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Michigan State University Cooperative Extension Service  
4-H Club Bulletin  
Robert George, Environmental Conservation Education  
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# Leader / Teacher Guide

4-H — Youth Programs  
Cooperative Extension Service  
Michigan State University

**LEADER/TEACHER GUIDE**

**for**

**AIR**

**by**

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Extension Specialist  
Environmental Conservation Education

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This guide is a result of the pilot program evaluations and assistance of the Michigan 4-H  
Natural Resources and Environmental Education Developmental Committee.

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# LEADER/TEACHER GUIDE FOR BASIC AIR

## To the Leader/Teacher

This unit of the Basic Environment Series is designed both to give members information about air and to help them use this knowledge in various activities. The intended result of this unit is a member who has the knowledge, abilities, and the environmentally sound attitudes to deal with our air resources and the pollution problems of today's world as well as with the world of the future.

## BEFORE STARTING

1. Read the leader/teacher guide completely.
2. Read the member guide completely.
3. Note the additional resources for the air unit. If any of these resources are desired, materials should be ordered and resource persons should be scheduled at least a month in advance.
4. Decide which discussion questions and activity options will be emphasized. (You may wish to involve your class or group in these decisions.)
5. Review the air glossary and be ready to further define or discuss any of the vocabulary words which the students may not know.
6. Choose which of the concepts you will stress, and be ready to emphasize them as they are encountered in the text.

## OVERALL OBJECTIVES

- To help youths understand air and its importance in our lives.
- To investigate the causes of air pollution.
- To appreciate the many uses for air and the need for air quality.
- To help - to do something about clean air.

## ORGANIZATION OF THE MEMBER'S GUIDE (4-H 1046)

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The Air Around Us .....	1
Our Air Environment .....	2
The Air We Breathe .....	3
The Importance of Air .....	4
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Air and Health .....	13
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What the Individual Can Do .....	17

## PROJECT OBJECTIVES

Through the activities and information in this project, each member will be able to demonstrate having learned about:

- The composition of air.
- The air needs of plants and animals.
- The effects of air pollution.
- Measuring particulates in air.
- The air content of soil and water.
- Air circulation.
- Air and health.

## LEARNING THROUGH ACTION

INDIVIDUAL activity is emphasized throughout this project. Through participation in self-conducted action projects, the learning process will be expanded and the information learned will be reinforced. The activities are designed to appeal to several areas of interest and varying levels of knowledge and development.

GROUP participation in the project activities is easily accommodated and may offer special advantages. This may be of particular value with younger members and for those with little prior experience in self-conducted activity. Guided group activity is also an excellent introduction before individual studies are undertaken.

## SUPPLEMENTAL ACTIVITIES

There are many opportunities for supplementing the activities offered in this project. A particular location may be selected for intensive observation, and a series of air pollution tests that might run for several days or even weeks will expand understanding. A series of photographs and appropriate captions makes an excellent display. The study of weather is a common extension of these project activities; visits to local weather stations or demonstrations by meteorologists are exciting group activities. Individuals or groups should also be encouraged to use their imaginations in devising activities which relate air to the total concept of environmental conservation.

## AIR POLLUTION

Although local air pollution and pollution control are important to any study of air, it is equally important that members understand air as a system of world-wide influence and that the activities of people in one part of the world affect people in other parts of the world as well. It is also of value for members to recognize the interactions that occur between air, soil, and water in addition to the relationships between air and living organisms.

## KEY CONCEPTS

Several major concepts are developed through this project to promote understanding of the earth's envelope of air.

- Air components
- Convection currents
- Observation and measurement
- Air in water and soil
- Interrelationships
- Oxygen-carbon dioxide cycle
- Habitat
- Air pollution effects
- Human responsibility

Check the *Glossary on Air* (pages 6 and 9 in this guide) for definitions of words and terms used in the text.

## ACTIVITY SEQUENCE

### Introduction

Read about and discuss the air around us. Demonstrate the weight of air with the "football activity." After discussing and reviewing "Our Air Environment" encourage each member to complete each of the demonstrations.

### Activity 1 - AIR COMPONENTS (page 3)

EACH MEMBER should perform each of the five parts of this activity. This will introduce the subject of air and demonstrate the major components of the air envelope that surrounds us.

### Activity 2 - IMPORTANCE OF AIR (page 4)

EACH MEMBER may expand knowledge of air quality and health from the ordinary activities of people. A scrapbook or poster-mounted collection of current air-pollution problems and solutions will make an excellent display. Suggest the following topics for scrapbooks or displays:

1. List human activities causing air pollution.
2. Collect news items on air pollution.
3. Draw or clip pictures of air pollution sources.

### Activity 3 - BE AN AIR POLLUTION DETECTIVE (page 5)

EACH MEMBER should select a different location and perform at least four of the five detection methods at that site. A display of the detection devices and records of the results make good exhibits.

MEMBERS will also find these detection devices useful in carrying out the activity on *Pollution Sources* (page 8).

Activity 4 - MAIN CAUSES OF AIR POLLUTION (page 8)

MEMBERS may carry on this investigation individually or in groups to become acquainted with possible sources of local air pollution. This activity provides opportunity for an expanded view of the community. Illustrated reports are especially good for sharing with others.

Activity 5 - AIR IN SOIL AND WATER - TERRARIUMS (page 10)

MEMBERS may choose to build and maintain their own terrariums, or this may be a good GROUP activity. The discussions in the Follow-Up Activity list are very important to learning about the value of air in an environment.

MEMBERS may also use this activity as an introduction to the ANIMALS or PLANTS units. It is important that members understand that all parts of the environment work together in the ecosystem.

Activity 6 - NATURE'S AIR CONDITIONER (page 12)

ALL MEMBERS should take part in the inversion concept demonstration (see page 12) and a discussion of the effect inversion has on air circulation.

EACH MEMBER will gain an understanding of air movement and weather patterns from a study of weather maps. Inviting a person knowledgeable about meteorology to explain the maps to a group meeting will be helpful.

Activity 7 - AIR POLLUTION AND HEALTH (page 13)

MEMBERS will find much information about air pollution disasters in their school or local library. This will help them understand how natural weather patterns combined with moderate air pollution can have terrible consequences.

ALL MEMBERS should be aware of respiratory diseases that result from exposure to contaminated air. A guest from the public health profession may help members understand the relationship between clean air and respiratory health.

Discuss why this awareness is so important.

Activity 8 - THINGS TO DO FOR CLEAN AIR (page 16)

EACH MEMBER can write and present a report on the changes needed to make air clean. Their investigation is important to help them understand that achieving and maintaining clean air is a very complicated problem that affects everyone.

ALL MEMBERS should join in a discussion of how they and their families can help make air cleaner and keep it that way.

## MEMBER ACHIEVEMENT

Member performance in each of the activities in this unit is only one means of demonstrating achievement. The development of an understanding about ecosystems and how the activities of people affect ecosystems does not lend itself to ready measurement. However, through this project, members will be able to more effectively describe how the activities of people in the various parts of the world affect each other and the air that surrounds everyone.

## INDOOR AND OUTDOOR

The activities in this project include some which may be conducted indoors and others for the outdoors. A study of weather variations offers important opportunities for expansion of activity and further understanding of air as part of the environment. Reading and seeking information from expert sources is a particularly useful support for the concepts studied and for member growth.

## FIELD ACTIVITIES

The learning experiences in this project are focused on activities concerning an essential but nearly invisible part of the surroundings too often taken for granted. It is recommended that investigation of the activities of public agencies be encouraged and assisted so that members may broaden their experience and more deeply appreciate the complexity of air. Some of these investigations may be especially effective when conducted as group experiences.

## DEMONSTRATION ACTIVITIES

Public demonstration of achievement is an important part of youth programs. The demonstration activities may be expanded or modified to suit the needs of each member. Some members may become so thoroughly involved in a learning experience that they would like to develop their own ideas for display and recognition. This creative imagination should, of course, be encouraged. As the public displays are intended to provide some definite goals, to show achievement, and to help develop individual self-esteem, competitive instincts should be channeled constructively.

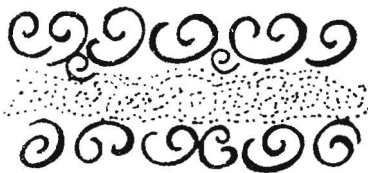


# ... a glossary on Air

**AEROSOL:** a dispersion of solid or liquid particles of microscopic size in gaseous media, such as smoke, fog or mist.

**AIR:** a colorless, odorless, tasteless gaseous mixture; mainly nitrogen (78%) and oxygen (21%) with lesser amounts of argon, carbon dioxide, neon, helium and other gases.

**AIR MONITORING:** the sampling for and measuring of pollutants present in the ambient air.



**AIR POLLUTION:** the presence in the outdoor atmosphere of one or more man-made contaminants in quantities, characteristics, and of duration such as to be injurious to human, plant or animal life or to property or which unreasonably interferes with the comfortable enjoyment of life and property.

**AIR QUALITY CONTROL REGION:** an area, designated by the federal government, where two or more communities - either the same or different states - share a common air pollution problem.



**AMBIENT AIR:** the air around you.

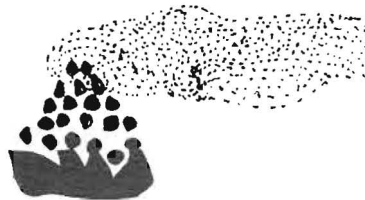
**ATMOSPHERE:** the envelope of air surrounding the earth.

**ATTRITION:** wearing or grinding down by friction; one of the three basic contributing processes of air pollution.

**CARBON DIOXIDE:** a colorless, odorless, incombustible gas formed during respiration, combustion and organic decomposition.

**CARBON MONOXIDE:** a colorless, odorless, highly poisonous gas formed by the incomplete combustion of carbon or any carbonaceous material.

**CHRONIC:** having a long duration or frequent occurrence.



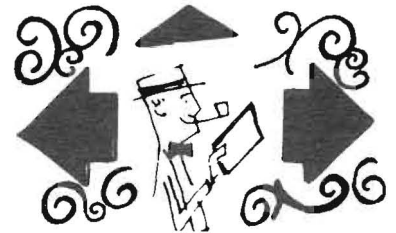
**COMBUSTION:** burning; a chemical change accompanied by the production of heat and light; one of the three basic contributing processes of air pollution.

**COMMUNITY AIR:** the air representative of an entire community.



**DUST:** solid particles capable of temporary suspension in the air or other gases; usually derived from larger masses through the application of physical force.

**ECOLOGY:** the science of the relationships between organisms and their environment.



**ENVIRONMENT:** the combination of all the external conditions and influences affecting the life, development, and survival of an organism.

**EVAPORATION:** the physical transformation of a liquid to a gas at any temperature below its boiling point.

**FLY ASH:** finely divided particles of ash entrained in gases arising from the combustion of fuel.



**FOG:** condensed water vapor in cloudlike masses close to the ground and limiting visibility.

**FOSSIL FUEL:** coal, oil and natural gas; so-called because they are the remains of ancient plant and animal life.

**GAS:** one of the three states of matter, having neither independent shape nor volume and tending to expand indefinitely.



**HI-VOLUME SAMPLER:** a device used to collect a sample of particulate matter on a filter; often called a Hi-Vol.

(Glossary continued on page 9)

After teaching this unit, please take a few moments to complete the following evaluation. It will help us in future revisions of this unit, as well as in the development of related units. Any additional comments would be especially appreciated. Upon completion of the evaluation, please send it to:

Extension Project Leader  
 Environmental Conservation Education  
 9 Natural Resources Building  
 Michigan State University  
 East Lansing, MI 48824

## BASIC AIR PROJECT

### EVALUATION

*HOW* to use this form: Encircle the number after each statement that indicates the degree of understanding the members have attained as you have taught the project.

*WHAT* the numbers indicate: (Degree of understanding)

1 — none    3 — some  
 2 — very little    4 — very much

#### A. *Characteristics, Distribution, and Status of Air Resources*

- |  |   |   |   |   |
|--|---|---|---|---|
| 1. Air is a mixture of gases, not a chemical compound.   | 1 | 2 | 3 | 4 |
| 2. Air is composed of approximately 78% nitrogen, 21% oxygen, plus carbon dioxide, water vapor, and other gases. | 1 | 2 | 3 | 4 |
| 3. The sun plays an important role in the mixing and distribution of air.  | 1 | 2 | 3 | 4 |
| 4. "Air-conditioning" is a natural phenomenon of great importance to people.                                     | 1 | 2 | 3 | 4 |
| 5. "Clean Air" is of special importance in a valley area with limited "air mixing."                              | 1 | 2 | 3 | 4 |
| 6. The quality of our air resources has decreased greatly because of people's actions.                           | 1 | 2 | 3 | 4 |
| 7. A major source of air pollution is the automobile.  | 1 | 2 | 3 | 4 |
| 8. Smog is more than a physical mixing of smoke and fog because the sun's energy interacts with particles.       | 1 | 2 | 3 | 4 |
| 9. Carbon dioxide is a very basic gas for our life (the importance of green plants).                             | 1 | 2 | 3 | 4 |
| 10. Water and soil life is dependent upon the air in the water and soil.   | 1 | 2 | 3 | 4 |

#### B. *Understanding the Uses of Air and its Importance to People*

- |   |   |   |   |   |
|---|---|---|---|---|
| 1. The oxygen in air is important to both combustion and decomposition.                 | 1 | 2 | 3 | 4 |
| 2. Nitrogen is a basic element in the growth of green plants (our earth's "producers"). | 1 | 2 | 3 | 4 |

Cut here

3. Incomplete burning is a major source of air pollution - particulate matter. 1 2 3 4
4. Air pollution is a major threat to the health of people and to the total environment. 1 2 3 4

C. *Understanding Problems and Techniques of Management*

1. Modern technology can greatly reduce the problems of air pollution if we are willing to pay for it. 1 2 3 4
2. When certain chemicals are released into the air they can have long-time effects on plant and animal life. 1 2 3 4
3. Wind action and location greatly affect the natural movement and mixing of air. 1 2 3 4
4. Particulate matter visible to the eye tends to filter out of the air quickly while very small particles can move similar to a gas and affect areas far from the source of pollution. 1 2 3 4
5. Electrostatic precipitators and "scrubbers" can greatly reduce air pollution. 1 2 3 4

*We invite your comments and suggestions.  
Please use an additional sheet if necessary.*

ADDITIONAL MATERIALS - FILMS, SLIDES, PUBLICATIONS

Michigan TB and RD Association, 403 Seymour Avenue, Lansing, MI 48914  
(write for catalog).

Michigan Department of Public Health, Air Pollution Control, 3500 N.  
Logan Street, Lansing, MI 48914.

Michigan Department of Natural Resources, Film Service, Lansing, MI  
48926.

United States Department of HEW, Public Health Service, Film Library,  
Atlanta, GA 30333 (write for catalog).

- "Sources of Air Pollution" - color, 5 minutes
- "Effects of Air Pollution" - color, 5 minutes
- "Control of Air Pollution" - color, 5 minutes

**HYDROCARBONS:** any of numerous organic compounds that contain carbon and hydrogen in various combinations.

**INCINERATION:** burning of waste material.



**INTERNAL COMBUSTION ENGINE:** an engine in which fuel is burned within the engine proper.

**INVERSION:** a state in which the air temperature increases with increasing altitude, holding surface air down along with its pollutants.

**MICRO:** a prefix meaning one-millionth; abbreviated by the Greek letter  $\mu$ .

**MICROGRAMS PER CUBIC METER:** unit used to express concentration of many air pollutants; abbreviated  $\mu\text{g}/\text{m}^3$ .

**MICRON:** a unit of measurement equal to one-millionth of a meter; symbol  $\mu$ .

**MIST:** a mass of fine droplets of water in the atmosphere.

**MIXING DEPTH:** the depth in which air rises from the earth and mixes with the air above it until it meets air equal or warmer in temperature.

**NITROGEN OXIDES:** gases formed from nitrogen and oxygen when combustion takes place under conditions of high temperature and pressure.

**ORGANIC:** of, pertaining to, or derived from living organisms; in chemistry, a carbon-containing compound.



**OXYGEN:** a colorless, odorless, tasteless gas which makes up 21% of the atmosphere by volume.

**OZONE:** an unstable, poisonous, oxidizing agent with a pungent, irritating odor.

**PARTICULATE:** a particle of solid or liquid matter.

**PARTS PER MILLION:** unit sometimes used to express volumetric concentration of gaseous pollutants; abbreviated ppm.

**PHOTOCHEMICAL:** chemical reaction initiated by sunlight.

**RINGELMANN:** a chart used for measuring the opacity of black smoke.

**SCRUBBER:** a type of control device using a liquid spray to remove solid and gaseous pollutants from an air stream.

**SMOG:** irritating haze resulting from the sun's effect on certain pollutants in the air, notably those from automobile exhaust; also a mixture of smoke and fog.

**STABILITY:** a term used to describe the ability of the air to diffuse pollution vertically; stable air results in little or no vertical diffusion, causing a buildup of pollution; unstable air has much vertical diffusion of pollution and air of neutral stability has "average" vertical diffusion.



**STACK:** a smokestack; a vertical pipe or flue designed to exhaust gases and any particulate matter suspended therein.

**SULFUR OXIDES:** compounds formed from sulfur and oxygen primarily by the combustion of fossil fuels.

**TAPE SAMPLER:** an air sampling device that automatically collects samples of gases or particles on a roll of filter paper tape at predetermined time intervals.

**TOPOGRAPHY:** the geographical surface features of a region or place.

**TURBULENCE:** air movement and mixing.

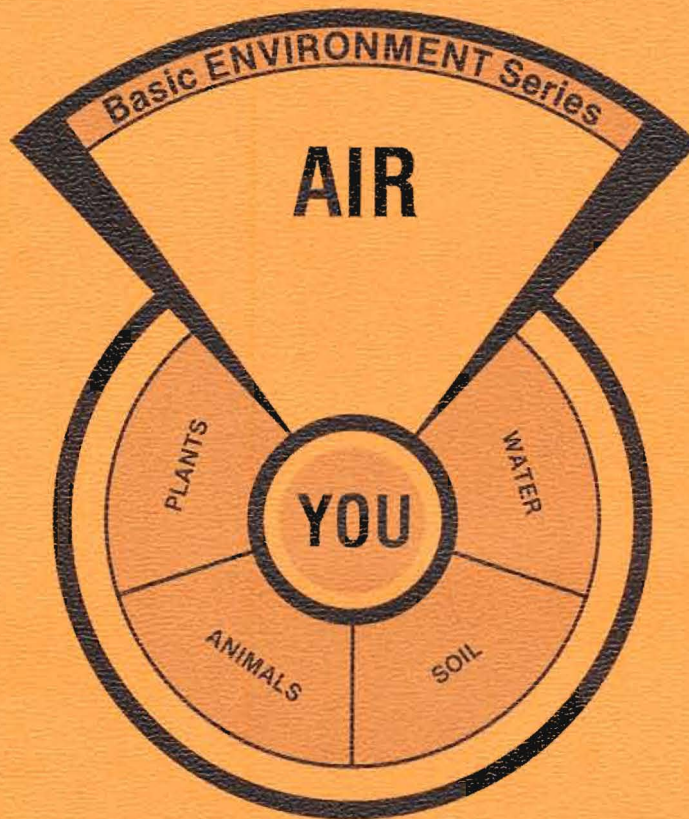
**VAPOR:** the gaseous state of any substance which normally exists in a liquid or solid state.

**VAPORIZATION:** the change of a substance from the liquid to the gaseous state; one of the three basic contributing processes of air pollution.

**VOLATILE:** evaporating readily at normal temperatures and pressures.



**WIND:** the natural, horizontal movement of air.



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