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Healthier air, healthier planet

Air pollution is a leading cause of death globally. Efforts to clean the air will not only save lives but contribute to addressing broader environmental and socioeconomic challenges.

In 2021, the World Health Organization (WHO) tightened its air quality guidelines — the first adjustment since the 2005 update — lowering levels of air pollutants by up to 75%. The guideline for annual concentration of the most toxic pollutant, fine particulate matter (known as $PM_{2.5}$), was halved from 10 to 5 μg m^{-3}. The WHO's adjustment was a result of a mounting body of evidence suggesting that there is no safe exposure level to air pollution. Globally, air pollution has become one of the leading threats to public health, causing around 6.7 million premature deaths each year[1]. However, about 97% of countries failed to meet the new guidelines in 2022, including those with decades of pollution control and air quality improvement, such as the United States. In this issue, accompanied by an online collection of work from across Nature Portfolio, we feature articles on air pollution and pollution control efforts in different regions around the world and discuss how actions for healthier air promote efforts for a healthier planet.

Air pollution is formed by emissions from both natural and anthropogenic sources, but most pollution today is caused by human activities. Although air pollution is a problem around the world, the history of anthropogenic pollution varies from place to place and not all countries are at the same stage in cleaning up their air. In the mid-twentieth century, Los Angeles and London both experienced deadly smog events, killing thousands of local residents in the space of a few days. These events led to the introduction of clean air regulations in both the UK and the US. Through the implementation of end-of-pipe control technologies on large emission sources, such as power plants and vehicles, the US greatly reduced emissions of sulfur oxides and nitrogen oxides in the 1980s. These emission reductions have led to significantly reduced levels of $PM_{2.5}$ and ozone pollution, and improved air quality, as discussed by Colette Heald in a Q&A. However, Heald points out that challenges remain when it comes to meeting the new WHO guidelines, owing to increasing fire smoke in the US under climate change[2].

In China, the employment of advanced end-of-pipe emission control technologies on coal power plants, industrial facilities, and vehicles has already helped the country make big improvements in air quality, reducing the exposure of millions of local residents to some of the world's deadliest pollution. For example, between 2013 and 2020, annual $PM_{2.5}$ concentrations in Beijing and Shanghai declined from 85 to 38 μg m^{-3} and from 50 μg m^{-3} to 28 μg m^{-3}, respectively[3]. However, since highly efficient emission control technologies have been widely employed, further pollution reduction is becoming costly and technically challenging, especially considering the large amounts of coal consumption in China. In another Q&A Qiang Zhang argues that China's pollution control efforts should shift toward energy transition, including the promotion of electric vehicles and renewable energies and the development of affordable alternatives to coal for energy-intensive industries.

Reduction of coal consumption and promotion of renewable energies not only reduce emissions of air pollutants but also climate pollutants, such as CO_2 and methane, so it is a win-win for air pollution control and climate change mitigation. For example, measures on energy use in China's air pollution control, such as switching 35 million households in North China to clean fuels for heating, reduced emissions by around 2.43 Gt CO_2 (ref. 4).

A transition to clean energy use in households is key to clearing the current deadly smog in India. In contrast to the US and China, where industrial facilities and transportation vehicles have been the largest emission sources, in India, biomass burning for residential heating and cooking is the single largest source of air pollution. In a third Q&A, Chandra Venkataraman highlights that the current pollution control strategy in India is focused on cities. However, biomass fuels are widely used in non-urban regions due to a lack of access to clean fuels, resulting in severe indoor and regional air pollution. In fact, about 70% of pollution-associated premature deaths in India are non-urban residents.

For Africa, protecting air quality in the upcoming decades of industrialization and urbanization will require the continent to take a greener approach to development and systematically tackle the challenge ahead. In a Comment, Mead et al. call for more attention to be given globally to Africa's air pollution problem. The current annual concentration of $PM_{2.5}$ in some of the regions in Africa has reached as high as ten times above the WHO guidelines. The route that Africa chooses to go in further development is not only important to protecting the health of millions of Africans but also mitigating global climate change. Mead et al. argue that to achieve healthy and green socioeconomic growth, the region needs to accelerate the energy transition in residential and transportation sectors, prioritize green industries for development, and improve waste and pollution management.

The tightening of WHO air quality guidelines requires regions around the world to take more vigorous action on air pollution control to protect public health. Such action also contributes to climate change mitigation, sustainable economic growth, transition to renewable energy, and increased waste recycling, all of which will make our planet a better place to live for all its residents.

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References

1. *State of Global Air 2020* (Health Effects Institute, 2020).
2. Burke, M. et al. *Nature* https://doi.org/10.1038/s41586-023-06522-6 (2023).
3. Air quality in China. *IQAir* (accessed 23 October 2023); https://www.iqair.com/china
4. Shi, Q. et al. *Nat. Commun.* **13**, 5061 (2022).