

Health Effects of Air Pollution on Man

Air pollution is generally known as the presence of gases, dust, fumes or odour in the atmospheric air which are (potentially) at a harmful amount. These chemicals, particulate matters and or biological materials may have pathological effects on humans, animals or plant. In Humans, this can range from a mere temporary discomfort to serious long term effects.

Pollutants and Effects on Health

Various different types of harmful materials exist in air (with variable prominence either indoors or outdoors). The extent of their severity depends on its concentration, persistence and its chemical nature. Pollutants emerging from process such as eruption of volcano, direct burning of fuel in motors and or factories to release carbon monoxide are termed Primary pollutants. Subsequent interactions of these in air give rise to so called Secondary Pollutants (e.g. Ground level ozone).

Sulphur Dioxide:

SO₂ is an evident gas molecule in today's atmosphere. Its natural production is erupting volcanoes whereas majority of man-made production is accounted by industrial processes and combustion of petroleum (as it contains sulfur compounds). This impacts the environment (and thus living habitats) in several ways. In the presence of NO₂ as a catalyst, further oxidation of SO₂ creates H₂SO₄ which plays a role in formation of acid rain. The negative impacts of acid rain are mostly direct on vegetation, soil, aquatic-life creatures and buildings. The acid in rain water is too dilute to have significant health effects on humans directly. The hazard of acid rain to human health to be of most consideration is leaching of toxic trace metals from soil, acidification of lake water and entrance to the household water supply. Lead plumbing exposed to acidified water has a risk of lead enter drinking water. The parental compounds SO₄ and NO₂ themselves in air are established to have direct health effects on humans. Being a mild to strong irritant, SO₂ in air is established to have quick effects on respiratory function. Long term respiratory effects are now also becoming more evident. Under quite nasal breathing, SO₂ has more prominent effect only as far as the nose and throat. As per a study conducted for Canadian Centre for Occupational Health and Safety in 1997, short exposure (1-6 hours) with low concentration of 1ppm show reversible decrease in lung function. Shorter duration of higher concentration (5ppm) produces bronchial constriction. Very high concentration in closed spaces causes severe airway obstruction, hypoxemia, and pulmonary oedema. Long term exposure of many years (of even less than 5ppm) is believed to cause pulmonary impairment. IARC reviewed many studies and concluded that there is inadequate evidence to support the hypothesis that SO₂ causes cancer thus is not classifiable as to its carcinogenicity to humans (Group 3).

Ozone O₃

Is a key constituent of the troposphere (Low level Ozone). It is also an important constituent of certain regions of the stratosphere commonly known as the (high) Ozone layer. Being a powerful oxidising agent, it spontaneously decomposes to oxygen. The amount of anthropogenic emissions to the atmosphere is minute, but it can be formed by the photochemical reaction involving gaseous hydrocarbons and nitrogen oxides and Sunlight. Ozone has health effects mainly in two ways: 1) Direct effect via oxidation of polyunsaturated fatty acids in cell membranes (causing cellular injury) to fatty acid peroxides (which, along with free radicals and ozonides, have subsequent indirect damaging effects). 2) Oxidation of structural proteins, enzymes etc (specifically the sufhydryl groups and amino acids) Generally, O₃ causes irritation of eyes, nose and throat; chest discomfort; headache noted to be linked with roughly with 200 µg/m³ of hourly average oxidant levels. Children at this dose tend to present with decrement of pulmonary functions. At a range of between 270-740 µg/m³, there is an increased incidence of asthmatic attacks. Rise in asthmatic attacks is explained by the increased sensitivity of susceptible individuals to allergens. As per the statistical study of 95 large urban communities in America by Bell et al (2004), an almost 33% reduction in urban ozone concentrations would save roughly 4000 lives per year. Troposphere ozone causes approximately 21,000 premature deaths per year in 25 countries in the European Union. (WHO, 2008)

Nitric Oxide

NO₂ is most commonly emitted in urban cities via motor vehicles exhaust and include unvented combustion appliances. Accumulation of the pollutant is more evident during weather periods of calm still weather. This acrid compound is toxic when inhaled. However, majority of the evidence is weighted toward the adverse health effects of NO₂ mainly on children and elderly with cardio-respiratory disease. Symptoms, such as lung oedema, are manifested with a delay after inhalation. Even low concentrations (4ppm) have lethal effects on the susceptible ages with an underlying pulmonary or cardiovascular pathology; reinforced by the fact that these low doses anesthetize the nose, presenting as risk of overexposure. As per WHO, long-term exposure to NO₂ at concentrations above 40-100 µg/m³ also has a detrimental effect on lung function and increases the risk of respiratory symptoms.

Overview of Effects on Health from Air pollution

Air pollution can have either short term effects or long-term effects. The criterion for understanding the extent of the effect includes duration of exposure to pollutant and more importantly, concentration of pollutant. Short-term reactions: are irritation to the eyes, nose and throat, and upper respiratory. Headaches, malaise, and allergic reactions may also be present. Short-term air pollution can worsen the medical conditions of individuals with asthma and emphysema. In the great "Smog Disaster of London" (1952), over four thousand people died within in a few days due to the high concentrations of pollution. Long-term reactions: Cystic Fibrosis (mucus hyper-secretion); COPD and Asthma; Lung cancer (especially when tobacco is the pollutant)

Air pollution can be indoors or outdoors. The California Air Resources Board estimates that indoor air pollutant levels are 25-62% greater than outside levels and can pose serious health problems. Health effects from indoor air pollution maybe sourced from tobacco smoke, cooking and heating appliances, and vapours from building materials, paints, furniture etc. Acute lower respiratory infections in children under five, and chronic obstructive pulmonary disease and lung cancer (where coal is used) in adults have been evidenced in people exposed to particulate matters indoors.

Links

Related Articles

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