Wales- Welsh Government- fine particulate matter: Fine particulate matter air quality targets

https://www.gov.wales/fine-particulate-matter-air-quality-targets

Question 1a

To what extent do you agree with the level of ambition proposed for the Annual Mean Concentration Target (AMCT)?

Answer: Partially agree.

Question 1b

Please explain your answer

We support the introduction of a legally binding Annual Mean Concentration Target (AMCT) for $PM_{2.5}$ in Wales, and agree that setting a statutory limit is an important step for public health protection. However, from a health perspective, the proposed level of ambition i.e. an annual mean of 10μg/m^3 by 2035 is insufficiently ambitious given the strength of the evidence on health harms at and below this level, and the urgency of preventing disease and mortality.

$PM_{2.5}$ is the air pollutant with the strongest and most consistent evidence base linking exposure to adverse health outcomes, including all-cause mortality, cardiovascular disease, stroke, lung cancer, asthma, chronic respiratory disease, kidney, diabetes, neurological and mental conditions, and adverse pregnancy outcomes, and it produces significant and permanent adverse health effects in children.

Belch JJF, Elder E, Bartlett S, Flinn K, Hughes RC, Miller MR, Newby D, Quinn T. Air pollution is the largest environmental risk to public health and children are especially vulnerable. BMJ 2023;381:p1037. https://doi.org/10.1136/bmj.p1037

Fitton C.A et al. Respiratory Admissions Linked to Air Pollution in a Medium Sized City of the UK: A Case-crossover Study. Aerosol Air Qual. Res. 2023; 23(8), 1-10, 230062. https://doi.org/10.4209/aaqr.230062

Schraufnagel DE. Air Pollution and Noncommunicable Diseases: A Review by the Forum of International Respiratory Societies' Environmental Committee, Part 2: Air Pollution and Organ Systems. https://pubmed.ncbi.nlm.nih.gov/30419237/

The World Health Organization (WHO) 2021 Air Quality Guidelines recommend an annual mean $PM_{2.5}$ level of 5μg/m^3, based on robust global evidence that health risks persist at concentrations below 10 μg/m^3:

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

Importantly, there is no known safe threshold, with large cohort studies and meta-analyses demonstrating health benefits from reductions well below 10 μg/m^3. Large, high-quality epidemiological studies continue to show measurable increases in

mortality and cardiovascular risk even at low concentrations, including in high-income countries with relatively “clean” air. They show associations below the proposed regulatory limit, even at low concentrations, with continued health benefits from incremental improvements.

Pope et al. Fine-particulate air pollution and life expectancy in the United States https://www.nejm.org/doi/full/10.1056/NEJMsa0805646

Liu, Cong, et al. Ambient particulate air pollution and daily mortality in 652 cities.

New England Journal of Medicine 381, no. 8 (2019): 705-715. https://www.nejm.org/doi/full/10.1056/NEJMoa1817364

Bert Brunekreef et al. Mortality and Morbidity Effects of Long-Term Exposure to Low-Level PM2.5, BC, NO2, and O3: An Analysis of European Cohorts in the ELAPSE Project. https://pmc.ncbi.nlm.nih.gov/articles/PMC9476567/

Stacey E et al. Association of Long-term Exposure to Particulate Air Pollution With Cardiovascular Events in California. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2801820

From a health inequalities perspective, a target of 10μg/m³ risks locking in avoidable harm for vulnerable groups, including children, older adults, people with cardiovascular or respiratory disease, pregnant women, and communities experiencing higher baseline exposure. These groups bear a disproportionate burden of disease, and slower progress prolongs preventable NHS costs and loss of healthy life years.

The consultation document explicitly acknowledges the WHO 2021 Air Quality Guideline of 5μg/m³ for annual mean $PM_{2.5}$ and recognises that the WHO guideline is health-based, health effects occur below 10μg/m³ and that further reductions below 10μg/m³ would deliver additional health benefits. However, the document then states that 5μg/m³ is not being proposed as a statutory target ‘at this time’, and 10μg/m³ by 2035 is considered the most ambitious level currently achievable in Wales, taking into account feasibility, modelling and policy constraints.

We acknowledge the constraints described but would urge the Welsh Government to move to the 10μg/m³ target immediately and to explicitly commit to a short timeline and roadmap for when a regulatory level of 5μg/m³ will be introduced. 2035 condemns a generation of children to future ill health.

Question 2a

To what extent do you agree with the level of ambition proposed for the Population Exposure Reduction Target (PERT)?

Answer: Partially agree.

Question 2b

Please explain your answer

We strongly support the inclusion of a Population Exposure Reduction Target (PERT) as this is particularly important from a public health and health inequalities perspective. Reducing average population exposure to $PM_{2.5}$ reflects the cumulative health burden across society and complements concentration-based targets by addressing widespread, lower-level exposure that drives most attributable disease.

However, the proposed ambition of a 25% reduction in population exposure by 2035 is insufficiently ambitious given the scale of the health impacts, the strength of the evidence and the availability of effective interventions. It is unclear why the target is substantial lower than the proposed PERT in England (35% reduction, albeit by 2040) given that many of the logistical constraints outlined (such as transboundary PM) apply equally, or more so, to many regions of England.

A large proportion of $PM_{2.5}$ harm arises from chronic exposure across the whole population, including in areas that already meet existing limit values. Extensive epidemiological evidence shows linear or near-linear associations at low concentrations, meaning that population-wide reductions deliver substantial health benefits, even where absolute concentrations are relatively low.

The *Lancet* Global Burden of Disease (GBD) analyses demonstrates that $PM_{2.5}$ contributes significantly to cardiovascular disease, stroke, lung cancer, diabetes and premature mortality, largely through population-wide exposure rather than extreme hotspots. Further large cohort studies show measurable mortality effects even at low average concentrations.

Cohen AJ et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)30505-6/fulltext

Long term exposure to low level air pollution and mortality in eight European cohorts within the ELAPSE project: pooled analysis. Https://pubmed.ncbi.nlm.nih.gov/34470785/

From a health equity standpoint, this proposed modest PERT risks perpetuating avoidable inequalities, as disadvantaged communities often experience higher baseline exposure and greater vulnerability due to comorbidities, housing quality, and occupational exposure. Stronger population-wide reductions would deliver disproportionately larger health gains in these groups.

In addition, evidence from elsewhere suggests that more rapid population exposure reductions are achievable, particularly through accelerated transport decarbonisation, facilitation of active travel, tighter controls on domestic solid fuel burning, green and bluespace adoption, and integrated action linking air quality, climate and public health policy. There are many examples of case stories in major cities across the world, including those with greater air pollution challenges, that have committed to strong action in these areas, and achieved considerable air quality improvements as a results

https://www.weforum.org/stories/2025/03/clean-air-pollution-stories-from-2024-cities-innovation-policy/

https://www.vitalstrategies.org/mega-cities-successfully-reduce-toxic-air-pollution-by-as-much-as-50/

https://www.cleanairfund.org/news-item/stories-of-impact/

https://world-heart-federation.org/resource/world-heart-report-2024/

The achievability and benefits of ambitious UK air quality interventions, such as the London Ultra-Low Emission Zone, also highlight the feasibility of this approach in UK settings, and the large numbers of individuals whose lives will be improved as a result of these measures

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

Given the well-established and preventable burden of $PM_{2.5}$ related disease, we would encourage the Welsh Government to increase the ambition of the PERT, introduce stronger interim milestones, and commit explicitly to reviewing and strengthening the PERT earlier than 2035 as evidence and monitoring improve.

Question 3a

To what extent do you agree with the proposed arrangements for assessing $PM_{2.5}$ levels and achievement of the targets?

Answer: Partially agree.

Question 3b

Please explain your answer

We agree that having clearly defined arrangements for assessing $PM_{2.5}$ levels and monitoring progress towards the targets is essential, and we welcome the intention to use established monitoring networks and modelling approaches. However, from a health perspective, we have several concerns that the proposed arrangements may underestimate true population exposure and therefore the health burden, unless strengthened.

First, fixed-site ambient monitoring alone does not fully capture population exposure, particularly for groups at highest health risk. $PM_{2.5}$ exposure varies substantially by proximity to traffic and other sources, housing quality and infiltration, and time/activity patterns (e.g. children, older adults, people with chronic illness). In particular our work shows that very few monitors are within a range that will detect problematical levels round these schools. From a Scottish perspective – a region that has numerous parallels with Wales - in 5 of Scotland's major cities less than 3% of

schools are within 250m of a monitor. As schools are frequently on main roads, this is a concern.

Evidence consistently shows that health impacts are driven by long-term personal exposure, not just area-wide averages. Greater integration of high-resolution modelling, population-weighted exposure metrics, and demographic stratification would improve the public health relevance of assessment.

Second, we are concerned that current approaches risk masking health inequalities. Area-wide averages can conceal substantially higher exposures in more deprived communities, urban areas with dense traffic, and populations living near major roads or industrial sources. While we welcome the proposal for 9 extra monitors to improve the air quality network, we would suggest that this number is insufficient to address the aforementioned concerns, especially when factoring in the balance between background, urban background and roadside monitoring. The latter, in particular, is needed to better address the impact of sub-$PM_{2.5}$ particles and gases derived from traffic that show higher degrees of spatial distribution. Further consideration on the strategic placement of monitors, and use of modelling to address spatiotemporal distribution of pollutants from sources that are less well predicted from emission inventories, will be necessary.

Additionally, given the strong evidence that $PM_{2.5}$ contributes to health inequalities, monitoring and assessment should explicitly support disaggregated analysis by deprivation, age and vulnerability, rather than relying solely on national or regional means. We would strongly encourage greater transparency and regular public reporting of population-weighted $PM_{2.5}$ exposure, estimated health impacts (e.g. attributable mortality, hospital admissions), and progress by local/unitary authority – all with disaggregated analysis.

A more detailed cost-benefit analysis of air pollution interventions in Wales may be required. Health Impact Assessment approaches are well established and already used internationally to link $PM_{2.5}$ concentrations directly to avoidable deaths and morbidity, which improves policy relevance and public understanding.

Reports and statements from the Committee on the Medical Effects of Air Pollutants (COMEAP). https://www.gov.uk/government/collections/comeap-reports

Question 4a

To what extent do you agree with the provision in the draft regulations to allow the subtraction of the ‘natural contribution’ to particulate matter where exceedances of a target are due in whole or in part to these natural contributions?

Answer: Partially agree.

Question 4b

Please explain your answer

We recognise that there are circumstances in which $PM_{2.5}$ concentrations are influenced by natural sources (for example sea salt, wind-blown dust or long-range transboundary events such as wildfire smoke) and that distinguishing these contributions can be important for regulatory fairness. However, from a public health perspective, we have significant reservations about allowing subtraction of natural contributions unless this is very tightly defined, transparently applied and limited in scope.

$PM_{2.5}$ causes harm irrespective of its source. While the current scientific consensus is that it is not possible discount any constituent of $PM_{2.5}$ as non-harmful, the general assumption is that sea salt has relatively little toxicity. However, there is capacity for sea salt PM to absorb other pollutants (such as those from urban sources, or even microbial contaminant), therefore, there remains considerable debate as to whether it is appropriate to subtract the sea-salt proportion of $PM_{2.5}$ from the total PM mass. The health effects, particularly cardiovascular disease, stroke, respiratory illness, adverse pregnancy outcomes, and premature mortality are underpinned by large epidemiological studies which almost universally do not classify particles as ‘natural’ or ‘anthropogenic’. From a health protection standpoint, exposure remains harmful even when $PM_{2.5}$ originates from natural or semi-natural sources.

Second, there is a risk that routine subtraction of natural contributions could weaken incentives for action, particularly if exceedances are reclassified away from regulatory responsibility. This is concerning because natural and anthropogenic particles often co-exist and interact - climate change is likely to increase natural $PM_{2.5}$ episodes (e.g. wildfires, dust) - and the degree to which cumulative exposure, rather than source, drives long-term health impact cannot be adequately disentangled by current models. Furthermore, evidence from large epidemiological studies shows that long-term $PM_{2.5}$ exposure increases mortality even at relatively low concentrations, regardless of episodic attribution.

From a health inequalities perspective, communities already experiencing higher baseline exposure, often more deprived and/or urban populations, may still experience the health consequences of exceedances, even if those exceedances are partly attributed to natural sources. Subtraction mechanisms should not obscure real-world exposure or its unequal health impacts. Many PM standards (e.g. WHO) and indexes from air quality websites do not differentiate between PM sources, therefore, there is a high potential for misconceptions, or indeed perceived degrees of misinformation, that could arise from the reporting of modified PM metrics.

We therefore believe that any provision to subtract natural contributions should be exceptional rather than routine, apply only where robust, transparent, and independently verifiable attribution is possible, never substitute for action to reduce controllable anthropogenic sources, and be accompanied by clear public reporting of both total measured $PM_{2.5}$ and the subtracted component.

Question 5

We have asked some specific questions. If you have any other relevant thoughts or comments on our proposals, please provide them here.

We welcome the Welsh Government's proposal to introduce legally binding targets for $PM_{2.5}$, which represents an important step forward for public health protection in Wales. Fine particulate air pollution remains one of the leading preventable environmental causes of disease and premature mortality and the decision to regulate $PM_{2.5}$ explicitly is strongly supported by robust health evidence.

However, we believe the proposals would be strengthened by a clearer and more explicit framing of $PM_{2.5}$ as a major public health issue, rather than primarily an environmental compliance matter. The evidence base demonstrates that $PM_{2.5}$ contributes substantially to cardiovascular disease, stroke, lung cancer, chronic respiratory disease, diabetes, neurological and mental health impairments, adverse pregnancy outcomes, impaired child health and reduced life expectancy, with impacts observed across the entire population and at concentrations below current regulatory limits.

We are particularly concerned that the proposed targets risk locking in avoidable health harm until 2035, the ambition does not align with the best available health evidence, and insufficient emphasis is placed on health inequalities, despite strong evidence that air pollution disproportionately harms more deprived communities, children, older people, and those with pre-existing cardiovascular and respiratory disease.

We also highlight that these proposals do not provide new guidelines on other air pollutants - such as nitrogen dioxide, ozone, sulphur dioxide or ammonia - or indicate how the Welsh air quality strategy will otherwise address them. All these pollutants have the capacity to induce multiple and significant effects on health, and may do so synergistically with PM. It is also notable that there has been significantly less progress on some of these pollutants (e.g. ammonia, which is also a significant source of secondary PM, even in urban areas) or that the impact of these pollutants may because more severe with the changing climate (e.g. ozone, which also may react with PM to increase its toxicity). Consideration could also be given to the WHO Global Air Quality Guidelines 'best-practice pollutants', e.g. black carbon and ultrafine particles

We are further concerned that the proposals do not sufficiently highlight the role of domestic wood burning as a major and growing contributor to $PM_{2.5}$ exposure.

No fire without smoke: is it time to ditch burning wood in the home?
https://bylines.scot/health/no-fire-without-smoke-is-it-time-to-ditch-burning-wood-in-the-home/

Indoor wood-burning from stoves and fireplaces and incident lung cancer among Sister Study participants
https://www.sciencedirect.com/science/article/pii/S0160412023004014

UK evidence indicates that domestic solid fuel use is now responsible for a substantial proportion of primary $PM_{2.5}$ emissions, often exceeding those from road transport. Unlike many other sources, emissions from wood burning occur directly in residential areas, increasing exposure for households and neighbours, including vulnerable populations. Stronger action to reduce emissions from domestic wood burning would represent a significant and achievable public health gain.

Finally, the consultation proposes ambitious air quality targets but does not set out how these will be achieved in practice. For public health, it is crucial not just to define targets but to identify and implement related policies with timelines that will swiftly drive reductions in key sources of $PM_{2.5}$ such as transport emissions, active travel (which brings additional health benefits), industrial and agricultural processes, and domestic combustion (including wood burning). We recommend that the final strategy accompanying the targets should include clear measures, interim milestones, accountability mechanisms to ensure the targets deliver real improvements in population health.