United Nations A/HRC/61/47

General Assembly

Distr.: General
12 January 2026

Original: English

Human Rights Council
Sixty-first session
23 February–2 April 2026
Agenda item 3
Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development

Priority actions towards breathing clean air, protecting public health and ensuring a healthy environment

Report of the Special Rapporteur on the human right to a clean, healthy and sustainable environment, Astrid Puentes Riaño

Summary

Breathing clean air is vital for all. Science has unequivocally proven that air pollution poses significant risks to public health, especially for persons in vulnerable situations, and to a healthy environment. The public health crisis can be solved and further risks prevented, as evidenced by research and improved monitoring and governance to tackle main drivers linked to a fossil-fuel-dependent economy and unsustainable activities. Stronger measures to improve air quality, prioritizing health to protect people, must be urgently implemented by States, aligned with their international and human rights obligations. The duty of private actors to support these efforts, and their urgent responsibility to prevent, reduce and remediate pollution, must also be underscored.

I. Introduction

1. The present report is submitted pursuant to Human Rights Council resolution 55/2, building on past reports[1] and research. It contributes to a deeper understanding of air pollution impacts on human rights, including the right to a healthy environment. In the report, which is focused on the protection of marginalized people and groups and based on updated science and legal advances, the Special Rapporteur identifies priority actions for States and businesses to improve air quality with a human rights perspective, highlighting urgent actions required to protect the health of children and of the most vulnerable people.

2. Clean air is an element of the human right to a clean, healthy and sustainable environment, and is essential for the enjoyment of all human rights, including to life and health. However, most people do not enjoy clean air, primarily owing to a lack of health and environmental protections, as economic growth and industrial activity is prioritized. The extraction and use of fossil fuels, inadequate urban and land-use planning, the lack of sustainable public transport, use of biomass for cooking and heating, and unsustainable industrial agricultural practices severely degrade the air everyone breathes.

3. There is extensive and conclusive scientific evidence of the health risks posed by air pollution, which has an impact on all organs of the human body throughout life, including in utero. Children are the most vulnerable, along with older persons, pregnant people, people with pre-existing health conditions, and members of marginalized groups, especially those living in urban areas. Air pollution transcends borders, causing transboundary impacts; systemic inequalities and climate change, ecosystem loss and toxic pollution aggravate the impacts. Currently, air pollution is linked to about 8 million premature deaths annually worldwide, and causes or worsens multiple health harms.[2]

4. The severity of the situation contrasts with existing solutions, the clarity of States' obligations, and actions and measures that can and must be implemented. Important improvements, including transitions to cleaner energy, stricter emissions controls, improved planning and better public transport, have been implemented, mostly in high-income areas. At the same time, air pollution continues to worsen, especially in low- and middle-income countries. Access to air quality information and how to appropriately monitor and control sources is unequal, as is the access to needed funds and expertise to act. Addressing these gaps is urgent and a clear human rights obligation.

5. The Special Rapporteur extends her gratitude to the Governments of Armenia, Brunei Darussalam, Burundi, China, Colombia, Estonia, Ireland, Jordan, Mexico, Myanmar, Peru, the Republic of Korea, Romania, Saudi Arabia, Serbia, Singapore, Spain and Uzbekistan for the contributions they sent to inform the present report. She also thanks the 60 civil society organizations, international entities, academics, universities and individuals for their inputs, and the 75 participants who attended the four consultations held.[3]

II. Air pollution: an unequivocal risk for human rights

6. Exposure to polluted air affects all organs and systems in the body, causing or aggravating health harms, including cardiovascular and respiratory diseases, cancer,[4] miscarriages, reproductive harms, dementia, depression and developmental delays, with cumulative effects that worsen long-term health harms. Many of these are noncommunicable diseases, including cancer and cardiovascular diseases (such as heart attacks and strokes) and chronic respiratory diseases, such as asthma;[5] 83 per cent of premature deaths associated with

[1] See, for example, A/HRC/40/55.
[2] See https://www.stateofglobalair.org/resources/archived/state-global-air-report-2024.
[3] Submissions will be available at https://www.ohchr.org/en/calls-for-input/2025/call-input-protecting-clean-air.
[4] See https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health.
[5] See https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases.

air pollution are from chronic diseases.[6] These impacts undermine the rights to life, health, a healthy environment and an adequate standard of living, and to equality and non-discrimination, imposing a major burden on public health while being largely preventable, as sources are mainly created by humans.

7. Harms and risks are unequally distributed. Globally, 2.5 billion people are exposed to hazardous particulate matter (PM) concentrations, especially in low- and middle-income countries and regions, such as in South Asia (1,200 million people), East Asia (660 million), sub-Saharan Africa (330 million) and North Africa and the Middle East (224 million).[7] Over 90 per cent of global air pollution-related deaths are linked to outdoor fine particulate matter ($PM_{2.5}$),[8] and concentrations commonly and significantly exceed World Health Organization (WHO) guidelines.

8. Some of the highest levels of nitrogen oxides, including nitrogen dioxide, have been recorded in North Africa, the Middle East, Southeast Asia and East Asia,[9] reflecting a combination of high-emitting vehicle density, industrial growth and inadequate urban air quality management. Persistent hotspots of sulfur dioxide pollution are found near major industrial hubs in India, Iran (Islamic Republic of), Mexico, the Russian Federation, Saudi Arabia, Serbia, South Africa, Türkiye and the United Arab Emirates.[10] Elevated exposure to carbon monoxide persists in regions reliant on biomass fuels, particularly in sub-Saharan Africa.[11]

9. The health, developmental and economic consequences of different pollution sources vary. The major sources involve the burning of fossil fuels, such as vehicle emissions and industrial activities, and also include inadequate agricultural practices and uncontrolled fires;[12] inadequate urban planning is an exacerbating factor. The table below summarizes key information regarding the worst pollutants, their sources and the related health impacts; the Special Rapporteur underscores that exposure usually involves several pollutants, and is aggravated by climate change.

Most important pollutants affecting clean air and human health

Pollutant	*Source*	*Impacts on human health*
Carbon monoxide (CO)	Incomplete combustion of carbon-based fuels (wood, kerosene and coal) associated primarily with household cooking, wildfires and vehicular emissions	Respiratory acidosis, dizziness and fatigue; life-threatening at high concentrations
Nitrogen oxides (NO_x), including nitrogen dioxide (NO_2)	Vehicular emissions (fossil fuel combustion), industrial processes, wildfires and coal-power plants	Asthma, reduced lung function and respiratory infections, particularly in children and older persons
Sulfur dioxide (SO_2)	Fossil fuel combustion in power plants, smelters, heavy industry, flaring and residential heating	Asthma, respiratory symptoms and increased hospital admissions

[6] See https://www.who.int/news-room/commentaries/detail/air-pollution--tackling-a-critical-driver-of-the-global-ncd-crisis#:~:text=Air%20pollution%20affects%20virtually%20every,well-being%20and%20public%20health.

[7] See https://documents1.worldbank.org/curated/en/099032625132535486/pdf/P502230-d16d0858-2e18-41df-a7a6-f1188121ac83.pdf.

[8] See https://www.unicef.org/press-releases/air-pollution-accounted-81-million-deaths-globally-2021-becoming-second-leading-risk.

[9] See https://www.stateofglobalair.org/pollution-sources/nitrogen-dioxide.

[10] See https://www.greenpeace.org/static/planet4-africa-stateless/2019/08/5f139f4c-final-global-hotspot-and-emission-sources-for-so2_19th_august-2019.pdf.

[11] See https://doi.org/10.1016/j.enpol.2025.114936.

[12] See https://lancetcountdown.org/air-pollution-and-health/.

Most important pollutants affecting clean air and human health

Pollutant		*Source*	*Impacts on human health*
Particulate matter ($PM_{2.5}$ and PM_{10})		Vehicular emissions (fossil fuel combustion), agricultural waste and coal and wood burning	Cardiovascular disease, stroke, respiratory illness, impaired child development, and lung cancer
Short-lived climate pollutants	Black carbon	Component of particulate matter, results from incomplete combustion of carbon-based fuels and fossil fuels and the burning of biomass	Neurological damage, slower cognitive development in children, increased bone loss, decreased cognitive function in older persons, cardiovascular and respiratory symptoms, lung and bladder cancer, lower lung function, and premature death
	Methane (CH_4)	Greenhouse gas and ozone precursor, fossil fuel use and combustion, mostly gas (flaring, fracking), agriculture and waste management	Leukaemia and asthma, especially in children
	Tropospheric ozone (O_3)	Formed by nitrogen oxides and volatile organic compounds in the presence of sunlight; vehicular emissions (fossil fuel combustion), oil refining, chemical production, heating and use of solvents	Constricts airways, aggravates lung disease, increases the rate of cardiovascular mortality (heart attacks and strokes), damages the nervous and immune systems; children, older persons and individuals with pre-existing health conditions are most affected
Volatile organic compounds		Industrial and household organic chemicals such as fuels, solvents, paints, refrigerants, pesticides and cleaning agents	Suspected or proven carcinogens; damage internal organs or the respiratory system

Sources: See https://iris.who.int/server/api/core/bitstreams/551b515e-2a32-4e1a-a58c-cdaecd395b19/content.

A. More vulnerable populations

1. Children

10. The right to a healthy environment is essential for children's survival and development.[13] Still, almost every child globally is exposed to at least one environmental or climate-related hazard, including air pollution. Children are the most vulnerable to air pollution impacts because their bodies and organs are still developing and their immune systems are not fully formed, limiting their capacity to eliminate harmful substances.[14]

[13] See Committee on the Rights of the Child, general comment No. 26 (2023).

[14] See https://www.unicef.org/media/91216/file/Healthy-Environments-for-Healthy-Children-Global-Programme-Framework-2021.pdf.

11. This widespread exposure occurs across regions; children in low and middle-income countries face a double burden from both ambient and household air pollution.[15] Over 700,000 children under 5 years of age died in 2021 from causes linked to air pollution – nearly 2,000 per day.[16] Over 70 per cent of these deaths were linked to household air pollution from cooking with polluting fuels, mostly in Africa and South Asia.[17]

12. Air pollution is associated with approximately one in three preterm births globally. Babies born prematurely face increased risks of lifelong disabilities, developmental delays and chronic illnesses. Emerging evidence links air pollution to cognitive and mental development impacts. Early childhood exposure to high pollutant concentrations is associated with enduring consequences for health, learning and well-being, such as impaired cognitive performance, reduced educational attainment and greater vulnerability to behavioural and emotional disorders, including attention deficit hyperactivity disorder, anxiety and depression.[18]

2. Pregnant people and newborns

13. Pregnant people are particularly vulnerable to the adverse effects of air pollution, owing to the physiological and immunological changes that occur during gestation. Exposure to ambient pollutants has been consistently associated with adverse maternal outcomes.[19] Robust evidence links air pollution to gestational diabetes, hypertensive disorders of pregnancy, pre-eclampsia, spontaneous abortion and post-partum depression.[20] Pregnant people and neonates exposed to high levels of pollutants face elevated risks of placental abruption, low birth weight, preterm birth, infant mortality, and long-term respiratory and lung development impairments.[21] The compound effects of air pollution and climate-related stressors, particularly extreme heat, exacerbate these risks,[22] creating a double burden that threatens maternal health, pregnancy outcomes and child development.

3. Older persons

14. Air pollution exacerbates cardiovascular, respiratory and other chronic illnesses and contributes to increased morbidity and mortality in older persons.[23] The Independent Expert on the enjoyment of all human rights by older persons has emphasized the need for policies to reduce air pollution, which disproportionately affects older persons.[24] Age-related physiological changes, historical exposure, a higher prevalence of pre-existing health conditions and functional limitations increase the susceptibility of older persons to harmful pollutants, which may affect persons in different ways, depending on multiple factors, including gender.

15. Ageing involves a gradual decline in respiratory, cardiovascular and immune function, reducing the body's resilience to environmental stressors. Furthermore, fossil fuel pollution over a lifetime can lead to chronic illnesses and avoidable deaths; for example, one study of older adults demonstrated that sulfur dioxide exposure from burning coal and oil was associated with premature mortality.[25]

16. There are strong links between air pollution and neurodegenerative diseases, such as dementia and Alzheimer's disease, and older persons are disproportionately affected. A recent global study estimated that air pollution-related dementia causes over 625,000 deaths

[15] See https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf.
[16] See https://www.stateofglobalair.org/resources/archived/state-global-air-report-2024.
[17] Ibid., and https://ceh.unicef.org/country-data/childrens-environmental-health-country-profiles.
[18] See https://www.unicef.org/media/49966/file/UNICEF_Clear_the_Air_for_Children_30_Oct_2016.pdf.
[19] See https://doi.org/10.1016/j.scitotenv.2025.178999.
[20] See https://doi.org/10.1016/j.jped.2024.10.006.
[21] See https://doi.org/10.1016/j.semperi.2023.151838.
[22] See https://doi.org/10.1038/s41591-024-03395-8.
[23] See https://www.paho.org/sites/default/files/2022-01/decade-connection-series-climatechange.pdf.
[24] See A/HRC/39/50.
[25] See https://climateandhealthalliance.org/wp-content/uploads/2025/09/C2G-Report-low-_res-English.pdf.

annually, underscoring its toll on older persons.[26] Extreme heat further amplifies these risks. A single day of extreme heat can elevate hospitalization risks among people with dementia for several subsequent days, with especially severe impacts on marginalized groups.[27]

17. Exposure to polluted air is linked to oxidative damage to bone cells and significantly reduces bone mineral density, heightening the risk of osteoporosis and fractures, conditions that already disproportionately affect older women:[28] in one country, women account for 80 per cent of osteoporosis cases.[29]

4. Persons living in poverty

18. Structural inequalities disproportionately affect communities living in poverty; often those communities are also racialized. Industrial facilities, transport corridors, extractive industries and other pollution-intensive activities are largely installed close to marginalized communities, sometimes described as "sacrifice zones".[30] Climate change and environmental degradation exacerbate these inequalities. The Inter-American Court of Human Rights has noted that individuals in poverty typically live in climate-vulnerable areas, face greater losses from disasters and have fewer resources to help them recover. When poverty intersects gender, age or disability, vulnerability multiplies.[31]

19. WHO, the United Nations Development Programme, the United Nations Environment Programme and *Lancet* reports have indicated that health impacts in marginalized communities include elevated rates of asthma, bronchitis, lung cancer, heart disease and other chronic respiratory and cardiovascular conditions resulting from prolonged pollutant exposure. Vulnerability is most acute in urban areas of low- and middle-income countries, where persistent pollution hotspots are most common. Cumulative health risks, illness and premature mortality increases when people living in high polluting areas spend their entire lives there; are additionally exposed through long commutes or outdoor work; and have limited access to quality healthcare.

20. As health deteriorates, livelihoods suffer and social exclusion deepens, reducing options to avoid air pollution exposure or mitigate its effects and increasing cumulative environmental health harms. About 716 million of the world's lowest-income people live in highly polluted areas, many of those in the Democratic Republic of the Congo and in India,[32] facing sharply increased risk of asthma, stroke,[33] ischemic heart disease and lung cancer.[34] In Nigeria, industrial-zone workers and roadside vendors experience the highest particulate matter levels in sub-Saharan Africa, while indoor biomass use accounts for 30 to 40 per cent of respiratory illnesses in low-income locations. In the United Arab Emirates, migrant workers – 88 percent of the population – suffer severe respiratory, cardiovascular and neurological symptoms linked to outdoor labour. In the United States of America, African American and Latino communities near highways and industrial sites experience higher pollution-related mortality, and along "Cancer Alley" in Louisiana, predominantly African American residents face elevated cancer rates, respiratory disease, reproductive harm and adverse birth outcomes owing to petrochemical emissions; additional petrochemical plants are planned, threatening to deepen these disparities and risks.[35]

[26] See https://www.stateofglobalair.org/resources/report/state-global-air-report-2025.
[27] See https://hsph.harvard.edu/news/extreme-heat-may-raise-risk-of-hospitalization-for-adults-with-alzheimers/.
[28] See https://www.science.org/content/article/breathing-polluted-air-increases-risk-osteoporosis-growing-evidence-shows.
[29] See https://doi.org/10.1016/j.eclinm.2023.101864.
[30] See A/HRC/49/53.
[31] See https://www.corteidh.or.cr/docs/opiniones/seriea_32_en.pdf, paras. 624 and 625.
[32] See https://pmc.ncbi.nlm.nih.gov/articles/PMC10363163/.
[33] See https://www.who.int/teams/environment-climate-change-and-health/air-quality-and-health/health-impacts/types-of-pollutants.
[34] See https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases.
[35] See https://www.ohchr.org/en/press-releases/2021/03/usa-environmental-racism-cancer-alley-must-end-experts?LangID=E&NewsID=26824.

21. In Kenya, low-income communities located near dumpsites, industrial corridors and congested transport hubs endure constant multi-source exposure.[36] In Nairobi, $PM_{2.5}$ concentrations reach 3.7 times WHO guidelines, contributing to 400 to 1,900 premature deaths annually, 5 to 8 per cent of adult mortality, and 2 to 3 per cent of economic losses, in terms of gross domestic product.[37]

III. Main sources and cumulative impacts

22. Air pollution main drivers are human-made, therefore they can and must be prevented and addressed through human action. These drivers emit harmful and toxic substances, including particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, volatile organic compounds and greenhouse gases, contaminating indoor and outdoor air and creating cumulative impacts that substantially harm health.

23. Transportation dependent on fossil fuels remains one of the largest anthropogenic sources of air pollution. Vehicles emit pollutants through exhaust (tailpipe emissions) or non-exhaust sources (non-tailpipe emissions) such as evaporative emissions of fuel, resuspension of dust, wear of brakes and tyres and abrasion of road surfaces. Traffic-related pollution includes $PM_{2.5}$, PM_{10} and nitrogen dioxide – major contributors to urban smog and deteriorating air quality. Because transportation is mainly concentrated in cities, vehicular transit is a main source of urban exposure.

24. Globally, traffic emissions are strongly linked to asthma in children; data from 2015 indicate that over 64 per cent of such cases of asthma occur in urban centres.[38] The situation affects all regions.[39] Researchers conducting a study in Isfahan, Islamic Republic of Iran, identified vehicular emissions as the dominant source of $PM_{2.5}$ in the city.[40] During the coronavirus disease (COVID-19) pandemic, $PM_{2.5}$ and nitrogen dioxide concentrations in Delhi, India, fell by roughly half, confirming the massive share of pollution attributable to vehicles.[41]

25. Residential heating and cooking with coal and biomass and the use of inefficient technologies are major sources of indoor and outdoor air pollution, especially in poorly ventilated spaces. These sources generate pollutants exceeding WHO air quality guidelines[42] causing millions of deaths annually (2.9 million, in 2021), mainly affecting women and children, who spend more time exposed to polluting fuels and technologies in the home.[43] Indoor and outdoor air pollution are interconnected: emissions from household fuels escape outdoors, contributing significantly to urban air pollution.

26. Human-driven fires worsen air pollution and have significantly increased due to deforestation, land-use change and climate-related factors. In tropical regions, fires are almost entirely anthropogenic; often started to clear land, they then spread uncontrollably. Fires in 2024 burned five times more tropical primary forest than fires in 2023. Latin America is particularly affected and, as the hottest year on record, 2024 brought extreme heat, fuelling over 346,000 fire outbreaks, with $PM_{2.5}$ concentrations exceeding 400 µg/m³ in cities such as Porto Velho, Brazil.[44] Europe recorded 383,317 hectares burned, which was above the 17-year average, and over 8,300 fires, with Bulgaria, Greece, Italy, Portugal and Spain among the worst affected European Union countries. Preliminary 2025 data suggest an escalation,

[36] Submission from Kirigo Wachira.
[37] Submission from Gillian Onyango.
[38] See https://www.thelancet.com/journals/lanpla/article/PIIS2542-5196(19)30046-4/fulltext.
[39] See https://www.stateofglobalair.org/resources/health-in-cities#no-sub-2-sub-levels-vis-a-vis-who-guidelines.
[40] See https://doi.org/10.1016/j.jth.2022.101329.
[41] See https://doi.org/10.48550/arXiv.2203.02258.
[42] See https://www.undrr.org/terms/hips/EN0101.
[43] See https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health.
[44] See https://doi.org/10.1007/s44274-025-00340-5.

with more than 7,200 fires and over 1 million hectares burned across Europe by mid-year, making it likely the worst fire season on record.[45]

27. Wildfires release large amounts of $PM_{2.5}$ and carbon monoxide and increase ozone. Added to this, dust transported from arid regions can increase pollutant concentrations thousands of kilometres from the source and worsening urban and rural air quality.[46] The 2023 Canadian wildfires worsened air quality across North America and Europe, contributing to thousands of deaths.[47] In Australia, wildfire-specific $PM_{2.5}$ was associated with thousands of respiratory hospital admissions.[48] People in rural areas and Indigenous Peoples face disproportionate exposure; the lack of contingency plans and cross-border cooperation exacerbates violations of the right to health and a healthy environment.[49]

28. Every stage of the fossil-fuel exploration and extraction cycle contributes to air pollution and its harms. Site preparation for coal, oil and gas projects generates dust and diesel exhaust. Communities near extraction sites face additional health impacts, displacement and evictions with violence and legal intimidation; Indigenous Peoples, people of African descent and peasants are particularly affected.[50]

29. Oil and gas extraction also releases methane and volatile organic compounds that drive ozone formation and respiratory disease. Studies have linked proximity to fracking-extracted wells with preterm births, low birth weight and congenital defects. Processing and refining stages release hazardous air pollutants, such as benzene, formaldehyde and toluene.[51] Urban refinery belts and petrochemical zones commonly expose nearby low-income communities to persistent toxic emissions.

30. Coal extraction exposes miners and surrounding communities to particulate matter, diesel particulates, dust chemicals, fuels and elemental toxicants.[52] Open-pit mining and mountaintop removal release airborne pollutants and heavy metals such as selenium, contaminating soil, air and water. Coal-fired power plants also emit $PM_{2.5}$, sulfur dioxide, nitrogen oxides and volatile organic compounds; coal ash, a toxic by-product, often contaminates soil, air and groundwater when mismanaged.[53] Thus, coal-fired power plant emissions are linked to thousands of premature deaths annually.

31. Flaring – burning gas during oil extraction – emits carbon dioxide, methane, black carbon, nitrogen oxides, sulfur dioxide and volatile organic compounds, such as benzene, harming communities near oil fields. Flaring pollution causes an estimated $7.4 billion annually in health damages, over 700 premature deaths and 73,000 asthma exacerbations, mainly in children.[54] Several countries have banned or dramatically reduced the practice, demonstrating that its risks are avoidable. Norway has prohibited flaring except for safety reasons since 1996;[55] Kazakhstan has reduced associated-gas flaring volumes by over 75 per cent since 2012,[56] and 36 countries have committed to ending routine flaring by 2030.[57]

32. Many developing countries are expanding renewables, while simultaneously expanding fossil fuel demand. Despite a global increase in renewables, with wind and solar increasing by 16 per cent in 2024[58] and renewables accounting for 92.5 per cent of new power

[45] See https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/europes-fire-season-expanding-new-jrc-report-shows-2025-12-05_en.
[46] See https://www.who.int/news-room/fact-sheets/detail/sand-and-dust-storms.
[47] See https://doi.org/10.1038/s41586-025-09482-1.
[48] See https://doi.org/10.1038/s41893-025-01535-7.
[49] See https://www.oas.org/es/cidh/informes/pdfs/2025/redesca_bolivia_2024_spa.pdf (in Spanish).
[50] See A/HRC/59/42.
[51] See https://doi.org/10.1146/annurev-publhealth-040218-043715.
[52] See https://doi.org/10.1016/j.exis.2015.08.006.
[53] See https://www.nrdc.org/sites/default/files/coalhealth.pdf.
[54] See https://doi.org/10.1029/2023GH000938.
[55] See https://flaringventingregulations.worldbank.org/norway.
[56] See https://www.catf.us/2025/06/kazakhstans-progress-reducing-gas-flaring-model-world/.
[57] See https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030/endorsers.
[58] See https://www.energyinst.org/exploring-energy/resources/news-centre/media-releases/renewables-soar,-but-fossil-fuels-continue-to-rise-as-global-electricity-demand-hits-record-levels?ABOUT=&.

additions,[59] fossil fuel production and use are still rising, particularly in the global South. In 2024, energy demand increased for all energy sources; 38 per cent of electricity demand was met by low-emissions sources. However, over 50 per cent of the rise was still linked to fossil fuels.[60] Coal demand globally rose by over 1 per cent to a record high, driven by power generation needs in China and India, while gas demand reached a new all-time high, especially in emerging markets. Oil demand continued growing in India and Southeast Asia.[61] The increase in fossil fuel use by cities continues to drive high urban exposure, despite progress in renewable deployment.

33. Energy demand in sub-Saharan Africa, the Middle East and Southeast Asia is projected to rise substantially through 2050. In sub-Saharan Africa, fossil fuels still supplied 43 per cent of primary energy in 2024, despite growing investment in renewables.[62] Similarly, in Southeast Asia, fossil fuels are the main energy source and, even considering increases in renewable energy, under current policies the tendency will continue; furthermore, regional carbon dioxide emissions are projected to rise by one third by 2050.[63] In the Middle East and North Africa, fossil fuel dependence is also expected to deepen if oil and gas diversification strategies fall short; demand for both fuels could rise by 25 per cent by 2035.[64]

34. While important efforts to phase it out are being made, coal remains central to the worldwide energy mix. In 2024, total global coal demand rose to 8.8 billion metric tons, an increase of 1.5 per cent over 2023, driven mainly by growing coal use in developing economies. Coal-fired power generation reached a record high in 2024, supplying over a third of global electricity.[65]

35. Major oil, gas and coal projects in Africa, Asia and Latin America are led by Northern capital and demand, perpetuating extracting patterns that externalize environmental and health harms to marginalized communities. Governments and development banks increased funding for fossil fuel projects, from $1.2 billion in 2021 to $5.4 billion in 2022, while funding for clean air initiatives remained below 1 per cent of total development assistance.[66] Despite fossil fuel emissions causing over half of the 8.3 million annual deaths from outdoor air pollution, Governments continue to direct far more resources towards fossil fuel expansion than to pollution reduction.[67] About 92 per cent of air-quality funding is provided as loans rather than grants, an unusually high share compared with other development sectors. This disparity pushes highly polluted and low-income countries further into debt, precisely when accessible financing to address severe public health risks is greatly needed and should be prioritized.[68]

36. Finally, fireworks, especially in already highly polluted areas, can also cause serious peaks of air pollution, worsening health risks, as seen in Delhi, India[69] and Mexico City. Therefore, States must implement measures to prevent increased risks, prioritizing public health, especially among vulnerable people; action must include restricting use and enforcing regulations. Some cities, such as Bogotá, have restricted fireworks use, enforcing controls and prioritizing children's health.

[59] See https://www.irena.org/News/articles/2025/Apr/Renewables-in-2024-5-Key-Facts-Behind-a-Record-Breaking-Year.

[60] See https://iea.blob.core.windows.net/assets/5b169aa1-bc88-4c96-b828-aaa50406ba80/GlobalEnergyReview2025.pdf, pp. 3 and 5.

[61] See https://www.iea.org/reports/renewables-2024/executive-summary.

[62] See https://www.dnv.com/energy-transition-outlook/2025/sub-saharan-africa/.

[63] See https://www.iea.org/reports/southeast-asia-energy-outlook-2024/executive-summary, pp. 6 and 18.

[64] See https://iea.blob.core.windows.net/assets/830fe099-5530-48f2-a7c1-11f35d510983/WorldEnergyOutlook2022.pdf, p. 13.

[65] See https://iea.blob.core.windows.net/assets/912db89a-4625-498d-9efc-a558e49b7eab/TheFutureofElectricityintheMiddleEastandNorthAfrica.pdf.

[66] See https://s40026.pcdn.co/wp-content/uploads/State-of-Global-Air-Quality-Funding-2024-UPDATED.pdf.

[67] See https://doi.org/10.1136/bmj-2023-077784.

[68] See https://www.cleanairfund.org/news-item/governments-funding-fossil-fuel/.

[69] See https://doi.org/10.1016/j.atmosenv.2022.119223.

IV. Obligations of States and duties of businesses regarding clean air

A. States must prevent harms, act with stringent due diligence and implement effective measures to guarantee clean air

37. Given that air pollution poses significant risks to human rights, the environment and the climate system, under international law States have the obligation to protect the environment and prevent significant harms, as clarified by the International Court of Justice in its recent advisory opinion *Obligations of States in respect of Climate Change*. This duty is part of customary international law, is an obligation *erga omnes*, and is also related to transboundary harms such as those from air pollution. Accordingly, States must act with due diligence, preventing risks based on the best available science and considering the probability, foreseeability, severity and magnitude of the occurrence of the harm. In the face of significant risks, the standard of States' due diligence is stringent as regards climate change.[70]

38. States must take appropriate measures, implement precautionary measures when needed and undertake strategic and environmental impact assessments prior to applying policies and implementing activities and projects. Assessments must consider cumulative and long-term impacts,[71] and potential transboundary risks, for which coordination with potentially affected States is needed. Particularly regarding air pollution, States have the obligation to regulate and implement effective measures to control industrial sources of contamination affecting clean air. The duty to regulate and control applies both when air pollution is a consequence of the industrial activities of a single source and when it is generated as a result of complex activities of multiple sources, including by organized criminal groups.[72]

39. The obligation is to prevent the risk, thus avoiding the materialization of significant or irreversible human rights or environmental harms. In air pollution cases, courts have analysed real and imminent risks, understood the genuine and sufficiently ascertainable threat, and determined that imminent refers to proximity, considering physical conditions and time.[73]

40. The Inter-American Court on Human Rights, in *La Oroya v. Peru*, recognized that a State can be responsible for the creation of risks to human rights and thus be internationally responsible for violations. Moreover, victims do not have to prove a direct link between alleged health impacts and the exposure to contaminants when: (a) significant risks to human health posed by pollutants have been proven; (b) it has been demonstrated that persons have been exposed to such pollutants under conditions that endangered their health; and (c) the State has breached its obligation to prevent environmental pollution.[74]

41. Similarly, the European Court on Human Rights, in *Cannavacciuolo and others v. Italy*, concluded that when there is exposure to a sufficiently serious, genuine and ascertainable risk to life, the States have the duty to act. The Court stated that it "does not consider it necessary or appropriate to require that the applicants demonstrate a proven link between the exposure to an identifiable type of pollution or even harmful substance and the onset of a specific life-threatening illness or death as a result of it".[75]

[70] *Obligations of States in respect of Climate Change*, *Advisory Opinion*, paras. 132–134, 137, 271–274 and 440.

[71] Ibid., paras. 275, 276 and 282.

[72] European Court of Human Rights, *Cannavacciuolo and others v. Italy*, Application No. 51567/14 and others, Judgment, 30 January 2025, para. 384; Inter-American Court of Human Rights, *La Oroya v. Peru*, Judgment, 27 November 2023, paras. 119 and 121; Inter-American Court of Human Rights, Advisory Opinion AO-32/25, para. 348.

[73] European Court of Human Rights, *Cannavacciuolo and others v. Italy*, para. 377.

[74] *La Oroya v. Peru*, para. 204.

[75] Para. 390.

1. Effective measures: regulate, control, monitor and enforce

42. Effective measures to guarantee healthy air, taking into consideration human health and the environment, include legislative, judicial and administrative measures preventing violations, enforcement measures for responding to non-compliance, and remediation mechanisms. The lack of effective prevention of risks posed by air pollution and ecological degradation can violate the State's obligation to respect human rights.[76] Measures must provide effective deterrence against threats to the right to life, and be timely, appropriate and consistent.[77] Specifically related to air pollution, States must refrain from contributing to such pollution, given its impacts on human health,[78] and must control and monitor public and private actors in that regard.[79]

43. Moreover, as confirmed by the International Court of Justice, enforcement and monitoring mechanisms are indispensable to ensuring that public and private operators within a State's jurisdiction comply with regulatory standards. Additionally, State responsibility may arise from fossil fuel production or consumption and the granting of licences or subsidies, owing to the direct link to greenhouse gas emissions and the resulting failure to protect the climate system,[80] which also aggravates air pollution.

44. Prolonged inaction in controlling pollution also constitutes a violation of human rights, as concluded by the European Court of Human Rights in *Cordella and others v. Italy*, where the Court found that, with regard to toxic emissions from a steel plant, the State's inaction in preventing environmental harm had violated the right to private and family life.[81]

45. Failure to monitor pollution and inform the public violates the rights of affected populations, as concluded by the Inter-American Court of Human Rights and the European Court of Human Rights.[82] Effective measures should reflect the best available science and meet the criteria of availability, accessibility, sustainability, quality and adaptability, as well as participation in international cooperation. Additionally, scientific uncertainty cannot justify inaction as, when risks of significant or irreversible harm exist, States must act promptly and effectively under the precautionary principle.

46. Several courts have found that States have failed to fulfil their obligation to prevent significant risks to human rights from air pollution. In *Trustees for the time-being of Groundwork Trust and another v. Minister of Environmental Affairs and others* (the "Deadly Air" case),[83] the High Court of South Africa held that delays in regulatory action violated the constitutional right to an environment not harmful to health, owing to the poor air quality in the Highveld Priority Area. In a judgment regarding the postponement of the next phase of low-emission zone restrictions in the Brussels region, the Belgian Constitutional Court similarly concluded that delaying low-emission zone implementation was inconsistent with environmental and health protection obligations, particularly affecting vulnerable

[76] European Court of Human Rights, *Verein Klimaseniorinnen Schweiz and others v. Switzerland*, Application No. 53600/20, Judgment, 9 April 2024; African Charter on Human and Peoples' Rights, art. 24; and African Commission on Human and Peoples' Rights, *The Social and Economic Rights Action Center and the Center for Economic and Social Rights v. Nigeria*, communication No. 155/96, para. 52.

[77] European Court of Human Rights, *Cannavacciuolo and others v. Italy*, paras. 380 and 381.

[78] Committee on Economic, Social and Cultural Rights, general comment No. 14 (2000); and Inter-American Court of Human Rights, *La Oroya v. Peru*, para. 133.

[79] European Court of Human Rights, *Cannavacciuolo and others v. Italy*, para. 431; Inter-American Court of Human Rights, *La Oroya v. Peru*, para. 156; and Inter-American Court of Human Rights, Advisory Opinion AO-32/25, paras. 347–351.

[80] International Court of Justice, *Obligations of States in respect of Climate Change*, para. 282 and 427.

[81] Application Nos. 54414/13 and 54264/15, Judgment, 24 January 2019.

[82] Inter-American Court of Human Rights, *La Oroya v. Peru*, paras. 120, 121, 127 and 176; and European Court of Human Rights, *Cannavacciuolo v. Italy*, para. 377–382.

[83] Case No 39724/2019, Judgment, 18 March 2022.

populations such as children.[84] In *Koalisi Ibu Kota v. Indonesia*,[85] the Jakarta High Court concluded that public officials had breached their duty to protect citizens from environmental harm by not regulating and enforcing air quality standards, monitoring pollution sources effectively, or coordinating emission-reduction actions.

2. Obligation to undertake environmental, social and human rights impact assessment processes, including with regard to health impacts

47. Preventing human rights violations and significant environmental harms requires effective planning and undertaking comprehensive, integrated and prior environmental, social and human rights impact assessments to identify risks, and ensuring that all necessary measures are taken to avoid them. Only when this is not possible should mitigation measures be identified, as well as remediation actions in cases where the environment or human rights are violated. In that regard, the Special Rapporteur refers to her report on environmental, social and human rights impact assessments[86] and highlights the importance of implementing comprehensive assessments for projects that might affect air quality. These assessments must also take into consideration health impacts, especially among persons in more vulnerable situations.

48. The International Court of Justice has reiterated the obligation to undertake environmental, social and human rights impact assessments for the protection of the environment and the climate system and in the context of activities posing significant risks of adverse transboundary impacts.[87] Recently, the European Court of Human Rights concluded that States have the obligation to conduct an "adequate, timely and comprehensive environmental impact assessment in good faith and based on best available science" before authorizing activities that might be harmful to the right for individuals to have effective protection from serious effects of climate change on affecting their life, health, well-being and quality of life.[88] In *African Climate Alliance and others v. Minister of Mineral Resources and Energy and others*, the High Court of South Africa held that failing to evaluate environmental risks in the procurement of new coal-fired capacity was unconstitutional, especially given the impacts on children and future generations.[89]

B. Businesses must also prevent risks from air pollution

49. Businesses are major sources of air pollution globally and must respect human rights across their operations. Under the Guiding Principles on Business and Human Rights, businesses must: avoid causing or contributing to harm (principle 13), conduct ongoing human rights due diligence (principles 17–21), and provide remediation when violations have occurred (principle 22). This framework applies directly to air quality, given the significant health and environmental harm linked to business activities. The jurisprudence of the Inter-American Court of Human Rights in the context of air pollution and its impacts on human rights has reinforced that businesses must respect human rights in their operations and take immediate, effective measures to prevent and mitigate risks that their activities cause.[90]

50. States must require companies to carry out due diligence processes in relation to human rights and the environment, particularly for operators emitting air pollutants. Due diligence includes strict compliance with environmental licensing conditions, such as

[84] Judgment No. 115/2025, Role No. 8487, 11 September 2025. Available at https://fr.const-court.be/public/f/2025/2025-115f.pdf (in French).

[85] Available at https://putusan3.mahkamahagung.go.id/direktori/putusan/zaec2b0d732a5e24a30f313033353330.html (in Indonesian).

[86] A/80/187.

[87] *Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, I.C.J. Reports 2010*, p. 14 and *Obligations of States in respect of Climate Change*, paras. 272 and 297.

[88] European Court of Human Rights, *Case of Greenpeace Nordic and others v. Norway*, Application No. 34068/21, Judgment, 28 October 2025, para. 318.

[89] Case No 56907/2021, Judgment, 4 December 2024, paras. 22 and 25.

[90] *La Oroya v. Peru*, para. 114.

emission limits, continuous monitoring obligations, periodic reporting and the adoption of effective pollution control measures.

51. Stringent due diligence entails differentiated obligations for high-emitting businesses. Those who contribute most to pollution must bear greater burdens, which may include higher taxation, stricter regulatory standards, mandatory participation in just transition initiatives or targeted investments in mitigation and adaptation measures.

V. Viable solutions to overcome challenges and breathe clean air

52. Economic growth is still prioritized over human rights and the environment, and reflected in unsustainable economic and development models, threatening the effective implementation of the human right to a clean, healthy and sustainable environment, which includes breathing clean air.[91] This is evidenced by air pollution drivers, including transportation, industries, infrastructure development and housing. Rapid, unsustainable urbanization, along with inadequate planning, results in hazardous levels of air pollution.

53. Undue influence from sectors and businesses linked to air pollution drivers continues to delay regulations that would prioritize health over profit and economic growth, as highlighted in consultations and contributions received. Business pressure, diplomatic lobbying and investor-State dispute settlements often delay or weaken environmental measures.

54. Examples of prioritization of economic growth over protecting health include:

(a) Delhi, India, where the vehicular fleet amounts to 12 million units, while 7 out of 10 residents rely on public transit, bicycles or walking.[92] Meanwhile, for example, in November 2024, all schools in Delhi closed and switched to online classes due to severe air pollution.[93] Studies recommend both short- and long-term actions to restrict vehicles and reduce the number of trips through effective urban planning;[94]

(b) Detroit, United States, where members of communities near the Downriver industrial corridor live among highways, refineries and steel plants and in the vicinity of one of the region's largest ports. Port operations generate roughly 30,000 metric tons of carbon dioxide annually, along with nitrogen oxides, sulfur dioxide and particulate matter contributing to elevated rates of asthma and cardiovascular disease. The implementation of control measures to prevent health and environmental damage from air pollution is still inadequate. The city partnered with Just Air for the installation of low-cost air quality monitors along the Detroit Port Corridor in 2024. This led to the identification of the major contributors to localized pollution and additional results are anticipated.

55. Implementing measures to tackle air pollution can be less expensive than expected, and costs of inaction can be considerably higher. In 2019, air pollution cost $8.1 trillion globally, owing to the health cost of mortality and morbidity from $PM_{2.5}$ pollution.[95] In Indonesia alone, annual air pollution costs exceed $27 billion, driven by healthcare expenses, productivity losses and premature deaths, compared with the roughly $7.5 billion in public and private investment required to meet national reduction targets by 2030.[96] World Bank analysis shows that it is feasible and affordable to implement clean air policies that would halve the number of people exposed to $PM_{2.5}$ concentrations above 25 $\mu g/m^3$ globally by 2040.[97]

[91] See A/79/270.
[92] Submission from Chetan Bhattacharji.
[93] Submission from Our Kids' Climate.
[94] See https://www.intechopen.com/chapters/86023.
[95] See https://ceh.unicef.org/events-and-resources/knowledge-library/global-health-cost-pm25-air-pollution-case-action-beyond.
[96] Submission from Bicara Udara.
[97] See https://documents1.worldbank.org/curated/en/099032625132535486/pdf/P502230-d16d0858-2e18-41df-a7a6-f1188121ac83.pdf.

56. Yet allocation of financial resources still flows disproportionately to sectors contributing to air pollution, such as the fossil fuel sector, notwithstanding commitments made to eliminate fossil fuel subsidies, for example those made by the Group of 20 in 2009 and the Group of Seven in 2016.[98] Meanwhile air-improving actions remain underfunded and avoidable healthcare costs continue rising. Between 2018 and 2024, an average of around $600 billion was spent globally per year subsidizing fossil fuels, and only $3.16 billion was spent on outdoor air pollution control.[99]

57. Investments in reducing air pollution generate tangible and quick health and economic improvements. It is estimated that, in Ethiopia, some such actions have a return on investment of seven times.[100] Over 70 per cent of low-income households benefiting from the Ujjwala clean-cooking subsidy plan in India reported health improvements.[101] During significant periods of deteriorating air quality, the Haze Subsidy Scheme in Singapore provides affordable treatment.[102] Ulaanbaatar has shifted from raw coal to cleaner fuels, achieving a 51 per cent reduction in winter $PM_{2.5}$ levels (2019/20 compared to 2016/17), following Asian Development Bank-supported clean energy investments in Mongolia.[103]

A. Pathways to include health into air quality frameworks and policies

58. The clear correlation between air pollution and health impacts underscores the need and opportunity for air quality and health policies to complement and inform each other. However, legal frameworks on air pollution remain primarily technical, often developed without adequate health-sector input or considering health risks. Consequently, contingency and action plans often focus only on environmental parameters. A fragmented approach across all policies, including energy, transport, housing,[104] environment and climate, along with a lack of interdisciplinary, cross-sectoral collaboration,[105] hinders the ability to analyse long-term exposure and health impacts.

59. For example, during the 2023 El Niño pollution crisis in Greater Jakarta, authorities acknowledged health risks, but issued only generic recommendations, such as wearing masks or working remotely.[106] Similarly, in Brazil, contingency measures for high-polluting events, like wildfires, in the Amazon region, rarely include public health guidance or standardized health thresholds.[107]

60. Correcting this gap includes incorporating sociodemographic indicators (age, gender)[108] and health risk criteria (morbidity, mortality or exposure limits) within environmental and air quality frameworks. Some States are starting to use specialized tools to incorporate health into environmental policies. Colombia and Uzbekistan use the WHO Air Quality software (AirQ+) to quantify the health burden and impact of air pollution, to complement their own monitoring and to inform their policies and programmes.[109]

61. Health impact assessments are another useful tool. Estonia now includes them in environmental permit processes in industrial areas, while Japan is working to integrate health into its environmental impact assessments.[110] The tool is intended for planning purposes that extend beyond the scope of project-level developments, combining pollution data with health

[98] See https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/03/oecd-companion-to-the-inventory-of-support-measures-for-fossil-fuels-2021_50960d6b/e670c620-en.pdf and https://www.mofa.go.jp/files/000160266.pdf.
[99] Submission from Our Kids' Climate.
[100] See https://www.undp.org/ethiopia/publications/investment-case-air-pollution-reduction-ethiopia.
[101] See https://actascientific.com/ASWH/pdf/ASWH-04-0411.pdf.
[102] Submission from Singapore.
[103] Submission from World Heart Federation.
[104] Submission from European Respiratory Society.
[105] Submissions from Kirigo Wachira and Nurses across Borders.
[106] See https://ditjenbinaadwil.kemendagri.go.id/download/file/Inmendagri_2_tahun_2023.pdf (in Indonesian), as cited in submission from Bicara Udara.
[107] Submission from Respira Amazônia.
[108] Submission from Global Youth Strategy.
[109] Submissions from Colombia and Uzbekistan.
[110] Submission from Health and Global Policy Institute.

statistics to estimate effects, such as premature deaths and hospitalizations, especially related to $PM_{2.5}$, with a view to demonstrating the correlation between air quality and public health, and acting on it.[111] Health, as a cross-cutting issue, must be considered in order to achieve the proper implementation of environmental, social and human rights impact assessments and close existing gaps.[112]

62. Epidemiological studies provide solid evidence for regulations. Japan conducted epidemiological studies in the 1970s to control vehicular emissions, especially to protect children.[113] The strategic horizontal programmes in Asturias, Spain, determine the conduct of epidemiological studies in priority areas to detect health and mental health effects and establish a specific system of epidemiological surveillance in high-sensitivity zones, including school areas, thereby enabling more targeted planning.[114]

63. Transboundary cooperation also strengthens health-environment integration and can help in fulfilling the obligation to cooperate. Under the ASEAN Agreement on Transboundary Haze Pollution, the ASEAN Specialized Meteorological Centre [115] is mandated to monitor, assess and issue warnings on weather, climate, fires and transboundary haze. The Lao People's Democratic Republic, Myanmar and Thailand work together under the CLEAR Sky Strategy to improve the prevention of transboundary haze. [116] Implementation of the Convention on Long-range Transboundary Air Pollution in Europe has been strengthened through increased collaboration with external organizations.[117] The WHO Second Global Conference on Air Pollution and Health reflected growing commitments around the world; 79 cities, regions and countries are members of the BreatheLife Network.[118] Implementing these commitments should be prioritized.

B. Air quality regulations: from rigidity to action

64. Air pollution is not merely an environmental concern, but a critical issue that must be addressed through the lenses of human rights, health equity and strengthened social protection systems.[119] Ghana, in its 2018 short-lived climate pollutants action plan and its 2025 air quality management regulations, has recognized clean air as a human right and emphasized health co-benefits.[120]

65. Only 96 of 252 evaluated countries and territories have adopted national particle matter air quality standards, and a third of those standards are weaker than the WHO interim target of 15 $\mu g/m^3$.[121] Some countries still lack specialized air quality legislation. Bosnia and Herzegovina, Brazil, India, Peru, the Philippines, Türkiye and the United Arab Emirates have legal limits above WHO guidelines for key pollutants[122] ($PM_{2.5}$, PM_{10}, ozone, sulfur dioxide and nitrogen oxides, including nitrogen dioxide), and 55 per cent of countries routinely allow air quality standards to be exceeded.[123] In Mexico, only 1 of 52 cities evaluated met the $PM_{2.5}$ health protection limits in 2022.[124]

66. Systematic non-compliance and inadequate enforcement allow pollution to worsen. India required 17 categories of hazardous industries to install online continuous emissions

[111] Submission from Estonia.
[112] See A/80/187.
[113] See https://doi.org/10.1265/ehpm.25-00020.
[114] Submission from Instituto Alana and others.
[115] See https://asmc.asean.org/home/.
[116] Submission from Myanmar.
[117] See https://doi.org/10.1163/9789004684089_007.
[118] See https://breathelife2030.org/breathelife-cities/.
[119] Submission from the Republic of Korea.
[120] Submission from Lancet Countdown on Health and Climate Change.
[121] Submission from Air Quality Life Index, Energy Policy Institute at the University of Chicago.
[122] Submissions from Instituto Alana and others; Patricia Iturregui and others; and University of the Philippines – Center for Air Research in Urban Environments (UP-CARE).
[123] See https://uniatf.who.int/docs/librariesprovider22/default-document-library/raq-gaapl.pdf?sfvrsn=e3c580f9_1.
[124] See https://sinaica.inecc.gob.mx/archivo/informes/Informe2022.pdf (in Spanish), p. 35.

monitoring systems, yet it is difficult to gain access to compliance data.[125] Since 2018, the United States has required 13 petrochemical facilities to install monitors; only 4 have provided enough data for analysis, and 2, including 1 in "Cancer Alley", exceeded benzene regulation limits.[126] In the Islamic Republic of Iran, studies showed that inadequate and ineffective supervision undermines the country's Clean Air Act.[127]

67. Examples of adequate policies improving health include the implementation in China of restrictions on factory emissions and travel to improve air quality ahead of the Olympics in Beijing, resulting in a 58 per cent reduction in asthma-related physician visits and reduced cardiovascular mortality within just two months. Nationally, $PM_{2.5}$-related diseases fell 30 per cent between 2013 and 2017, due to clean air policies, and by 2024, national $PM_{2.5}$ averaged 29.3 µg/m³, a 36 per cent drop from 2015.[128]

68. The response by Japan to the Yokkaichi asthma event, a major pollution-related epidemic of respiratory diseases, illustrates an achievable health-based system (conducting epidemiological studies) and the "polluter-pays principle", holding those who cause pollution accountable for the costs of remediation and restoration and victim compensation for medical and livelihood assistance.[129] Under the Act on Compensation for Pollution-Related Health Damage (Act No. 111 of 1973), victims of extreme air pollution received medical coverage, disability compensation, child allowances, and in the case of death, funeral service fees and compensation were provided to surviving families.

69. The Environmental Justice Law of the State of New Jersey, in the United States, restricts projects contributing to environmental and health stressors in "overburdened communities" unless a compelling public interest is proven; cost cannot be the determining factor, and approval requires the adoption of the most emission-reducing measures available.[130]

70. The London Ultra Low Emission Zone, in the United Kingdom of Great Britain and Northern Ireland, improved air quality at 99 per cent of monitoring sites.[131] In September 2025, London met the legal nitrogen dioxide limits nearly 200 years earlier than projected.[132] Children in London had faster lung growth following this policy, as compared to those in Luton, which lacked similar programmes.[133] In 1991, Kathmandu started to replace diesel three-wheelers with electric ones. As of 2025, there are 700 electric three-wheelers operating with no government subsidies, serving mainly women, children and low-income groups. In Nigeria, cooking on ethanol stoves was associated with improved infant birth weight, gestational age at delivery and perinatal mortality compared to cooking with open fire.[134]

71. Policies of this nature can be both preventive and provide redress measures. These examples demonstrate a clear path to achieve long-lasting results: air quality regulations must set safe limits on pollutants in relation to human and environmental health, through epidemiological studies and health impact assessments; the regulations must be enforced through health- and human rights-based actions prioritizing more vulnerable populations and include stringent due diligence standards regarding polluting industries and projects; policies such as ultralow emission zones must be implemented, and reparations based on victim compensation and the polluter-pays principle must be integrated into the regulations.

[125] See https://sansad.in/getFile/annex/257/AU508.pdf?source=pqars.
[126] Submission from Human Rights Watch.
[127] See https://doi.org/10.22034/envj.2024.444120.1358 (in Persian).
[128] Submissions from China; NCD Alliance; and Xi'an Jiaotong University Health Science Centre.
[129] Submission from Health and Global Policy Institute.
[130] Submission from Earthjustice.
[131] See https://www.london.gov.uk/media-centre/mayors-press-releases/new-evidence-reveals-all-londoners-are-now-breathing-cleaner-air-following-first-year-expanded-ultra.
[132] See https://www.london.gov.uk/london-meets-legal-limits-toxic-no2-pollution-first-time-almost-200-years-earlier-predicted.
[133] See https://doi.org/10.1093/eurpub/ckaf161.486.
[134] Submission from NCD Alliance.

C Monitoring: deficiencies and good practices

72. Effective monitoring provides policymakers and other stakeholders with comprehensive data and valuable insights to ensure informed decision-making. In Europe, 95 per cent of countries legally require monitoring; in the Americas, the figure is 53 per cent; among Eastern Mediterranean countries, 50 per cent; and in Africa, 30 per cent, where only 24 of 54 countries have the capacity to monitor air quality. Just 3 out of 10 States in Southeast Asia have ambient air quality monitoring stations that fulfil population-weighted criteria.[135] Only 7 per cent have indoor air quality standards.[136]

73. Most monitoring stations are concentrated in cities, excluding rural or inaccessible areas, increasing inequalities and information gaps especially in relation to marginalized communities. In Latin America and the Caribbean, only 117 cities in 17 of the 33 countries have official information available on ground-level air pollutants.[137]

74. While most systems track $PM_{2.5}$, PM_{10}, nitrogen dioxide, sulfur dioxide and ozone, monitoring must include pollutants posing risks to health, considering sources and factors such as climate and extreme weather events. Short-lived climate pollutants, such as black carbon and methane, should also be monitored.

75. With regard to low-cost sensor data for governmental air monitoring networks, concerns about data accuracy and reliability remain;[138] however these data are increasingly used to complement and cross-reference official monitoring, mostly where reference grade monitors are not available. Low-cost sensors should be calibrated with reference grade monitors when possible. In difficult-to-access areas, such as the Amazon forests in Brazil, low-cost monitors have been installed to monitor smoke and issue public health alerts during severe fire episodes.[139] The air quality network in Nairobi includes two reference stations and 87 active low-cost sensors posted in strategic locations, including informal settlements, industrial areas and vehicular transit zones.[140] Burundi, Singapore and Thailand[141] have also included low-cost sensors as part of their air-quality monitoring networks.

76. For some communities, citizen-led monitoring initiatives using low-cost sensors are the main or only source of information regarding air pollution. The City of Pasig, in the Philippines, partnered with the University of Philippines Center for Air Research in Urban Environments, launching a community-based low-cost air quality monitoring network in 2023, due to a long-standing monitoring gap, as there is no government-operated reference station within the city limits.[142] Boston Public Schools, in the United States, installed a district-wide network of 4,400 sensors to cover classrooms, main hallways and nurse's offices in over 120 schools. Data from those sensors is made publicly available to increase transparency and drive evidence-based decision-making.[143]

D. Access to air quality information, and raising awareness

77. To fulfil the obligation of States to provide timely and accessible information,[144] air quality data must be updated, comprehensive, reliable, disaggregated, open, user-friendly and real-time. While 61 per cent of countries recognize the human right to access air-quality information, only 39 per cent impose a legal duty on the State to proactively disseminate the information. Worldwide, over 5 billion people still lack access to air pollution information.[145]

[135] Submissions from World Heart Federation and Sunway Centre for Planetary Health.
[136] Submission from Brown University Pandemic Center and others.
[137] Submission from Asociación Interamericana para la Defensa del Ambiente.
[138] Submission from Ireland.
[139] Submission from Coalizão Respira Amazônia.
[140] Submission from Gillian Onyango.
[141] Submissions from Burundi; Singapore; and Sunway Centre for Planetary Health.
[142] Submission from University of the Philippines – Center for Air Research in Urban Environments.
[143] Submission from Brown University Pandemic Center and Air Club.
[144] See A/HRC/40/55.
[145] See https://aqli.epic.uchicago.edu/files/Report%20-%20English%20Global%20View.pdf.

78. Obstacles include outdated, and inconsistent publication of, data; a lack of public historical records; difficult-to-navigate online platforms; and complex information without interpretation for the public. Disaggregated information, socioeconomic indicators, areas of monitoring and relevant context aspects, such as variations among neighbourhoods, are frequently absent, especially in low- and middle-income countries, for example in Bangladesh, Brazil, India, Indonesia and Türkiye.[146]

79. Limited awareness among the population of the consequences of air pollution can impede the acceptance of and adherence to measures intended to protect health and the environment, such as warnings to avoid outdoor activities or to limit vehicular traffic.[147] Uneven generation of data can produce defective action plans and warning systems driven by incomplete information. Some States have yet to implement warning systems; others have limited ones.

80. The disclosure of air pollution information should also be a socially inclusive[148] and context-dependent process. Several States,[149] United Nations entities[150] and civil society organizations have launched digital platforms in order to disseminate this information, increase awareness and contribute to improving air quality measures, constituting interesting examples to learn from. Citizen engagement has been a catalyst for improvement around the world. Civil society groups in Poland helped make air quality data accessible, which led to Krakow issuing, in 2016, a ban on solid fuels for household heating.[151]

81. The Lancet Countdown on Health and Climate Change connects academic, governmental and citizen-led air monitoring initiatives, providing multi-annual data for indicators on wildfires, sand, dust, ambient and household air pollution, and agricultural emissions at the country level, with further downscaling possible in some cases. OpenAQ[152] is an open-source, open-access database of outdoor air quality measurements. It hosts government-measured and research-grade data from locations around the world, as well as air sensor data.

82. In Spain, AirQ+ serves as the primary risk communication system: it translates pollutant concentrations into a colour code and accompanies the code with specific health recommendations for the general population and more vulnerable groups.[153]

VI. Conclusions and recommendations

83. **Air pollution's severe impacts on people's rights and well-being are undeniable and scientifically proven, and are particularly evident among persons living in low- and middle-income countries and in marginalized situations. Existing risks are exacerbated for more vulnerable people, including children, pregnant people, older persons and persons with pre-existing health conditions.**

84. **Tackling the root causes of air pollution requires urgent preventive and corrective action to address transboundary and localized sources with short and long-term action. Because geography and meteorology influence contaminant transport and deposition, States must define air quality basins or districts among and within which to prioritize actions, bringing rapid relief for the most vulnerable populations.**

85. **States must act decisively to address cumulative pollution sources, prioritize areas with persistent non-compliance, ensuring transparency and public oversight. Without consistent implementation and enforcement, air quality frameworks and efforts risk becoming symbolic rather than delivering the real improvements needed.**

[146] Submissions from Global Youth Strategy; Chetan Bhattacharji; and Bicara Udara.
[147] Submission from Air Quality Life Index, Energy Policy Institute at the University of Chicago.
[148] Submission from Imperial College London.
[149] For example, Colombia, Estonia, Ireland, Japan, Jordan, Mexico, Myanmar, Romania, Singapore, Spain and Uzbekistan.
[150] United Nations Environment Programme and WHO.
[151] Submission from Air Quality Life Index, Energy Policy Institute at the University of Chicago.
[152] See https://openaq.org/.
[153] Submission from Spain.

The private sector must reduce emissions to protect communities and workers, making clean air possible.

86. **The former Special Rapporteur provided recommendations on clean air that remain urgent today.[154] To this end, and considering recent advances, the current Special Rapporteur underscores that States must prioritize the additional recommendations below towards clean air and protecting public health, which complement and build upon past recommendations. States must:**

(a) **Ensure that air quality policies, laws, regulations and actions incorporate a human health-based approach, recognizing the severe risk and harm air pollution poses to health, prioritizing effective actions with an intersectional perspective that respond to the needs of the most vulnerable people and ensure their protection, including:**

(i) **Undertaking and effectively enforcing air pollution action plans that guarantee health protection, including adequate warning systems and protocols for when air quality reaches dangerous levels, considering in particular populations most at risk;**

(ii) **Establishing emissions limits for each contaminant and facility that prioritize human health protection and ensure that cumulative emissions from multiple facilities will not cause air quality violations and health impacts;**

(iii) **To protect health, enacting a presumption against permitting new contaminating facilities in already overburdened communities that do not meet air quality standards, regardless of the purported economic benefit. Only exceptionally permits for facilities in such communities should be allowed, with stricter conditions;**

(b) **Enact and regularly update air quality standards and progressively strengthen and avoid regressions, based on best available science, including WHO guidelines and considering particularly vulnerable populations. Implementation schedules should be aggressive and seek short-term, real improvements reducing health risks and avoiding repetition;**

(c) **Establish and regularly update effective, best science-based, adequately funded air quality and emissions monitoring programmes that:**

(i) **Provide reliable, comprehensive and continuous air quality monitoring (24-hour, year-round) through a combination of government, private sector and public monitoring networks, including innovative ways of incorporating low-cost monitoring and satellite data to allow rapid identification of high-priority problems;**

(ii) **Monitor all contaminants of concern based on known sources, and local conditions, adding monitoring for specific hazardous and toxic contaminants in high-risks areas;**

(iii) **Require continuous monitoring of stationary source (stack) emissions for all regulated and toxic pollutants and especially $PM_{2.5}$;**

(iv) **Closely monitor key industries such as fossil fuel production, refining and transport; metal processing and smelting; electricity generation; chemical, plastic, cement or metal manufacturing; brick kilns; waste management; and data centres;**

(v) **Monitor fence-line air quality at industrial sites, ports, airports, distribution centres and major transit routes, especially when near communities;**

[154] A/HRC/40/55.

(vi) **Require air quality reports showing daily, quarterly and annual averages, along with maximum peak concentrations of all contaminants. This includes up-to-date air quality monitoring maps disclosing disproportionally affected areas;**

(vii) **Require regular reporting of all toxic substances released by industry, showing total amounts by substance, location and facility;**

(viii) **Make all air quality, emissions and toxic release reporting data publicly available upon receipt, electronically and free of charge;**

(ix) **Fill data gaps with a focus on public health, considering differentiated risk situations and particularly vulnerable populations. Review the data considering both long-term persistent and short-term acute health risks and implement emergency protocols in case of exceedances;**

(d) **Strengthen the institutional capacity-building required to protect air quality, prioritizing coordination between health and environment sectors;**

(e) **Require environmental, social and human rights impact assessments in licensing processes for all major polluting activities, requiring thorough assessment of health and air pollution impacts; environmental licensing and permitting processes must be based on robust baseline data, rigorous air quality prediction and analytical methods, and consider health and environmental risks of hazardous air pollutants. Assessments that inaccurately predict harms of air pollution over time should be avoided, as should processes granting licences based on evaluations that do not consider variations of the project operation over time, worst-case scenarios, cumulative industrial growth and adverse climate conditions;**

(f) **Effectively control main drivers of air pollution through enforcement that stops and prevents harms, and to that end:**

(i) **Charge costs of oversight and enforcement to polluters through: proportionate project application fees covering all costs of review processes, including hiring technical experts; and operation fees that fully fund permanent air quality enforcement and oversight programmes, including monitoring data analyses, site inspections and the issuance of fines and penalties;**

(ii) **Establish fines and penalties that create real economic disincentives for violations. Fines should be automatic, cumulative for each day of violation, dependent on air contaminant and subject to increases for repeated violations, culminating in forced closures in cases of severe incompliance;**

(iii) **Place the burden of proof on the polluter by requiring injunctive relief in the form of payment of fees and penalties for continued operations, limiting the time frames;**

(g) **Ensure that, when identifiable harmful pollution poses serious health risks, victims and potential victims are not required to prove direct causation between alleged health impacts and exposure to it;**

(h) **Proactively generate and disseminate timely, updated and easily understandable information about how air quality threatens populations, especially more vulnerable groups;**

(i) **Explain information about acute air pollution, corrective actions and health protections to combat misinformation and increase compliance when policies may otherwise be perceived as generating inconvenience or unnecessary expense;**

(j) **Strengthen international cooperation by increasing financial support for clean air and human rights initiatives and sharing and supporting replication of successful actions for air quality improvement.**

87. **City and subnational governments should prioritize actions to improve air pollution and health, including by:**

(a) **Limiting new fossil fuel production and mandating strict control of air pollution at existing facilities, including minimum distances to populated centres, schools or homes and requirements for capture and use of methane and other greenhouse gases;**

(b) **Eliminating subsidies and other economic incentives for the fossil fuel sector, and shifting support to just transition and healthy air alternatives such as increased electrification, local distributed renewable energy generation and storage options;**

(c) **Strengthening fuel efficiency and quality standards and vehicle exhaust controls, and establishing programmes to retire and prohibit superpolluter vehicles and control ship emissions and truck pollution at ports and other transport and delivering centres near communities;**

(d) **Developing efficient, sustainable and affordable "zero emissions" public transportation systems and improving traffic patterns to reduce congestion and eliminate contamination hotspots in marginalized communities;**

(e) **Strictly regulating and enforcing products contributing to air pollution, including chemicals, paints and fireworks, and requiring progressive reduction of the use of products and processes that generate toxic air releases;**

(f) **Requiring strategic impact assessments and environmental, social and human rights impact assessments – including health assessments – for urban planning and municipal project approval to reduce air pollution and build green cities;**

(g) **Strengthening home and commercial building codes and construction standards for more efficient heating and cooling;**

(h) **Protecting and expanding green spaces and increasing tree coverage to improve natural air filtering and shading that diminishes air pollution;**

(i) **Adopting and enforcing strong measures to prevent forest fires, agricultural burning and waste burning, and disincentivizing the use of biomass for heating and cooking by subsidizing cleaner fuels;**

(j) **Improving waste collection and management, especially minimizing emissions from incineration, and requiring the capture and use of methane released at landfills;**

(k) **Ensuring access to information, public participation and access to justice to all, especially those in marginalized situations, by improving and implementing regulations.**

88. **Businesses have the obligation to prevent, avoid and stop worsening air pollution and subsequent health risks, especially in relation to children, workers and other persons in vulnerable situations. Businesses must:**

(a) **Comply with emissions limits and reduce emissions, if operating in areas that do not meet air quality standards, proactively contributing to air quality improvement; and abstain from interfering with the improvement and enforcement of standards seeking to protect human rights;**

(b) **Share reliable and comprehensive information regarding contaminants and activities related to their operations that might be contributing to air pollution;**

(c) **Protect workers from unhealthy air by installing appropriate technologies and personal protective equipment and ensuring healthcare and social security;**

(d) **Abstain from undue influence or disinformation or misinformation campaigns concerning air quality and its relation to human rights, human health and the right to a healthy environment.**