THE IMPACT OF AIR, SOIL, AND WATER POLLUTION ON PUBLIC HEALTH IN MODERN CONDITIONS AND WAYS TO ADDRESS THEM

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Pollution of atmospheric air, soil, and water resources significantly worsens public health, leading to an increase in respiratory and cardiovascular diseases, as well as higher economic costs for healthcare and ecosystem restoration. In particular, the rising concentration of harmful substances in the air—such as sulfur dioxide, carbon dioxide, and fine particulate matter (PM2.5)—contributes to chronic respiratory diseases, including asthma, bronchitis, and chronic obstructive pulmonary disease (COPD).

Around the world, PM2.5 particles have become a growing concern because of their severe health impacts. Between 1990 and 2010, 3.1 million people died from causes related to PM2.5 exposure. Another alarming statistic shows that PM2.5 reduces average life expectancy by approximately 8.6 months. Overall, PM2.5 is responsible for 3% of deaths from cardiovascular and respiratory diseases and 5% of lung cancer deaths. According to the World Health Organization's (WHO) major report on air pollution and its health effects, an average urban resident inhales around 200 billion PM2.5 particles daily, with half of them depositing in the lungs. While a single exposure may not cause significant harm, continuous accumulation of these particles can lead to critical health consequences over time.

What does PM2.5 do to the body? When a person inhales air with critically high concentrations of PM2.5 particles, the respiratory tract receptors become irritated, triggering a neural response that forces the lungs to work harder. The bronchial passages narrow, resulting in rapid and shallow breathing. The heart experiences increased strain, leading to conditions such as arrhythmia and tachycardia.

Water Pollution: Pollution of water resources is among the most serious environmental issues affecting human health. One of the most dangerous water pollutants is heavy metals, including lead, mercury, cadmium, and arsenic. These substances enter water bodies through industrial waste, leakage from water supply systems, agricultural runoff, and household waste. Lead, in particular, poses a major health risk as it accumulates in the body and causes harm even at low concentrations. The main routes of lead exposure are contaminated drinking water, contact with polluted soil, and consumption of contaminated food. In resource-limited countries, lack of access to clean water leads to increased disease rates and mortality.

Soil Pollution: Soil contamination is primarily associated with the intensive use of pesticides and chemical fertilizers in agriculture, as well as with industrial waste. This leads to land degradation, reduced fertility, threats to food security, and the accumulation of harmful substances in crops, which can result in poisoning and toxic buildup in the human body. Soil pollutants such as petrochemicals, heavy metals, and plastics have long-term impacts on health, as they can enter the human body through food consumption.

To address water pollution, it is essential to develop and implement effective water purification systems at municipal and industrial levels. Regular monitoring of water quality and stricter control of chemical and heavy metal discharges into water resources are crucial. Reducing the use of agricultural chemicals and pesticides will also help limit water contamination.

To reduce air pollution, it is necessary to enforce and comply with strict environmental regulations, including limits on industrial and transportation emissions. Promoting public transport with low emissions and encouraging the use of renewable energy sources such as solar and wind power are key measures. Expanding green spaces in urban areas can help improve air quality, while implementing emission control technologies for vehicles and factories will further reduce pollution.

To combat soil pollution, it is important to limit the use of toxic substances and pesticides and to develop sustainable agricultural practices resistant to chemical exposure. Expanding recycling and waste management systems will reduce soil contamination levels. Additionally, effective reclamation of polluted lands should be a strategic priority for ensuring ecological and public health safety.

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