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Health Effects

Ambient Air Quality and Human Health

Ambient air quality, especially in highly industrialized and urbanized areas, is a growing concern to the health of the U.S. citizens. The magnitude and variety of these pollutants across the country depends mainly on the number and types of air emission sources and meteorological conditions. To protect public health and welfare, the U.S. Environmental Protection Agency (EPA) has set national standards for six ambient pollutants that tend to reach unsafe levels: carbon monoxide, lead, nitrogen oxides, tropospheric ozone, sulfur dioxide and particulate matter. However, there are other pollutants of concern, some of which occasionally reach dangerous levels under certain conditions or in accidental releases. The EPA is evaluating these pollutants and may require emission reductions for some of them. The EPA also is implementing programs to reduce emissions of chlorofluorocarbons (CFCs) and other pollutants that are depleting stratospheric ozone.

Indoor Air Quality and Human Health

EPA studies of human exposure to indoor air pollutants indicate that pollution levels may be 2-5 times, and occasionally more than 100 times, higher than outdoor levels. Because most people spend at least 90% of their time indoors, indoor air quality is a growing concern. Virtually all ambient air pollutants can be found in indoor air, but some also are generated indoors. For example, carbon monoxide may be produced from tobacco smoking and faulty heating appliances, lead from old paint, and nitrogen and sulfur dioxides from coal-burning stoves. The primary sources of indoor air pollution are carpeting, wood products made with synthetic glues, combustion appliances and tobacco products.

Determining Risk Associated with Air Pollution

To determine the risks to human health posed by air pollutants, the EPA obtains the best available toxicological data from animal studies and human studies. Risks associated with exposure to carcinogens (chemicals with cancer causing potential) are analyzed separately from those associated with exposure to noncarcinogenic chemicals (with the potential for causing pulmonary, liver and kidney damage, nervous system changes, birth defects, immune system dysfunction and other effects).

Even though some chemicals have the potential for generating both carcinogenic and noncarcinogenic effects, the means by which they produce them in the body is thought to be substantially different for most chemicals. In calculating the likelihood that someone will develop cancer, risk assessors assume there is some chance a person will get cancer even from extremely low exposures to a cancer causing substance. For a pollutant that causes noncarcinogenic health problems, risk assessors assume that there is a level of exposure below which people are not likely to experience adverse health effects over a time period, usually a lifetime. These assumptions are based on considerable evidence of adverse health effects in animal and human studies, such as occupational exposures.

Although air pollutants can enter the body by several routes, the primary route is through the lungs, which have a total surface area about 25 times greater than that of the body's skin surface. In the lungs, air pollutants directly damage the lung tissue causing several types of diseases, including cancer. In addition, most air pollutants are absorbed into the blood and transported to sensitive organs throughout the body.

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Health Effects of Ambient Air Pollution

The pollutants for which EPA has set National Ambient Air Quality Standards produce a wide variety of health effects. Ambient carbon monoxide, which comes primarily from motor vehicles, enters the blood from the lungs and permanently binds to hemoglobin, preventing it from carrying oxygen needed to sustain life. Lead, from multiple sources including leaded gasoline, accumulates in the body and may cause neurological impairments such as mental retardation and behavioral disorders, especially in the very young. Even at low doses, lead is associated with changes in fundamental enzymatic and energy transfer mechanisms in the body. Nitrogen dioxide, mainly from coal burning power plants and motor vehicles, can irritate the lungs and lower resistance to respiratory infections. It also is a precursor to acid deposition and ozone. Ozone, formed mainly at ground level from other air pollutants in the presence of sunlight, damages lung tissue, reduces lung function, and sensitizes the lungs to other irritants. Decreased lung function can be accompanied by chest pain, coughing and nausea. Ozone also causes agricultural crop loss. Sulfur dioxide, mainly from coal-burning power and industrial plants, is associated with decreased lung function, respiratory diseases, and lowered resistance to lung problems. It also damages plant life. Particulate matter (less than 10 microns in size) comes from a number of different sources such as diesel engines, burning wood and windblown dust. It can aggravate lung and cardiovascular diseases, alter the body's defense systems and cause cancer.

Health Effects of Indoor Air Pollution

Indoor air pollutants may cause a wide variety of adverse health effects ranging from rashes and eye irritation to cancer, breathing difficulties, kidney failure, liver damage and birth defects. The degree of toxicity depends on the physical/chemical characteristics of the air pollutant; the magnitude, frequency and duration of exposure; and the overall health of those exposed. Some populations, such as children and the elderly often are more susceptible to the adverse health effects of pollution. Tobacco smoke, benzene, vinyl chloride, trichloroethylene and asbestos are common indoor pollutants with the potential for causing cancer. Some pesticides used or accidentally leaked indoors can cause cancer and a number of non-cancer effects including lung, kidney, liver and nervous system dysfunction. Radon gas causes lung cancer. Formaldehyde, from the outgassing of particle board and similar products, not only irritates eyes, lungs and skin, but also is a potential carcinogen. Even though the list of potentially dangerous indoor air pollutants seems endless, not all of the pollutants — for example, those produced during combustion or released during the outgassing of synthetic carpet — have been identified. Furthermore, the combined effects of air pollutants on human health are largely unknown.

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