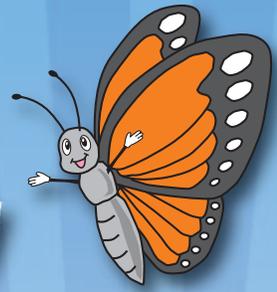


Air, Air, Everywhere



**Teacher's Guide
and Activities**

**GRADES
3-5**



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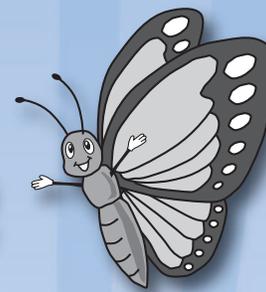
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To download electronic copies of this activity guide or to print the student worksheets, please visit:

<http://dnr.wi.gov/eek/teacher/air.htm>

Air, Air, Everywhere



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Introduction



Air can be difficult to teach about because you can't always see it, smell it, hear it, or taste it. But we cannot live without it, so learning how air quality affects our health and the health of our world is important. The pollution in the air, or "air hitchhikers," can do more than just look dirty, it can harm plants and wildlife, it can destroy buildings and surfaces, it can affect human health, and it can contribute to acid rain, ozone depletion, and climate change.

The quality of the air cannot be taken for granted. In previous generations, people burned large amounts of coal without pollution control equipment, turning our skies black. They put lead into gasoline to make engines run smoother, but didn't realize the lead was emitted into the very air we breathe. Burning of waste was common practice. These and other sources of air pollution degraded the air quality and affected public health.



We've also learned air pollution doesn't stay put. Polluted air can travel both very long distances and across our neighborhoods. If we produce air pollution in our backyards by burning trash, using wood-

fire boilers inappropriately, or idling our vehicle engines, it may move into our neighbor's yard, settle on nearby fields of crops, or end up in our water and contaminate fish and waterways.

Do you wonder if our air quality is getting worse, especially when you hear about air quality advisories? The quality of the air is actually improving, but the standards are also getting stricter. As scientists have learned

more about how air pollution affects people, they have realized air pollution can cause adverse health effects at lower levels than those at which the standards were set originally. In response to new information, the U.S. Environmental Protection Agency (U.S. EPA) has tightened standards. Since the air quality standards are stricter, we may see more days where air pollution exceeds standards even though the air is as clean as or even cleaner than it used to be. The U.S. EPA and Wisconsin DNR are constantly working to reduce pollution emissions wherever possible to make sure we meet the most recent standards.

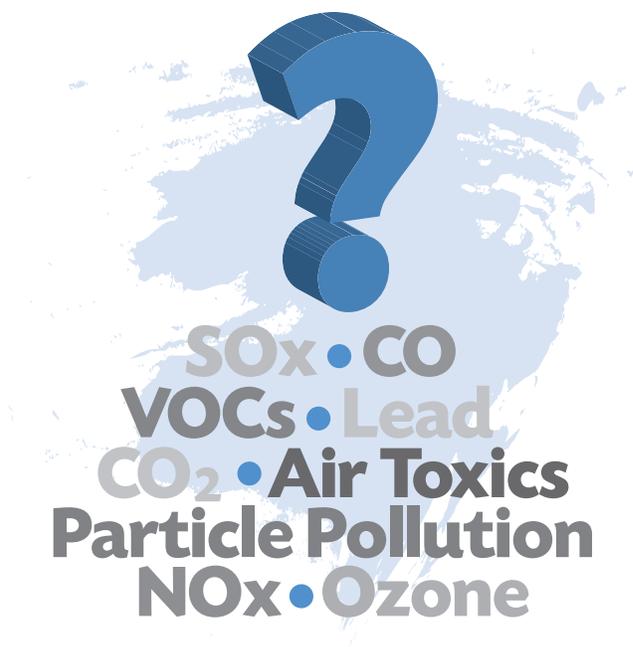


We have learned we cannot assume the air is clean. The quality of the air we breathe is important. We know air pollution can cause respiratory issues as well as cardiovascular problems. The quality of the air can also affect our immune systems—our defense against getting sick. Air quality can also influence the amount of oxygen our body receives. The more pollution in the air the less oxygen is able to travel into our bodies.

Outdoor air quality affects the respiratory health of EVERYONE. Air pollution can cause a spectrum of health effects—from mild eye, nose and throat irritation to an asthma attack. Some people may be more sensitive to air pollution due to their age, the amount of time they spend outdoors, or whether they have a respiratory ailment like asthma. Children are generally more sensitive to air pollution than adults because:

- **Children’s respiratory organs are still developing** and thus are more sensitive to air pollution.
- **Children have narrower airways** that are more severely affected by tissue inflammation from poor air quality.
- **Children have weaker immune systems** that are more vulnerable to air pollution and the substances found in it.
- **Children breathe air faster and deeper into their lungs than adults.** This allows more pollution to enter and travel deeper into the lungs.
- **Children often breathe through their mouths instead of their noses.** Breathing through the mouth bypasses the mucus and cilia of the nose which are designed to catch “air hitchhikers” and stop them from entering the lungs.

For more information on asthma, visit EEK! (dnr.wi.gov/eeek) and download the Asthma Basics reference sheet.



So where is all of this air pollution coming from?

Well, lots of places. Each time you turn on a light in your house or turn on the air conditioner, you are using power generated by a power plant. Most power plants burn fossil fuels, such as coal, oil, or gas, to create energy for our use. Other tasks we do, such as mowing our lawn, driving to the store, or painting our home, all contribute to air pollution. The U.S. EPA monitors six criteria air pollutants: particle pollution, ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur oxides (SO_x), and lead.

Particle Pollution

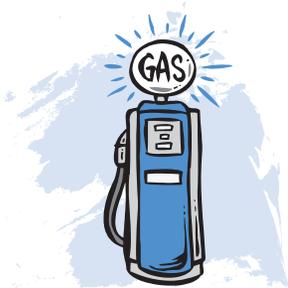


Particle pollution, also called haze or smog, is made up of tiny particles of almost any compound. Smoke, dust, water vapor, and chemicals can all be components of particle pollution. Particles can come from anywhere: driving down a dusty dirt road; smoke from burning wood, leaves, or trash; exhaust from

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your vehicle; etc. Particles are then suspended in the air and can travel in air currents for very long distances. Most of the particles cannot be seen because they are so tiny. However, we do breathe them into our lungs and the smaller the particles the deeper into our respiratory system they can travel. When in our lungs, these particles can cause coughing and wheezing. Individuals with asthma or other respiratory ailments may notice these effects sooner. Particle pollution can also interfere with oxygen getting into the blood stream. This can cause shortness of breath and extra work for the heart.

Ozone



Ozone is a colorless, odorless gas that reacts aggressively to just about anything with which it comes in contact with, including eye, nose, and throat tissue. Ozone is what we call a secondary pollutant. It is not directly emitted into the air, but rather forms from a chemical reaction between nitrogen oxides (NO_x), volatile organic compounds (VOCs), and sunlight. NO_x and VOCs primarily come from vehicle exhaust and power plant emissions. Ozone concentrations are at their greatest when the right conditions exist—hot sunny weather in the summer with plenty of NO_x and VOCs present.

You may also have heard of the ozone layer. This protective layer high up in the atmosphere protects us from the sun's harmful ultraviolet rays. The ozone layer is created from naturally occurring ozone molecules, whereas ground level ozone does not occur naturally. And we don't breathe the ozone in the high-up ozone layer. A good way to remember the difference is to say, "Ozone is good up high, but bad nearby."

Carbon Monoxide



Carbon monoxide (CO) is another odorless and tasteless gas that is very harmful to human health. CO enters the lungs and binds to hemoglobin in the blood, taking the place of oxygen. When too many CO molecules are in the blood stream not enough oxygen is getting to the muscles, organs, and brain. So where does CO come from? CO is a byproduct of incomplete combustion, commonly found in vehicle engine emissions.

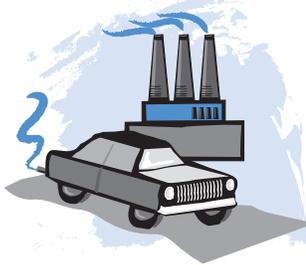
Carbon Dioxide



Carbon dioxide (CO₂) is emitted into the air through the burning of fossil fuels as well as with every breath we breathe out. Humans breathe in oxygen and breathe out CO₂. The good news is that trees and plants take in CO₂ and emit oxygen (the reverse of human and animal respiration). Plants help keep much of the CO₂ out of the atmosphere, but when we cut down trees that are storing CO₂ and then use those trees for fuel by burning them, we are not only reducing the overall amount of CO₂ that is respired by the tree, we are also emitting more CO₂ in the combustion process.

CO₂ is also well known because it is a greenhouse gas. A greenhouse gas is a gas in the atmosphere that traps the heat from the sun. On a natural scale, the greenhouse effect is very important for keeping the hospitable temperatures of our earth. However, when too much CO₂ is present in the atmosphere from the depletion of forested areas and the burning of fossil fuels and vegetation, the CO₂ in the atmosphere can trap too much of the sun's heat and cause the atmosphere to warm.

Nitrogen Dioxide and Sulfur Oxides



Commonly known as NO_x and SO_x, nitrogen dioxide and sulfur oxides are two major contributors to air pollution. The most common source of NO_x is vehicle emissions while SO_x is emitted from the burning of coal. Both can affect human health in much the same way that ground-level ozone can. The lungs can become irritated and people with asthma may have symptoms exacerbated.

Lead



Lead has been known to be a very dangerous substance for a long time. Lead can affect almost every system in the body from causing mild respiratory distress to central nervous system impairment. According to the U.S. EPA, now that we only use unleaded gasoline, the most significant source of lead exposure in the U.S. today is from the improper removal and discard of lead-based paints. If you suspect your home or school may have lead-based paint needing removal, please contact the National Lead Information Center for information.

Volatile Organic Compounds



VOCs, or volatile organic compounds, are all hydrocarbons. This means the compounds are all made up of hydrogen and carbon. VOCs are created mostly by vehicles, but can also come from industries that burn fossil fuels, ordinary house paint, charcoal lighter fluid, aerosol cans, motor boats, lawn mowers, permanent markers, and nail polish remover.

Some sources of VOCs come from nature such as the spray from a skunk. VOCs are an important component in creating ground level ozone.

Air Toxics



Air toxics, or just toxics, are pollutants in the air that can cause serious human health issues. Many toxics are suspected to cause cancer, reproductive problems, decreased immune system function, respiratory issues, or even birth defects. Some examples of air toxics are dioxin, from the open burning of trash; asbestos, found in older homes; benzene, found in gasoline; perchlorethylene, emitted from dry cleaners; and methylene chloride, a solvent and paint stripper. Other air toxics include metals such as cadmium, mercury, chromium, and lead compounds. All of these substances are considered hazardous to humans and are regulated by the EPA.

Humans can come in contact with air toxics a few different ways. One way is to breathe in the toxins. Many times we do not know we are breathing in polluted air and will not notice any effects for some time. Another way humans come into contact with air toxics is from chemicals such as mercury in the air depositing on our water or land. Plants and animals take in these pollutants through the soil and water. The toxics then accumulate in the plants' and animals' bodies until humans eat them. Then the toxics are transferred to our bodies and begin to accumulate. The more contaminated food we eat and water we drink, the more toxics accumulate in our bodies. This is called bioaccumulation. Many times we will not notice any effects of the chemicals in our bodies until the concentrations build.

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So how do we find air quality information?

Visit the DNR's Air Management web site at dnr.wi.gov/air. There you can find information on pollutants, sources of pollution, and health effects. While visiting the site, you can also learn if an Air Quality Advisory (AQA) has been called. Air Quality Advisories were created to let the public know when pollution levels are unhealthy. An Air Quality Advisory is called when air pollution levels have reached or exceeded set standards. Let your school nurses, physical education teachers, and coaches know if an AQA has been called. Students who are sensitive to air pollution should take it easy outdoors on these days.

So what can we do about air pollution?

- **Teach, teach, teach!** Get the word out about how important good air quality is and how to find out the quality of the air in your area. The younger children learn about the importance of keeping our air clean the better chance they have at being part of the solution, instead of the problem.
- **Encourage even the smallest of efforts!** It all adds up! Even tiny efforts can really add up to a large change. Remind yourself and your students that they can be the difference in keeping our air clean.
- **Implement school-wide projects** like waste-free lunches, idle-free school zones, or start a student energy patrol program
- **Visit Wisconsin DNR's "Do A Little, Save A Lot" web pages** to learn how you can reduce your personal emissions at home, at work, and while traveling to help keep our air clean.