

Air Quality Activity

Background

Each of your students begins the demonstration with a cup of clean water representing unpolluted air. During the demonstration, you'll read them 6 everyday activities. Each of the activities generates one or more of the pollutants listed below. When your students recognize an activity that they have participated in, they add a drop of food colouring to their cups to represent the pollutant or pollutants created by that activity. At the end of the demonstration, their cups of coloured water provide a striking visual reminder of each student's contribution to air pollution.

Familiarize yourself with the pollutants in the list below so that you can explain them to your students during the demonstration.

Particulate matter (PM10)—Particulate matter consists of airborne solids less than 10 micrometers in diameter. These tiny particles are easily inhaled into the lungs, where they can cause damage to lung tissue. Diesel fumes from busses and trucks are a source of airborne particulate matter. **Sulfur dioxide (SO₂)**—Sulfur dioxide is a toxic gas with a pungent odour. Electric power plants fuelled by coal or oil are the primary source of sulfur dioxide pollution. Sulfur dioxide emissions can cause respiratory diseases and are a key factor in acid rain formation.

Nitrogen dioxide (NO₂)—Nitrogen dioxide is a toxic, reddish brown gas by product of the combustion of fossil fuels (e.g., coal, diesel fuel, and gasoline). Nitrogen dioxide can irritate airways and increase susceptibility to respiratory diseases. It is also a factor in the formation of acid rain.

Carbon monoxide (CO)—Carbon monoxide is a colourless, odourless toxic gas. Motor vehicles are the primary source of carbon monoxide pollution. CO is highly toxic. At low concentrations it causes drowsiness and headache; it is lethal in high concentrations..

Volatile organic compounds (VOCs)—Volatile organic compounds are toxic gases made of carbon, hydrogen, oxygen, and other atoms that form gases easily. They are found in nature as well as in glue, paint, gasoline, tobacco smoke, and clothes that have been dry-cleaned. VOCs form ground level ozone, a main component of smog.

The Activity

We are often unaware of how our everyday activities contribute to air pollution. The purpose of this demonstration is to make you aware of the air pollution you create every day. The cup of clean water in front of you represents unpolluted air. You'll add drops of food coloring to the cup to represent the different types of air pollutants caused by the everyday activities that I'll describe to you. We'll use the following colors to represent these pollutants:

Color Key



Blue—pollutants from consumer products and paints (VOCs)



Green—pollutants from lawn, garden, and construction machinery (CO, NO₂, PM10, SO₂, and VOCs)



Red—pollutants from cars and trucks (CO, NO₂, PM10, SO₂, and VOCs)



Yellow—pollutants from power plants and industrial processes (CO, NO₂, PM10, SO₂, and VOCs)

Listen carefully while I describe the following activities. If you participated in the activity during the past 24 hours, add one drop of the appropriate color of food coloring to your cup of water. Some activities may not apply to you (for example, applying nail polish or mowing the lawn). That's why you each have your own cup, because each individual's contribution to air pollution is unique.

1. You showered and got ready for school. Add one drop of **blue** and one drop of **yellow** food coloring to your cup if this activity applies to you.

Blue—VOCs emitted by soap, shampoo, deodorant, hair spray, perfume, and fingernail polish.

Yellow—CO, NO₂, PM10, and SO₂ emitted by combustion used to heat the water for the shower. Remember, electric water heaters often depend on combustion too, because a lot of power plants burn fossil fuels to generate electricity.

2. You put on your favorite shirt, which your mom had dry-cleaned for you.

Add one drop of **yellow** food coloring to your cup if this activity applies to you.

Yellow—VOCs emitted by the dry-cleaning process.

3. Coming to school, you took the bus or rode in a car. Add one drop of **red** food coloring to your cup if this activity applies to you.

Red—CO, NO₂, PM10, SO₂, and VOCs emitted by the engine in your school bus or car.

4. At lunchtime, you bought lunch in the cafeteria. Add one drop of **yellow** food coloring to your cup if this activity applies to you.

Yellow—CO, NO₂, PM10, SO₂, and VOCs emitted by cooking lunch, Styrofoam trays, and plastic utensils.

5. Going home, you took the bus or rode in a car. Add one drop of **red** food coloring to your cup if this activity applies to you.

Red—CO, NO₂, PM10, SO₂, and VOCs emitted by the engine in your school bus or car.

6. You mowed the lawn with a gasoline-powered lawnmower. Add one drop of **green** food coloring to your cup if this activity applies to you.

Green—CO, NO₂, PM10, SO₂, and VOCs emitted by your lawnmower's engine.

Discussion

Ask your students the following questions:

Look inside your cups. If the air pollution around you were this apparent, would you want to breathe the air?

What other sources of air pollution, beyond those mentioned in this demonstration, could you think of as being produced in a single day?

What could you do to reduce the number of pollutants released each day?

If you have a container large enough, ask your students to pour their water into it, and then ask them to comment on the combined effect of each individual's pollution.