Air, Noise, and Light Pollution

People who are very young or very old and people who have heart or lung problems are most affected by air pollutants. Decades of research have linked air pollution to disease. But because pollution adds to the effects of existing diseases, no death certificates list the cause of death as air pollution. Instead, diseases such as emphysema, heart disease, and lung cancer are cited as causes of death. The American Lung Association has estimated that Americans pay tens of billions of dollars a year in health costs to treat respiratory diseases caused by air pollution.

**Short-Term Effects of Air Pollution on Health**

Many of the effects of air pollution on people’s health are short-term and are reversible if their exposure to air pollution decreases. The short-term effects of air pollution on people’s health include headache; nausea; irritation to the eyes, nose, and throat; tightness in the chest; coughing; and upper respiratory infections, such as bronchitis and pneumonia. Pollution can also make the condition of individuals who suffer from asthma and emphysema worse.

**Long-Term Health Effects of Air Pollution**

Long-term effects on health that have been linked to air pollution include emphysema, lung cancer, and heart disease. Long-term exposure to air pollution may worsen medical conditions suffered by older people and may damage the lungs of children.

**FIGURE 2.1**

Air Pollution  This police officer wears a smog mask as he directs traffic in Bangkok, Thailand.
The Health Effects of Ground-Level Ozone

You have learned that the ozone layer in the stratosphere shields Earth from the harmful effects of ultraviolet radiation from the sun. At the surface of the Earth, however, ozone is a human-made air pollutant that at certain concentrations damages human health.

Ozone forms from the reaction of volatile organic compounds (VOCs) and nitrogen oxides (NOx) in the presence of heat and sunlight. High concentrations of ozone form in the atmosphere on sunny days that have high temperatures. The sources of VOCs and NOx emissions are largely motor vehicles, power plants, gasoline vapors, and chemical solvents. Most ozone pollution forms in urban and suburban areas. However, ozone-producing chemicals may be transported hundreds of kilometers from their source.

As ozone concentrations in the atmosphere increase, greater numbers of people may experience harmful health effects of ozone on the lungs. Some of the short-term effects of ozone on health include irritation of the respiratory system, a reduction in lung function, the aggravation of asthma, and inflammation to the lining of the lungs. Scientists believe that ozone may have other damaging effects on human health. Lung diseases such as bronchitis and emphysema may be aggravated by ozone.

**Indoor Air Pollution**

The quality of air inside a home or a building is sometimes worse than the quality of the air outside. Chemicals that are used to make carpets, building materials, paints, and furniture are major sources of pollutants in buildings. Figure 2.2 shows examples of some indoor air pollutants.

Buildings that have very poor air quality have a condition called **sick-building syndrome**. Sick-building syndrome is most common in hot places where buildings are tightly sealed to keep out the heat. In Florida in the early 1990s, for example, a newly built, tightly sealed county courthouse had to be abandoned. Half of the people who worked there developed allergic reactions to fungi that were growing in the air-conditioning ducts, ceiling tiles, carpets, and furniture.

Identifying and removing the sources of indoor air pollution is the most effective way to maintain good indoor air quality. Ventilation, or mixing outdoor air with indoor air, is also necessary for good air quality. Activities such as renovation and painting, which produce indoor air pollution, require good ventilation.

**CHECK FOR UNDERSTANDING**

Apply Why is sick-building syndrome most common in hot places?

Children who engage in vigorous outdoor activities when pollutant concentrations are often high may have a greater risk of developing asthma or other respiratory illnesses.
Scientists believe that permanent lung injury may result from repeated short-term exposure to ozone pollution. Children who are regularly exposed to high concentrations of ozone may have reduced lung function as adults. Exposure to ozone may also accelerate the natural decline in lung function that is part of the aging process.

Those who are most at risk from ozone include children, adults who exercise or work outdoors, older people, and people who suffer from respiratory diseases. In addition, there are some healthy individuals who have unusually high susceptibility to ozone.

**Critical Thinking**

1. **Making Decisions** Write a brief paragraph explaining whether or not lung-function tests should be mandatory for children who live in urban areas where high concentrations of ozone are frequent.

2. **Making Decisions** If lung-function tests become mandatory, who will pay for these tests, and who will provide the equipment? Should these tests be performed at school, in a doctor's office, or at a hospital?
Radon Gas

Radon is a colorless, tasteless, odorless gas. It is also radioactive. Radon is produced by the decay of uranium, a radioactive element that occurs naturally in the Earth’s crust. Radon can seep through cracks and holes in foundations into homes, offices, and schools, where it adheres to dust particles. When people inhale the dust, radon enters their lungs. In the lungs, radon can destroy the genetic material in cells that line the air passages. Such damage can lead to cancer, especially among people who smoke. Radon is the second-leading cause of lung cancer in the United States.

Asbestos

Several minerals that form in long, thin fibers and that are valued for their strength and resistance to heat are called asbestos. Asbestos is primarily used as an insulator and as a fire retardant, and it was used extensively in building materials. The U.S. government banned the use of most asbestos products in the early 1970s. Exposure to asbestos in the air is dangerous. Asbestos fibers that are inhaled can cut and scar the lungs, which causes the disease asbestosis. Victims of the disease have more and more difficulty breathing and may eventually die of heart failure. Schools in the United States have taken this threat seriously. Billions of dollars have been spent to remove asbestos from school buildings. Figure 2.3 shows asbestos fibers and asbestos removal from a building.

Noise Pollution

Unwanted sound is noise pollution, and it is one of the prices we pay for modern living. It is irritating, and it damages our hearing by destroying cells in our ears. Hearing loss has roughly doubled in the United States since the 1970s. About 14.9 percent of teens have permanent hearing loss, likely due to the prevalence of portable listening devices. One study found that people living in a quiet environment in Africa had better hearing at the age of 80 than most Americans do at 30. Noise can also have a negative impact on organisms on land and in the oceans. For example, loud sounds have caused whales and dolphins to strand on beaches.

The intensity of sound is measured in units called decibels (dB). Figure 2.4 shows the intensity of some common noises. Each increase of 10 dB results in a 10-fold increase in sound intensity. For example, 20 dB is 10 times the intensity of 10 dB. A sound of 120 dB is at the threshold of pain. Noise pollution can be controlled by devices such as mufflers on vehicles and lawn mowers, and by insulation. In Europe, MP3 players must not produce more than 100 dB of noise. According to the National Institutes of Health, the safe threshold for personal listening devices is 85 dB for 8 hours. Personal listening devices are not regulated in the United States.
Section 2  Formative Assessment

Light Pollution

Research suggests that light pollution can increase headaches, fatigue, stress, and anxiety in humans. Also, light pollution in urban areas diminishes our view of the night sky, as shown in Figure 2.5, and can negatively affect our environment. Hatching baby sea turtles instinctively move towards light. They may move the wrong way towards street lights and may not survive. Some communities near sea turtle beaches turn off their lights at hatching time. Light can also cause problems for birds that migrate at night. Light can also cause problems for birds that migrate at night. In Chicago, lights of tall buildings are dimmed during the migration season, saving many birds.

Another important environmental concern of lighting is energy waste. One solution to energy waste includes shielding light so it is directed downward. Two other solutions are to use time controls so that light is used only when needed and to use low-pressure sodium sources—the most energy-efficient source of light—where possible.

CHECK FOR UNDERSTANDING

Identify  What are some effects of light pollution?

FIELD STUDY

Go to Appendix B to find the field study Light Pollution.

Reviewing Main Ideas

1. Describe  the long-term effects and the short-term effects of air pollution on health.
2. Describe  two ways in which indoor air pollution can be prevented.
3. Describe  some of the human health problems caused by noise pollution.
4. Describe  several solutions to the energy waste associated with light pollution.

Critical Thinking

5. Making Comparisons  Read the descriptions of noise and light pollution in this section. Explain ways in which noise pollution and light pollution are similar.

6. Analyzing Relationships  Molds can grow in new, tightly sealed buildings where the humidity is high and the ventilation is poor. Explain how you would control the growth of mold in this type of environment.