

**Grade: 5**

**Subject: Science, Language Arts**

**NGSS (DCI) Connections: ESS3.C**

**Time: 1 to 2 Class Periods**

## Student Objectives

- Define air pollution.
- Demonstrate the presence of air pollution in the air around us.
- Hypothesize on the sources of air pollution in the air around us.

## Materials

- Notebook and pencil for each student
- A milk carton for each student, team or group of students
- Double-sided carpet tape
- Waterproof marker
- Directional compass
- Magnifying glass
- Colored pencils, markers or crayons
- Flashlight (optional)
- Posters (optional)

## Background Information

Clean air is healthy for us to breathe. However, air can become polluted - that is, made dirty with particles and gases - making the air unhealthy. In general, air pollution is any visible or invisible particle or gas found in the air that is not part of the standard composition of air.

Some air pollution is from natural sources, but much of it comes from human-related activities such as car exhaust, factory emissions, and products that we use. It is important to note that both indoor air and outdoor air can be polluted. This lesson is focused on outdoor air. Air pollutants can be in one of two forms: particulate or gaseous. Particle pollution is in the form of small solids or droplets. Dust, smoke, sand, ash, smog and pollen are examples of particle pollution. Particle pollution is often easy for us to notice because it can make the air look dirty or smell unusual. Sometimes we can see particle pollution when it settles out of the air and accumulates on surfaces - our cars can be covered with yellow pollen, outdoor surfaces can be covered with dust and statues can become dirty from deposited soot.

Gaseous air pollutants are in the form of a gas: carbon monoxide, radon, ozone, and sulfur dioxide are a few examples. Some gaseous pollutants are invisible and odorless, making them more difficult to detect than particle pollution. Two such invisible pollutants are carbon monoxide and radon.

## Background Info (Cont.)

Others are more obvious because we can smell them or immediately feel their effects. Gaseous pollutants can combine with water vapor and other elements to create other pollutants. For example, ozone is created by an interaction of volatile organic compounds (VOCs), nitrogen oxides, natural atmospheric gases, and sunlight.

How do we know when air pollutants are present? As mentioned previously, sometimes we can see them or smell them. Other times we might experience noticeable effects of the pollutants, such as difficulty breathing when there's a lot of ozone in the air or watery eyes when there is excessive pollen in the air.

We can also obtain air quality information from apps, websites, government agencies, the news media and social media to inform us of the air quality conditions or forecast. You can check your air at [AirQualityNow.gov](https://airqualitynow.gov) or download the AirNow app.

## Setting the Stage

### What is Air Pollution?

- Students will discover ways in which they can tell that the air is polluted, learn that there are both particulate and gaseous air pollutants, and define (in their own words) the term "air pollution".

- The class will take a "walking" field trip outside in the area around the school or learning environment. Each student should have a notebook and pencil or pen for recording their observations. (*NOTE: This does not work as well immediately after a rain, because the air and surfaces have been cleansed of most air pollution.*)
- Before going outside, students should respond to the following in their notebooks using the [NASA Kids air pollution site](https://climatekids.nasa.gov/air-pollution/) (<https://climatekids.nasa.gov/air-pollution/>):
  - *What causes air pollution? (solid and liquid particles and gases suspended/floating in the air)*
  - *Why is it important to keep track of pollutants in the air? (because they can be harmful to people and the environment)*
- Now take the students outside. Have students "smell" the air. Ask them if it smells clean, the way it does right after it rains, or if they can detect any other smells. Ask students to record what they smell in their notebooks.
- Ask students to look at the air, both right around them and toward the horizon. Is it clear or hazy? Ask them to record their observations in their notebooks.

## Setting the Stage (Cont.)

- Have students inspect objects in the vicinity to see if they can find any physical evidence of air pollutants (*stationary objects that collect dust, dirt, etc.*) and record their descriptions in their notebooks.
- When they have finished the field trip, return to the classroom and ask the students to share their findings. Ask them the following questions:
  - *Do you think polluted air always contains the same pollutants? (No) What observations tell you this? (Deposited pollutants look different, sometimes I sneeze when I go outside and sometimes I don't, etc.)*
  - *Do you think air pollutants are particles or gases? Why? (They can be either. Some we can see; some we can smell.)*
  - *You mentioned several things that you smelled or saw that let you know the air contained pollutants. Which indicate the presence of particulate air pollutants and which indicate the presence of gaseous air pollutants? (Deposited particles indicate particle pollution; smells indicate gaseous or particulate pollutants.)*
- Ask students to write a definition of the term "air pollution" in their notebooks.

## Activity

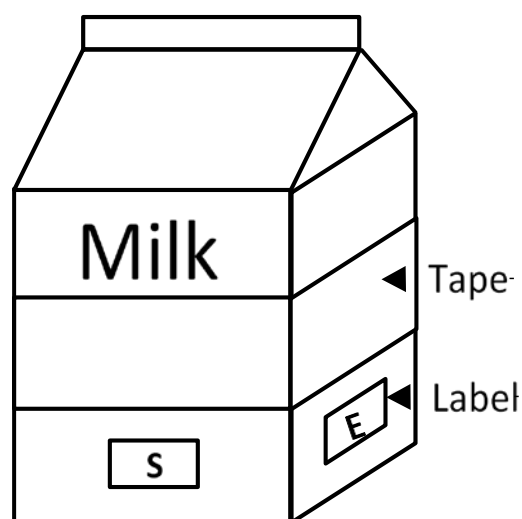
### Catching Particle Pollutants

Students will collect particle pollutants to demonstrate the presence of particle pollution have the carton labeled in the correct orientations.

1. Label the catchers 1, 2, 3, etc.
2. Place the cartons in various spots around the school, using the compass to make sure that N is facing north, etc. (*NOTE: Write on the bottom of carton the location where it is placed.*) Make a list showing where each catcher was placed.
3. Have students write their predictions about which side will "collect" more pollutants and explain their rationale.
4. After a few days, collect the cartons and examine them. On a chart write the location where the carton was placed, how much particulate matter was stuck to the tape, what it looked like (use a magnifying glass), and the direction from which the majority of the pollutants came, etc.



## Extension



- Create and share a simple map that shows all the locations where the cartons were placed, with potential pollutant sources identified (*traffic, pollen sources, factories, etc.*)
- Use colored pencils, markers, or crayons, to indicate the relative amount of particulate matter "collected" at each of the locations. This can be done as a group or students can individually create these maps.
- Discuss possible reasons more particles were caught in some locations than in others (*proximity to road, exposure, wind direction, etc.*).
- Have students write a paragraph in their notebooks that lays out the observed air pollutants and hypothesizes on where they may have originated.
- Turn off the lights in the room. Ask the students if they think that the air in the classroom is clean. Shine a bright flashlight in the dark room and ask students to observe what they see around the beam of light. Have each student draw and describe in writing what they saw. Discuss their findings. Ask the students what senses were used and what senses were not used and why.
- Have the students make a collage using pictures cut from magazines. On one half of the paper, glue pictures of people or things polluting the air. On the other half, show pictures of people cleaning up and taking care of the earth.
- Have students write a cinquain (5-line stanza) on the topic of air pollution.
- Have students work in groups to create a "Don't Pollute" poster. They can make up their own catchy slogan. Display the posters around the school.
- Have the students create an opinion survey and ask older students or adults what they think are the biggest contributors to air pollution. Have the students record only what that individual thinks is the largest contributor. Have the students bring the results back to class and discuss their findings.