



4th - 8th Grade

4-H PROJECT

LESSON

PLANS:

4-H Helps

YOUth

into the

21st Century



Series

2

“A-OK Air”

LSU
AgCenter
Research & Extension

Dear Project Leader,

This lesson, “A-OK Air,” is part of an effort by the 4-H Youth Development Department of the LSU AgCenter to provide teaching activities that are fun, educational and interesting. This lesson is designed to encourage application of principles taught. Students should learn key scientific concepts that can not only enhance their LEAP test scores, but be useful for years to come.

This lesson addresses Louisiana Content Standards Science Benchmarks:

- SE-E-A3: identify ways in which humans have altered their environment, both in positive and negative ways, either for themselves or for other living things;
(1, 2, 3, 4, 5)

- SE-E-A5: understanding that most plant and animal species are threatened or endangered today due to habitat loss or change;
(1, 2, 4)

- SE-M-A3: defining the concept of pollutant and describing the effects of various pollutants on ecosystems;
(1, 2, 3, 4, 5)

- SE-M-A4: understanding that human actions can create risks and consequences in the environment;
(1, 2, 3, 4, 5)



Learning Activity: “A-OK Air”

Key Concepts:

1. Air pollution is a major problem that affects our everyday lives.
2. Air pollution can lead to health risks and even death.
3. We can prevent air pollution through our everyday activities in life.

How Can Members Apply this Information?

1. Change their personal practices to help improve local air quality.
2. Use information learned to inform friends and family members about better practices to prevent air pollution.

Getting Ready:

1. Prepare set of Term and Descriptor Cards needed to play matching game.
2. Read the lesson and be prepared to teach and answer questions accurately.

What You Need for the Lesson:

Set of Term and Descriptor Cards (Provided)
 Model of Air Pollution Pathways (Provided)
 Handouts
 Perfume or air freshener

Track:

Environmental Science

Life Skills:

Critical Thinking,
 Communication, Making
 Decisions, Visualizing
 Information

Character Focus:

Citizenship, Responsibility

Project Skill:

Awareness of causes,
 effects and ways to prevent
 air pollution

Louisiana Content

Standards

Benchmarks:

SE-E-A3, SE-E-A5,
 SE-M-A3, SE-M-A4

Delivery Mode:

4-H Club meeting, science
 class, school enrichment
 and after-school programs

Time Allotted:

20-45 minutes

Number of

Participants:

Minimum 14

Background:

The air we breathe can be contaminated with pollutants from factories, vehicles, power plants and many other sources. These pollutants can be very harmful to people's health and the environment. The effects of air pollutants can be minor and reversible (such as eye irritation) or debilitating (such as aggravation of asthma) and even fatal (such as cancer).

Since 1970, the Clean Air Act has provided the primary framework for protecting people and the environment from the harmful effects of air pollution. This act has helped reduce air pollutants that are known to cause cancer and birth defects.

There are six major air pollutants for which air quality standards have been set by the U.S. Environmental Protection Agency (EPA). They are carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, particulate matter and lead. In addition to these six pollutants, toxic air pollution, also referred to as hazardous air pollution, consists of those substances in the air which are known or suspected to cause cancer, genetic mutation, birth defects or other serious illnesses in people even at relatively low exposure levels. Exposure to these toxic contaminants is regulated nationally by requiring the use of pollution controls on sources such as motor vehicles and industry, rather than by air quality standards.

Air pollution is a problem for all of us. The average adult breathes more than 3,000 gallons of air every day. Children breathe even more air per pound of body weight and are even more susceptible to air pollution.

Scientists estimate that millions of tons of pollutants are released into the air each year. Most air toxics originate from manmade sources, including both mobile sources (for example, cars, buses, trucks) and stationary sources (for example, factories, refineries, power plants). However, some are released in major amounts from natural sources such as forest fires.

Once released, pollutants can be carried by the wind, away from their sources, to other locations. Some pollutants remain airborne and contribute to air pollution problems far from the pollution source. Some air pollutants are of particular concern because they degrade very slowly or not at all, as is the case of metals such as mercury or lead. These persistent air toxics can remain in the environment for a long time (or forever, in the case of metals) and can be transported great distances.



4th-8th Grade “A-OK Air”

What You Say:	What You Show or Do:	What Participants Do:
<p>Today we will talk about air quality and its effects on the environment.</p> <p>Can anyone give me a good definition of environment? A major part of our environment is air. Why do you think air is so important? What is air pollution?</p>	<p>Encourage audience to answer questions. Give tips and help if needed.</p>	<p>Define environment (everything that surrounds us, including the Earth’s atmosphere).</p> <p>Give reasons for importance of air. (All life on Earth depends on air to survive. Humans can survive only a few minutes without oxygen in air. Plants and animals also depend on clean air to survive, and humans depend on plants and animals for food. When this air becomes polluted and dirty, all living things suffer.)</p> <p>Define air pollution (the presence of foreign chemical(s), particles or gas(es) in the air).</p>
<p>Air pollutants:</p> <ul style="list-style-type: none"> A. Are often invisible to humans B. Threaten human life and other living things C. Cause cancer, health risks and death D. Cause acid rain, smog, ozone depletion, global warming, radiation, haze and airborne toxins 	<p>Spray perfume or air freshener in the air. Have participants give their ideas of what happened to the spray and describe how it relates to air pollution.</p>	<p>Describe what happens to the spray. (You see the mist, it slowly disappears and then the smell finally goes away.) Describe how this relates to air pollution. (Even though we cannot see it or smell all the time, it is still in the air and affects us. Pollution is the same way. The smoke, haze and smell of pollution may disappear, but we still suffer the affects of this over time.)</p> <p>NOTE: Instead of this activity, have middle school participants match the six major air pollutants (Carbon Monoxide <u>CO</u>, Ozone <u>O₃</u>, Nitrogen Dioxide <u>NO₂</u>, Sulfur Dioxide <u>SO₂</u>, Particulate Matter and Lead <u>Pb</u>) with their sources and health effects. See “Six Major Air Pollutants” handout.</p>

4th-8th Grade “A-OK Air”

What You Say:	What You Show or Do:	What Participants Do:
<p>What produces air pollution?</p>	<p>Allow audience to guess sources of air pollution.</p>	<p>List sources of air pollution (vehicles, factories, power plants, construction, excavation, open fires, accidental spills, aerosols, etc.)</p>
<p>Air pollutants harm our everyday life. Today you will play a matching game to learn more about seven major effects of air pollution — acid rain, ozone depletion, haze and low visibility, global warming, smog, radiation and toxic air pollutants. You will match each of these effects with a descriptor card that gives information that is most closely related to it.</p> <p>(Share) Which major effect was hardest to match with the information that described it? The easiest?</p> <p>(Process) Why is it important to be aware of sources of pollutants and effects?</p> <p>(Generalize) Which of these has been a major effect in your community?</p>	<p>Explain to the students how to play the matching game. Select seven students or teams to be major effects of air pollution. Give each one a card with a major effect (ozone depletion, smog, acid rain, haze and visibility, global warming, radiation and toxic air pollutants). Select other students or teams to give a descriptor card with information related to one of the major effects. Give students 5 minutes to match the information to the major effect. Go around to each major effect and see if the students were able to match the effects with the correct information.</p>	<p>Play the matching game.</p>

4th-8th Grade “A-OK Air”

What You Say:	What You Show or Do:	What Participants Do:
<p>(Optional) What paths might air pollution take to reach us in our everyday lives? People are exposed to toxic air pollutants in many ways that can pose health risks, such as by:</p> <ul style="list-style-type: none"> • Breathing contaminated air. • Eating contaminated food products, such as fish from contaminated waters; meat, milk or eggs from animals that fed on contaminated plants; and fruits and vegetables grown in contaminated soil on which air toxins have been deposited. • Drinking water contaminated by toxic air pollutants. • Eating contaminated soil. Young children are especially vulnerable because they may ingest contaminated soil from their hands or from objects they place in their mouths. • Touching (skin contact) contaminated soil, dust or water (for example, swimming or boating in contaminated water bodies). <p>Where on this model might these health risks occur?</p>	<p>Show model of the path of air pollution from its source to the different ways it is deposited. Explain how we can come in contact with contaminated air, water, soil, food, etc.</p> <div data-bbox="649 619 1542 1239" data-label="Diagram"> <p>The diagram illustrates the cycle of air pollution. On the left, a factory with two smokestacks is labeled 'Toxic Pollutants Enter Atmosphere'. An arrow points from the factory to a cloud in the sky. From the cloud, two arrows point downwards: one labeled 'Some Pollutants Fall as Dry Substances' and another labeled 'Some Pollutants Fall in Rain or Snow'. Below the cloud is a large, dark mound of earth or soil. An arrow points from the mound back up to the sky, labeled 'Deposited Pollutants Evaporate to Pollute the Air Again'.</p> </div>	<p>Point out where on the model the five health risks might occur.</p>

Model of Air Pollution Pathways

4th-8th Grade “A-OK Air”

What You Say:	What You Show or Do:	What Participants Do:
<p>Now how can you and your families prevent air pollution? (Apply) How could you teach others “Solutions to Air Pollution”? What kind of game would you develop to make it fun?</p>	<p>Distribute and discuss handout to take home to families on automobile, home and shopping tips to prevent air pollution. Challenge students to promote better air quality. Ask for a show of hands from those who agree to promote better air quality as a result of this lesson.</p>	<p>Say what they will do to prevent air pollution and/or teach others. Describe game they might develop as teaching tool.</p>

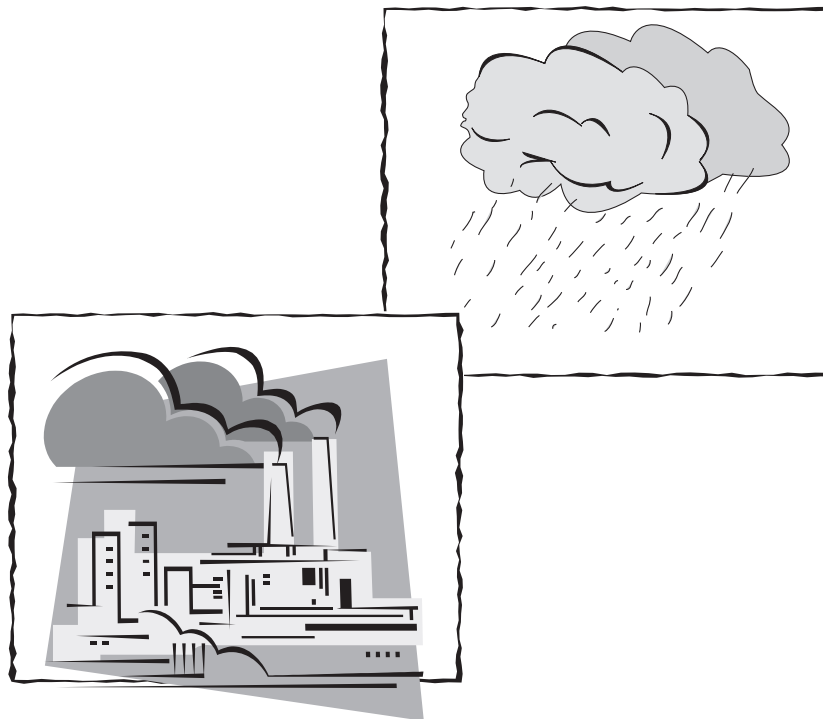
Answer Key for Matching Game

<p>Term Card (TC): SMOG Descriptor Card (DC) # 1 Can cause human lung problems including problems with the body’s ability to use oxygen # 2 Can damage aquatic life, vegetation and animals # 3 Carbon monoxide, nitrogen oxides, sulfur dioxide and lead in air over large cities</p>	<p>TC: Acid Rain DC: #1 Acid precipitation, which could also be snow or fog #2 Caused by sulfur dioxide and nitrogen oxides released by power plants, vehicles and other sources #3 Can harm people’s lungs and reduce how far we can see through the air</p>
<p>TC: Haze and Low Visibility DC: #1 Caused by tiny particles in the air #2 Decreases the view in scenic areas such as the Grand Canyon and Yellowstone National Park</p>	<p>TC: Ozone Depletion DC: #1 Damage to the protective layer above the Earth’s surface #2 Can cause skin cancer and cataracts (thick film on human eyes) #3 Caused by chemicals (aerosol propellants, for example)</p>
<p>TC: Radiation DC: #1 Caused by materials that are used to generate electricity #2 Can cause cancer or mental retardation</p>	<p>TC: Global Warming DC: #1 Increase in the Earth’s temperature (scientists are still debating this issue) #2 Can cause changes in climate or seasons #3 Can threaten human health as well as birds and fish</p>
<p>TC: Toxic Air Pollutants DC: #1 188 hazardous substances such as benzene, methylene, chloride, mercury and dioxins #2 May cause cancer #3 Can cause serious injury or death if accidentally released in large amounts</p>	

Ways to Help Members

Learn More:

- Have older members look at models and diagrams that trace the path of pollutants as they leave factories, enter the atmosphere and cycle back throughout the environment.
- Plan a field trip into the community to find sources of air pollution.
- Have them search Internet sites about specific air pollution sources and effects.
- Help them make a model of how air pollution occurs in their hometown. They can draw all major points of pollutants (power plants, paper mills, etc.) and show how they place pollutants in the air. Then they can demonstrate how these pollutants affect the surrounding area.



Resources:

<http://oaspub.epa.gov/enviro/ef-home2.air>
<http://www.awesomelibrary.org/Classroom/Science/>
www.epa.gov
www.epa.org
<http://www.tnrcc.state.tx.us/air/monops/lessonspathlesson.html>
<http://www.bio.org> (career opportunities)



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Career Opportunities:

Civil and Environmental Engineers
Ecologist
Biologist
Marine Scientist
Chemical Engineer
Science Teacher
Elementary Teacher
Botanist
Soil Scientist

Acknowledgments:

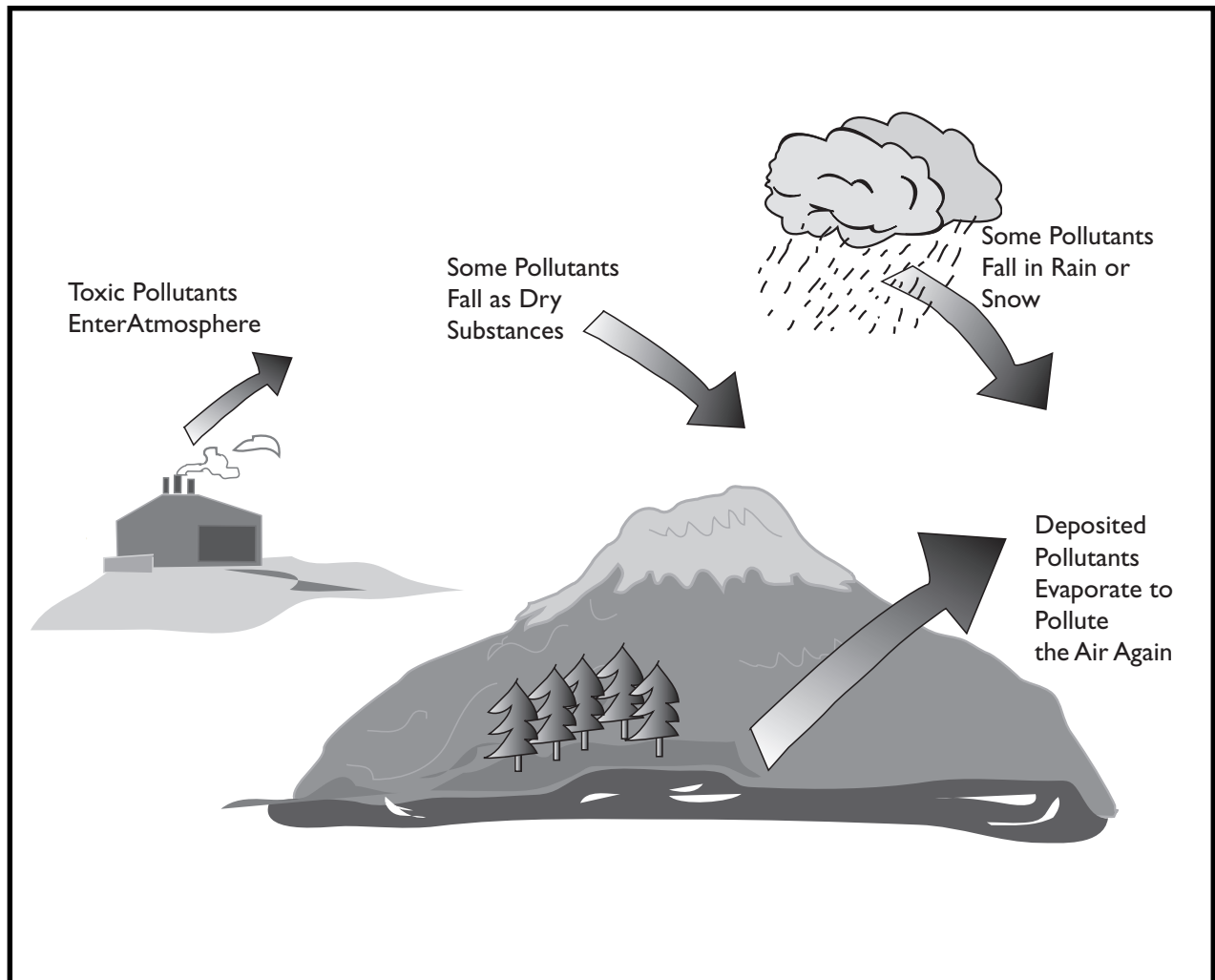
Most information for this lesson was adapted from the Environmental Protection Agency Web site. Louisiana Content Standards, published by Louisiana State Department of Education





Model of Air Pollution

Pathways:



TC

SMOG

DC

I Can cause human lung problems including problems with the body's ability to use oxygen



DC

2 Can damage aquatic life, vegetation and animals

DC

3 Carbon monoxide, nitrogen oxides, sulfur dioxide and lead in air over large cities

TC

Haze and Low Visibility

DC

#1 Caused by tiny particles in the air



DC

#2 Decreases the view in scenic areas such as the Grand Canyon and Yellowstone National Park

TC

Radiation

DC

**#1 Caused by materials
that are used to generate
electricity**

DC

**#2 Can cause cancer or
mental retardation**



TC

Toxic Air Pollutants

DC

#1 188 hazardous substances such as benzene, methylene, chloride, mercury and dioxins

DC

#2 May cause cancer

DC

**#3 Can cause serious
injury or death if
accidentally released in
large amounts**



TC

Acid Rain

DC

**#1 Acid precipitation,
which could also be snow
or fog**

DC

#2 Caused by sulfur dioxide and nitrogen oxides released by power plants, vehicles and other sources

DC

#3 Can harm people's lungs and reduce how far we can see through the air



TC

Ozone Depletion

DC

#1 Damage to the protective layer above the Earth's surface

DC

#2 Can cause skin cancer and cataracts (thick film on human eyes)

DC

#3 Caused by chemicals (aerosol propellants, for example)



TC

Global Warming

DC

#1 Increase in the Earth's temperature (scientists are still debating this issue)

DC

#2 Can cause changes in climate or seasons

DC

#3 Can threaten human health as well as birds and fish



Handout #1

Prevent Air Pollution



At Home

The choices you make affect the amount of pollution both inside and outside your home. Here is what you should do to decrease pollution and save money at the same time.

- Use energy-efficient lighting and appliances.
- Turn off appliances and lights when you leave the room.
- Use the microwave to cook small meals.
- Recycle or reuse when you can.
- Dispose of household paints, solvents and pesticides properly.
- Paint with a brush, not a sprayer.
- Keep woodstoves, fireplaces, air conditioning and heating systems well maintained.
- Cut down on air conditioning and heating use if you can.
- Insulate your home, water heater and pipes.
- Check filters monthly to save money and ensure cleaner air.

REMEMBER:

Everyone has the power to reduce air pollution.

This information is adapted from the American Lung Association Web site.

Buy Smart

Everything you buy has an effect on the environment. When you buy products that consume less energy and last longer than others, you not only pollute the air less, you send a message to industries that you want them to produce environmentally responsible products. Here's what you can do when it's time to shop:

- Buy ENERGY STAR products, including cars and houses. They are environmentally friendly products approved by the Environmental Protection Agency (EPA).
 - Choose efficient, low-polluting models of vehicles.
 - Choose recycled products.
 - Choose products that have less packaging and are reusable rather than disposable.

Drive Wise

- Drive less, especially during peak traffic periods or hot days.
- Use public transportation, walk or ride a bike.
- Shop by phone, mail or Internet.
- Combine your errands into one trip.
- Avoid waiting in long drive-through lines. Turn off your car and go in.
- Use energy-conserving (E.C.) grade motor oil.
- Minimize use of air conditioning if you can.
- Maintain auto for efficiency.
- Fill gas tank during cooler evening hours to cut down on evaporation. Avoid spilling gas, and don't "top off" the tank. Replace gas tank cap tightly.



Handout #2

Six Major Air Pollutants



What can make you cough and sneeze or make your eyes water? Air pollution! But that's mild! It can cause or worsen lung disease like asthma, bronchitis and emphysema. It can even cause premature death.

The U.S. Environmental Protection Agency (EPA) has developed health-based national air quality standards for six pollutants:

1. Carbon Monoxide _____

Carbon monoxide (CO) is an odorless, colorless, poisonous gas that comes mainly from motor vehicles and other combustion exhaust.

Health effects: Carbon monoxide interferes with the blood's ability to carry oxygen to the brain, heart and other tissues, and it is particularly dangerous for people with existing heart disease and unborn or newborn children.

2. Ozone _____

Ozone (O₃) is the major harmful ingredient in smog. It is not emitted directly into the air but produced in the atmosphere when gases or vapors of organic chemicals called hydrocarbons combine with nitrogen oxide compounds in the presence of sunlight. Major sources include refineries, gas stations, motor vehicles, chemical plants, paints and solvents.

Harmful ozone in the lower atmosphere should not be confused with ozone in the upper atmosphere, which protects us from ultraviolet radiation.

Health effects: Ozone reacts with lung tissue. It can inflame and cause harmful changes in breathing passages, decrease the lungs' working ability and cause both coughing and chest pains.

3. Nitrogen Dioxide _____

Nitrogen dioxide (NO₂) is produced when fuel is burned, especially in power plants and motor vehicles.

Health effects: NO₂ may threaten human health. Nitrogen dioxide seems to act on the body like both ozone and sulfur dioxide.

4. Sulfur Dioxide _____

Sulfur dioxide (SO₂) is created when sulfur-containing fuel is burned, primarily in power plants and diesel engines.

Health effects: Sulfur dioxide constricts air passages, making it a problem for people with asthma and for young children whose small lungs need to work harder than adult lungs. Even brief exposure to relatively low levels of sulfur dioxide can cause an asthma attack.



5. Particulate Matter

Particulate matter (PM) includes microscopic particles and tiny droplets of liquid. These particles come from the burning of fuels by industry and diesel vehicles and from earth-moving activities such as construction and mining.

Health effects: Larger particles can be stopped in the nose and upper lungs by the body's natural defenses. The smallest particles escape the body's defenses and go deep into the lungs, where they may become trapped. Exposure can cause wheezing and other symptoms in people with asthma or sensitive airways.

6. Lead

Lead (Pb) has been known as a poisonous substance for many years. Because of past major reductions and now the elimination of lead in gasoline, public exposure to lead in outdoor air has decreased significantly.

Remaining air pollution sources include lead smelters, incineration of lead batteries and burning lead-contaminated waste oil. The most common sources of current lead exposure are indoors — old lead-containing paint and soil.

Health effects: Exposure to high levels of lead can damage the blood, brain, nerves, kidneys, reproductive organs and the immune system. Lower levels can result in impaired mental functioning and development in children and high blood pressure in middle-aged men. Lead accumulates in the body, so repeated small doses can be harmful.



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