

IMPACT OF CHEMICAL POLLUTION ON THE HUMAN BODY

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Abstract. Chemical pollution of the environment poses a serious threat to human health. The article considers the main sources of chemical pollution, mechanisms of its impact on the body, as well as statistical data confirming the scale of the problem. Special attention is paid to the influence of pollutants on the development of acute and chronic diseases, mutagenic and teratogenic effects. The data of the World Health Organization and Russian studies demonstrating the growth of morbidity in regions with high levels of pollution are given. Finally, measures to reduce the negative impact of chemical pollutants are proposed, including technological, legislative and educational initiatives.

Key words: chemical pollution, human health, toxic substances, environment, chronic diseases, cancer risks, mutagenic effects, air pollution, water pollution, pesticides, heavy metals, environmental risks, World Health Organization, prevention measures, pollution monitoring.

Chemical pollution of the environment is one of the most significant environmental problems of our time, which has a serious impact on human health. According to the World Health Organization (WHO), about 4.2 million people die prematurely every year due to air pollution. About 99% of the world's population lives in regions where air pollution levels exceed established safety standards. In addition, according to the European Environment Agency, long-term exposure to polluted air leads to an increase in the incidence of chronic diseases such as bronchial asthma, cardiovascular pathologies and cancer. In the Russian Federation, according to Rospotrebnadzor, more than 60% of the population lives in areas with high levels

of chemical pollution, which leads to an increase in the number of allergic and respiratory diseases, as well as an increased risk of cancer pathologies.

In this regard, the study of the impact of chemical pollution on the human body is of particular relevance. This article considers the main sources of chemical pollution, mechanisms of its impact on human health, as well as statistical data confirming the scale of the problem.

The main sources of chemical pollution are industrial enterprises, transportation, agriculture and household waste. Industrial emissions include heavy metals, volatile organic compounds and other toxic substances that enter the atmosphere and water resources. Motor vehicles are a significant source of nitrogen oxides, carbon monoxide, and hydrocarbons. Pesticides and fertilizers are widely used in agriculture, which can accumulate in the soil and infiltrate into groundwater. Household waste, especially when disposed of improperly, also contributes to environmental pollution with various chemical compounds. The problem is also acute in the Russian Federation. According to Rospotrebnadzor, in 2021, 136,000 deaths (6% of total mortality) and almost 4.3 million cases of disease (2% of morbidity) were attributed to poor quality of atmospheric air, drinking water, soil and unsafe food. More than 90 million people (63.6% of the country's population) are affected by chemical, biological and other types of environmental pollution.

In Uzbekistan, chemical pollution has a significant impact on public health. According to IQAir, in 2023, the average air quality index (AQI) for the country is 86, which corresponds to the Moderate category. However, some cities, such as Tashkent, have significantly higher levels of pollution. In 2019, the average concentration of PM_{2.5} in Tashkent reached 41.2 µg/m³, which is 4 times higher than the World Health Organization's recommended value of 10 µg/m³. The main sources of pollution are:

Industrial emissions: Factories and mills emit heavy metals, dioxins and volatile organic compounds into the atmosphere, causing air and water pollution.

Transportation: Automobiles, especially old and inefficient ones, emit nitrogen oxides, carbon monoxide and particulate matter, worsening air quality in cities.

Agriculture: The use of pesticides and fertilizers leads to nitrate accumulation in soil and water, which can adversely affect human health.

Long-term exposure to polluted air is associated with an increased risk of respiratory system diseases, cardiovascular diseases and cancer. In 2019 in Tashkent, PM_{2.5} levels reached 75.5 µg/m³ in November, which corresponds to the Unhealthy category and can cause serious health problems.

The entry of chemical pollutants into the human body can occur through the respiratory tract, digestive system or skin. Depending on the nature of the substance and the route of entry, various adverse effects are possible:

Acute poisoning: occurs with short-term exposure to high concentrations of toxic substances and is manifested by symptoms of intoxication such as headache, nausea, vomiting, and impaired consciousness.

Chronic diseases: long-term exposure to low concentrations of pollutants can lead to the development of chronic diseases, including diseases of the respiratory system (asthma, chronic bronchitis), cardiovascular pathologies, and cancer.

Genetic mutations and birth defects: some chemicals have mutagenic and teratogenic properties, which can lead to genetic changes and congenital abnormalities in offspring.

To reduce the negative impact of chemical pollution on human health, a comprehensive approach is needed, including:

Reduction of emissions: introduction of modern technologies for cleaning industrial emissions, transition to environmentally friendly fuels, development of public transportation.

Control and monitoring: regular monitoring of air, water and soil quality, as well as control of harmful substances in food.

Education and information: raising public awareness of the risks associated with chemical pollution and how to minimize them.

Legislative measures: development and implementation of strict environmental standards and regulations and their enforcement.

Conclusion. Chemical pollution of the environment is a serious threat to human health and the sustainability of ecosystems. Exposure to toxic substances through the atmosphere, water and soil causes a wide range of diseases, including respiratory diseases, cardiovascular disorders, cancer and genetic anomalies. Based on statistical data confirming high levels of pollution in various countries, including Uzbekistan, it can be argued that the problem requires a comprehensive approach for its solution.

The following key measures are necessary to effectively minimize the negative impact of chemical pollution: reduction of industrial pollutant emissions, introduction of modern cleaning technologies, development of environmentally friendly modes of transport and renewable energy sources, as well as enhanced environmental quality control. Regular monitoring of pollutants, especially in large cities, will help to promptly respond to changes in the environment and prevent potential threats to public health.

A special role in solving the problem is played by public education, which should be aware of the risks of chemical pollution and methods to minimize them. The development and implementation of strict environmental standards at the legislative level will help ensure compliance with norms and restrictions aimed at protecting human health and improving environmental quality.

Only comprehensive measures combining technological innovation, legal regulation and social awareness will be able to significantly reduce the impact of chemical pollution and improve public health, contributing to the sustainable development of society.

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