

# HOME OWNERS GUIDE TO RADON

*A guide to radon risks, testing protocol,  
and mitigation for home owners.*



**Department  
of Health**



## WHY SHOULD I TEST FOR RADON?

Radon is a radioactive gas that has been found in homes all over the United States. It comes from the natural breakdown of uranium in soil, rock, and water and gets into the air you breathe. Radon typically moves up through the ground to the air above and into your home through cracks and other holes in the foundation. Radon can also enter your home through well water. Your home can trap radon inside.

Any home can have a radon problem. This means new and old homes, well sealed and drafty homes, and homes with or without basements. In fact, you and your family are most likely to get your greatest radiation exposure at home. That is where you spend most of your time.

Nearly one out of every 15 homes in the United States is estimated to have an elevated radon level (4 pCi/L or more). Elevated levels of radon gas have been found in homes in your state. Contact your state radon office for information about radon in your area.

Testing is the only way to know if you and your family are at risk from radon. EPA and the Surgeon General recommend testing all homes below the third floor for radon. You cannot predict radon levels based on state, local, and neighborhood radon measurements. Do not rely on radon test results taken in other homes in the neighborhood to estimate the radon level in your home. Homes which are next to each other can have different indoor radon levels. Testing is the only way to find out what your home's radon level is.

### U.S. SURGEON GENERAL HEALTH ADVISORY

*"Indoor radon is the second-leading cause of lung cancer in the United States and breathing it over prolonged periods can present a significant health risk to families all over the country. It's important to know that this threat is completely preventable. Radon can be detected with a simple test and fixed through well-established venting techniques."*

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## I'M SELLING A HOME. WHAT SHOULD I DO?

### *If Your Home Has Already Been Tested for Radon...*

If you are thinking of selling your home and you have already tested your home for radon, review the Radon Testing Checklist to make sure that the test was done correctly. If so, provide your test results to the buyer.

No matter what kind of test was done, a potential buyer may ask for a new test, especially if:

- The Radon Testing Checklist items were not met;
- The last test is not recent, e.g., within two years;
- You have renovated or altered your home since you tested; or
- The buyer plans to use a lower level of the house than was tested, such as a basement that could be used regularly by the buyer.

A buyer may also ask for a new test if your state or local government requires disclosure of radon information to buyers.

### *If Your Home Has Not Yet Been Tested for Radon...*

Have a test taken as soon as possible. If you can, test your home before putting it on the market. You should test in the lowest level of the home that could be used regularly. This means testing in the lowest level that you currently live in or a lower level not currently used, but which a buyer might use as a family room or play area, etc.

The radon test result is important information about your home's radon level. Some states require radon measurement testers to follow a specific testing protocol. If you do the test yourself, you should carefully follow the testing protocol for your area or EPA's Radon Testing Checklist. If you hire a contractor to test your residence, protect yourself by hiring a qualified individual or company.

You can determine a service provider's qualifications to perform radon measurements or to mitigate your home in several ways. Check with your state radon office. Many states require radon professionals to be licensed, certified, or registered. Most states can provide you with a list of knowledgeable radon service providers doing business in the state. In states that don't regulate radon services, ask the contractor if they hold a professional proficiency or certification credential. Such programs usually provide members with a photo-ID card, which indicates their qualification(s) and its expiration date. If in doubt, you should check with their credentialing organization. Alternatively, ask the contractor if they've successfully completed formal training appropriate for testing or mitigation, e.g., a course in radon measurement or radon mitigation.

## I'M SELLING A HOME. WHAT SHOULD I DO? CONT.

### *If the Home Has Not Yet Been Tested for Radon...*

Make sure that a radon test is done as soon as possible. Consider including provisions in the contract specifying:

- Where the test will be located;
- Who should conduct the test;
- What type of test to do;
- When to do the test;
- How the seller and the buyer will share the test results and test costs (if necessary); and
- When radon mitigation measures will be taken, and who will pay for them.

Make sure that the test is done in the lowest level of the home that could be used regularly. This means the lowest level that you are going to use as living space whether it is finished or unfinished. A state or local radon official or qualified radon tester can help you make some of these decisions.

If you decide to finish or renovate an unfinished area of the home in the future, a radon test should be done before starting the project and after the project is finished. Generally, it is less expensive to install a radon-reduction system before (or during) renovations rather than afterwards.

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### *If the Home Has Already Been Tested for Radon...*

If you are thinking of buying a home, you may decide to accept an earlier test result from the seller or ask the seller for a new test to be conducted by a qualified radon tester.

Before you accept the seller's test, you should determine:

- The results of previous testing;
- Who conducted the previous test: the homeowner, a radon professional, or some other person;
- Where in the home the previous test was taken, especially if you may plan to live in a lower level of the home. For example, the test may have been taken on the first floor. However, if you want to use the basement as living space, test there; and
- What, if any, structural changes, alterations, or changes in the heating, ventilation, and air conditioning (HVAC) system have been made to the house since the test was done. Such changes might affect radon levels.

If you accept the seller's test, make sure that the test followed the **Radon Testing Checklist**. If you decide that a new test is needed, discuss it with the seller as soon as possible. If you decide to use a qualified radon tester, contact your state radon office to obtain a copy of their approved list of radon testing companies.

## RADON TEST DEVICE PLACEMENT

EPA recommends that the test device(s) be placed in the lowest level of the home that could be used regularly, whether it is finished or unfinished. Conduct the test in any space that could be used by the buyer as a bedroom, play area, family room, den, exercise room, or workshop. Based on their client's intended use of the space, the qualified testing professional should identify the appropriate test location and inform their client (buyer). Do not test in a closet, stairway, hallway, crawl space or in an enclosed area of high humidity or high air velocity. An enclosed area may include a kitchen, bathroom, laundry room or furnace room.

## PREVENTING OR DETECTING TEST INTERFERENCE

There is a potential for test interference in real estate transactions. There are several ways to prevent or detect test interference:

- Use a test device that frequently records radon or decay product levels to detect unusual swings;
- Employ a motion detector to determine whether the test device has been moved or if testing conditions have changed;
- Use a proximity detector to reveal the presence of people in the room which may correlate to possible changes in radon levels during the test;
- Record the barometric pressure to identify weather conditions which may have affected the test;
- Record the temperature to help assess whether doors and windows have been opened;
- Apply tamper-proof seals to windows to ensure closed-house conditions; and
- Have the seller/occupant sign a non-interference agreement.

Home buyers and sellers should consult a qualified radon test provider about the use of these precautions.

## LENGTH OF TIME TO TEST

Because radon levels tend to vary from day to day and season to season, a short term test is less likely than a long term test to tell you your year round average radon level. However, if you need results quickly, a short term test may be used to decide whether to fix the home.

## THERE ARE TWO GENERAL WAYS TO TEST YOUR HOME FOR RADON:

### SHORT-TERM TESTING

The quickest way to test is with short term tests. Short term tests remain in your home from 2 to 90 days, depending on the device. There are two groups of devices which are more commonly used for short term testing. The passive device group includes alpha track detectors, charcoal canisters, charcoal liquid scintillation detectors, and electret ion chambers. The active device group consists of different types of continuous monitors.

### LONG-TERM TESTING

Long term tests remain in your home for more than 90 days. Alpha track and electret ion chamber detectors are commonly used for this type of testing. A long term test result is more likely to tell you your home's year round average radon level than a short term test. If time permits (more than 90 days), long term tests can be used to confirm initial short term results. When long term test results are 4 pCi/L or higher, EPA recommends fixing the home.

Whether you test for radon yourself or hire a qualified tester, all radon tests should be taken for a minimum of 48 hours. Some devices require a longer (minimum) length of time, e.g., a 7-day charcoal canister device.

### Doing a Short-Term Test...

If you are testing in a real estate transaction and you need results quickly, any of the following three options for short term tests are acceptable in determining whether the home should be fixed. Any real estate test for radon should include steps to prevent or detect interference with the test device.

SHORT-TERM TESTING OPTIONS:	WHAT TO DO NEXT:
<ul style="list-style-type: none"> <li>• <b>PASSIVE</b> Take two short term tests at the same time in the same location for at least 48 hours.</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• Take an initial short-term test for at least 48 hours. Immediately upon completing the first test, do a second test using an identical device in the same location as the first test.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Fix the home if the average of the two tests is 4 pCi/L or more.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>ACTIVE</b> Test the home with a continuous monitor for at least 48 hours.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Fix the home if the average radon level is 4 pCi/L or more.</li> </ul>

### When Choosing a Short-Term Testing Option...

There are trade-offs among the short term testing options. Two tests taken at the same time (simultaneous) would improve the precision of this radon test. One test followed by another test (sequential) would most likely give a better representation of the seasonal average. Both active and passive devices may have features which help to prevent test interference. Your state radon office can help you decide which option is best.

### Using Testing Devices Properly for Reliable Results

#### If You Do the Test Yourself:

When you are taking a short term test, close windows and doors to the outside and keep them closed, except for normal entry and exit. If you are taking a short term test lasting less than four 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 less than four days during severe storms or periods of high winds;
- Follow the testing instructions and record the start time and date;
- Place the test device at least 20 inches above the floor in a location where it will not be disturbed and where it will be away from drafts, high heat, high humidity, and exterior walls;
- Leave the test kit in place for as long as the test instructions say; and
- Once the test is finished, record the stop time and date, reseal the package, and return it immediately to the lab specified on the package for analysis.

You should receive your test results within a few days or weeks. If you need results quickly, you should find out how long results will take and, if necessary, request expedited service.

## IF YOU HIRE A QUALIFIED RADON TESTER

In many cases, home buyers and sellers may decide to have the radon test done by a qualified radon tester who knows the proper conditions, test devices, and guidelines for obtaining a reliable radon test result. They can also:

- Evaluate the home and recommend a testing approach designed to make sure you get reliable results;
- Explain how proper conditions can be maintained during the radon test;
- Emphasize to a home's occupants that a reliable test result depends upon their cooperation. Interference with, or disturbance of, the test or closed-house conditions will invalidate the test result;
- Analyze the data and report the measurement results; and
- Provide an independent test result.

Your state radon office may also have information about qualified radon testers and certification requirements.

## INTERPRETING RADON TEST RESULTS

The average indoor radon level is estimated to be about 1.3 pCi/L; roughly 0.4 pCi/L of radon is normally found in the outside air. The U.S. Congress has set a long term goal that indoor radon levels be no more than outdoor levels. While this goal is not yet technologically achievable for all homes, radon levels in many homes can be reduced to 2 pCi/L or less. A radon level below 4 pCi/L still poses a risk. Consider fixing when the radon level is between 2 and 4 pCi/L.

Sometimes short-term tests are less definitive about whether the radon level in the home is at or above 4 pCi/L; particularly when the results are close to 4 pCi/L. For example, if the average of two short term tests is 4.1 pCi/L, there is about a 50 percent chance that the year round average is somewhat below, or above, 4 pCi/L.

However, 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. You can reduce your risk of lung cancer by lowering your radon level.

As with other environmental pollutants, there is some uncertainty about the magnitude of radon health risks. However, we know more about radon risks than risks from most other cancer causing substances. This is because estimates of radon risks are based on data from human studies (underground miners). Additional studies on more typical populations are under way.

Your radon measurement will give you an idea of your risk of getting lung cancer. Your chances of getting lung cancer from radon depend mostly on:

- Your home's radon level;
- The amount of time you spend in your home; and
- Whether you are a smoker or have ever smoked.

Smoking combined with radon is an especially serious health risk. If you smoke or are a former smoker, the presence of radon greatly increases your risk of lung cancer. If you stop smoking now and lower the radon level in your house, you will reduce your lung cancer risk.

## RADON TESTING CHECKLIST

For reliable test results, follow this Radon Testing Checklist carefully. Testing for radon is not complicated. Improper testing may yield inaccurate results and require another test. Disturbing or interfering with the test device, or with closed house conditions\*, may invalidate the test results and is illegal in some states. If the seller or qualified tester cannot confirm that all items have been completed, take another test.

### BEFORE CONDUCTING A RADON TEST:

- ☐ Notify the occupants of the importance of proper testing conditions. Give the occupants written instructions or a copy of this Guide and explain the directions carefully.
- ☐ Conduct the radon test for a minimum of 48 hours; some test devices have a minimum exposure time greater than 48 hours.
- ☐ When doing a short term test ranging from 2-4 days, it is important to maintain closed house conditions for at least 12 hours before the beginning of the test and during the entire test period.
- ☐ When doing a short-term test ranging from 4-7 days, EPA recommends that closed-house conditions be maintained.
- ☐ If you conduct the test yourself, use a qualified radon measurement device and follow the laboratory's instructions. Your state may be able to provide you with a list of do-it-yourself test devices available from qualified laboratories.
- ☐ If you hire someone to do the test, hire only a qualified individual. Some states issue photo identification (ID) cards; ask to see it. The tester's ID number, if available, should be included or noted in the test report.
- ☐ The test should include method(s) to prevent or detect interference with testing conditions or with the testing device itself.
- ☐ If the house has an active radon-reduction system, make sure the vent fan is operating properly. If the fan is not operating properly, have it (or ask to have it) repaired and then test.

### DURING A RADON TEST:

- ☐ Maintain closed house conditions during the entire duration of a short-term test, especially for tests shorter than one week in length.
- ☐ Operate the home's heating and cooling systems normally during the test. For tests lasting less than one week, operate only air conditioning units which recirculate interior air.
- ☐ Do not disturb the test device at any time during the test.
- ☐ If a radon-reduction system is in place, make sure the system is working properly and will be in operation during the entire radon test.

### AFTER A RADON TEST:

- ☐ If you conduct the test yourself, be sure to promptly return the test device to the laboratory. Be sure to complete the required information, including start and stop times, test location, etc.
- ☐ If an elevated radon level is found, fix the home. Contact a qualified radon-reduction contractor about lowering the radon level. EPA recommends that you fix the home when the radon level is 4 pCi/L or more.
- ☐ Be sure that you or the radon tester can demonstrate or provide information to ensure that the testing conditions were not violated during the testing period.

\* Closed-house conditions means keeping all windows closed, keeping doors closed except for normal entry and exit, and not operating fans or other machines which bring in air from outside. Fans that are part of a radon-reduction system or small exhaust fans operating for only short periods of time may run during the test.

## WHAT SHOULD I DO IF THE RADON LEVEL IS HIGH?

### *High Radon Levels Can Be Reduced*

EPA recommends that you take action to reduce your home's indoor radon levels if your radon test result is 4 pCi/L or higher. It is better to correct a radon problem before placing your home on the market because then you have more time to address a radon problem.

If elevated levels are found during the real estate transaction, the buyer and seller should discuss the timing and costs of radon reduction. The cost of making repairs to reduce radon levels depends on how your home was built and other factors. Most homes can be fixed for about the same cost as other common home repairs. Check with and get an estimate from one or more qualified mitigators.

## HOW TO LOWER THE RADON LEVEL IN YOUR HOME

A variety of methods can be used to reduce radon in homes. Sealing cracks and other openings in the foundation is a basic part of most approaches to radon reduction. EPA **does not** recommend the use of sealing alone to limit radon entry. Sealing alone has not been shown to lower radon levels significantly or consistently.

In most cases, a system with a vent pipe(s) and fan(s) is used to reduce radon. These "sub-slab depressurization" systems do not require major changes to your home. Similar systems can also be installed in homes with crawl spaces. These systems prevent radon gas from entering the home from below the concrete floor and from outside the foundation. Radon mitigation contractors may use other methods that may also work in your home. The right system depends on the design of your home and other factors.

Techniques for reducing radon are discussed in EPA's Consumer's Guide to Radon Reduction. As with any other household appliance, there are costs associated with the operation of a radon-reduction system.

You should also test your home again after it is fixed to be sure that radon levels have been reduced. If your living patterns change and you begin occupying a lower level of your home (such as a basement), you should retest your home on that level. In addition, it is a good idea to retest your home sometime in the future to be sure radon levels remain low.

## MITIGATION

A radon mitigation system is a way to capture soil gases and re route them to bypass the home. A variety of methods can be used to reduce radon in homes. The most common method for mitigation is sub-slab depressurization.

The basics are to seal up the penetration, gaps, and cracks in the floor and walls in the basement. Then create a suction point. Sealing cracks and other openings in the foundation is a basic part of most approaches to radon reduction. EPA does not recommend the use of sealing alone to limit radon entry. Sealing alone has not been shown to lower radon levels significantly or consistently.

Sometimes the sump pit is used to create this suction point, sometimes the sump is simply sealed off, and the suction point is in another part of the floor. A hole is drilled through the floor and a schedule 40 PVC pipe is sealed into the hole. This pipe is routed up through the house or out the wall and then up the exterior wall.

The vent pipe exhaust point should always be at least 10 feet away from any vents, or doors and windows, and 2 feet above the roof line, to prevent gas re-entry. The suction fan must not be mounted inside or below living space. Outdoors, in the attic, or garage is the only acceptable location for a radon mitigation fan. The basement is not OK, as there will be pressurized pipe in or below living space and if the, fan, pipe, or fittings leak then the fan will be pushing radon dense air directly back into the home.

The mitigation fan must have a hard wired shut off switch within 6 feet, and in the line of sight of the fan. All components of a radon mitigation system must be labeled as a part of the system, including the breaker in the panel that supplies the circuit for the fan.

As most radon fans are relatively low amperage, radon fans are not required to be on a dedicated circuit, however it is recommended that the system have some sort of a monitor to determine weather or not the system is running. A U-tube manometer is most commonly used, there are audible alarms available as well.

If you are testing a home with a mitigation system already installed it is important to ensure that the system is running properly before beginning the test, for at least 24 hours. This can be an issue in real estate transactions where the power has been shut off due to the building being unoccupied.

## RADON & HOME RENOVATIONS

If you are planning any major renovations, such as converting an unfinished basement area into living space, it is especially important to test the area before you begin. If your test results indicate an elevated radon level, radon-resistant techniques can be inexpensively included as part of the renovation. Major renovations can change the level of radon in any home. Test again after the work is completed.

You should test your home again after it has been mitigated to be sure that radon levels have been reduced. If your living patterns change and you begin occupying a lower level of your home (such as a basement), you should retest your home on that level. In addition, it is recommended to retest your home after making any changes to the footprint of the property, additions, patio's, new "city" water connections, or septic systems, to be sure radon levels remain low.

*According to the EPA all homes should be tested every 5 years, and a home with a mitigation system should be retested every 2 years, to ensure radon levels remain low.*

