

# WE CARE ABOUT AIR: Air Pollution Problems and Solutions

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## OBJECTIVES

The students will do the following:

1. Identify air pollution problems and match these problems with possible solutions.
2. Identify ways that people can reduce air pollution.

## BACKGROUND INFORMATION

Air pollution first became a major health problem as energy was sought to power the machines and factories of the Industrial Revolution. Today the major cause of air pollution problems throughout the world is still the burning of fuels for energy.

Whether it's burning wood for heat, burning gasoline or oil for locomotion, or burning coal to produce electricity, converting fuels into useful forms of energy for today's society generates waste gases that sometimes enter the atmosphere untreated.

Certain pollutants have been identified as the most widespread problems in the air we breathe. Because of the need to establish criteria for health effects determination, these substances were named "criteria pollutants" in the United States. These criteria pollutants include carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), ozone (O<sub>3</sub>), particulate matter less than 10 micrometers in diameter (PM<sub>10</sub>), particulate matter less than 2.5 micrometers in diameter (PM<sub>2.5</sub>), sulfur dioxide (SO<sub>2</sub>), and lead (Pb). Contact with these substances at high concentration levels can cause various adverse health effects, from eye irritation and sore throat to bronchitis and more serious conditions. Other pollutants, known as "hazardous or toxic air pollutants" can also cause problems, but they tend to be more "localized" (less widespread) and near their sources.

Respiratory problems can occur when the air that we breathe carries with it irritating or harmful pollutants. Some of those pollutants are expelled from our bodies when we cough or sneeze, but others are types of gases or smaller particles that tend to stay in the lungs longer or that are absorbed into the blood and carried to other parts of the body. External problems, such as eye irritation or skin irritation, can be caused when air carrying very acidic or very basic pollutants comes in contact with our eyes and other body surfaces.

The burning of wood in fireplaces, wood-burning stoves, and campfires releases carbon dioxide, carbon monoxide and particulate matter into the air. Although the switch to unleaded gasoline has eliminated lead as a pollutant in vehicle exhaust, carbon monoxide, nitrogen dioxide, organic compounds, and particulate matter are still released from gasoline-powered engines, including automobiles. Sulfur dioxide and nitrogen oxides are the primary criteria pollutants of concern in

**SUBJECTS:** Science, Language Arts, Social Studies

**TIME:** 2 class periods

**MATERIALS:**

One die per team

One game board per team

One game marker per student

Pollution Problem Cards (included)

Solution Grid (included)

Solution Grid Key (included)

Air Pollution Awareness Certificates (included)

Air Pollution Patrol Badges (included)

Poster board or heavy card stock

Scissors

Glue

Access to laminating machine (optional)

Envelope

the burning of fossil fuels, such as oil and coal, at electricity-generating power plants, and in the smelting of metals.

Fossil fuel burning power plants are now required to control their emissions with scrubber systems in their smoke stacks, thereby greatly reducing the pollutant emissions. However, this is merely an “end-of-pipe” patch to the pollution problem – the pollutants are still being produced even though their concentrations in the atmosphere are reduced. Many other power plants have switched from coal to oil or natural gas which reduces pollutant emissions. In the smelting industry, pollutants are being reduced significantly by engineering process changes.

For general pollution control, more focus must be placed on the first of the three R's: reduce, reuse, and recycle. As end-users of energy, individuals can do much to decrease the amount of pollutants generated in the first place if they strive to minimize energy consumption.

Most families in industrialized nations have become dependent on gasoline-burning vehicles, which emit tons of pollutants into the atmosphere daily. All efforts to use these vehicles less or to use them more efficiently will have a beneficial impact. Reducing the use of vehicle might involve bicycling to closer destinations, carpooling to work and school, and combining shopping trips to minimize the total distance traveled. As for increasing the efficiency of vehicles, keeping engines tuned up and tires properly inflated will help, as will using cleaner burning fuels. Also, using slow, steady acceleration and deceleration and avoiding excessive speeds will substantially reduce the amount of fuel burning and the pollution produced. Electric vehicles also reduce air pollution because their power is usually generated by more efficient power sources.

At home, school, and work everyone can help reduce pollution by minimizing electricity consumption. Turning off lights when they're not being used, drying clothes on lines or racks instead of in electric dryers, and washing dishes by hand (or at least not using the dry cycle of electric dishwashers) are some fairly easy ways to conserve energy. Keeping appliances well-maintained and operating efficiently will also help. Regular cleaning of the coils on the back of refrigerators and changing of the air filters in furnaces will help in this regard. Homeowners can make sure their houses are heated and cooled efficiently by checking for adequate insulation and weather-stripping.

### ADD A PARAGRAPH ABOUT RADON

### ADVANCED PREPARATION

- A. NOTE: Depending on the age and abilities of your students, you may want to prepare only pollution problem and solution cards and conduct the game included in the Follow-up section instead.
- B. To make the “We Care About Air” game, copy the Gameboard, Solution Grids (front and back), and Pollution Problem Cards onto heavy card stock (one each per team). Match the front and back of each solution grid and glue together. (NOTE: You may want to let the students color the “Solution Grid” and “Pollution Problem Cards.” Consider putting the gameboard and one or more of the Solution Grids on one large sheet of poster board and laminate the entire board for future use. You may want to put the solutions on the back of the large poster board.) Then cut up the “Pollution Problem Cards” separately, laminate, and put them in an envelope.

- C. Obtain dice and game markers.
- D. Copy the Air Pollution Awareness certificates and Air Pollution Patrol Badges. (NOTE: You may want to copy the badges on heavy card stock.)

## PROCEDURE

- I. Setting the Stage
  - A. Explain that people can reduce or prevent air pollution by changing the way we do some of our daily activities.
  - B. Go over some examples of how air pollution can be prevented. Individuals can:
    - 1. Ride a bike or walk instead of driving or riding in a car. As a car burns fuel, carbon monoxide and other pollutants are released into the air.
    - 2. Use mass transit instead of riding in a car.
    - 3. Conserve electricity at home and school by turning off lights in a room that is not being used.
    - 4. Hang clothes on a line to dry instead of using an electric dryer.
    - 5. Use their leaves in a compost pile instead of burning them in a fire.
    - 6. Open windows in their schools, homes and cars instead of using the air conditioner. Air conditioners use a lot of electricity. Another way to avoid using the air conditioner is to plant trees or grow climbing vines to shade your home or school.
    - 7. Make sure that all cracks in schools, homes, and other buildings are completely sealed to save energy or to eliminate radon gas from entering the building.
    - 8. Have their cars inspected annually to make sure they are tuned and maintained properly. Not only will this increase the mileage and the longevity of their car, it will lower their car's pollutant emissions.
    - 9. Carpool to school with friends.

10. Recycle and use recycled products. Recycled products often use less energy to manufacture and save natural resources.
11. Teach others how to prevent air pollution.

## II. Activity

- A. Tell the students they will be playing a game called “We Care About Air.”
- B. Go over the scenes depicted on the Pollution Problem Cards and Solution Grid and explain each one. See the examples listed above for descriptions.
- C. Divide the students into groups of two to four.
- D. Give each group a die, two game markers, a Gameboard, a stack of Pollution Problem Cards, and a Solution Grid.
- E. Explain how to play the game.
  1. The object of the game is to reach the finish line first.
  2. Students take turns rolling one die. (They may want to roll the die once to determine who starts first.)
  3. After they roll the die, they are to move forward the number of spaces indicated on the die.
  4. If they land on a space with a “frowny sun,” they should pick up a Pollution Problem Card.
  5. Then have them try to match the pollution problem on their card with the appropriate solution on the solution grid. To see if they got the answer right, have them turn the solution grid over and check to see if the number on their Pollution Problem Card matches the number on the back of the Solution Grid. If they do, they can take the short cut to the next space. If not, they stay on that space. The short cut will advance them 8 spaces! Be sure to have them put the card back on the bottom of the stack after their turn.
  6. The first person to the finish line is the winner.
- F. Have them play the game once.

### III. Follow-Up

- A. Play a different game using the We Care About Air Problem Cards.
  1. Divide the class into two teams.
  2. Have each team line up single file. (NOTE: For younger students, instead of lining up single file, you may want to let the students work together as teams to arrive at the answer.)
  3. Explain how to play the game.
    - a. Only the first two people in each line can respond.
    - b. Tell them that you are going to turn over the game cards one at a time.
    - c. When you turn over the card, ask them to be ready to describe the source of air pollution on the card. When they are, they are to raise their hand. The first one to raise their hand gets to respond.
    - d. If they come up with a possible source, they get 10 points. If not, they get no points and the other team gets a chance to answer. If the other team is right, they get 5 points. If neither team is right, go over the scene and discuss what some possible answers might be.
    - e. The first team with 50 or more points wins.
  4. Repeat the game and have them look at the card and come up with at least one solution to the problem.
- B. Make new game cards. Have the students think up other pollution problems and solutions and draw pictures of them. Use these to make new Solution Grids and Pollution Problem Cards. Play either game again using the new cards.

### IV. Extension

- A. Have each student generate a list of three things he/she can do to reduce air pollution. (NOTE: You may want to have younger students dictate the list to you as you write it down.) Then have the students take the list home to their parents. Have the parents write a note to you indicating that their child has implemented his/her plan. Give students a certificate and badge when you receive the note.

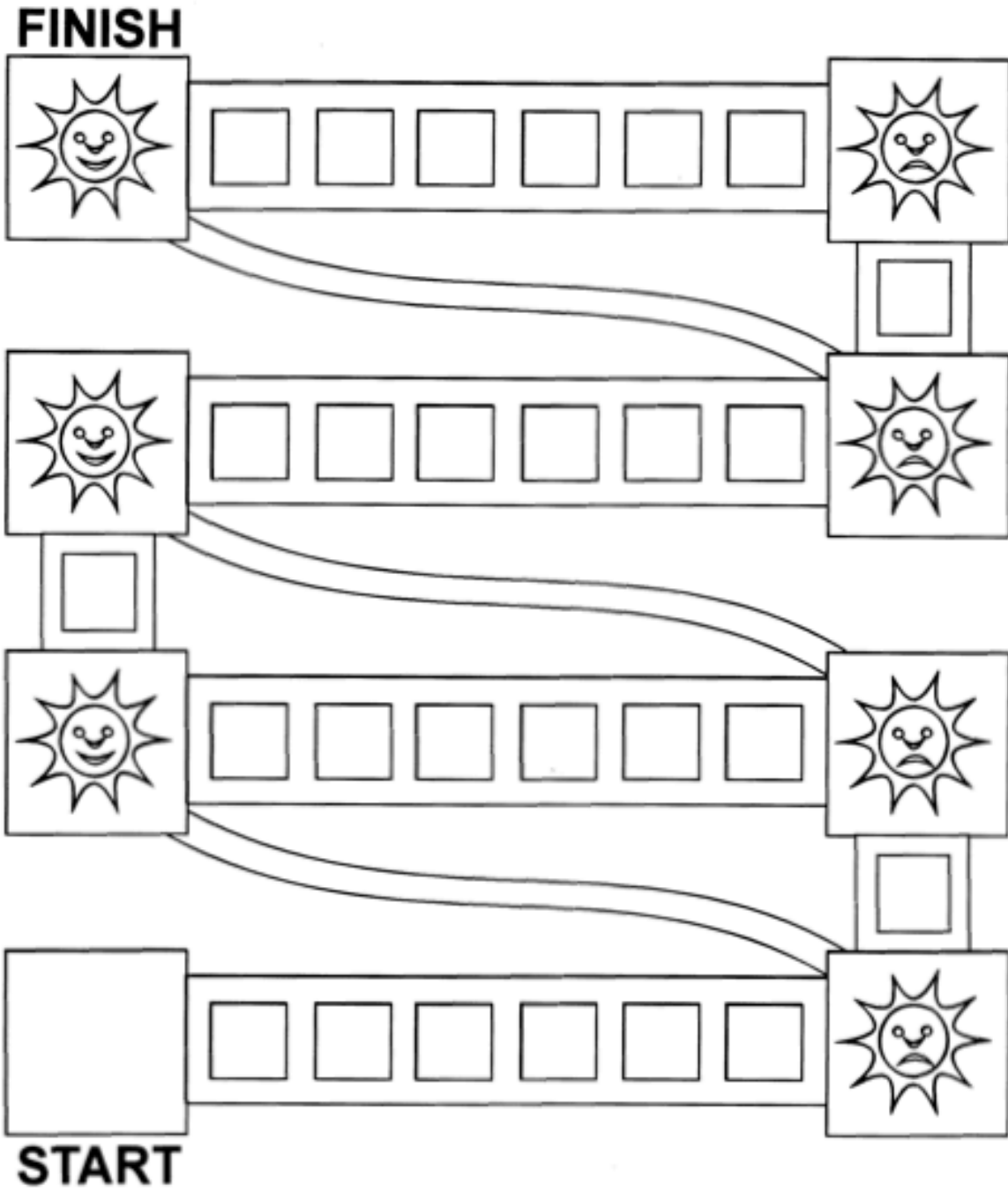
## RESOURCES

NYSDEC (New York State Dept of Environmental Conservation). Teaching Children about Air Pollution. <http://www.dec.ny.gov/education/52185.html>

WIDNR (Wisconsin Department of Natural Resources). Clean Air, Healthy Children: Teacher's Guide and Activities for Young Children. <http://dnr.wi.gov/files/pdf/pubs/ce/ce0454.pdf>

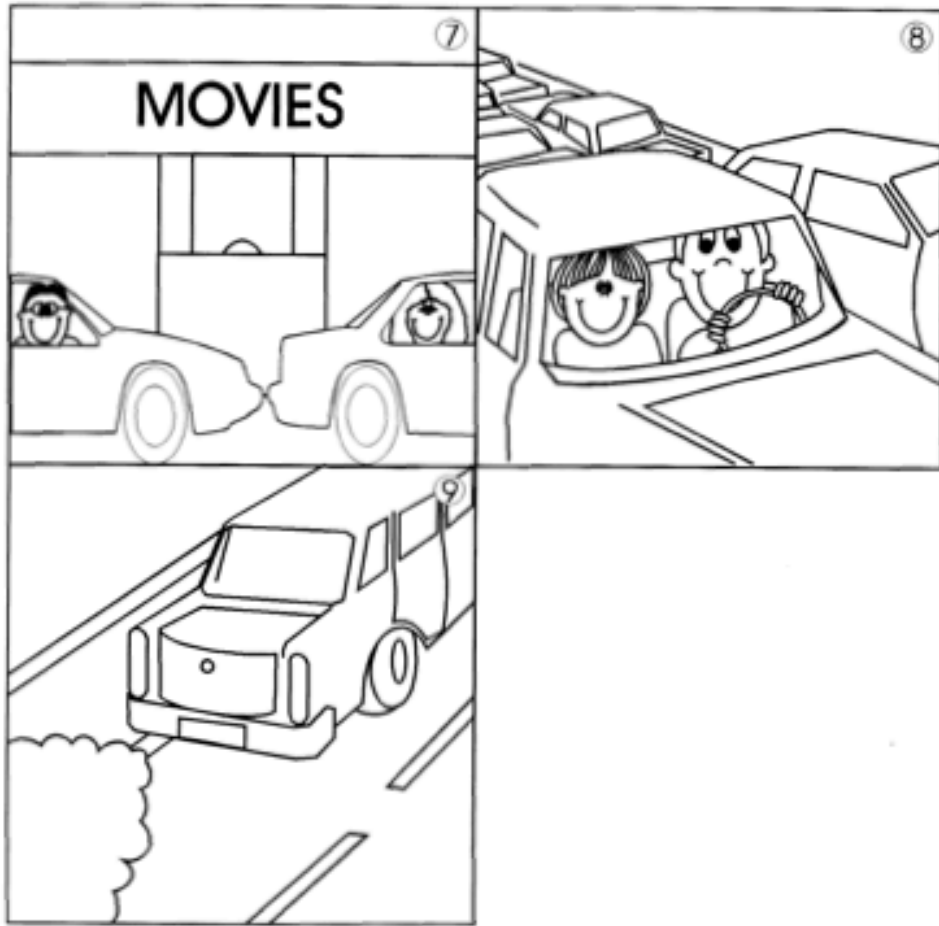
### ADD LINKS FOR:

- TIPS FOR REDUCING ENERGY CONSUMPTION IN YOUR DAILY LIFE
- RADON

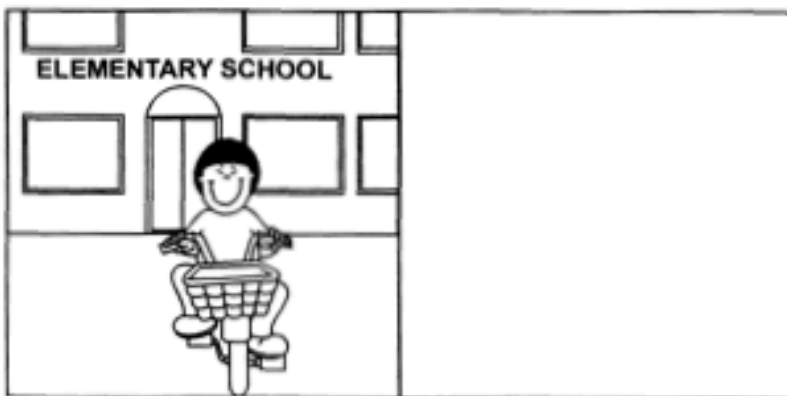
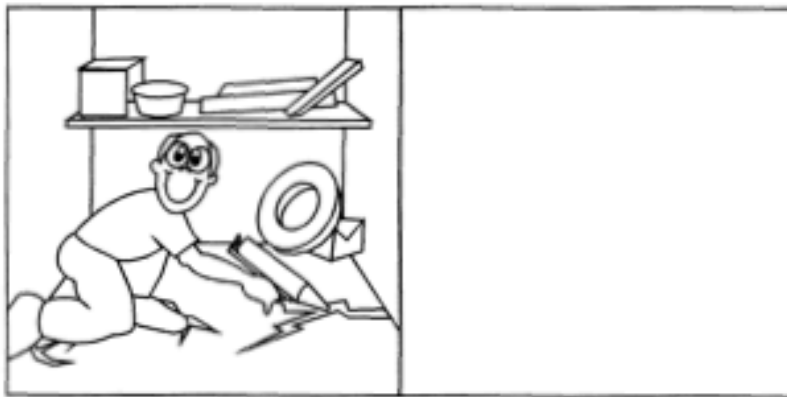
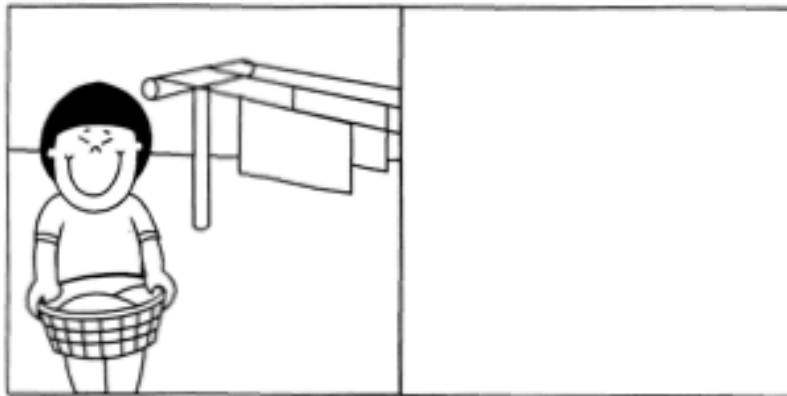








### Solution Grid Front #1



## Solution Grid Back #1 (Key)

3

Drying clothes in dryer —  
drying clothes on line

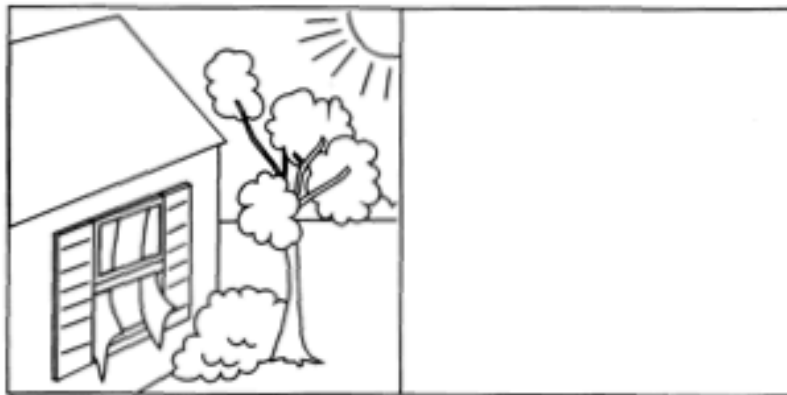
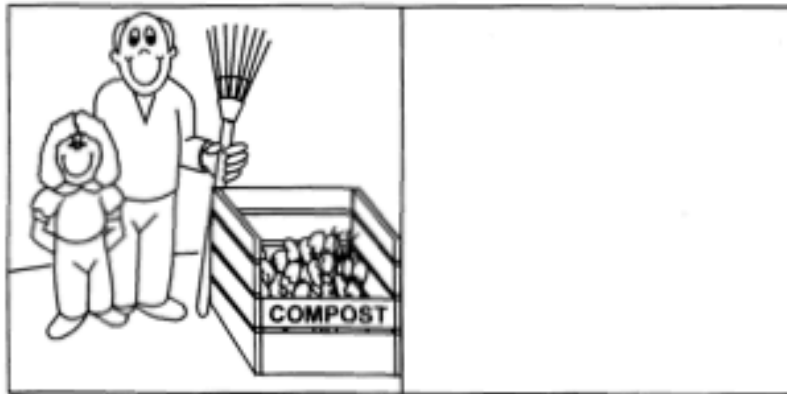
6

Garage floor cracks  
allowing radon  
seepage — cracks  
being filled

1

Child being dropped  
off at school —  
child riding bike  
to school

### Solution Grid Front #2



## Solution Grid Back #2 (Key)

4

Burning leaves —  
composting yard waste

5

Using air conditioner —  
using natural cooling

8

Using automobile —  
using mass transit

### Solution Grid Front #3



<p><b>MOVIES</b></p> A cartoon car with large eyes on the windshield, appearing to be watching something.	
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A cartoon mechanic holding a clipboard, standing next to a car on a lift.	
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A cartoon man sitting on a couch, adjusting a lamp on a side table.	
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## Solution Grid Back #3 (Key)

7

Not carpooling —  
carpooling

9

Car not properly maintained  
contributing to pollution —  
car being maintained

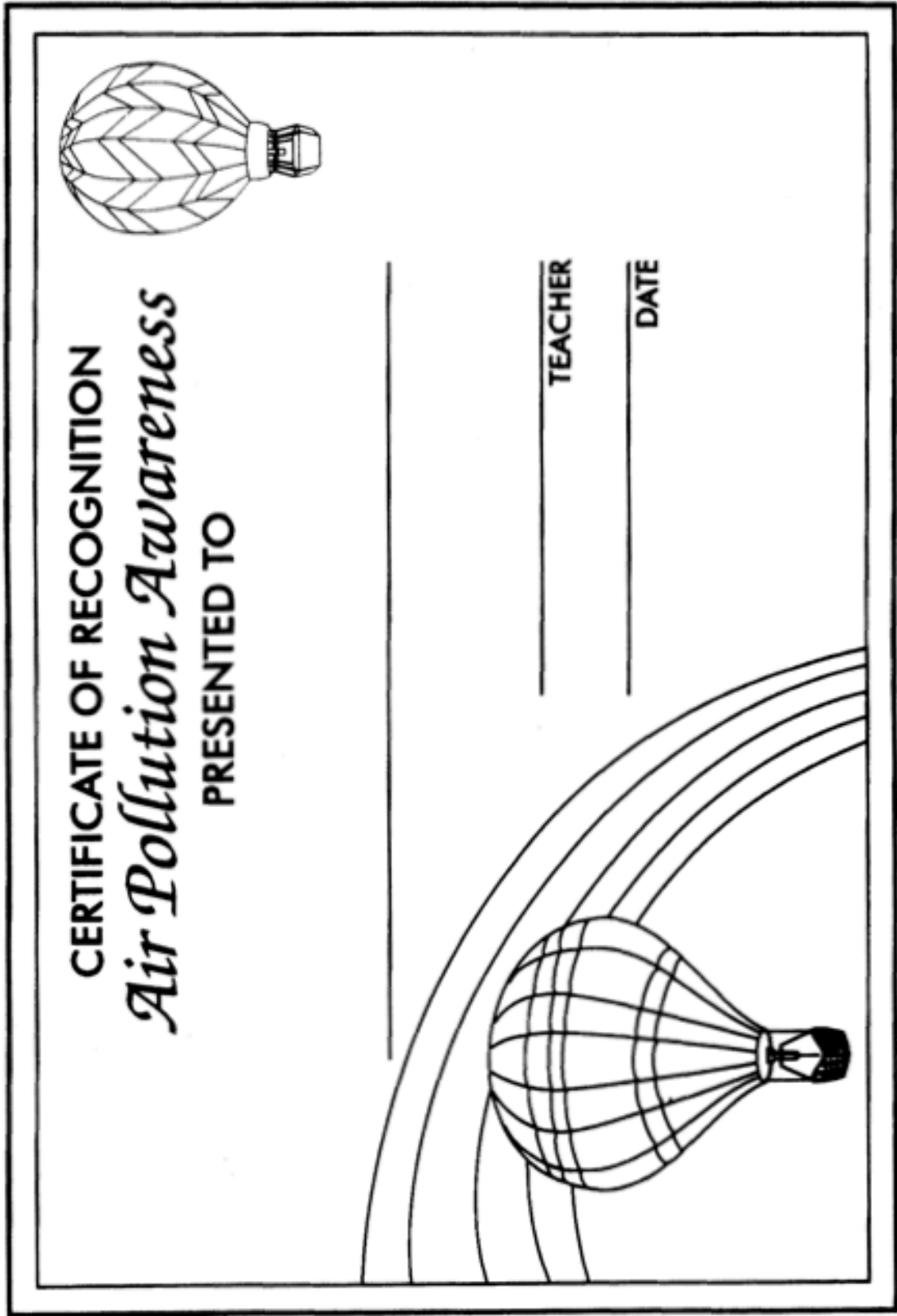
2

Light left on in empty  
room — light being  
turned off

**CERTIFICATE OF RECOGNITION**  
*Air Pollution Awareness*  
**PRESENTED TO**

\_\_\_\_\_

TEACHER \_\_\_\_\_  
DATE \_\_\_\_\_

The certificate is enclosed in a rectangular border. At the top left, there is a hot air balloon with a diamond-patterned basket. At the bottom right, there is another hot air balloon with a grid-patterned basket, positioned above a rainbow with multiple curved lines. The text is centered and includes a blank line for the recipient's name, and lines for the teacher's name and the date.



