

**AIR POLLUTION**

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***Annotation:** Pollution in the narrow sense is the introduction of new, uncharacteristic physical, chemical and biological agents into any environment or an excess of the natural average long-term level of these agents.*

Atmospheric air is polluted by introducing into it or forming in its pollutants in concentrations exceeding quality standards or the level of natural content.

Air pollution should be understood as any change in its composition and properties, which has a negative impact on human and animal health, the condition of plants and ecosystems.

By origin, air pollution can be natural (natural) and artificial (anthropogenic). Natural air pollution is caused by natural processes. These include volcanic activity, weathering of rocks, wind erosion, massive flowering of plants, smoke from forest and steppe fires, dust storms, volcanic eruptions, gas emissions from geysers and geothermal springs, intravital emissions into the atmosphere of plants, animals, and microorganisms.

Anthropogenic pollution is associated with the release of various pollutants generated by human activities. In scale, it significantly exceeds natural air pollution.

Depending on the scale of distribution, various types of anthropogenic air pollution are distinguished: local, regional, regional and global. The extent of pollution is related to the emission power and the nature of air flows.

Local pollution may be caused by one or more emission sources, the influence of which is determined mainly by variable wind speed and direction. Local pollution is determined by the combination of emissions from multiple sources located in the territory within the zone of influence and is characterized by an increased content of pollutants in small areas (city, industrial area, agricultural zone).

Regional pollution refers to air pollution over an area of hundreds of kilometers, which is influenced by emissions from large industrial and agricultural complexes.

Global pollution is associated with changes in the state of the planet's atmosphere as a whole.

According to their physical state, emissions of harmful substances into the atmosphere are classified into the following types:

- 1) gaseous - gases and vapors (sulfur dioxide, nitrogen oxides, carbon monoxide, hydrocarbons, etc.);
- 2) liquid - fogs (acids, alkalis, salt solutions);
- 3) solid - dust and fumes (carcinogenic substances, lead and its compounds, organic and inorganic dust, soot, tarry substances, etc.).

Of the total mass of substances emitted into the atmosphere, gases (vapors) make up about 90%. According to WHO experts, of the numerous air pollutants, the main ones are suspended

particles (aerosols of various compositions), followed by sulfur compounds and oxidants (substances formed in the atmospheric air as a result of photochemical transformations).

Aerosols are dispersed systems in which the dispersion medium is a gas, and the dispersed phases are solid or liquid particles. Typically, the size of aerosol particles is limited to the range of  $10^{-7}$  –  $10^{-3}$  cm. Aerosols are classified into three groups.

The first group includes dusts consisting of solid particles, dispersed in a gaseous medium.

The second group includes fumes - all aerosols that are obtained from gas condensation.

The third group includes fogs - a collection of liquid particles in a gaseous medium.

Currently, about 20 million tons of particles are suspended in the earth's atmosphere, about three quarters of which come from industrial emissions.

The special importance of dust and other suspended particles is explained by the fact that they pollute the atmosphere not only as a result of direct emissions, but to a greater extent as a result of various transformations of gaseous substances emitted into the atmosphere (sulfur compounds, nitrogen oxides, hydrocarbons) with the formation of fine aerosols.

Classification of air pollutants can be carried out by composition (for example, hydrogen chloride, fluoride compounds, etc.).

The main pollutants (pollutants) of atmospheric air generated during industrial and other human activities include sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), hydrocarbons (CH) and particulate matter. They account for about 98% of the total emissions of harmful substances.

The total global emission into the atmosphere of the main atmospheric pollutants (pollutants) in 1990 amounted to 401 million tons, incl. in Russia – 26.2 million tons.

In addition to these main pollutants, many other harmful and toxic compounds are released into the atmosphere, including formaldehyde, hydrogen fluoride, lead compounds, ammonia, phenol, benzene, mercury, cadmium, etc.

Of particular concern is radioactive contamination caused by globally distributed, long-lived radioactive isotopes—products of nuclear weapons testing conducted in the atmosphere and underground.

The surface layer of the atmosphere is also polluted by emissions of radioactive substances into the atmosphere from operating nuclear power plants (even during their normal operation) and other sources.

Another form of air pollution is excess heat from anthropogenic sources.

(Thermal) pollution of the atmosphere is the so-called thermal zones, for example, the so-called. “heat islands” in cities, discharge of hot wastewater from enterprises, causing warming of water in reservoirs.

Atmospheric pollutants are divided into primary, which enter directly into the atmosphere, and secondary, which are formed as a result of their transformations. For example, sulfur dioxide entering the atmosphere is oxidized by atmospheric oxygen to sulfur trioxide, which then reacts with water vapor to form droplets of sulfuric acid.

Sources of air pollution by emissions can be classified:

1. By purpose: a) technological, containing tail gases after recovery units (recycling, absorption, etc.); b) ventilation emissions – i.e. local suctions, hoods.
2. By location:

a) unshaded or high (high pipes, point sources), removal of contaminants to a height exceeding the height of the building by 2.5 or more times; b) shaded or low, located at a height less than the height of the building; c) ground – located near the surface of the earth (open technological equipment, industrial sewage wells, etc.).

3. According to geometric shape:

a) point (pipes, shafts, fans); b) linear (aeration lamps, open windows, torches).

4. By operating mode: a) continuous and b) periodic action, c) salvo and instant. Voltage surges are possible during accidents or burning of fast-burning industrial waste. In flash releases, pollutants are released to a significant height in a fraction of a second. This is possible during blasting operations and accidents.

5. By propagation range: a) on-site, that is, creating high concentrations only on the territory of an industrial site, and in residential areas not producing noticeable pollution (for such emissions, CVDs of sufficient size are provided); b) outside the facility, when emitted contaminants can create high concentrations in residential areas.

Industrial gas emissions can be organized or unorganized. Organized industrial emissions are emissions that enter the atmosphere through special structures - chimneys, air ducts, pipes.

Fugitive emissions are emissions released into the atmosphere as a result of equipment leaks, poor operation of the ventilation system, etc.

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