Air Pollution England Final

Who we are: The Royal College of Physicians of Edinburgh (RCPE) Air Pollution Working Group is concerned with the impact of poor air quality on health. This reflects the College's aim of improving health for all. We enable our global community of physicians and their teams to improve the health of their patients and populations for the long-term benefit of society. Attenuating the significant ill health that occurs secondary to air pollution is a key part of our work.

1. What are the main causes and sources of air pollution?

Air pollution in England arises from a mix of human (anthropogenic) and natural sources, but the vast majority of harmful exposure, especially to fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) is attributable to human activities. These sources vary by pollutant, geography and season, but collectively they create a persistent and avoidable burden of disease.

A. Road Transport

Road vehicles, particularly those powered by petrol and diesel engines, are a major source of nitrogen oxides (NO_x) and NO_2, and these contribute to respiratory irritation and long-term lung damage. Much scientiific evidence now also links NO_2 exposure with increased cardiovascular morbidity and mortality, adverse pregnancy outcomes including low birth weight and preterm birth, impaired child neurodevelopment and cognitive performance, and increased all-cause mortality. Emerging evidence also links long-term NO_2 exposure with metabolic disease, including type 2 diabetes. Importantly, these effects are observed at concentrations below current legal limits, reinforcing the need for stronger action on traffic-related air pollution in England[1,2].

Nitrogen dioxide: effects on mortality. *https://www.gov.uk/government/publications/nitrogen-dioxide-effects-on-mortality*

Respiratory Admissions Linked to Air Pollution in a Medium Sized City of the UK: A Case-crossover Study. *https://link.springer.com/article/10.4209/aaqr.230062*

Fine particulate matter ($PM_{2.5}$) release can also be traffic-related,from exhaust emissions (diesel) and non-exhaust emissions (brakes, tyres, road dust). $PM_{2.5}$ is associated well documented adverse health outcomes, including increased all-cause and cardiovascular mortality, myocardial infarction and stroke, lung cancer, chronic respiratory disease, type 2 diabetes, adverse pregnancy outcomes, impaired lung development in children, and reduced life expectancy, with scientific evidence showing harm occurs at concentrations below England's current legal limits and with no safe threshold identified. Vehicles also produce smaller ultrafine particles, which potentially have even greater toxicity than PM2.5, although these particles are not routinely measured.

Particulate air pollution: quantifying effects on mortality. *https://www.gov.uk/government/publications/particulate-air-pollution-quantifying-effects-on-mortality*

Long term exposure to low level air pollution and mortality in eight European cohorts within the ELAPSE project: pooled analysis.
https://pmc.ncbi.nlm.nih.gov/articles/PMC8409282/

Transport is a significant contributor to urban air pollution and disproportionately affects people living near busy roads, schools, and urban centres, thus for the urban population this source is often key.

Air pollutants. https://naei.energysecurity.gov.uk/air-pollutants?pollutant_id=7

B. Domestic Combustion

Burning solid fuels (e.g. wood, coal, smokeless fuels) in homes for heating and cooking contributes significantly to $PM_{2.5}$ emissions, especially in winter. Although a minority of households use these fuels, they produce a disproportionate amount of ambient particulate levels in many towns and cities. The characteristics of these emissions are such that they are likely to have multiple adverse effects on health.

A comprehensive bibliometric analysis of research on health and environmental impacts of particle emissions from wood combustion in residential heating.
https://link.springer.com/article/10.1007/s11356-025-36736-2

Woodsmoke Health Effects: A Review.
https://www.tandfonline.com/doi/full/10.1080/08958370600985875

There is a significant research effort underway to characterise other sources of air pollution in indoor environments and determine their health effects. We would recommend consideration of the public messaging, potential regulation, and possible mitigation, of indoor air pollution sources in the intervening time until the body of evidence matures.

C. Industrial and Commercial Sources

Industrial processes and energy generation contribute through $PM_{2.5}$ emissions from combustion and processing, sulphur dioxide (SO_2), and NO_x.

While regulatory controls and cleaner technologies have significantly reduced industrial emissions, they remain important at regional levels and near industrial clusters.

Emissions of air pollutants in the UK – Summary.
https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-summary

D. Agriculture and Ammonia (Indirect $PM_{2.5}$ Formation)

Agricultural activities release ammonia (NH_3) from fertiliser use, livestock manure, and slurry spreading. Ammonia is an irritant at high concentrations, but it also reacts in the atmosphere with NO_x and SO_2 to form secondary $PM_{2.5}$, significantly contributing to fine particulate levels, especially in rural areas. The impact of secondary ammonium particulates on health remains to be determined.

Health impact of policies to reduce agriculture-related air pollutants in the UK: The relative contribution of change in PM2.5 exposure and diets to morbidity and mortality. https://www.sciencedirect.com/science/article/abs/pii/S0013935124018280

E. Long-Range Transboundary Pollution

Pollutants emitted in continental Europe can be transported atmospherically into England, particularly under certain weather conditions. This affects background concentrations of $PM_{2.5}$ and ozone, and, although collaborative working internationally is key for the future alone, it contributes to overall exposure.

Quantifying the transboundary contribution of nitrogen oxides to UK air quality. https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/asl.955

F. Natural Sources

Natural contributions (sea salt, windblown dust, wildfires) can generate high spikes in particulate concentrations, but these are typically episodic and not the dominant cause of chronic exposure driving health impacts in England. Nonetheless, wildfires are increasing in number in the UK as the climate warms, the potential health effects of their emissions will likely require more attention in the future.

These six major sources collectively drive a preventable health burden across England, with evidence showing that even modest reductions in $PM_{2.5}$ and other pollutants deliver measurable population health benefits and reduce health inequalities.

2. What evidence exists of the extent of air pollution directly or indirectly impacting the health of individuals or communities in England?

There is now strong and consistent evidence that air pollution in England, particularly $PM_{2.5}$ and NO_2, causes substantial, preventable ill health and premature mortality, with impacts across the life course and multiple organ systems. Many peer-reviewed studies support a significant burden of ill health and mortality from long-term air pollution exposure. The World Health Organization (WHO) concludes there is no safe threshold for $PM_{2.5}$ and that health benefits accrue as concentrations fall.

Do current levels of air pollution kill? The impact of air pollution on population mortality in England.
https://onlinelibrary.wiley.com/doi/epdf/10.1002/hec.1475?saml_referrer

Evidence links air pollution to cardiovascular disease (MI, stroke, heart failure), chronic respiratory disease, lung cancer, adverse pregnancy outcomes, impaired child lung development, diabetes and dementia, contributing to avoidable NHS and social care costs.

Exposure to air pollution and risk of incident dementia in the UK Biobank.
https://www.sciencedirect.com/science/article/abs/pii/S0013935122002225

Long-term exposure to ambient air pollution is a risk factor for trajectory of cardiometabolic multimorbidity: A prospective study in the UK Biobank.
https://www.thelancet.com/journals/ebiom/article/PIIS2352-3964(22)00464-9/fulltext

England-specific modelling tools have been produced to estimate health and care costs attributable to $PM_{2.5}$ and NO_2 at national and local authority level.

Estimation of costs to the NHS and social care due to the health impacts of air pollution.
https://assets.publishing.service.gov.uk/media/5d9707d640f0b66914f72767/Estimation_of_costs_to_the_NHS_and_social_care_due_to_the_health_impacts_of_air_pollution.pdf

a. What are the differential impacts, geographically, and across socioeconomic groups, of poor air quality?

Air pollution exposure and its health impacts in England vary substantially by place, reflecting differences in emission sources, population density, land use and weather. These different geographies are critical for understanding health inequalities and for targeting effective interventions.

The highest concentrations of NO_2 and elevated $PM_{2.5}$ exposure occur in urban areas, particularly along major road corridors, near junctions, and in areas with high traffic density. Populations living, working, or at school near busy roads experience higher long-term exposure, which is associated with increased risks of cardiovascular disease, respiratory illness and poor child health outcomes described above.

Every breath we take: The lifelong impact of air pollution
https://www.rcp.ac.uk/media/jzul5jgn/every-breath-we-take-the-lifelong-impact-of-air-pollution-full-report.pdf

These exposures are not confined to city centres as other main roads, freight routes, and urban motorways create linear corridors of elevated exposure extending into suburban areas.

Assessing the environmental impact of freight transport.
https://www.koganpage.com/logistics-supplychain-operations/green-logistics-9780749471859

Air quality on UK diesel and hybrid trains
https://www.sciencedirect.com/science/article/pii/S016041202400268X

Air pollution exposure and vulnerability are socially patterned: more deprived communities often face higher exposure (e.g. proximity to busy roads, poorer housing/infiltration) and higher baseline susceptibility (comorbidities, occupational exposures). This contributes to widening health inequalities.

Systemic inequalities in indoor air pollution exposure in London, UK
https://pmc.ncbi.nlm.nih.gov/articles/PMC7610964/

Air pollution emissions inequality in England
https://etheses.whiterose.ac.uk/id/eprint/37988/

Certain coastal and estuary areas in England experience elevated pollution linked to shipping, ports, industry and freight movements, including NO_x, $PM_{2.5}$, and sulphur compounds. These exposures affect nearby residential communities and often overlap with areas of economic deprivation.

Atmospheric Pollution in Port Cities https://www.mdpi.com/2073-4433/14/7/1135

b. What are the differential impacts of air pollution across different age groups? How does this impact future generations?

Air pollution harms health from womb to tomb. Evidence links pollution exposure to adverse birth outcomes (e.g. low birth weight, preterm birth), with lifelong implications for cardio-metabolic and respiratory health.

Air pollution is the largest environmental risk to public health and children are especially vulnerable. https://www.bmj.com/content/381/bmj.p1037

Respiratory Admissions Linked to Air Pollution in a Medium Sized City of the UK: A Case-crossover Study. https://aaqr.org/articles/aaqr-23-03-oa-0062

Why does this matter so much for children? Because the damage starts early and lasts a lifetime. Children are disproportionately affected because lungs are still developing, breathing rates are higher per body weight, and exposure often occurs around schools and homes near roads. Cardiovascular and cognition effects are also reported. Unfortunately, these effects are often permanent.

How does air quality affect the health of children and adolescents? Recent UK evidence also links childhood exposure to poorer health later in adolescence. https://www.sciencedirect.com/science/article/pii/S0021755724001621

In adults, long-term exposure increases risk of cardiovascular events, chronic respiratory disease, and lung cancer. Short-term exposure triggers acute exacerbations and hospital admissions.

Chief Medical Officer's annual report 2022: air pollution.
https://www.gov.uk/government/publications/chief-medical-officers-annual-report-2022-air-pollution

In older adults and people with chronic disease the greatest immediate risks are from exacerbations of established conditions (heart failure, COPD, asthma, arrhythmias), lung cancer, dementia and higher attributable mortality.

Associations of ambient air pollution exposure and lifestyle factors with incident dementia in the elderly: A prospective study in the UK Biobank.
https://www.sciencedirect.com/science/article/pii/S0160412024004562

As exposure in early life can alter lung growth and long-term cardio-metabolic and brain trajectories, reducing air pollution now delivers multi-decade and multi-

generational health dividends (healthier adulthood, reduced NHS burden, and improved resilience to other climate stressors such as heat).

Effect of In utero Exposure to Air Pollution on Adulthood Hospitalizations
https://www.sciencedirect.com/science/article/pii/S0160412024004562

3. What are the wider environmental impacts of air pollution, and what are their cascading effects? What evidence exists of direct or indirect impact? i.e., reduced crop yields, biodiversity loss, pollinator loss, acid rain, ozone depletion, depleted water/soil quality, etc.

There are very clear environmental impacts of air pollution in England, and they have important cascading effects for ecosystems, food production, water quality and climate resilience, all of which ultimately feed back into human health.

Ground level ozone damages vegetation, reducing photosynthesis and growth, causing visible leaf injury, reducing root growth, and lowering crop yields. These effects reduce food productivity and can weaken ecosystems' resilience to drought and heat, which matters as climate extremes will increase.

UK Centre for Ecology and Hydrology: Ozone impacts on vegetation.
https://www.ceh.ac.uk/our-science/case-studies/case-study-home-ozone-impacts-vegetation

Nitrogen in the air, largely from ammonia and nitrogen oxides, deposits onto land and water. This drives eutrophication (the over-enrichment of water bodies with nutrients, primarily nitrogen and phosphorus, causing excessive algae growth and severe oxygen depletion), changing plant communities, reducing species richness, and damaging sensitive habitats adapted to low nutrient conditions. In England, nitrogen deposition exceeds "safe loads" for many habitats, demonstrating the extent of ongoing ecological pressure.

Air Pollution: Area affected by acidity and area affected by nitrogen.
https://jncc.gov.uk/our-work/ukbi-air-pollution/

Sulphur dioxide and nitrogen oxides contribute to acid deposition ('acid rain'), historically causing major damage to forests and freshwater habitats. Emissions have fallen dramatically due to changes in industrial practices, but impacts and recovery can take a long time and acid-sensitive habitats remain a concern in some areas. UK Government statistics note the ecological damage caused by acid rain and the long-range transport of sulphur pollution.

Emissions of air pollutants in the UK – Sulphur dioxide (SO2).
https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-sulphur-dioxide-so2

Atmospheric deposition also affects ecosystems by altering biodiversity and reducing water quality, including through acid and nutrient inputs.

Water Quality, Air Pollution, and Climate Change: Investigating the Environmental Impacts of Industrialization and Urbanization.
https://link.springer.com/article/10.1007/s11270-024-07702-4

Air pollution from road transport can affect nearby ecosystems through nitrogen and acid deposition and direct toxicity.

The ecological effects of air pollution from road transport: an updated review (NECR199)
https://publications.naturalengland.org.uk/publication/6212190873845760

3a. Differential impacts geographically in England, and is policy overly urban-centred?

We have already commented on this in response to Q1 but extend the answer here. Ammonia emissions are geographically concentrated in agricultural areas and contribute to both biodiversity impacts through nitrogen deposition and to secondary $PM_{2.5}$ formation when combined with other pollutants. This creates an important rural, peri-urban, and downwind exposure to $PM_{2.5}$ and causes ecological harm.

The impact of ammonia emissions from agriculture on biodiversity.
https://royalsociety.org/~/media/policy/projects/evidence-synthesis/Ammonia/Ammonia-report.pdf

NO_2 and some components of $PM_{2.5}$ are concentrated along major roads and in dense urban networks, while ecological impacts extend beyond the carriageway through deposition onto soils and habitats. This means both people and nature experience corridor effects, often overlapping with deprivation and limited green space buffer capacity.

As above, some coastal and estuary locations experience elevated emissions from shipping, ports, and freight logistics, with implications for local ecosystems and adjacent communities. A national perspective is needed because these sources are not captured by an “urban traffic only” framing.

Is current policy overly urban-centred?

There is a strong case that it can be. England’s air pollution impacts are shaped by a dual geography: traffic and urban combustion dominate $PM_{2.5}$ and NO_2 hotspots, while agriculture-driven ammonia strongly influences secondary $PM_{2.5}$ and nitrogen deposition across wide rural areas. Ozone levels tend to be greater in rural locations. Effective policy therefore needs an explicitly cross-sector, cross-geography approach, with rural measures on ammonia and nutrient management treated as core air quality policy, not an add-on.

Air Pollution: Area affected by acidity and area affected by nitrogen.
https://jncc.gov.uk/our-work/ukbi-air-pollution/

4. Are the current national targets and performance for air pollution, such as those in the Air Quality Environment Act target delivery plan and the 10-year Health Plan, adequate, ambitious and wide-ranging enough to provide

adequate protection for public health and the environment, and how do they compare with WHO recommendations?

We do not think the current national targets for England are adequate to provide full protection for public health or the environment, because the statutory ambition remains materially below health-based WHO guidance, and progress depends on measures that are not consistently delivered across sectors and geographies.

Under the Environment Act framework, England's statutory $PM_{2.5}$ targets include an annual mean concentration target of 10μg/m^3 by 31 December 2040 and a population exposure reduction target of 35% (vs. 2018) by 2040. These targets, and interim milestones, are set out in the Government's Target Delivery Plan.

However, the WHO Air Quality Guidelines (2021) recommend an annual mean $PM_{2.5}$ level of 5μg/m^3, reflecting the evidence that health effects occur below 10μg/m^3 and that there is no safe threshold.

WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide
https://www.who.int/publications/i/item/9789240034228

Compared to WHO, England's statutory target of 10μg/m^3 (by 2040) should be an interim step, rather than a level that can be described as fully health-protective. The Target Delivery Plan notes the legal requirement for targets to be "achievable and measurable", but from a public health perspective the key issue is that the proposed endpoint remains well above WHO's health-based recomendations.

We would therefore suggest the Committee recommends that England adopt a more rapid and milestone driven, forward plan toward WHO levels over time, for example via strengthened interim milestones, earlier review points, and commitments to further reductions as increased delivery becomes possible, with for eg increased EV uptake.

Guidelines and roadmap to reduce other air pollutants known to have adverse health effects are missing from these plans.

4a. What are the major barriers and/or challenges to achieving national targets on air quality in England?

The major barriers are less about a lack of evidence, and more about delivery, governance, and cross-sector alignment:

A 2040 endpoint tolerates a preventable burden of cardiovascular and respiratory disease for many years, even though evidence indicates benefits from reductions or $PM_{2.5}$ below 10μg/m³. The current statutory framing can therefore feel more "compliance-led" than "health-led".

Insufficiently joined-up government action across key emitting sectors also contributes. Meeting $PM_{2.5}$ and NO_2 goals depends heavily on policies that are not solely the remit Defra, including transport (vehicle miles, non-exhaust emissions, freight), housing (energy efficiency and ventilation), energy and heat (domestic

combustion), and agriculture (ammonia). Cross-departmental delivery and accountability are key.

Domestic combustion, especially wood burning, remains a significant and harmful source. Domestic solid fuel burning contributes materially to $PM_{2.5}$ emissions, yet policy tools are challenging because they intersect with consumer behaviour, enforcement capacity, and energy affordability (this is particularly relevant to population exposure reduction). The recent legislative inclusion of wood burning stoves in new builds is a step backward.

Agricultural ammonia and secondary $PM_{2.5}$ formation also needs action. Reducing secondary $PM_{2.5}$ requires sustained reductions in ammonia alongside NO_x and SO_2. This is technically and politically complex because it involves farm practices, incentives, regulation, and monitoring, and its impacts span rural and urban areas.

Local authority capacity, monitoring density, and enforcement constraints should be considered. Delivery is uneven because local authorities vary greatly in resources, monitoring coverage, technical capacity, and powers. This affects the ability to identify hotspots, enforce measures, and sustain long-term action.

Transboundary and regional background pollution also needs consideration. A significant share of $PM_{2.5}$ exposure arises from regional background and long-range transport, which makes local-only action insufficient and increases the importance of national and international cooperation.

5**. Do local authorities in England have the resources and powers to enforce existing legislation and regulation to improve local air quality?**

In general, local authorities in England do not consistently have sufficient resources, capacity, or powers to deliver and enforce air quality improvements at the scale required to protect public health. While statutory duties exist, delivery is uneven and highly dependent on local funding, expertise, and political context.

Local authorities play a critical role in monitoring air quality, declaring and managing Air Quality Management Areas, implementing local transport and planning measures, and engaging communities. However, these responsibilities have expanded over time without commensurate, sustained funding or consistent national support.

This includes limited and short-term funding streams, variable technical expertise and staffing capacity, uneven monitoring coverage, and restricted enforcement powers for some key sources, including domestic combustion and agricultural emissions. These constraints risk undermining the effectiveness of national air quality targets and widening geographical and health inequalities.

Air quality: policies, proposals and concerns.
https://commonslibrary.parliament.uk/research-briefings/cbp-9600/

Local Air Quality Management Policy Guidance (PG22).
https://laqm.defra.gov.uk/wp-content/uploads/2023/11/LAQM-Policy-Guidance-2022.pdf

5a. What examples of best practice exist locally and how well are these being rolled out elsewhere?

There are strong examples of local best practice in England, demonstrating that meaningful air quality improvements are achievable when local authorities are adequately supported. Examples include Clean Air Zones and traffic reduction measures. Some cities have implemented charging Clean Air Zones and complementary measures that have delivered rapid reductions in roadside NO_2 and $PM_{2.5}$ concentrations and associated health benefits. There are also many examples in cities and countries elsewhere in the world, include those with similarities to the UK (e.g. Europe, North America).

London-wide Ultra Low Emission Zone One Year Report
https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/environment-and-climate-change-publications/london-wide-ultra-low-emission-zone-one-year-report

Integrated transport and public health approaches can also help reduce pollution. Authorities that integrate air quality objectives into transport planning, active travel investment, and public health strategies tend to achieve more sustained improvements.

Targeted monitoring and community engagement are also important. Innovative use of local monitoring, including around schools and major road corridors, has helped identify hotspots and build public and political support for action.

Despite these successes, best practice is not consistently replicated, largely because funding is often competitive, short-term, and uncertain, technical capacity varies widely between authorities, and there is no systematic national mechanism to scale up successful local interventions.

5b. How effectively are national government targets and local government actions aligned?

Alignment between national targets and local delivery in England is partial but incomplete. National government sets legal targets and frameworks, but the delivery responsibility is actually with local authorities. So for example key pollution controls remain national, particularly in transport, vehicle standards, agriculture, energy, and taxation, so local authorities often can lack direct control over large pollution sources affecting their communities.

The Government's Air Quality Target Delivery Plan acknowledges that achieving $PM_{2.5}$ and NO_2 reductions depends on action across multiple departments and sectors, but mechanisms to ensure consistent alignment and accountability remain limited.

From a public health perspective, stronger alignment would require longer-term, ring-fenced funding for local air quality action, clearer national guidance translating targets into local delivery expectations, stronger integration of air quality into transport, planning, housing, and agricultural policy, and enhanced data sharing and population-weighted exposure reporting to link local action to health outcomes.

Q6. Does the Government provide sufficient funding and devolved powers to comprehensively monitor air quality? Is data capture and analysis sufficient to provide a detailed and accurate assessment of air quality within England?

Overall, the Government does not yet provide sufficient funding, devolved powers, or data infrastructure to enable comprehensive and equitable monitoring of air quality across England. While national monitoring networks and modelling have improved, monitoring coverage remains uneven, particularly outside major urban centres, and local authorities vary widely in capacity to deploy and maintain high-quality monitoring. Data capture still relies heavily on sparse fixed-site networks and compliance-focused metrics, which can miss neighbourhood-level hotspots, rural secondary particulate formation, and exposures experienced by vulnerable populations such as around hospitals and schools. Our own work in the College has shown that in 5 major Scottish cities, only 4% of schools are within 50m of a monitor. More and sustained funding for local monitoring, improved data sharing between national and local bodies, and clearer alignment between levels detected by the monitors and health outcomes would be required to provide an informed and accurate assessment of air quality across England.

Air quality Environment Act target delivery plan. *https://www.gov.uk/government/publications/air-quality-environment-act-target-delivery-plan*

7. How joined up is government in planning, policies and action towards national targets and fostering communication and data sharing between departments?

Overall, government action on air pollution in England is not yet sufficiently joined up to deliver the statutory targets in a timely, health-protective way. While Defra provides policy leadership on air quality, delivery depends heavily on decisions taken by other departments whose primary objectives are not air quality, and coordination mechanisms remain limited. As a result, air quality is too often treated as a downstream environmental compliance issue rather than a core public health, transport, housing, and land-use priority.

a. Is Defra leadership sufficient to drive change across government?

Defra has a clear statutory role and has developed targets, monitoring frameworks, and delivery plans. However, Defra does not control many of the issues that affect air pollution, including transport use, vehicle standards, housing quality, domestic heating, agricultural practice, and monetary incentives. Without stronger cross-government accountability and clearer ownership at Cabinet level, Defra's leadership alone is insufficient to drive the scale and pace of change required to protect health.

b. Which other departments have the greatest opportunity to impact air pollution levels and how are their policies impacting on this?

Several departments have a decisive influence on air pollution outcomes in England.

Department for Transport can make policies affecting vehicle miles travelled, freight movement, road building, non-exhaust emissions, vehicle emission standards, and public and active transport investment have a major impact on NO_2 and $PM_{2.5}$ exposure.

Pollution control also receives a contribution from the Department for Levelling Up, Housing and Communities, via planning policy, housing location, density, ventilation standards, and proximity to major roads. These also shape long-term pollution exposure, particularly for children and deprived communities.

Department for Energy Security & Net Zero is also important as they make decisions on domestic heating, energy efficiency, and fuel poverty directly affect emissions from domestic combustion and indoor–outdoor exposure.

Department for Environment, Food & Rural Affairs (agriculture) should revisit standards and interventions for agricultural ammonia emissions which are a major driver of secondary $PM_{2.5}$ and nitrogen deposition, affecting both rural and urban air quality.

Without explicit alignment across these departments, policies can inadvertently undermine air quality objectives while pursuing other goals.

c. To what extent is air quality policy interacting with climate change mitigation, nature recovery and land use planning? How can benefits be maximised through joined up policy?

There is substantial untapped potential to maximise co-benefits through more integrated policy. Measures that reduce fossil fuel combustion, vehicle use and inefficient heating are likely to deliver simultaneous benefits for air quality, climate mitigation and health. Similarly, reducing ammonia emissions supports both nature recovery and $PM_{2.5}$ reduction. However, these co-benefits are not yet consistently embedded in decision-making, impact assessments, or funding frameworks.

Greater integration could be achieved by embedding air quality and health metrics into climate and transport appraisal, aligning local air quality action with net zero and nature recovery strategies, strengthening planning policy to prioritise healthy location and design, and routinely assessing population-weighted exposure and health impacts across policies.

The Chief Medical Officer for England and WHO (see documents referenced above) consistently emphasises that joined-up policy is essential to reduce air pollution effectively and equitably.

8. How well is the Government spreading awareness of the impacts of poor air quality and promoting action being taken to tackle the issue?

Overall, public awareness activity in England is uneven and insufficiently health focused. While national information tools exist, they are not consistently framed

around health risk, are variably promoted and are not always linked to clear actions that individuals, communities or institutions can take to reduce exposure or emissions.

The UK Air Quality Index and daily alerts provide useful information, but public understanding of what air pollution means for cardiovascular risk, child development, pregnancy outcomes, and long-term health remains limited. Messaging often emphasises short-term behaviour change during pollution episodes rather than sustained, preventive action and accountability for emission reduction.

Those involved with the health of the nation, have repeatedly drawn attention to the need for improved communication of the links between air pollution and preventable disease and health inequalities.

https://rcp.ac.uk/media/jzul5jgn/every-breath-we-take-the-lifelong-impact-of-air-pollution-full-report.pdf

https://www.gov.uk/government/publications/particulate-air-pollution-quantifying-effects-on-mortality

There is a clear need for a large-scale public health campaign across England and the devolved nations to raise awareness in the general public.

8a. How can communities be better empowered to strengthen accountability and drive local action?

Communities could be more effectively empowered through practical, transparent, and health-centred engagement, including clear health framing of air quality information, translating pollution levels into understandable health implications and protective actions, particularly for parents, schools, older adults, and people with long-term ill health and disability.

This includes improved access to local data, including their own neighbourhood monitoring, school-area data and population-weighted exposure metrics, enabling communities to understand and challenge local risk.

Much stronger links between the air quality data from monitors and local council decision-making are needed, so communities can see how monitoring actually affects transport planning, school siting, housing developments, and traffic management.

There should be more support for community-led initiatives, such as ‘school streets’, and citizen science, backed by consistent and significant funding and technical support rather than short-term pilots.

Taken together, these steps would help shift public engagement from some limited awareness, and sometimes antagonism, toward informed participation supporting more effective air quality action in England.

9. What are the economic or freedom of choice arguments for or against further action on air pollution?

Economic considerations strongly support further action on air pollution in England, particularly when health costs and productivity losses are taken into account. Air pollution is very costly to the NHS, social care and the wider economy through illness, premature mortality and reduced workforce.

UK Government analyses of data suggests that long-term exposure to air pollution costs the NHS and social care billions of pounds, with additional costs from lost productivity, benefits paid and reduced quality of life. Tin our experience, working with physicians and local authorities, these costs fall disproportionately on the more deprived communities and on children, older people, and those with long-term health disorders. Many studies have demonstrated that the economic benefits of limiting the health effects of air pollution who considerably outweigh the costs to implement air quality interventions.

Estimating the costs of air pollution to the National Health Service and social care: An assessment and forecast up to 2035.
https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002602

From a freedom of choice perspective, poor air quality constrains real choice by limiting people's ability to live healthy lives, travel actively, and allow children to play or walk to school safely. Framing air pollution reduction as an infringement on choice overlooks the fact that health harms are imposed involuntarily, particularly on those with the least ability to avoid exposure.

At the same time, concerns about affordability, mobility, and household costs are legitimate and need to be addressed through fair policy design e.g. removing the mileage cost for electric vehicles (EVs) and replacing it with a standard road tax, rather than being used as reasons for inaction.

a. What actions can be taken for a just transition and economic fairness for communities? How can the costs and benefits for cleaner air be shared fairly?

A just transition requires that the costs of cleaner air do not fall disproportionately on those least able to pay, and that the benefits are shared equitably. Key actions include targeted financial support for households affected by changes to heating e.g. as is happening with heat pumps, transport, or fuel standards, including grants for energy efficiency, clean heating, and vehicle transition to electricity, aligned with fuel poverty objectives, ensuring people have genuine choices rather than constraints.

Support is needed for workers and sectors in transition, particularly in polluting industries, agriculture, transport, and small businesses, through phased regulation, advice and incentives. We regularly see a tension develop when support is limited (e.g. taxi drivers with polluting taxis) when no incentive for EV change is provided.

'Health-first' targeting of action is important, prioritising interventions in communities with the highest exposure and greatest health burden, thereby delivering the largest health and economic gains per pound spent.

Transparent accounting of costs and benefits is also required, including explicit recognition of avoided NHS costs, productivity gains, and improved quality of life, to inform public debate and build trust.

Scientific papers consistently conclude that the economic benefits of reducing air pollution substantially outweigh the costs, particularly when long-term health savings are included.

The costs, health and economic impact of air pollution control strategies: a systematic review. https://pmc.ncbi.nlm.nih.gov/articles/PMC11337783/

10. How does UK air quality regulation compare with international counterparts? What comparisons or best practice can be learned from other countries? Has the UK kept pace with its international counterparts?

The UK regulations up until now have differed within the devolved nations. In England the EU Air Quality Directive 2008 was being implemented, with much higher limits than those recommended by WHO in 2021.

The EU has now brought in its new air quality directive, leaving England (and Wales) as an outlier within Europe until the new regulations come into force. In the EU this will tighten $PM_{2.5}$ limit values to 10μg/m^3 by 2030, with an explicit commitment to progressive alignment with WHO guidelines thereafter, alongside stronger enforcement and access to justice provisions.

New EU Air Quality Directive. https://www.bmluk.gv.at/en/topics/climate-environment/air-and-noise/law/new-eu-air-quality-directive

In the United States, in 2024, the US Environmental Protection Agency strengthened the annual $PM_{2.5}$ standard to 9μg/m^3, explicitly citing updated health evidence. However, whether this will hold under the current administration is unknown.

National Ambient Air Quality Standards (NAAQS) for PM. https://www.epa.gov/pm-pollution/national-ambient-air-quality-standards-naaqs-pm

Canadian Ambient Air Quality Standards include progressively tightening $PM_{2.5}$ objectives, with population-based exposure metrics and regular review cycles linked to health evidence.

Air quality. https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-quality.html

What we see with international best practice is shorter review cycles, clear trajectories toward WHO alignment, population-weighted exposure metrics, and stronger legal accountability for exceedences.

Within the UK, devolved administrations provide useful points of comparison. Scotland has adopted more stringent air quality objectives and has achieved consistently lower average $PM_{2.5}$ concentrations than England, reflecting earlier alignment with health-based standards and sustained cross-sector action.

Scottish monitoring data show that annual mean $PM_{2.5}$ concentrations have generally met Scottish objectives and are closer to WHO guideline levels, with very few exceedances above 10 µg/m^3 at automatic monitoring sites in recent years.

Air Quality Standards and Objectives. *https://www.scottishairquality.scot/air-quality/standards*

Scottish Air Quality Database. *https://www.scottishairquality.scot/sites/default/files/publications/2024-12/SAQD_annual_report_2023_final_0.pdf*

While contexts differ, and there are geographical differences, Scotland demonstrates that ambition, clearer health framing, and integrated delivery can translate into better air quality outcomes, offering transferable lessons for England.

Has the UK kept pace?

From a clinical and public health perspective, England has taken important steps by placing air quality targets on a statutory footing but has not yet matched the pace or ambition of leading international counterparts in translating health evidence into timely standards. The long target timelines, poorly defined and weak interim milestones, along with poor integration of climate with transport and land-use policies risk leaving avoidable health and environmental harms unaddressed.