PE2123: Update air quality standards in Scotland to align with 2021 World Health Organisation guidelines

Submission from UKRI Clean Air Champions, 30 June 2025

Response from the UKRI Clean Air Champions who support UKRI's Clean Air Programme

1. **Do you support amending the Air Quality Standards (Scotland) Regulations 2010 to align with the 2021 WHO air quality guidelines? Please explain your reasoning.**

On Clean Air Day, 19th June 2025, the Royal College of Physicians (RCP) released a new report "A breath of fresh air – Responding to the health challenges of modern air pollution". The authors of this written response were the leadership team for the report (SH, SB, GF) or contributed to the report (HP, SM). The RCP report outlines the growing evidence of the health harms posed by breathing polluted air, even at low concentrations. The report states that in 2025 air pollution is expected to contribute to 30,000 deaths in the UK. The economic costs, due to healthcare costs, productivity losses and reduced quality of life, are estimated at £27 billion annually in the UK. When the wider impacts of air pollution, for example dementia, are included in the calculations, costs are calculated to be as high as £50 billion. Air pollution has also been positively associated with the onset of over 700 health conditions (i.e., over 80% of the registered health conditions).

The RCP report sets out 19 recommendations aimed at all those with a role to play in reducing exposure to air pollution in the UK, including national, regional and local governments, industry, regulators, clinicians and individuals in society. The key recommendations of relevance here are:

1. **National, regional and local governments across the UK must recognise air pollution as a key public health issue and take increasingly ambitious action to reduce people's short- and long-term exposure to outdoor and indoor air pollution.**
2. **Governments across the UK should work with stakeholders and citizens, including marginalised and vulnerable groups, children and young people, older people, minoritised ethnic groups and disabled people, to identify robust pathways towards the delivery of the World Health Organization's 2021 global air quality guideline levels**. This recommendation outlines the

importance of ensuring that there are defined policy pathways towards achieving the 2021 WHO air quality guidelines. For Scotland, it is particularly highlighted that the **Air Quality Standards (Scotland) Regulations 2010 should align new limit values with the 2021 WHO guidelines**.

3. **Governments across the UK must take increasingly ambitious action on air pollution as our knowledge about its role in causing and accelerating disease and impairing fetal and child developmental processes continues to develop.**

As outlined in the RCP report, limit values must consider the latest health evidence regarding potential harms, as the WHO 2021 guidelines do, and be ambitious in terms of the challenges they present. However, standards should also reflect practicability, social acceptability, enforceability and economics and not lead to unintended negative impacts in other domains. Achievability is important – if failure to meet air quality standards is perceived as inevitable once all practicable actions are taken, this may lead to effective policy deprioritisation, because investment and change brings no likely compliance benefit.

On the other hand, in the situation where a single limit value is set, which is deemed to be achievable everywhere in Scotland within a reasonable timeframe, the level will be determined by the most polluted locations in highly populated urban areas. This was the case for the setting of the $PM_{2.5}$ concentration target for England in the Environment Act 2021 where the vast majority of locations outside of London were modelled to meet the 10 μgm^{-3} target by 2030 with no additional action except effective implementation of policy that was already in place. Ultimately the standard was set at 10 μgm^{-3} by 2040 as that was deemed achievable even in the very worst locations where $PM_{2.5}$ concentrations were modelled to be the most difficult to reduce. Setting a limit value that is driven by achievability in the most polluted areas in Scotland is likely to leave much of the country seemingly classified as having air that is ‘clean enough’ as they are not exceeding the limit, but many areas would still be exceeding the WHO guideline.

Given that we now know that there is not a threshold for impact in the case of air pollution, and given the concerns highlighted above, a shift in the way the system is designed could be more appropriate. Approaches other than a single limit value for all areas could be considered, such as the approach taken in Canada’s Air Quality Management System, which has a series of management levels under a top-level standard, and at each of those management levels a different level of action to improve air quality is required (Figure 1).

Air quality management level	Example of levels for annual $PM_{2.5}$ (µg/m³)	Example actions required
Red	>8.8 This represents areas that are above the air quality standard	> Development and implementation of a comprehensive air zone management plan, including short-, medium- and long-term milestones and targets > Compile emission inventory for air zone > Engage local stakeholders
Orange	6.5 to 8.8	> Development and implementation of a comprehensive air zone management plan > Compile emission inventory for air zone > Engage local stakeholders
Yellow	4.1 to 6.4	> Development and implementation of an air zone management plan > Compile emission inventory for air zone
Green	4.0	> Basic monitoring for trends

Figure 1: Canadian ambient air quality standard management levels for $PM_{2.5}$ and examples of the associated actions that are required. Taken from RCP Breath of Fresh Air report figure 3.2.

For $PM_{2.5}$, evidence is growing that specific components are responsible for driving the health impacts, i.e., all particles are not equal. Work to better understand which sub-fractions of PM are responsible for causing the observed health impacts continues, for example through the UKRI Clean Air Programme funded project HIPTox (Hazard Identification Platform to Assess the Health Impacts from Indoor and Outdoor Air Pollutant Exposures), which will be publishing findings over the coming months and years. It is also important to emphasise that the smallest particles (i.e., ultrafine particles; UFPs) are the most likely to cause the greatest health effects systemically, not only because of their small size, but also because of their combined large surface area and capacity to release toxic chemicals. However, UFPs are not routinely measured (independent of $PM_{2.5}$), nor specifically legislated for in Scotland. These are areas that warrant scrutiny over the coming years in terms of the potential implications of findings for future air pollution policy and legislation.

The growing evidence that air pollution affects us through our lifecourse, from pre-birth, as we grow up and during adulthood, requires that we view air pollution as a public health issue rather than one of narrow environmental compliance. This shift in perspective may help to maximise the health gain from air pollution interventions.

3. **To what extent has scientific and public health evidence about air quality evolved since the current standards were adopted? In your answer you could refer, for instance, to impacts on nitrogen dioxide or fine particulate matter on particular groups of people, the effect of Low Emission Zones (or other**

interventions of a similar nature) on air quality, or any new information or data about the effect of burning particular types of fuel.

Some key areas where scientific and public health evidence have evolved since the current standards for Scotland were adopted include:

Low Emission Zones (LEZs)

There are hundreds of LEZs across Europe, including four in Scotland; in Glasgow (June 2023-), Dundee (May 2024-), Edinburgh and Aberdeen (both June 2024-). LEZs (or Clean Air Zones) vary in terms of their specific scales, design and operation, however all aim to reduce air pollution across an area by reducing the number of highly polluting vehicles, normally older diesels. In a systematic review looking across a number of case studies, LEZs have been shown to be successful in reducing air pollution concentrations. A recent review published in the Lancet found that LEZs can also improve air pollution-related health outcomes, with the most consistent effect for cardiovascular disease.

A study focused on the introduction of London's low and ultra-low emission zones (ULEZ), found improvements in air quality after the zones were implemented. The researchers also looked at data from Quarterly Labour Force and Annual Population Surveys which are carried out by the Office for National Statistics. They found significant improvements in respiratory health and mental wellbeing, as well as an 18.5% reduction in the likelihood of taking sick leave. Another study looked at the impact of London's ULEZ on children's journeys to school. The researchers found that many families had experienced benefits of the ULEZ, including safer roads and cleaner air in London.

Air pollution does not get worse outside zones as a result of diverting vehicles. Instead, the experience from London and cities in Germany show the cleaner vehicles are also used in the surrounding area, spreading the benefit.

It is often said the zone charges unfairly penalise the least well off. There are many dimensions to this. It is not clear that the poorest people own the oldest cars. Some clearly do, but data from 2010 shows a more complex picture. Cars in the UK's poorest areas were, on average, just over a year older than those owned by the most well off. This was thought to be due to multi-car households in wealthier areas and the age of their second, third and, in some cases, fourth cars. Wealthier people also tended to own more polluting diesel cars, which are those most affected by low-emission schemes. It is unclear how these patterns have changed since the study was undertaken, though London data from 2019-20 showed the persistence of the clear relationship between wealth and multi-car households.

Solid fuel burning

It is clear that the burning of solid fuels is the most polluting way to heat your home. Measurements from Ireland, where a mixture of fuels are used, including coal, smokeless coals, peat and wood reveals that all of these contribute to higher levels of air pollution. A new study on home energy performance certificates reveals that the major wood burning hotspots are not in our major cities, but in smaller urban areas.

Turning to health impacts, a new study has revealed that daily death rates in London increase when the air is filled with pollution from the burning of wood and other solid fuels. This pattern was identified by looking at dates of death of more than 465,000 people over 10 years, with the clearest association seen in death rates from respiratory problems. The study set out to investigate if daily deaths in the city were affected by different types of carbon-containing air pollution particles. This includes particles from diesel exhaust and home burning as well as secondary particles that form in the air from solvents, paints, aerosol propellants and even everyday chemicals in personal care products and home printer ink.

Net zero and air pollution

Scotland has set a target date for net zero emissions of all greenhouse gases by 2045. Decarbonisation will require changes across all sectors of the economy and that presents an opportunity to reassess standards, particularly around any combustion activity that is retained. The current standards for emissions from alternative fuels have, in at least some cases, been set at the same level as for the fossil fuel being replaced. However, this has the potential to limit the progress on tackling air pollution that could be delivered through Net Zero-driven action. As an example, NOx emission limits for activities where hydrogen combustion replaces diesel could be kept at the current level, which could potentially be achieved by retrofitting existing technologies to burn hydrogen. However, there is evidence to show that specifically designed engines for hydrogen combustion can deliver far lower emissions of NOx (>99% lower emissions than stage V diesel). This means that far greater co-benefits for air pollution could be delivered from the decarbonisation action if that were required by legislation or another regulatory instrument. Considering air pollution co-benefits in both the decarbonisation choices and the implementation pathways is likely to deliver the greatest benefit in both the short and long term.

Indoor air quality

In addition to what is outlined here for outdoor air, it is also worth emphasising that the evidence that poor indoor air quality can have significant negative impacts on people's health is rapidly accumulating. For example, the UKRI Clean Air Programme project INGENIOUS (Understanding the sources, transformations and fates of indoor air pollutants) has shown how daily tasks like cooking and cleaning may contribute to poor indoor air quality, impacting our health. This contrasts with research showing that, in

Scotland, at-risk groups consider their home environment to be ‘safe spaces’ in terms of air pollution. We therefore emphasise the need to consider regulation of indoor as well as outdoor spaces over coming years, to ensure that people are not adversely affected by the air they breathe when at home, work or school.

Response submitted by the following on behalf of the UKRI Clean Air Champions:

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- Dr Sarah Moller, Senior Research Fellow at the National Centre for Atmospheric Science at University of York and the UKRI Clean Air Programme’s Co-Champion for Policy Impact
- Dr Gary Fuller, Assistant Professor in Air Quality Measurement at Imperial College London and one of UKRI Clean Air Programme’s Clean Air Champions