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Science-based Policy Recommendations for Fine Particulate Matter in the United States

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The importance of reducing air pollution concentrations is clear: lower air pollution levels will lead to improvements in public health and exert co-benefits for climate actions. The American Thoracic Society (ATS) has a responsibility as the world's leading medical society dedicated to advancing global respiratory health to advocate for protective air quality standards that reflect the latest scientific understanding of the health risks of outdoor pollution exposures.

In the United States (U.S.), the U.S. Environmental Protection Agency (EPA) Administrator is responsible for making final decisions in regard to the National Ambient Air Quality Standards (NAAQS) for fine particulate matter (PM_{2.5}) as directed by the Clean Air Act. This decision is greatly assisted by technical and policy documents prepared by EPA staff, under the guidance of the Clean Air Science Advisory Committee (CASAC), and for which ATS provided substantive public comments.

Scientific Evidence for a Revised PM_{2.5} Recommendation in the U.S.

ATS has long made science-based policy recommendations for the NAAQS for criteria pollutants (1). In 2019, ATS revised its recommendation for the annual PM_{2.5} standard to 8 µg/m³ and reaffirmed its recommendation of 25 µg/m³ for the 24-hour standard. Meeting these recommendations would result in substantial health benefits compared with current air quality conditions (2).

The revised recommendation for the annual PM_{2.5} standard was based primarily on epidemiological studies conducted among U.S. populations that observed increased risks for premature deaths associated with exposures below the current EPA standard (annual standard of 12 µg/m³ and 24-h standard of 35 µg/m³) and the previous ATS-recommended level (3–5). Valuable information from studies conducted in Canada, with lower ambient concentrations than the U.S., further supported the scientific rationale for the recommended level (6).

The 24-hour PM_{2.5} standard is designed to protect the public from health risks associated with elevated short-term exposures. But interpreting results from epidemiology studies to inform decisions regarding the level of the 24-hour standard can be challenging. For example, acute health risks are most clearly associated with exposures occurring across multiple days while the averaging time of the standard is based on a single day. However, studies that have restricted the analysis to days with exposures below 25 µg/m³ have demonstrated increased risk of mortality and morbidity on days with elevated levels of PM_{2.5} and provide strong evidence in support of the ATS recommendation for the 24-hour standard (7, 8).

Comparing ATS Recommendations with WHO Guidelines

Air Quality Guidelines (AQGs) from the World Health Organization (WHO) represent an important guidepost for environmental and public health and provide governments a clear recommendation to protect people from the severe health effects of air pollution (9). The updated WHO AQGs for PM_{2.5} are 5 µg/m³ for annual values and 15 µg/m³ for 24-hour values.

It is reasonable to ask why ATS doesn't adopt the WHO AQGs for its U.S. policy recommendations, even though it strongly supports their use at the global level as an aspirational target for providing clean air for all. The answer is that ATS recommendations apply specifically to the NAAQS established by the EPA under the Clean Air Act based on legal requirements unique to the U.S. The NAAQS are a legally binding standard that counties and states are required to attain through planning and management efforts. These standards are reviewed regularly and continue to be adjusted based on evidence primarily from U.S.-based studies.

The most recent epidemiological evidence of long-term exposures and mortality risks in the U.S. have reported exposure averages, after restricting the exposure levels, ranging from 8.1 to 10.7 µg/m³ for regional analyses and 9.7 to 11.0 µg/m³ for nationwide assessments (10). ATS recommendations for U.S. policy will be re-evaluated as more information from observational studies with lower pollutant concentrations becomes available. Until that time, ATS will continue to support the WHO AQGs as an ultimate goal for global ambient air quality while recommending slightly different levels for legally binding standards in the U.S.

Changing Conditions in Ambient PM_{2.5} in the U.S. That Should Inform the NAAQS

Wildland fires. Wildland fires are responsible for an increasing number of days exceeding NAAQS levels across the US at PM_{2.5} monitor locations (11). The majority of PM-related health impacts in the U.S. may be attributable to wildland fires in future years due to continued reductions in anthropogenic emissions combined with climate-related increases in wildland fire emissions (12). However, changes in health risks may not be directly proportional to changes in PM_{2.5} mass owing to differences in particle toxicity based on emission source and particle composition (13).

Implementation issues, which deal with the actions that states take to meet federal air quality standards, are typically not considered by EPA when reviewing the NAAQS. But given the increasing importance of wildland fire emissions, it would be wise to more fully consider how all aspects of the NAAQS (particularly the metric and

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form of the 24-hour standard) can help air quality agencies best plan to mitigate elevated pollution concentrations.

This additional consideration should also include a more thorough evaluation of the cut-points that are used for the Air Quality Index, specifically with an eye toward the range of concentrations commonly experienced in the ambient environment due to wildland fire emissions, to ensure that it provides meaningful risk communication information based on health risks.

Environmental Justice Considerations

Structural systems can produce and perpetuate inequities in exposure to air pollution and subsequent health effects (14). Impoverished communities, and particularly communities of color, are often disproportionately exposed to higher levels of air pollution that are not fully represented by monitored values. The resulting health impacts are likely to be amplified by a number of co-occurring factors, such as higher exposure to other environmental toxicants including psychosocial stress, more co-morbid diseases which can heighten sensitivity to air pollution, and poorer access to healthcare. These inequalities have been brought to the forefront with the coronavirus disease (COVID-19) pandemic, where environmental factors including air pollution increase risk for poorer outcomes (15).

Improvements in air pollutant concentrations measured at regulatory monitoring locations do not always result in the same level of improvement in “hot-spot” locations, which have markedly higher pollutant levels. This problem is exacerbated when the relationship between monitored pollutant concentrations and exposure levels at nearby hot-spot locations is not considered when determining the controlling standard for revised NAAQS levels.

Two remedies are needed to address this problem. First, there is an urgent need for more permanent, regulatory monitors in these communities. Second, ATS strongly recommends that EPA strengthen the 24-hour standard for PM_{2.5}, in conjunction with any improvement to the annual standard, to best account for these important environmental justice considerations.

Conclusions

The science-based policy recommendations provided by ATS, the science and policy documents prepared by EPA staff, and the recommended ranges provided by CASAC all provide a strong endorsement for adopting health-protective standards of 8 µg/m³ and 25 µg/m³ for the annual and 24-hour standard, respectively, as part of the evaluation of the standards in 2022. The increasing importance of wildland fire emissions and environmental justice considerations calls for a careful review of the multiple related aspects of the NAAQS (i.e., metric and form of the standard, air quality index, and monitoring) that goes beyond revising the level of the standards. These recommendations will be updated for future reviews, as needed, to reflect the best available scientific evidence. ■

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