

Whirling Swirling Air Pollution

Grades: 9-12 and Adult

Subject: Science

NGSS (DCI) Connections: ESS3.C

Time: 1 hour

Student Objectives

- To bring awareness to the air pollutants that we contribute to the air shed each day.
- To commit to reducing activities that contribute to air pollution.

Materials

- Water
- Clear plastic cups
- Food coloring (green, yellow, blue & red)
- Props can be used while narrating this activity. Use your imagination. Here are some suggestions:
 - Small plastic car
 - Child size lawn mower
 - Fast food containers
 - Shower and hair products
 - Electric hair dryer
 - Perfumes
 - Bug spray

Background Information

There are numerous ways that everyday human activities can contribute to air pollution. These activities may not be immediately apparent as a source of pollution when you consider them from an individual viewpoint. However, the

cumulative effect can be profound. This activity attempts to simulate the cumulative effect of various air pollution sources upon the air shed.

An air shed is a part of the atmosphere that behaves in a coherent way with respect to the dispersion of emissions. Potential emissions include the following:

- Particulate Matter (PM)
- Volatile Organic Compounds (VOCs)
- Nitrogen Oxides (NO_x)
- Sulfur Oxides (SO_x)
- Carbon Monoxide (CO)

In this activity, water is used to simulate mixing, which occurs in the air.

Setting the Stage

- **RED** food coloring represents car and truck pollution.
- **GREEN** food coloring represents lawn and garden, motor boat, and construction engines.
- **BLUE** food coloring represents consumer products and paints.
- **YELLOW** food coloring represents industry and commercial activities.
- Small clear cups half full of water represents the air shed.
- Students work in pairs

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Activity

Narrate A Day in the life of... (anyone: adults, teenagers, a movie star in New York City, etc.). Be creative with your story and embellish as needed. This can be a humorous and exaggerated depiction of how someone might excessively contribute air pollutants during their daily activities. Tell the students the water represents their air shed. During the narration they are to add a drop of food coloring when they hear something that contributes to air pollution. Have fun with this!

Alarm goes off! Jump into the shower and get ready for your day.

- VOC sources: perfumed soap, shampoo and shaving supplies in the shower; use excessive amount of hot water.
- Towel dry and use deodorant, electric hair dryer, hair spray, perfume, fingernail polish to repair a nail.
- CO, NOx, PM, SOx sources: Combustion to heat water.

Add one drop of **BLUE** food coloring to your air shed.

Jump into your car and drive to work! Single driver NO carpool; forget your dry-cleaning, back track to home; go to drive thru at Starbucks.

- PM, CO, VOCs, NOx, SOx

Add one drop of **RED** food coloring to your air shed.

Arrive at Work!

- Industrial sources: PM, CO, VOCs, NOx, SOx; manufacturing, mills, construction, space heating; choose any job that might contribute air pollutants.
- Commercial sources: PM, CO, VOCs, NOx, SOx printing, painting, delivery, small manufacturing, dry cleaning.

Add one drop of **YELLOW** food coloring to your air shed.

Time for your lunch break! Take friends with you. Two co-workers want a burger; sit in drive thru 10 min on a high ozone day. The other two want tacos – another drive thru idling to stay cool with the AC on.

- PM, CO, VOCs, NOx, SOx

Add one drop of **RED** food coloring to your air shed.

Eat your lunch (flame broiled burger with fries):

- PM, CO, VOCs, NOx, SOx

Add one drop of **BLUE** food coloring to your air shed.

Drive back to work!

- PM, CO, VOCs, NOx, SOx

Add one drop of **RED** food coloring to your air shed.

Back at work! Turns AC up. Same sources mentioned above.

Add one drop of **YELLOW** food coloring to your air shed.

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Activity (Cont.)

Time to go home! Drive home in your car: Almost home and had to turn around to go back to the grocery store.

- PM, CO, VOCs, NOx, SOx

Add one drop of **RED** food coloring to your air shed.

Stop off to pick up the dry cleaning!

- VOCs

Add one drop of **BLUE** food coloring to your air shed.

Get ready for the Barbeque! It's 4:30 just enough time to mow the yard before sundown.

- PM, CO, VOCs, NOx, SOx

Add one drop of **GREEN** food coloring to your air shed.

Cookout! The mosquitos are out - spray everyone with the repellent. Get charcoal hot – use lots of igniter fluid. Grill hamburgers.

- PM, CO, VOCs, NOx, SOx

Add one drop of **BLUE** food coloring to your air shed.

Now look at the air shed in the glass. The original water was clear and pristine.

- What happened to the air shed?
- What contributed to the pollution?
- What actions were unnecessary, careless?
- What would you do differently?

Discussion

Individuals should evaluate the environmental impacts which result from the choices we make in our everyday activities. When you make a choice that reduces or eliminates the amount of pollution you contribute to the air you also reduce the need for technologies to remove or recycle the pollution.

Have the students design a sequence which describes their daily activities. Ask the students if they are willing to make one or two lifestyle changes for a semester.