



Center for the Environment at Catawba College
Campaign for Clean Air
Clean Air in the Classroom

Stage 3 Activity 2

"The Awful 8" Play

Overview

In this lesson the students rehearse to perform a play for their school and/or parents at the end of the last week of the "no-idling" campaign or at the end of the unit focused on air quality.

This lesson is from the Texas Commission on Air Quality and can be found at <http://www.tceq.texas.gov/assets/public/assistance/education/air/awful8.pdf>.

North Carolina Standard Course of Study

This lesson meets seventh grade science competency goals 3.03 and 3.04.

Learning Objectives

Students will be able to list major air pollutants, what causes them, and their effects on people and the environment.

Materials

- markers
- yardsticks
- large pieces of poster board
- background information on air pollution
- library books that cover air pollutants
- materials for "costumes"
- copies of play for each student
- video camera (optional)

Background

The U.S. Environmental Protection Agency (EPA) has established national ambient air quality standards for six air pollutants - ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, respirable particulate matter, and lead.

Volatile organic compounds (VOCs) are emitted from sources as diverse as automobiles, refineries, chemical manufacturing, dry cleaners, paint shops, and other sources using solvents. VOCs are precursors to ground-level ozone, and some of the VOCs are toxic.

Chlorofluorocarbons (CFCs) are a family of chemicals commonly used in air conditioners and refrigerators as coolants and also as solvents and aerosol propellants. CFCs drift into the upper atmosphere where their chlorine components destroy upper-level ozone. CFCs are thought to be a major cause of the ozone

hole over Antarctica. The main man-made source of carbon dioxide emissions is fossil fuel combustion for energy-use and transportation.

Methane comes from landfills, cud-chewing livestock, coal mines, and rice paddies. The extent of the effects of climate change - or the "greenhouse effect" on human health and the environment is still uncertain, but could include increased global temperature, increased severity and frequency of storms and other "weather extremes," melting of the polar ice cap, and sea-level rise.

Ground-level ozone is a photochemical oxidant and the major component of smog. Ground-level ozone is not emitted directly into the air but is formed through chemical reactions between natural and man-made emissions of VOCs and oxides of nitrogen in the presence of sunlight. Since the reactions are stimulated by temperature, peak ground-level ozone concentrations occur in the summer months. Elevated levels above the national standard may cause lung and respiratory disorders. Short-term exposure can result in shortness of breath, coughing, chest tightness, or irritation of nose and throat. Individuals exercising outdoors, children, the elderly, and people with pre-existing respiratory illnesses are particularly susceptible.

Nitrogen dioxide is formed by both the combustion of nitrogen and the reaction of nitric oxide with oxygen in the atmosphere. Nitrogen dioxide emissions result almost entirely from fuel combustion by industry, energy producers, and motor vehicles. In addition to being a precursor to ground-level ozone, oxides of nitrogen react chemically in the atmosphere to form nitrates. These pollutants can be transported long distances from the source and can contribute to acid rain and impair visibility. Nitrogen dioxide can harm humans at elevated levels above the national standard. In particular, may cause increased respiratory illness such as chest colds and coughing with phlegm in children. For asthmatics, it can cause increased breathing difficulty.

Carbon monoxide is produced by incomplete combustion of carbon in fuels. The majority of carbon monoxide emissions come from transportation sources, principally from highway motor vehicles. Carbon monoxide reduces blood's ability to deliver oxygen to vital tissues, affecting primarily the cardiovascular and nervous systems. Lower concentrations have been shown to adversely affect individuals with heart disease and to decrease maximal exercise performance in young. Higher concentrations above the national standard can cause symptoms such as dizziness, headaches, and fatigue.

Sulfur dioxide results primarily from combustion of sulfur-bearing fuels, smelting of sulfur-bearing metal ores, and industrial processes. Major sulfur dioxide emission sources are power plants, refineries, some types of chemical plants, primary metal smelters, and cement plants. These pollutants can be transported long distances from the source and can contribute to acid rain and visibility impairment. Sulfur dioxide becomes sulfuric acid once it comes in contact with moist mucous membranes. At elevated levels above the national standard, it irritates the respiratory tract, causing restricted air flow and breathing difficulty. Individuals with pre-existing pulmonary disease are particularly susceptible to these effects.

Respirable particulate matter includes dust, dirt, soot, smoke, and aerosols emitted into the air by various sources. Major sources of particulate pollution are factories, power plants, refuse incinerators, motor vehicles, construction activity, fires, and natural windblown dust. These microscopic particles can be inhaled and deposited deep in the lungs where they can be trapped on membranes. If trapped, they can cause excessive growth of fibrous lung tissue, which leads to permanent injury. Children, the elderly, and people suffering from heart or lung disease are especially at risk.

The primary sources of lead in the atmosphere are lead-containing gasoline additives, nonferrous smelters, and battery plants. There has been a steady decline in lead levels in the air as a result of the phase out of leaded gasoline and pollution control programs. Elevated levels above the national standard can adversely affect mental development and performance, kidney function, and blood chemistry. Young children are particularly at risk due to their increased sensitivity of young tissues and organs.

Your group can learn about some of the major air pollutants by putting on a play called "The Awful 8". By performing the play, they can teach other people about the pollution problems in our atmosphere.

- Assign each part under the "Cast of Characters" and pass out copies of the play.
- Give the kids time to learn their lines, design costumes, and plan any special effects they might want to add.
- After the group performs the play, review the eight major air pollutants by having each "pollutant" come out and take a bow. The Pollutants should state their name; what causes them; how they affect people, wildlife and the environment; and what people can do to help reduce this type of pollution. Or you can have the audience supply this information to see how much they learned from watching "The Awful 8".

Procedures

- 1.) Distribute copies of the play to each student.
- 2.) Have class read play aloud, following seating arrangement for each part.
- 3.) Assign students to different roles; for homework practice lines and bring own props.
- 4.) Next 3 days - practice play.
- 5.) Present and/or video record play when students are ready.

Assessment

- 6.) Have the students list ways we can prevent or reduce the types of air pollution mentioned in the play.

Tips for Putting On the Play

- Have the Pollutants make picket signs by taping large pieces of poster board to yardsticks and writing slogans on the poster board. (See slogan suggestions in description of the play's setting.)
- If some kids prefer non-speaking roles, you can let them carry picket signs or be camera people filming the report. They could also take on the responsibilities of stage manager, costume designer or set designer.
- Go over these pronunciations with the kids playing the Toxins; benzene (BEN-zeen), xylene (ZI-leen), toluene (TOL-you-eeen).
- If your audience is small, have Harry and Connie (characters in the play) come up with some ways that people can help reduce air pollution at the end of the performance.

Sources

Pollution: Let's Clean Up Our Act, National Wildlife Federation, 8925 Leesburg Pike, Vienna, Virginia, 22184, 1-800-822-9919: The Environmental Protection Agency's Guide to Environmental Issues and What You Can Do To Reduce Air Pollution

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