention.
4. Consolidate the complex and disparate body of domestic, EU and international air pollution laws into one coherent and effective piece of legislation
5. Clarify the roles and responsibilities of national government, local authorities, the Mayor of London and the devolved administrations
6. Lay down a national framework for effective Clean Air Zones which phase out diesel and accelerate the shift to zero emission transport
7. Implement the UK's pollution reduction targets for 2020 and 2030 under the Gothenburg Protocol and the newly agreed EU NEC Directive, in order to tackle trans-boundary air pollution
8. Ensure coherence with other relevant policies and legislation, particularly the Climate Change Act and planning guidance;
9. Require national, local and city authorities to collect adequate information on air pollution – including data from a minimum number of air quality monitoring stations – and proactively provide the public with that information, including through smog warnings during high pollution episodes
10. Require national, local and city authorities to take measures to reduce exposure to air pollution – particularly for vulnerable groups such as children, older people and those suffering from pre-existing health conditions.

Health impact: 1952 Great Smog

- 5-8 December 1952: Great Smog. Estimated 4,075 premature deaths (and perhaps up to 12,000 in total)
- Government's initial response was to deny it had any responsibility in the matter
- Churchill Government appointed Sir Hugh Beaver as Chairman of the Committee on Air Pollution to make recommendations
- Sir Hugh Beaver called for "a national effort" of "costs and sacrifices" to combat "a social and economic evil which should no longer be tolerated"
- In 1955 it fell to Eden's new administration to enact the Committee's findings.
  - Civil servants were bothered by their practicality
  - The Federation of British Industry was concerned about costs
  - Libertarians argued that it was no business of Whitehall what burnt in an Englishman's hearth and home. Some argued the poor would freeze without coal
  - Treasury said it didn't have the money and was rumoured to be blocking change
  - Ministers worried there was insufficient smokeless fuel to replace coal
- But the public clamoured to go smoke-free
- Sir Gerald Nabarro tabled a private Members Bill which was withdrawn when the Government agreed to legislation. The Clean Air Act came into force in 1956