INVESTIGATION 6

HOW MUCH RADON IS AROUND YOU?

INTRODUCTION

There are three principal sources of radon found in indoor air: 1) rocks and soils under the building, 2) building materials used in construction, and 3) radon dissolved in the water supply. Of these three, the rocks and soils under the building are by far the most important. Some kinds of rocks, and the soils that form from their breakdown, are more prone to giving off radon than others. This is because some rocks contain more uranium than others, especially some granites and gneisses, marine shales, and some limestones.

Radon is a gas which can move through cracks and fissures in rocks and through the air spaces in soil. The major factors that influence the movement of radon into a home include the uranium and radium concentrations of the rock and soil materials beneath the home, pathways through the rocks and soil to the base of the home, openings from the soil directly into the home, and the amount of suction created by air flows within the home. Once radon gets into a home, its concentration in the indoor air is influenced by the amount of household ventilation. Opening windows and doors, operating bathroom and kitchen fans, and operating clothes dryers all tend to change the radon concentrations by increasing ventilation and/or by pulling more radon in from the soil to the lower levels of the home. Because radon enters the home from the underlying soil, it seldom reaches high concentrations above the second floor of a building. If you live on a higher floor, for example in an apartment building, you should carry out this exercise with a classmate who lives closer to the ground floor. **In this exercise you will conduct a radon audit of your home.**

OBJECTIVES

To identify sources of radon entry into homes and factors that influence radon concentrations in indoor air.

PROCEDURE

Students will conduct a radon audit of their homes to determine possible areas for radon entry into the home and to estimate the extent of household ventilation. Students will discuss factors influencing radon accumulation in their homes and strategies for reducing radon levels.

DATA GENERATION

1. Draw a schematic diagram of your entire home, illustrating the major potential routes of radon entry from beneath the home.

2. Using a tape measure and calculator, estimate the total size, in square centimeters, of all visible cracks, openings, and holes in your home that increase the ventilation inside the home even when all windows and doors are kept closed. Add three square centimeters to your total for each fan that is ducted to the outside and six square centimeters for each fireplace or woodstove. Divide the total size of all openings to the outside by the total area (also in square centimeters) of the *outside* walls, floors, and ceilings in the home. Do not include the area of inside walls, floors, or ceilings between floors. This calculation will give you the estimate of the ratio of air leaks to surface area of your house.

ANALYSIS

3. List what you believe to be the three most important routes of radon entry into your home.

(1) _____

(2) _____

(3) _____

4. Use a spreadsheet and graph to record the total amount of ventilation for each home in your class. If a spreadsheet is not available, graph the data by hand using a bar chart.

5. Assuming that the concentrations of radon in the air inside your home exhibit the following pattern, determine the person in your family who has the greatest exposure to radon at home.

- basement (or crawl space if there is no basement) - highest concentration
- first floor - 1/2 the concentration in the basement or crawl space
- second floor (if present) - 1/2 the concentration on the first floor
- all higher floors 1/10 the concentration in the basement or crawl space

Hint: You will need to estimate the average number of hours per day each family member spends on each floor of the home.

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6. How do the routes of radon entry into your home compare with the homes of your classmates? How about the total amount of ventilation under closed-door conditions?

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CONCLUSIONS

7. List three actions that you could take if you wanted to reduce the radon concentrations that you are exposed to inside your house.

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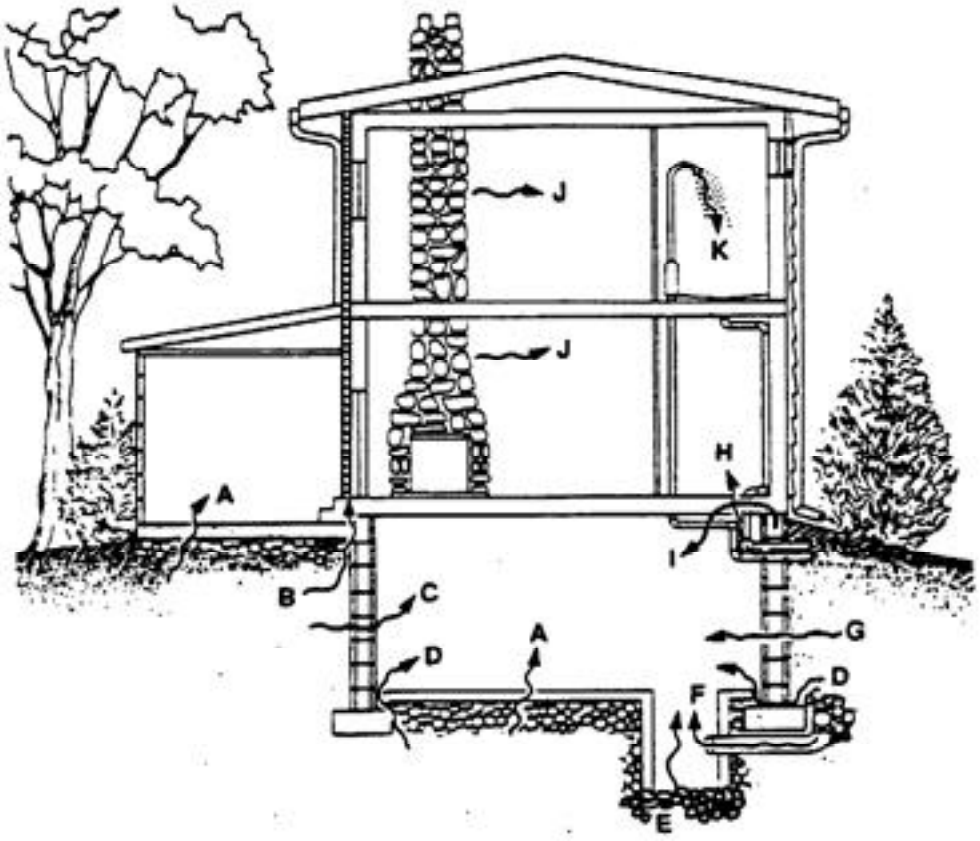
8. Given the information that you have collected in this exercise, do you think that radon is a problem in your home? What information are you lacking that you would need to make a reasonable evaluation? How could you obtain the needed additional information?



A. Cracks in concrete slabs
B. Spaces behind brick veneer walls that rest on hollow-block foundation
C. Pores and cracks in concrete blocks
D. Floor-wall joints
E. Exposed soil, as in a sump
F. Weeping (drain) tile, if drained to open sump
G. Mortar joints
H. Loose fitting pipe penetrations
I. Open tops of block walls
J. Building materials such as some rock
K. Water (from some wells)

Figure 1. Possible routes of radon entry from soil into a typical home.

NOTES