

Pollution

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Abstract

During this lesson students will clarify their understanding of weather and pollution through Internet research. The purpose of the lesson is to allow students the opportunity to explain how weather and pollutants are related.

Objectives

Students will be able to:

- Explain the relationship between pollutants and weather.
- Describe the effects of one pollutant on their hometown.
- Describe the effects one pollutant has on the human body.

National Science Education Standards

Content Standard D - STRUCTURE OF THE EARTH SYSTEM

The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations. Clouds, formed by the condensation of water vapor, affect weather and climate.

Content Standard D - EARTH IN THE SOLAR SYSTEM

The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface. This is due to the tilt of the earth's rotation on its axis and the length of the day.

Arizona Science Education Standards

Strand 6 - EARTH SCIENCE

Concept 1 – Structure of the Earth

PO 1. Describe the properties and the composition of the layers of the atmosphere.

PO 5. Describe ways scientists explore the Earth's atmosphere

Concept 2 – EARTH'S PROCESSES AND SYSTEMS

PO 5. Analyze the impact of large-scale weather systems on the local weather.

Teacher Background

Ozone is the name for 3 oxygen atoms linked together. When in the upper atmosphere, ozone protects us from harmful ultraviolet solar radiation. However, when it forms in the lower atmosphere, it is corrosive and a health hazard to humans. Ozone is formed when the combination of Volatile Organic Compounds (VOCs), Nitric Oxide (NO) and Nitrogen Oxides (NO_x) react in the presence of sunlight. Therefore, ozone levels are lower in the morning and at night, when it is not as sunny, and higher in the afternoon, in the presence of sunlight. In some studies, ozone has been shown to reduce lung function. Exposure to high levels of ozone severely aggravates respiratory illnesses like asthma. Studies show that children living in communities with high levels of ozone miss more days of school than children in less polluted communities.

Particulate Matter (PM) is solid particles and liquid droplets suspended in the air. PM comes from a variety of sources and breathing in the smaller particles can be dangerous. PM 10 describes particles that are less than 10 microns in diameter. They tend to come from dust from roads, industry, agriculture, wood fires, construction and demolition, and fly ash from fossil fuel combustion. The particles can be suspended in the air anywhere from a few minutes to hours and can travel up to 10 kilometers before settling. PM 2.5 describes particles that are less than 2.5 microns in diameter. Sources of PM 2.5 include fossil fuel combustion (such as industrial and vehicle emissions), agricultural burning, and the smelting and processing of metals. These tiny particles can be suspended in the air from days to weeks and can travel from hundreds to thousands of kilometers. Some particles are even smaller. Scientists worry about the small particles because they can be inhaled and the particles (as well as the chemicals attached to them) can get into the lungs, into the bloodstream, and to other parts of the body (including the brain and heart).

Carbon Monoxide (CO) is another air pollutant of concern. The primary source of CO is motor vehicles in urban areas, hot water heaters and home heating systems fueled by natural gas. CO can bond

Asthma and Allergies Health Observance Package

with the hemoglobin in the blood. This impairs the blood's ability to carry oxygen to rest of the body and strains tissues that require high levels of oxygen (such as the heart and brain) and can decrease the ability of other cells to utilize oxygen. In the outdoor air, high levels of carbon monoxide are an indicator that there is significant traffic. Traffic exhaust is linked to an increase in incidence and prevalence of asthma and in making asthma symptoms worse.

Related and Resource Websites

<http://coep.pharmacy.arizona.edu/air/>
<http://www.airinonow.org/html/health.html>
<http://www.airinonow.org/html/ozone.html>
<http://www.airinonow.org/monsites/report.asp>
<http://www.cdc.gov/nceh/airpollution/default.htm>
<http://airnow.gov/index.cfm?action=airnow.local>

Time	1-2 class period (45 minutes)
Preparation Time	5 minutes
Materials	Computers
Teacher Preparation	Reserve lab for 1-2 days

Activity

1. As students enter the rooms have the following statements / questions on the board for them to answer on paper: "Yesterday we examined ozone, carbon monoxide and two different sizes of particles – one called PM10 and another called PM2.5. Which of these 4 pollutants do you believe is the easiest to control? Why? The hardest? Why?"
2. Allow students a few minutes to write their answers, and then have a few volunteers share their ideas..
3. Tell the students that their groups will each research the effects of one of the four pollutants discussed yesterday in *Ozone, Particulate Matter, and Carbon Monoxide – Oh My!*
4. Divide your class into 8 groups and assign pollutants. (It is recommended that there be at least 8 groups, with 2 groups working on each pollutant. This will facilitate discussion in the following lesson *Pollutant Posters*.)
5. Direct students to the Environmental Protection Agency's AirInfoNow website to locate information about your city or your region. To obtain "Local Forecasts & Conditions" start with the map at <http://airnow.gov/index.cfm?action=airnow.local>. The map is interactive by clicking on the state of interest.
6. Tell students to be sure that their research includes the following items. Of course more information is better and should reflect a higher score.
 - What are the current levels of your pollutant in your community?
 - What are the monthly/yearly averages? (Might time of year affect these averages?)
 - What are the sources of this pollutant in your community? That is, where does the pollutant come from? (This should be very detailed)
 - Where are the highest levels of the pollutant in your community? Why?
 - What air currents affect the pollutant?
7. Remind students to take notes and cite their sources. Several good cites are listed in the resources section of this lesson. Of course the list is not all-inclusive.

Embedded Assessment

Move among the students while they are doing the research. Observe their abilities to follow instructions, manipulate the internet, and record notes answering the questions. Remind those who are not recording notes to do so. Consider collecting the answer sheets for future work.