The Southern Utes, a Native American Indian tribe, live in southwestern Colorado, within sight of the La Plata Mountains. Besides being beautiful, this area is rich in natural gas. The removal and processing of this fuel provide income and work for people in the tribe and surrounding communities. However, faulty processing of natural gas can pollute the air.

The Southern Utes want to keep the air clean and safe to breathe. To do that, leaders of the tribe have worked with the state and federal governments to develop an air quality program. The program currently involves monitoring the air for pollutants and identifying point and nonpoint sources of air pollutants on the Southern Ute reservation. In addition, the program conducts inspections of industries and sees to it that industries fix any problems that arise. The Southern Ute Air Quality Program also includes many other activities, such as research into methods of eliminating air pollution.

The Southern Utes are using technology, cooperation, creativity, and determination to preserve air quality. The Southern Ute Air Quality Program focuses on a relatively small area of land. At the national and global level, the United States and other nations are taking steps to deal with air pollution. We have a long way to go, but many of our efforts have been successful. You will read about some of those successes in this lesson.
The Clean Air Act

The Clean Air Act has provisions that have reduced air pollution in the United States.

To address air pollution in the United States, Congress has passed a series of laws, including the Clean Air Act. The Clean Air Act was first passed in 1963 and has been revised several times since. Revisions in 1970 and 1990 were especially important. Those revisions set stricter standards for air quality and strengthened the government’s ability to enforce regulations.

**Goal of the Clean Air Act** The Clean Air Act protects and improves the quality of air in order to safeguard human health and the environment. The law takes measures to reduce the emission of pollutants that cause health problems such as asthma and cancer. It also limits the release of pollutants responsible for environmental problems such as smog and acid deposition.

**Provisions of the Clean Air Act** Here are some of the measures taken by the Clean Air Act:

- The Act limits emissions of pollutants by motor vehicles and industries.
- It sets standards for air quality. The law limits the concentration of some specific air pollutants, such as carbon monoxide and particulate matter. The upper limit of each pollutant is based on the maximum amount that humans can tolerate without harm.
- It lets people sue industries that break the rules.
- It sets aside funds for research into pollution control.

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) sets nationwide standards governing air pollutants and air quality. However, the states and Native American tribes have the option of developing and enforcing specific regulations that are equivalent to—or exceed—those found in the Clean Air Act.

**Reading Checkpoint**

What is the Clean Air Act?
Effects of the Clean Air Act

The Clean Air Act has had major effects on the quality of the air we breathe. To monitor air quality, the EPA tracks emissions of several major air pollutants. The graph shows data for some air pollutants: carbon monoxide, nitrogen oxides, volatile organic compounds, sulfur dioxide, and lead. Look at the graph and then answer the following questions.

1. **Interpret Graphs** What do the green bars represent?
2. **Interpret Graphs** What do the purple bars represent?
3. **Analyze Data** What trend does the graph show?
4. **Analyze Data** Of the pollutants shown on the graph, which has changed by the greatest percentage?
5. **Interpret Graphs** Why is the bar for lead shown separately from the bars for the other pollutants? (Hint: Look at the axis labels.)
6. **Infer** Do you think that the general trend shown in this graph is also true for the air in London between 1952 and now? Explain your answer.

Reduction in Air Pollutants  Since the Clean Air Act, the release of the worst air pollutants has gone down by 57 percent. This decrease in pollution has happened even though there are now many more people in the United States, and we use much more energy. The reduction of outdoor air pollution is one of the nation’s greatest accomplishments in protecting the environment.

**Motor Vehicles**  Cars and trucks now cause less pollution. Catalytic converters have helped bring this about. A **catalytic converter** is a device in a motor vehicle that reduces the amount of air pollutants in emissions. It changes harmful emissions, such as carbon monoxide, into substances that are less harmful, such as carbon dioxide and water. Catalytic converters are usually located between the engine and the muffler of a car. Since 1975, all new cars in the United States have had catalytic converters.

**Cleaner Gasoline**  Gasoline once contained lead, and lead was part of the emissions from the exhaust systems of motor vehicles. Lead from vehicle emissions can settle to the ground and contaminate it. If lead gets into the bloodstream of a person—especially a young child—it can cause problems ranging from behavioral disorders to mental retardation. The EPA has been working to phase out lead in gasoline since 1973. Today gasoline used by cars and trucks contains almost no lead.

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**ANSWERS**

**Real Data**

1. The amount of pollutants emitted in 1980
2. The amount of pollutants emitted in 2008
3. The amount of pollutants emitted into the air has decreased since 1980.
4. Lead
5. The amount of lead is given in thousands of tons; the amounts of the other pollutants are given in millions of tons.
6. Sample answer: Yes; after the smog catastrophe of 1952, London took measures to curb air pollution.
Air with pollutants enters the scrubber.

The dirty air passes through clean water droplets.

Water and pollutants exit.

Clean water

Clean air

Cleaned air leaves the scrubber.

The water droplets capture pollutants and carry them to the bottom of the scrubber.

Figure 20 Scrubber
Scrubbers in a factory clean polluted air before it is released into the atmosphere.

Industries and Power Plants As a result of the Clean Air Act, industries and power plants have been required to reduce the amount of pollutants they release. Scrubbers are responsible for much of this reduction. A scrubber removes pollutants or changes them chemically before they leave factory smokestacks. Figure 20 shows one type of scrubber.

Ozone: A Success Story
Nations have taken steps to deal with the problem of ozone loss in the stratosphere.

Ozone is a pollutant in smog in the troposphere. However, recall that ozone is highly beneficial in the ozone layer of the lower stratosphere. Here, ozone absorbs ultraviolet radiation from the sun. UV radiation can harm living things. For example, it can cause skin cancer in humans by chemically changing the genetic material in skin cells.

The Ozone Hole Late in the twentieth century, scientists noticed that measurements of ozone in the stratosphere were lower than they should have been. By 1985, the level of ozone over Antarctica was 40 to 60 percent lower than it had been 10 years before. People began to use the term ozone hole for the area of lowered ozone concentration over Antarctica that occurs every year from August until October (Figure 21).

Chlorofluorocarbons Earlier, in 1974, two scientists, Sherwood Rowland and Mario Molina, had predicted ozone depletion, or loss, and had identified the probable cause. Rowland and Molina suggested that chemicals called chlorofluorocarbons could cause ozone depletion. Chlorofluorocarbons (CFCs) are a family of chemical compounds containing chlorine, fluorine, and carbon. In the 1970s and 1980s, CFCs were manufactured in large amounts. They were used in many ways—for example, in refrigerators and aerosol spray cans.
Molina and Rowland were correct in their prediction. CFCs were rising into the stratosphere and then releasing chlorine atoms that react with ozone. The chemical reactions destroy ozone molecules in the stratosphere. This destruction accounts for the ozone holes over Antarctica.

**The Montreal Protocol** Scientists and other people became concerned about the possible effects of ozone depletion. They were afraid, for example, that cases of skin cancer would increase. As a result of this concern, many nations, including the United States, began to work together to restrict production of CFCs and other ozone-depleting substances. In 1987, many nations signed the **Montreal Protocol**. The treaty, strengthened by later amendments, called for major cuts in CFC manufacture. Today the production and use of ozone-depleting compounds has fallen by 95 percent since the late 1980s. Industry was able to shift to different chemicals to perform the functions that CFCs used to perform. The new chemicals have largely turned out to be cheaper and more efficient.

Evidence indicates that the ozone layer is beginning to recover. In the last few years, concentrations of stratospheric ozone have stabilized, and scientists expect that they will soon begin to increase to their former levels. The Montreal Protocol is widely considered the biggest success story in addressing a global environmental problem. The Montreal Protocol is a model for international cooperation in dealing with other worldwide environmental problems, such as climate change.

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**FIGURE 21** The Ozone Hole
The dark blue areas in the photographs show the ozone hole over Antarctica. Notice how the size of the ozone hole grew between 1979 and 2000.

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**ANSWERS**

**Lesson 3 Assessment**

1. **Air pollution in the United States has been reduced. Sample reasons:** improved motor vehicle construction; cleaner gasoline; reduced industrial and power plant pollutant release.

2. **Stratospheric ozone should increase, because of the dramatic reduction in the production and use of CFCs.**

3. **Answers will vary but should include logical steps to balance the needs of the town and the environment. Sample answer:** Public funds should be set aside to help the power plant modernize its technology and reduce the amount of pollutants it releases.