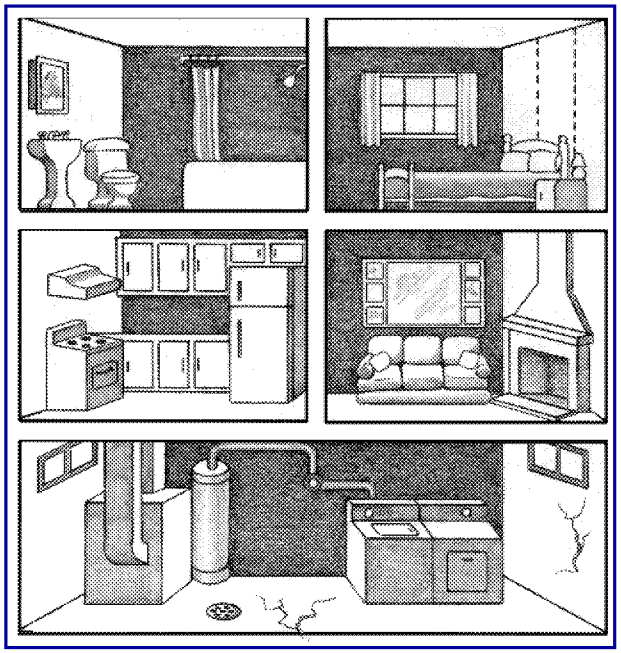
HOW-TO BOOKLET #3402

RADON IN THE HOME

TOOL & MATERIAL CHECKLIST

- ❑ Charcoal Test Canister
- ❑ Electret Ion Detector
- ❑ Sump Pump
- ❑ Crawlspace Vents
- ❑ Cement Crack Filler
- ❑ Heat Recovery Ventilator (HRV)
- ❑ Alpha Track Detector
- ❑ Drain Tile
- ❑ Plastic Pipe
- ❑ Heavy Plastic Sheeting
- ❑ Window Fan

Read This Entire How-To Booklet for Specific Tools and Materials Not Noted in the Basics Listed Above.



Radon is a colorless, odorless, tasteless radioactive gas that occurs naturally and is found in low levels everywhere. When radon becomes trapped in buildings, concentrations can increase in indoor air and radon exposure becomes a concern.

It's important to keep in mind that radon is a deadly gas. It is the second leading cause of lung cancer in the United States. Only cigarette smoking is responsible for more lung cancer deaths. The Environmental Protection Agency (EPA) and the Surgeon General have strongly recommended that all residences (except those above the second floor in multi-level buildings) be tested for radon. Of course, if you smoke and your home has high radon levels, your risk of lung cancer is even greater.

HOW RADON ENTERS THE HOME

Radon is a by-product of the natural decay of uranium, an element found in the ground. Uranium is a radioactive element that decays and forms radium which gives off radon gas. This gas travels up through the ground and infiltrates the water and air we breathe. When it reaches the surface of the ground, the gas can take one of two paths. Radon can go directly into the air, where it does not usually do any damage, or it can seep into a building, where it collects and causes health problems.

Some parts of the United States are more susceptible to radon gas than others. Air pressure inside your home is lower than pressure in the soil around your home's foundation. This difference in pressure makes your house act like a vacuum. Radon gas is drawn in through cracks, open seams, holes in the foundation and just about any other openings below the surface of the ground.

Radon may also be present in well water. It can be released into the air in your home from water used for showering and other household uses. In most cases, radon entering the home through water is a small risk compared to radon entering from the soil. In a small number of homes, the building materials can give off radon, although building materials rarely cause radon problems by themselves **(Fig. 1)**.

DETECTING RADON IN THE HOME

There is only one way to find out if radon is in a building. Test for it. The EPA recommends two general ways of testing for radon:

Short-Term Testing. The quickest and cheapest way to test is with short-term or passive tests. These remain in your home for 2 to 90 days, depending on the device. Charcoal canisters, electret ion chamber, continuous monitors, and charcoal liquid scintillation detectors are most commonly used for short-term testing. Because radon levels tend to vary from day to day and season to season, a short-term test offers a less conclusive evaluation than a long-term test. For quickest results, use a short-term test followed by a second such test.

There are many kinds of low cost short-term, "do-it-yourself" radon test kits available in hardware stores and home centers. Buy a test kit that has passed EPA's testing program or is state-certified. These kits display the phrase "Meets EPA Requirements." They are not very expensive.

Long-Term Testing. The more expensive long-term or active tests remain in your home for more than 90 days. Alpha track and electret detectors are commonly used for this type of testing. A long-term test gives a reading that is most likely to tell your home's year-round average radon level. Radon gas detectors that monitor gas levels on a continuous basis are also available.

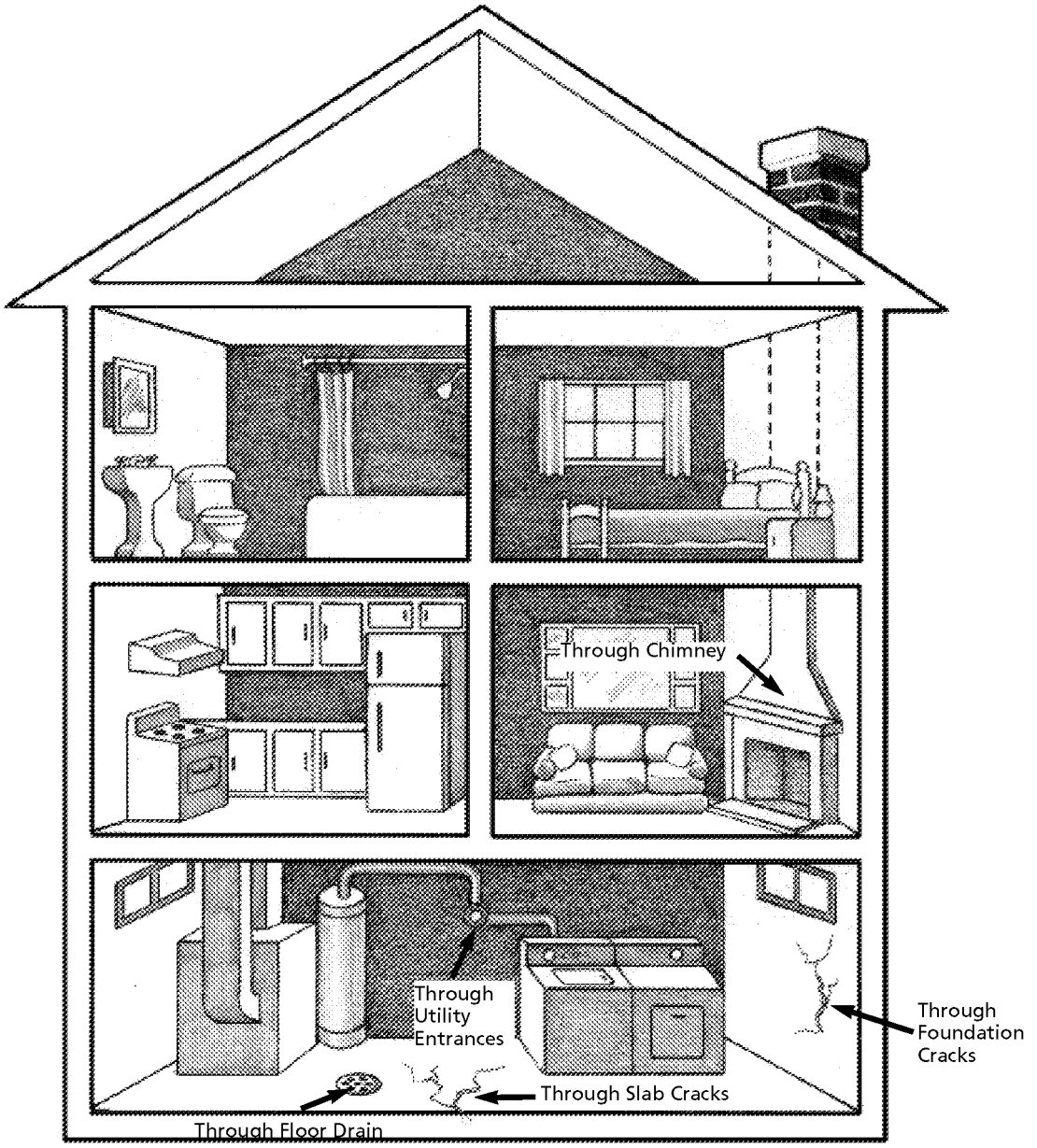


Fig. 1 How radon can enter a home.

If you prefer, you can hire a trained contractor to do the testing for you. Always hire an EPA-qualified or state-certified radon tester. When buying or selling a home, many lending institutions require certified test results to close the transaction.

How To Use A Test Kit. Follow the instructions that come with your test kit. If you are doing a short-term test, close your windows and outside doors and keep them closed as much as possible during the test. If you're doing a short-term test lasting just 2 or 3 days, be sure to close your windows and outside doors at least 12 hours before beginning the test. Do not conduct short-term tests lasting just 2 or 3 days during severe storms or periods of unusually high winds.

Place the test kit in the lowest lived-in level of the home. Put it in the basement if it is frequently used, otherwise the first floor. It should be put in a room that is used regularly, like a living room, playroom, den, or bedroom, but not your kitchen or bathroom. Place the kit at least 20 inches above the floor in a location where it won't be disturbed. Keep it away from drafts, high heat, high humidity, and exterior walls. Leave the kit in place for as long as the package says. Once you've finished the test, reseal the package and send it directly to the lab specified on the package. You should receive your test results within a few weeks.

Interpreting Test Results. The amount of radon in the air is measured in picocuries of radon per liter of air (pCi/l). Sometimes test results are expressed in Working Levels (WL), rather than pCi/l. The EPA recommends you take corrective measures if your radon level is 4 pCi/l or higher or if the working level is 0.002WL or higher. A sample test report is shown in **Figure 2**.

If your first short-term test result is 4 pCi/l or higher, (or 0.002 WL or more), the EPA recommends that you take a second test to be sure. For a better understanding of your year-round average radon level, take a long-term test.

NOTE: The EPA believes that any radon exposure carries some risk-—no level of radon is safe. Even radon levels below 4 pCi/l pose some risk.

Sample Test Report

Test Site:
123 Any Street
Any Town, State, Zip

Date: 6/02/96
REC # 000000

CHARCOAL CANISTER ANALYSIS FOR RADON-22

Canister Number: 12345 ***CANISTER COUNTING***
Canister Location: Basement Front

Exposure Start: 5/28/96 11:30:00
Exposure Stop: 6/01/96 14:50:00
Expose Time: 99.33 hours
Initial Weight: 117.9 grams
Final Weight: 120.1 grams
Weight Gain: 2.2 grams

Analysis Start: 6/02/96 8:30:00
Analysis Count Time: 20 minutes
Sample Gross Counts: 8,466
Radon Concentration: 5.9 pCi/liter
Margin of Error +/-: 1.10%

Radon levels are above E.P.A. guidelines of 4.0 pCi/L

In certain specific situations the U.S. Environmental Protection Agency and the Centers for Disease Control have used a continuous exposure of 4 pCi/L as a guideline level at which remedial action is indicated.

The test results listed above are for the specific area tested on the dates specified. Radon levels can change over time and conditions, therefore subsequent tests may yield different results.

Fig. 2
A sample test report.

RADON REDUCTION TECHNIQUES

There are several ways to lower radon levels in your home. Some techniques prevent radon from entering your home. Others methods reduce radon levels already present in your home.

Your house type will greatly affect the kind of radon reduction system that will work best. Houses are generally categorized according to their foundation design. For example: basement, slab-on-grade, or crawlspace. Some houses have more than one foundation design feature. It is common to have a basement under part of the house and to have a slab-on-grade or crawlspace under the rest of the house. In these situations a combination of radon reduction techniques may be needed.

BASEMENTS AND SLAB-ON-GRADE

In houses that have a basement or a slab-on-grade foundation, radon is reduced by one of five types of soil suction:

Active Subslab Suction. Also called subslab depressurization. This is the most common and usually the most reliable radon reduction method. Suction pipes are inserted through the floor slab into the crushed rock or soil underneath. They also may be inserted below the concrete slab from outside the house. The number and location of suction pipes needed depends on how easily air can move in the crushed rock or soil under the slab, and on the strength of the radon source. Acting like a vacuum cleaner, a fan connected to the pipes draws the radon gas from below the house. The gas is then released into the outdoor air **(Fig. 3)**.

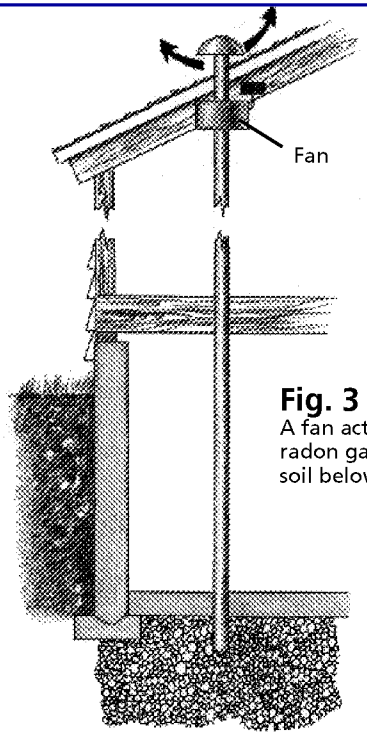


Fig. 3
A fan actively pulls radon gas out of the soil below a house.

Passive Subslab Suction. Similar to active suction, but it relies on natural air currents to draw radon up from below the house. Passive subslab suction is generally not as effective in reducing high radon levels as its active counterpart.

Perforated Drainpipe. Also known as drain tile suction, this involves the use of a continuous loop of perforated pipes buried around the outside perimeter of the house. Radon is pulled through the pipe from the surrounding soil. Usually, an exhaust fan is used to increase the pull.

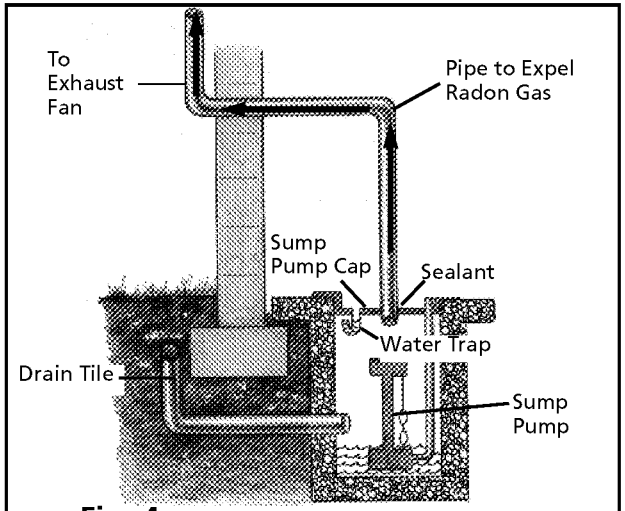


Fig. 4
The sump pump location doubles as a pipe vent for gas to escape.

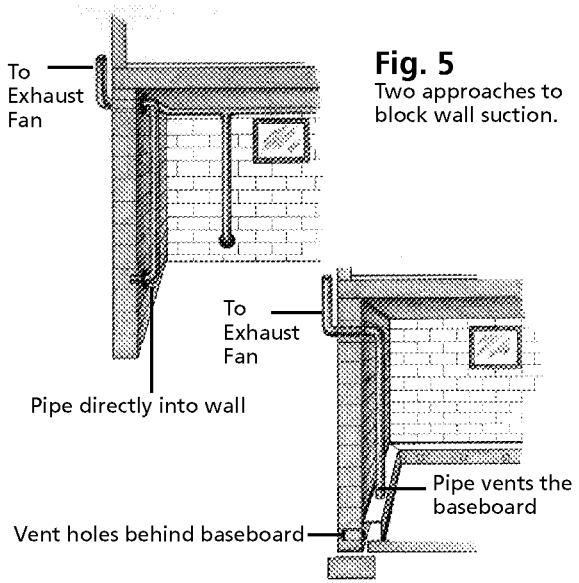


Fig. 5
Two approaches to block wall suction.

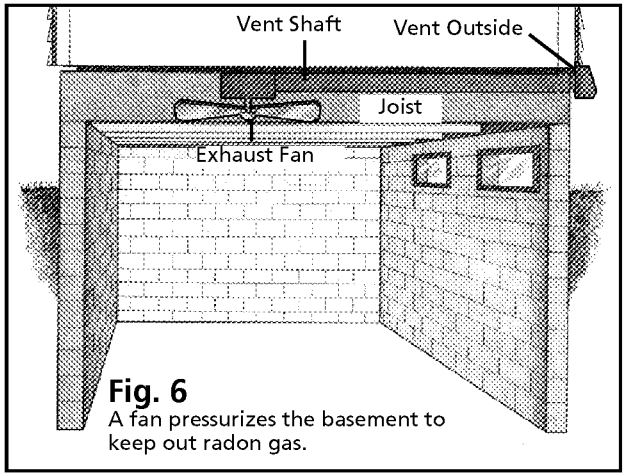


Fig. 6
A fan pressurizes the basement to keep out radon gas.

Sump Hole Suction. A variation of subslab and drain tile suction. Often, when a house with a basement has a sump pump to remove unwanted water, the sump can be capped to continue to drain water as well as serve as the location for a radon suction pipe **(Fig. 4)**.

Block Wall Suction. Used in basement houses with hollow block foundation. This method generally uses fans to either draw radon gas from the hollows in block walls (wall suction), or to keep radon from entering walls (wall pressurization). Block wall suction is often used together with subslab suction **(Fig. 5)**.

CRAWLSPACE HOUSES

In houses with crawlspaces, radon levels can be lowered by ventilating the crawlspace. This ventilation reduces the home's suction on the soil and dilutes the radon beneath the house.

There are two ways to ventilate the crawlspace. Active ventilation uses a fan to blow air through the crawlspace. Passive ventilation uses vents. In colder climates, either method is facilitated by insulating water pipes and heating ducts in the crawlspace.

Another effective method of reducing radon levels in crawlspace houses involves covering the earth floor with a heavy plastic sheet. A vent pipe and fan draws the radon from under the sheet and expels it outdoors. This form of soil suction is called submembrane depressurization.

OTHER RADON REDUCTION METHODS

Other radon reduction techniques that can be used in any type of house include:

Sealing Cracks. Filling cracks and other openings in the foundation is a basic part of radon reduction. Sealing does two things: it limits the flow of radon into your home and it reduces the loss of conditioned air, thereby making other radon reduction techniques more effective and cost-efficient.

House Pressurization. A fan to blow air into the basement or living area from either upstairs or outdoors attempts to create enough pressure at the lowest level indoors to prevent radon from entering the house. The effectiveness of this technique is limited by house construction, climate, other appliances in the house, and occupants' lifestyle. To maintain enough pressure to keep radon out, the doors and windows at the lowest level must be left closed, except for normal entry and exit **(Fig. 6)**.

Natural Ventilation. Ventilation occurs in all houses to some extent. By opening windows, doors, and vents on the lower floors, you increase the ventilation in your house. This increase mixes radon with outside air and can result in reduced radon levels. In addition, ventilating your house helps lower indoor radon levels by reducing the vacuum effect.

Install a heat recovery ventilator (HRV), (also called an air-to-air heat exchanger), to increase ventilation. An HRV will increase house ventilation while using the heated or cooled air being exhausted to warm or cool the incoming air. HRVs can ventilate all or part of your home, although they are more effective in reducing radon levels when used to ventilate only the basement. HRVs also improve air quality in houses that have other indoor pollutants.

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