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UNDERSTANDING RADON IN THE HOME

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Concern about indoor radon gas concentrations has been increasing. Radon gas is odorless, colorless, tasteless and is the result of the natural breakdown of uranium. Radon is commonly found in rocks and soils containing uranium, granite, and pitchblende. Outdoors, radon gas is not a problem because it is diluted in the air. High indoor radon concentrations were first detected in energy-efficient or "tight" homes. These homes have a low air exchange rate which causes the radon gas to collect. A factor involved in determining radon concentrations is the underlying soil and rock. But housing construction differs, and the only sure way to know if there is a radon problem is to test for it.

Exposure to radon gas over a period of time can cause lung cancer. As radon decays, radioactive alpha particles are formed. These particles are inhaled and damage lung tissue resulting in cancer.

Radon Entry Routes

Radon gas can enter a home through cracks in concrete walls and floors, sumps, hollow block walls, and dirt floors. (See Figure 1). The gas seeps into the house from underlying soil and rocks. Therefore, a house with a basement or unventilated crawl space has a greater incidence of radon entry. But houses may be built to prevent the entry through the use of plastic films and barriers. Another possible entry route is through the water supply. Ground water passes over rocks that contain radon. The gas is then absorbed in the water and released when the water is used in the home. Building materials such as stones in a fireplace or a storage bed for a solar heating system can also release radon gas.

Radon Testing Methods

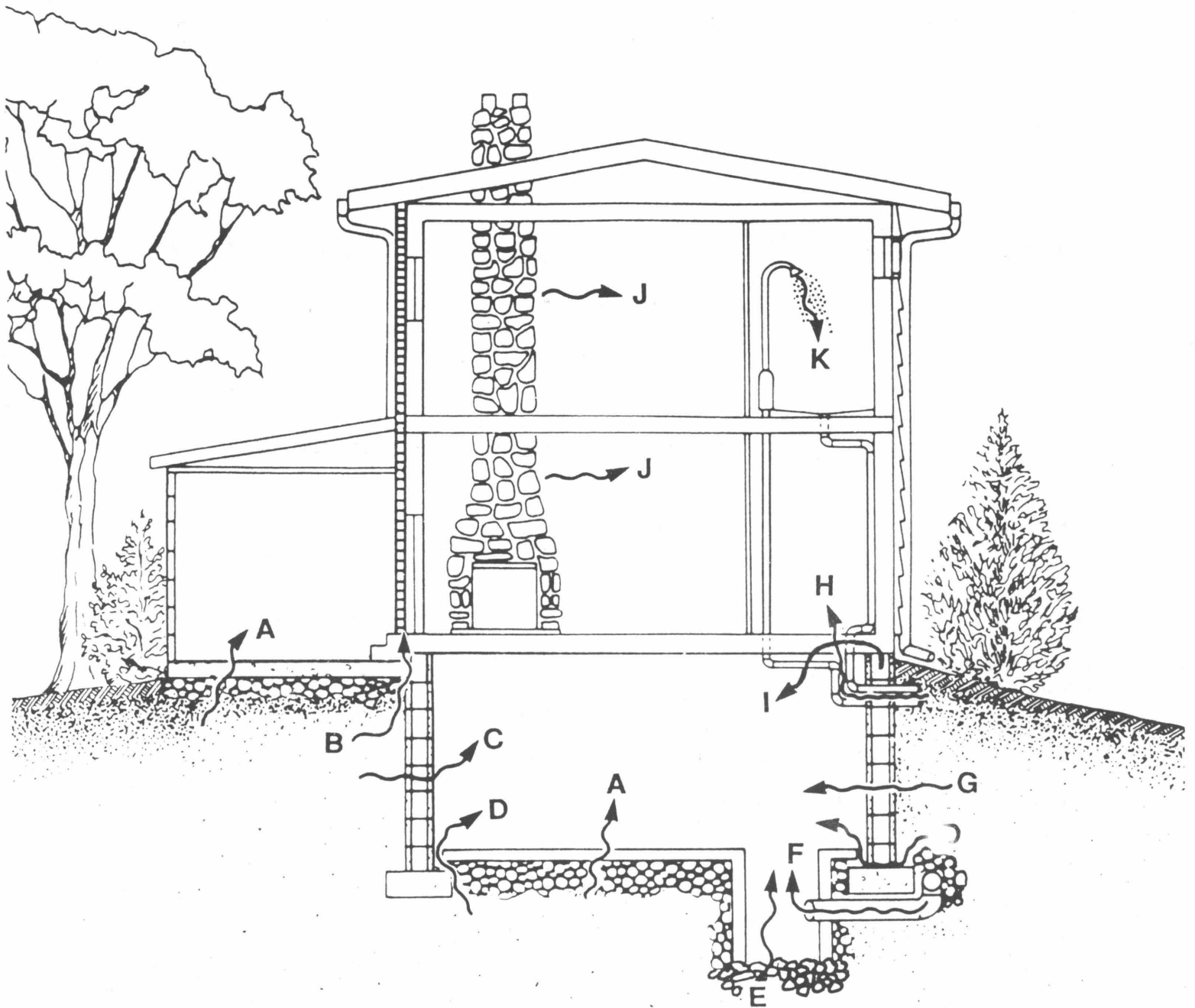
When deciding to test for the presence of radon gas, remember that radon levels can vary depending on the season. Levels seem to be lower in the summer when windows are open and higher in the winter because the house is closed up. Therefore, several measurements are recommended to insure an accurate reading.

There are several different testing methods. The devices differ in the exposure time, availability, cost, and the experience needed for operation. The most common short-term devices are the charcoal canister and the alpha-track detector. These devices are recommended for screening or initial testing and can be used several times throughout the year to establish an average radon concentration reading. A high reading from a screening test may need to be followed up with a more precise test using another measuring device.

Charcoal Canisters The charcoal canister measures radon gas. It consists of a container filled with activated charcoal (see Figure 2). Charcoal canisters can be ordered from distributors and received through the mail. The canister is placed in a closed area from 3 to 7 days. When testing is completed, the canister is resealed and returned to the distributor for processing and evaluation.

The cost for these services ranges from \$10 to \$25. Any homeowner can perform the testing since no special skills are needed for making the measurement. The canister can be placed anywhere and will yield precise results with the proper analysis. Charcoal canisters, however, are sensitive to temperature and humidity which may affect the test re-

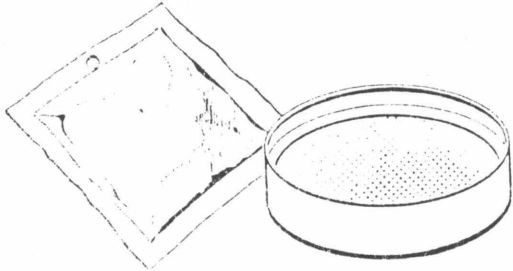
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MAJOR RADON ENTRY ROUTES

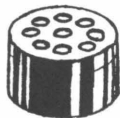
- A. Cracks in concrete slabs
- B. Spaces behind brick veneer walls that rest on uncapped hollow-block foundation
- C. Pores and cracks in concrete blocks
- D. Floor-wall joints
- E. Exposed soil, as in a sump
- F. Weeping (drain; tile, if drained to open sump)
- G. Mortar joints
- H. Loose fitting pipe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

sults. This is only a short-term testing method and careful control must be taken to make sure that the house is closed 12 hours before and during the test.



Alpha-Track Detectors The alpha-track detector measures radon alpha particle activity. The testing device is made up of a small sheet of special plastic material enclosed in a filtered container (see Figure 3). Radon gas enters the container and radon particles collect on the filter paper. As the gas decays, alpha particles are emitted and permanently mark the plastic sheet.

The alpha-track detector can be mail ordered and usually costs between \$20 and \$60. This type of testing device is good for both screening and follow-up measurements. The testing period lasts from a minimum of 3 months to 1 year. The detector is returned to the distributor at the end of the testing period for processing and evaluation. The advantages of the alpha-track detector include that no special skills are needed for making a measurement and no power source is needed for the device. The disadvantage is the length of time it takes for the testing period.



Test Results

The actual test results will provide the homeowner with an idea of the average radon concentration in the home. The test results will be recorded in either picocuries or working levels. A picocurie (pCi/l) is a measure of the amount of radon gas present in a liter of air. The results from a charcoal canister and alpha-track detector will be in picocuries. A few companies will report test results using working levels (WL) which measure the amount of radon decay products present. The Environmental Protection Agency (EPA) has established 4 pCi/l or .02 WL as the measurement above which action should be taken to reduce the radon level in the home.

One way to consider the risk associated with radon exposure is to compare it to other risks from different activities. Exposure to various radon levels over a lifetime can be compared to the risk of developing lung cancer from smoking. For example, a radon measurement of 4 pCi/l is 10 times the average outdoor level. The estimated number of lung cancer deaths due to radon exposure at this level is 13 to 15 per 1000 people. Compare this level to 20 pCi/l which is equivalent to 100 times the average outdoor level. This measurement is comparable to smoking 2 packs of cigarettes a day and estimated deaths are 60 to 120 per 1000 people. In addition, risks are multiplied when combined with other air pollutants such as cigarette smoke.

There are several factors to consider when deciding what action, if any, should be taken to reduce the radon concentration. One must determine the amount of time spent in the home, how long you will live in the home, characteristics of the residents living in the home, the radon concentration detected, and the costs of reduction methods. The longer one is exposed to radon, the higher the risk of developing lung cancer. Children are especially at risk because they spend the greatest amount of time in the home and their bodies are still growing.

Radon Prevention

A basic way to prevent radon entry is to avoid an unbalanced airflow between the indoors and the outdoors. When the difference between the indoor and outdoor air pressure is unequal, radon gas is drawn into the house. Having the windows open only on the downwind side of a house causes air to be drawn out of the house. This pulls the radon gas

from the soil into the house through cracks in basement walls and floors. Opening windows on the opposite sides of the house allows for cross ventilation and establishes a more equal indoor/outdoor air pressure. Exhaust fans and other appliances such as clothes dryers, woodstoves, and gas, oil, or wood furnaces contribute to a low indoor air pressure by consuming indoor air or forcing it out of the house. To help reduce the amount drawn in, open a window when using an exhaust fan or install external air sources for appliances.

Simple measures can be taken to reduce the radon level in your home. Just increasing the amount of

air flow in the house through the use of windows, doors, and air-to-air heat exchangers can help decrease the radon concentration. Further managed ventilation of the basement or crawl space can dilute the radon level and lessen the risks. Sealing cracks in the basement floor and walls can also help. These are only a few of the radon reduction methods available. Others differ in their complexity and costs. More information about any of the topics discussed can be obtained from the Virginia Bureau of Radiological Health or the U.S. Department of Environmental Protection.

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