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Air Pollution

What Is Air Pollution?

The natural composition of air is mostly nitrogen and oxygen, along with water droplets, fine particles, and small amounts of other gases such as carbon dioxide, nitrous oxide, methane, ammonia and argon. These gases can be either free in the air or associated with water vapor.

Air pollution is any visible or invisible particle or gas found in the air that is not part of the normal composition of air. Natural air pollution has been around for millions of years, but during the last century, pollution created by humans has become a major concern. While we are most familiar with visible air pollution (such as smog), many other air pollutants, including some of the most dangerous, are invisible.

From Where Does Air Pollution Come?

Natural air pollutants have always been part of the Earth's history. Particulate matter and a variety of different gases from volcanoes, forest fires and decaying organic materials in oceans and swamps enter the atmosphere at irregular intervals, sometimes in amounts that have dramatic effects. Naturally produced "greenhouse" gases, such as methane from plant decay, may have contributed significantly to periods of global warming in the past. Carbon dioxide and water vapor react to form carbonic acid, which makes rain slightly acidic even without pollution from other sources.

Naturally produced pollutants are present in greater amounts than those of human origin. However, they do not present as serious a problem as man-made pollutants because they are not concentrated over large cities and many are less harmful than man-made pollutants.

Air pollution from man-made sources is the result of our increasing use of large quantities of fuel and high levels of industrial activity. Not only are some of these pollutants very harmful, but they also tend to be concentrated in urban areas in which many people live and work. Many of these air pollutants come from burning the coal, oil, wood and other fuels we use to run factories, cars and power plants that generate heat and light for our homes.

Once pollutants are added to the air, they can chemically react to form more dangerous pollutants. The interaction of nitrogen oxides and other components near ground level in the presence of sunlight forms another atmospheric gas — ozone. Ozone has two very important but different effects. The layer of ozone found in the upper atmosphere (stratosphere) provides a major protective barrier against harmful radiation from the sun. However, ozone near the Earth's surface can become a serious health problem when the ozone concentration becomes too high, usually on long, sunny, summer days.

Pollutants of any sort can ride the air currents for long distances. It has become very clear that the air around us and the pollutants it carries are never just a local concern, but transcend regional, national and hemispheric boundaries.

What Are the Effects of Air Pollution on Plants, Animals, and Humans?

Plant and animal life has adapted to most natural pollutants except for the rare catastrophic occurrences that create worldwide climate changes. The most serious air quality concerns are the additional, often harmful, pollutants that humans add to the air.

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Eventually, most of the water droplets carried by air fall to Earth as precipitation. Many of the small particles and chemicals are washed from the atmosphere when precipitation falls. Air pollution then becomes land and water pollution, which can influence the structure and function of ecosystems, including their ability for self-regulation. Numerous small lakes in the eastern U.S. are devoid of fish because of the effects of "acid rain."

The impact of air pollution on humans is broad, causing symptoms ranging from itchy eyes to cancer. The absorption of inhaled chemicals can have direct consequences for health. However, public health also can be indirectly affected by the deposition of air pollutants on plants, animals and water. These chemicals, by entering the food chain or being present in drinking water, constitute additional sources of human exposure.

How Do We Detect Air Pollution?

Every year, millions of tons of man-made chemicals are released into the atmosphere, mostly by industrialized countries. However, the toxic effects of these chemicals often are not recognized or understood until the chemicals have been widely used for considerable periods of time. A chemical compound that initially appears to have little or no effect on plants and animals may eventually produce extremely harmful results, often hidden for many years.

DDT (dichlorodiphenyltrichloroethane) and related chemicals are a classic case of such a situation. DDT is a very effective insecticide that showed great promise for fighting harmful insects all over the world. It was not until after many years of widespread use that DDT was discovered to have devastating toxic effects. A high DDT level in bald eagles causes their eggs to be so thin-shelled that they are crushed during incubation. This results in a reduction in the population, putting bald eagles on the endangered species list. Similar disastrous repercussions can and are being repeated with other toxic chemicals in other food chains.

Governments around the world have established programs to measure and monitor levels of airborne pollution. For many years, cities in the U.S. developed and used their own indices for reporting air pollution levels to the public. These individual indices have now been replaced by the Pollution Standards Index (PSI) or the Air Quality Index (AQI), both recognized as standardized measures that allow comparison from city to city.

How Do We Reduce Air Pollution?

Since little can be done by humans about natural pollution, our main concern has to be with the additional pollutants from human activity. Because of the increasing concern over toxic chemicals in the air we breathe, many laws have been passed to control emission sources.

Certain air pollutants are so pervasive that they show up wherever air quality is poor. Six have been designated criteria pollutants: particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The U.S. Environmental Protection Agency set national ambient air quality standards to protect health and welfare in connection with these pollutants. Where these standards are exceeded, the EPA takes steps to control pollutant emissions.

Identification and control of other hazardous air pollutants are critical steps to controlling air quality. Seven hazardous materials (arsenic, asbestos, benzene, beryllium, mercury, vinyl chloride and radionuclides) already have U.S. standards. However, this start represents only a very small portion of the entire hazardous waste problem. An expanded list of 189 hazardous chemicals was identified for regulation and are listed in the 1990 Clean Air Act Amendments. Some states, even some cities, have been

particularly aggressive in battling pollution of various sorts. New legislation is constantly being discussed. Alternative energy sources and alternative strategies, such as mass transit and energy conservation, are all part of the solution. Gradually, the international scope is being recognized and international agreements are being developed to try to address air quality problems on a global scale.

Source: Project A.I.R.E. at http://www.epa.gov/region01/students/teacher/airqual.html