Seminar on Air Pollution

Introduction

Air pollution is the presence of substances in the air that are harmful to humans, other living beings or the environment. Pollutants can be gases like ozone or nitrogen oxides or small particles like soot and dust. It affects both outdoor air and indoor air.

Natural sources of air pollution include wildfires, dust storms, and volcanic eruptions. Indoor air pollution is often caused by the use of firewood or agricultural waste for cooking and heating. Outdoor air pollution comes from some industrial processes, the burning of fossil fuels for electricity and transport, waste management and agriculture. Many of the contributors of local air pollution, especially the burning of fossil fuels, also cause greenhouse gas emissions that cause global warming. However air pollution may limit warming locally.

Air pollution causes around 7 or 8 million deaths each year. It is a significant risk factor for a number of diseases, including stroke, heart disease, chronic obstructive pulmonary disease (COPD), asthma and lung cancer. Particulate matter is the most deadly, both for indoor and outdoor air pollution. Ozone affects crops, and forests are impacted by the pollution that causes acid rain. Overall, the World Bank has estimated that welfare losses (premature deaths) and productivity losses (lost labour) caused by air pollution cost the world economy over $8 trillion per year.

Various technologies and strategies reduce air pollution. Key approaches include clean cookers, improved waste management, industrial scrubbers, electric vehicles and renewable energy. National air quality laws have often been effective, notably the 1956 Clean Air Act in Britain and the 1963 US Clean Air Act. International efforts have had mixed results: the Montreal Protocol almost eliminated harmful ozone-depleting chemicals, while international action on climate change has been less successful.

Sources:

Major pollutants:

Air pollutants can be tiny solid or liquid particles dispersed in the air (called aerosols), or gases. Pollutants are classified as primary or secondary. Primary pollutants are produced directly by a source and remain in the same chemical form after they have been emitted into the atmosphere. Examples include carbon monoxide gas from car exhausts, and sulfur dioxide from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react with each other or with other parts of the atmosphere. Ground-level ozone is one example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants.

Exposure:

Exposure to air pollution varies widely across the world and across groups. Children, for example, are more exposed because they breathe more rapidly than adults and closer to the ground, where pollution from vehicle exhaust and dust is more concentrated. Similarly, people engaging in strenuous exercise inhale more pollutants than those at rest. On the other hand, people can reduce their exposure by wearing high-quality face masks or by using air purifiers.

For some pollutants, low exposure can be seen as safe, whereas other pollutants have negative health effects even at low levels. As evidence has grown that even very low levels of air pollutants hurt human health, the WHO halved its recommended safe limit for particulate matter from 10 ?g/m3 to 5 ?g/m3 in 2021. Under the new guideline, nearly the entire global population?97%?is classified as exposed to unsafe levels of PM2.5. The new limit for nitrogen dioxide (NO_2) became 75% lower. For all pollutants together, the WHO concluded that 99% of the world population is exposed to harmful air pollution.

For some pollutants such as black carbon, traffic related exposures may dominate total exposure

despite short exposure times, since high concentrations coincide with proximity to major roads or participation in (motorized) traffic. A large portion of total daily exposure occurs as short peaks of high concentrations.

Health effects:

Air pollution is an important risk factor for various diseases, such as COPD (a common lung disease), stroke, heart disease, lung cancer and pneumonia. Indoor air pollution is also associated with cataract. Air pollution has further been linked to brain disorders, such as dementia, depression, anxiety and psychosis.

Pollutants strongly linked to ill health include particulate matter, carbon monoxide, nitrogen dioxide (NO_2), ozone (O_3), and sulphur dioxide (SO_2). Fine particulates are especially damaging, as they can enter the bloodstream via the lungs and reach other organs. Air pollution causes disease by driving inflammation and oxidative stress, suppressing the immune system and by damaging DNA.

Even at very low levels (under the World Health Organization recommended levels), fine particulates can continue to cause harm. However, according to the WHO, 99% of the world's population lives in areas with air pollution that exceeds WHO recommended levels. People living in poverty, babies and older people are also disproportionately affected by air pollution; pregnancy is also more risky when exposed to air pollution.

Social and environmental impacts:

History of air pollution:

Mummified remains of people in Peru, Egypt and Britain show that ancient people in these regions suffered from blackening of the lungs caused by open fires in poorly ventilated homes. Recorded complaints of air pollution go back to the Greek and Roman period. Outdoor air pollution became a

problem with the rise of cities, caused by household smoke and by early industrial activities (such as smelting and mining). In particular, lead levels, found in Arctic ice cores, were about ten times higher in the Roman period than in the period before.

Measurement and monitoring:

Pollution reduction by sector:

Pollution prevention seeks to prevent pollution such as air pollution and could include adjustments to industrial and business activities such as designing sustainable manufacturing processes (and the products' designs) as well as efforts towards renewable energy transitions.

Policy and regulation:

See also:

References:

Further reading:

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External links:

WHO Ambient Air quality database

Global real-time air quality index map

Air Quality Index (AQI) Basics and Calculator

European Commission > Environment > Air > Air Quality

Hazardous air pollutants at EPA.gov