Definition: **air pollution** from *Processing Water, Wastewater, Residuals, and Excreta for Health and Environmental Protection: An Encyclopedic Dictionary*

The presence of contaminant or pollutant substances in the air that do not disperse properly, that interfere with human health and welfare, or that produce other harmful environmental effects. Rainfall sometimes returns to land and water the substances causing air pollution. See acid rain.

Summary Article: **air pollution**

From *The Columbia Encyclopedia*

contamination of the air by noxious gases and minute particles of solid and liquid matter (particulates) in concentrations that endanger health. The major sources of air pollution are transportation engines, power and heat generation, industrial processes, and the burning of solid waste.

**Sources of Air Pollution**

The combustion of gasoline and other hydrocarbon fuels in automobiles, trucks, and jet airplanes produces several primary pollutants: nitrogen oxides, gaseous hydrocarbons, and carbon monoxide, as well as large quantities of particulates, chiefly lead. In the presence of sunlight, nitrogen oxides combine with hydrocarbons to form a secondary class of pollutants, the photochemical oxidants, among them ozone and the eye-stinging peroxyacetylnitrate (PAN). Nitrogen oxides also react with oxygen in the air to form nitrogen dioxide, a foul-smelling brown gas. In urban areas like Los Angeles where transportation is the main cause of air pollution, nitrogen dioxide tints the air, blending with other contaminants and the atmospheric water vapor to produce brown smog. Although the use of catalytic converters has reduced smog-producing compounds in motor vehicle exhaust emissions, studies have shown that in so doing the converters produce nitrous oxide, which contributes substantially to global warming.

In cities, air may be severely polluted not only by transportation but also by the burning of fossil fuels (oil and coal) in generating stations, factories, office buildings, and homes and by the incineration of garbage. The massive combustion produces tons of ash, soot, and other particulates responsible for the gray smog of cities like New York and Chicago, along with enormous quantities of sulfur oxides (which also may be result from burning coal and oil). These oxides rust iron, damage building stone, decompose nylon, tarnish silver, and kill plants. Air pollution from cities also affects rural areas for many miles downwind. In less developed regions, indoor air pollution from open fires burning wood and other fuels for heating and cooking can be a significant health hazard.

Every industrial process exhibits its own pattern of air pollution. Petroleum refineries are responsible for extensive hydrocarbon and particulate pollution. Iron and steel mills, metal smelters, pulp and paper mills, chemical plants, cement and asphalt plants—all discharge vast amounts of various particulates. Uninsulated high-voltage power lines ionize the adjacent air, forming ozone and other hazardous pollutants. Airborne pollutants from other sources include insecticides, herbicides, radioactive fallout, and dust from fertilizers, mining operations, and livestock feedlots.

**Effects on Health and the Environment**

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Like photochemical pollutants, sulfur oxides contribute to the incidence of respiratory diseases. Acid rain, a form of precipitation that contains high levels of sulfuric or nitric acids, can contaminate drinking water and vegetation, damage aquatic life, and erode buildings. When a weather condition known as a temperature inversion prevents dispersal of smog, inhabitants of the area, especially children and the elderly and chronically ill, are warned to stay indoors and avoid physical stress. The dramatic and debilitating effects of severe air pollution episodes in cities throughout the world—such as the London smog of 1952 that resulted in 4,000 deaths—have alerted governments to the necessity for crisis procedures. Even everyday levels of air pollution may insidiously affect health and behavior. Indoor air pollution is a problem in developed countries, where efficient insulation keeps pollutants inside the structure. In less developed nations, the lack of running water and indoor sanitation can encourage respiratory infections. Carbon monoxide, for example, by driving oxygen out of the bloodstream, causes apathy, fatigue, headache, disorientation, and decreased muscular coordination and visual acuity.

Air pollution may possibly harm populations in ways so subtle or slow that they have not yet been detected. For that reason research is now under way to assess the long-term effects of chronic exposure to low levels of air pollution—what most people experience—as well as to determine how air pollutants interact with one another in the body and with physical factors such as nutrition, stress, alcohol, cigarette smoking, and common medicines. Another subject of investigation is the relation of air pollution to cancer, birth defects, and genetic mutations.

A relatively recently discovered result of air pollution are seasonal “holes” in the ozone layer in the atmosphere above Antarctica and the Arctic, coupled with growing evidence of global ozone depletion. This can increase the amount of ultraviolet radiation reaching the earth, where it damages crops and plants and can lead to skin cancer and cataracts. This depletion has been caused largely by the emission of chlorofluorocarbons (CFCs) from refrigerators, air conditioners, and aerosols. The Montreal Protocol of 1987 required that developed nations signing the accord not exceed 1986 CFC levels. Several more meetings were held from 1990 to 1997 to adopt agreements to accelerate the phasing out of ozone-depleting substances.

**Solutions to Air Pollution**

To combat pollution in the United States, the Clean Air Act Amendments of 1970 gave the Environmental Protection Agency (EPA) the authority to establish and enforce air pollution standards and to set emission standards for new factories and extremely hazardous industrial pollutants. The states were required to meet “ambient air quality standards” by regulating the emissions of various pollutants from existing stationary sources, such as power plants and incinerators, in part by the installation of smokestack scrubbers, electrostatic precipitators, and other filters. Auto manufacturers were mandated to install exhaust controls or develop less polluting engines. The Clean Air Act, as amended in 1977, authorized the EPA to impose stricter pollution standards and higher penalties for failure to comply with air quality standards.

In 1990 when the act was reauthorized it required most cities to meet existing smog reduction regulations by the year 2005. The 1990 amendments also expanded the scope and strength of the regulations for controlling industrial pollution. The result has been limited progress in reducing the quantities of sulfur dioxide, carbon monoxide, nitrogen oxide, ozone, particulate matter, and lead in the air. The EPA also regulated hazardous air pollutants, which in 1992 included mercury, beryllium, asbestos, vinylchloride, benzene, radioactive substances, and inorganic arsenic.
The most satisfactory long-term solutions to air pollution may well be the elimination of fossil fuels and the ultimate replacement of the internal-combustion engine. To these ends efforts have made in the United States, Japan, Europe, and China to develop alternative energy sources (see energy, sources of), as well as different kinds of transportation engines, such as one powered by electricity. A system of pollution allowances based on trading emission rights has been established in the United States in an attempt to use the free market to reward pollution reductions, and the international sale of surplus emission rights is permitted under the Kyoto Protocol (see below). Other proposed solutions include raising electricity and gasoline rates to better reflect environmental costs and to discourage waste and inefficiency, and mechanical controls on coal-fired utility plants.

In 1992, 150 nations signed a treaty on global warming at the UN-sponsored summit on the environment in Rio de Janeiro. A UN Conference on Climate Change, held in Kyoto, Japan, in 1997, produced an international agreement to combat global warming by sharply reducing emissions of industrial gases produced by industrialized nations. Although the United States abandoned the treaty in 2001, saying it was counter to U.S. interests, most other nations agreed that year on the details necessary to make the protocol a binding international treaty, and the necessary ratifications brought the treaty into force in 2005. Efforts to develop a new, more encompassing binding treaty that would build on the Kyoto Protocol were long unsuccessful, and in 2012 Canada became the first ratifying nation to withdraw. Later in 2012 the Kyoto Protocol was extended to 2020. In 2015, however, the world's nations agreed for the first time to take measures to hold global warming below 3.6 degrees Fahrenheit (2 degrees Celsius), and all parties, not just developed nations, agreed to reduce emissions; a revision of emissions targets (beginning in 2020) and a review of actual emission reductions (beginning in 2023) were required every five years. U.S. support for the 2015 agreement, however, reversed with the election (2016) of Donald Trump as president; he moved to dismantle federal policies intended to address climate change and announced the United States would withdraw from the agreement.

See environmentalism; pollution.

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