

# WHAT IS GROUNDWATER POLLUTION DOING TO THE NEIGHBORHOOD?

9-12

## OBJECTIVES

The student will do the following:

1. Explain the potential impact of the environment on health.
2. Describe some carcinogenic contaminants and possible sources of them.
3. Develop possible ways to work toward lessening or eliminating the contaminants from the environment.

### SUBJECTS:

Science (Ecology, Social Studies (Geography), Health

### TIME:

1 class period

### MATERIALS:

colored pencils  
student sheets

## BACKGROUND INFORMATION

Chemicals introduced into the environment may find their way into groundwater and become hazards. The Environmental Protection Agency (EPA) has set drinking water standards that list amounts in mg/l (ppm) above which a health hazard could be posed either immediately or over the long term at sustained exceedance levels. They also list some possible sources for carcinogens and other hazardous compounds.

### Terms

**carcinogen:** cancer-causing agent

**hot spot:** region where an unusually high number of deaths are due to cancer that might be linked to environmental contamination

**parts per million (ppm):** a measurement of concentration of 1 unit of material dispersed in 1 million units of another (for water, same as mg/l)

## **ADVANCE PREPARATION**

- A. Copy Student Sheets for each student.
- B. Become familiar with Ellen's story.

## **PROCEDURE**

### **I. Setting the stage**

Share Ellen's story with the students. Distribute Student Sheet Limestone Ridge drawing and (optional) EPA Standards (located on Factsheet pages F-73 thru F-77).

### **II. Activity**

- A. Have students follow the coded key, complete the schematic using the given information, and answer the questions.
- B. Discuss findings as a group

### **III. Follow-up**

- A. Have students write a statement accepting or rejecting their hypotheses. Explain why the test turned out like it did.
- B. Have students list some possible sources of coliform contamination in the samples that were positive.
- C. Discuss how these contaminants affect the cost of purifying drinking water. Ask students for ideas on how to prevent contamination.

### **IV. Extensions**

- A. Have students ask questions of relatives and friends to try to discover any potential "hot spots."
- B. Have students write a letter to the EPA regarding a problem they may discover from their questions (A) or write a "simulated letter" regarding the problem in the activity (the "hot spot" on Limestone Ridge Road).

## RESOURCES

Arms, Karen, Environmental Science, Holt, Rinehart, and Winston, Inc., Austin, TX 1996.

Chiras, Daniel D. Environmental Science, High School Edition, Addison-Wesley, Menlo Park, CA, 1989.

"National Primary Drinking Water Standards," EPA, Washington D.C, February, 1994. (Latest version obtainable from the Safe Drinking Water Hotline, 1-800-426-4791).

Nebel, Bernard J. And Richard T. Wright, Environmental Science: The Way The World Works, 4th Edition, Prentice-Hall, Englewood Cliffs, NJ, 1993.

### ELLEN'S STORY - LIFE (AND DEATH) ON LIMESTONE RIDGE ROAD

Ellen had lived on Limestone Ridge Road for 44 years, all of her life except for the four years she had gone away to college. She was typical of many of the residents of Limestone Ridge Road whose parents and grandparents had lived there before them. All of the households obtained their drinking water from wells, and most of the families had been farmers for several generations.

In the 40 years Ellen had lived on the road, many of the residents had died, especially in the last ten years. Ellen's parents and sister had died of cancer in the last ten years.

Ellen had just returned from yet another neighbor's funeral, a neighbor who had, coincidentally, died of cancer. As Ellen began to think about those who had died in the last ten years, she was astonished to realize that almost every death she could remember could be attributed to cancer!

Ellen began a neighborhood drawing recording deaths by the house location of each, recording surrounding industry at its location, and also recording what information she could obtain about chemicals that had been used in farming along the road.

It is important to note that farmers are among the highest occurrences of skin cancer due to long/frequent exposure to sun. Therefore, all cancer sources may not be totally due to drinking water.

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

## LIMESTONE RIDGE ROAD DATA

# OF HOUSEHOLD  
MEMBERS  
(INCLUDES DECEASED)HOUSEHOLD  
DEATH INFORMATION

4	A. Male, age 54, heart attack; Female, age 52, cancer
2	B. Male, age 72, cause unknown
1	C. Female, age 62, cancer
5	D. Male, age 14, cancer
5	E. Male, age 53, cancer
4	F. Female, age 64, cancer; Male, age 68, cancer; Female, age 47, cancer
2	G. Male, age 62, heart attack
4	H. Female, age 41, cause unknown
2	I. No deaths in ten years
3	J. No deaths in ten years
2	K. Female, age 60, cancer
0	L. Unoccupied house
6	M. Male, age 51, cancer
3	N. No deaths in ten years

### KNOWN CHEMICAL USE

1. In fields behind houses E-H and K; ALACHLOR, SIMAZINE, NITRATES.
2. In fields behind houses M and K: METHOXYCHLOR, HEXACHLOROBENZENE, NITRATES.

Record the above information on the schematic drawing of the neighborhood. Use the following KEY:

(RED DOT)	cancer death	(BROWN SHADING)	herbicide
(ORANGE DOT)	heart disease death	(PURPLE SHADING)	insecticide
(YELLOW DOT)	cause unknown		pesticide

Answer the following questions:

- a. How many deaths have occurred in the past ten years along this section of Limestone Ridge Road?
- b. What percentage of the deaths were caused by:
 

Cancer?	_____	Heart Attack?	_____
---------	-------	---------------	-------
- c. What appear to be some environmental factors that could have influenced the development of cancer? \_\_\_\_\_  
\_\_\_\_\_
- d. If you lived in this neighborhood, what could you do to try to change the contaminant levels in the area? \_\_\_\_\_  
\_\_\_\_\_
- e. Have students research the carcinogenic nature of each chemical.
- f. Assess neighbor's well depth.
- g. What is the direction of groundwater flow?

1. Look at student's color coded drawing, or prepare an overhead transparency of the drawing and color code with input from students.
  
2.
  - a. 13 deaths
  - b.  $9/13 = 69\%$  of the deaths were due to cancer
  - c.  $2/13 = 15\%$  of the deaths were due to heart attack
  - d. Answers will vary -

Could include: limit or eliminate contaminants sprayed on crops; check and change, if needed, by-products of plastics plant.

NOTE: Accumulated contaminants in the soil would be difficult to "clean-up."

# LIMESTONE RIDGE ROAD

