

Pennsylvania Home Buyers' and Sellers' Guide to

Radon



- ▶ If you are buying a home or selling your home, have it tested for radon.
- ▶ For a new home, ask if radon-resistant construction features were used and if the home has been tested.
- ▶ Fix the home if the radon level is 4 picocuries per liter (pCi/L) or higher.
- ▶ Radon levels less than 4 pCi/L still pose a risk and in many cases may be reduced.
- ▶ Take steps to prevent device interference when conducting a radon test.

EPA estimates that radon causes thousands of lung cancer deaths in the U.S. each year.



* Radon is estimated to cause about 21,000 lung cancer deaths per year, according to EPA's 2003 Assessment of Risks from Radon in Homes (EPA 402-R-03-003). The numbers of deaths from other causes are taken from the Centers for Disease Control and Prevention's 2005-2006 National Center for Injury Prevention and Control Report and 2006 National Safety Council Reports.



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OVERVIEW

The U.S. Environmental Protection Agency (EPA) and the U.S. Department of Health and Human Services, as well as the Pennsylvania Department of Environmental Protection (DEP) and major health organizations including the American Lung Association, the Centers for Disease Control and Prevention and the American Medical Association agree that, next to tobacco smoke, radon is the second leading cause of lung cancer.

This guide answers important questions about radon and lung cancer risk. It also answers questions about testing and fixing for anyone buying or selling a home in Pennsylvania.

Reprinted with permission from EPA, this guide is based on the EPA's Home Buyer's and Seller's Guide to Radon (U.S. EPA 402-K-006-093, November 2006) with a few changes that reflect the specifics of the Radon Program in Pennsylvania.

EPA Risk Assessment for Radon in Indoor Air

EPA has updated its estimate of the lung cancer risks from exposure to radon in indoor air. The agency's updated risk assessment, EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003, June 2003), is available as a downloadable Adobe Acrobat PDF file at www.epa.gov/radiation/docs/assessment/402-r-03-003.pdf. EPA's reassessment was based on the National Academy of Sciences (NAS) report on the Health Effects of Exposure to Radon (BEIR VI, 1999). The Agency now estimates that there are about 21,000 annual radon-related lung cancer deaths, an estimate consistent with the NAS Report's findings.

RADON IS A CANCER- CAUSING, RADIOACTIVE GAS

You cannot see, smell or taste radon. But it still may be a problem in your home. When you breathe air containing radon, you increase your risk of getting lung cancer. In fact, the U.S. Surgeon General has warned that radon is the second leading cause of lung cancer in the United States today. If you smoke and your home has high radon levels, your risk of lung cancer is especially high.

TEST FOR RADON

Testing is the only way to find out your home's radon levels. DEP, as well as EPA and the Surgeon General, recommend testing all homes below the third floor for radon.

FIX A RADON PROBLEM...

If you find that you have high radon levels, there are ways to fix a radon problem. Even very high levels can be reduced to acceptable levels.

**IF YOU ARE
SELLING A
HOME...**

DEP recommends that you test your home before putting it on the market and, if necessary, lower your radon levels. Save the test results and all information you have about steps that were taken to fix any problems. This could be a positive selling point.

**IF YOU ARE
BUYING A
HOME...**

DEP recommends that you know what the indoor radon level is in any home you consider buying. Ask the seller for their radon test results. If the home has a radon-reduction system, ask the seller for any information they have about the system.

If the home has not yet been tested, you should have it tested.

If you are having a new home built, there are features that can be incorporated into your home during construction to reduce radon levels.

The radon testing guidelines in this guide have been developed specifically to deal with the time-sensitive nature of home purchases and sales and the potential for radon device interference. These guidelines are slightly different from the guidelines in other DEP publications which provide radon testing and reduction information for non-real estate situations.

This guide recommends three short-term testing options for real estate transactions. DEP considers the basement, if any, to be the lowest livable area if it can be used as a living area without major structural change even if it has not been renovated into a “finished” living space. The buyer may want to renovate and use the basement as living space such as a bedroom, family room or office. Naturally, areas such as basements with ground floors or low ceilings, etc., need major structural changes before they can become a livable area. These areas are not considered to be a lowest livable area. Further, DEP suggests testing in two or more locations, including the lowest livable area, if the house has separate structural zones such as a family room above a crawl space or on a slab-on-grade.

WHY SHOULD I TEST FOR RADON?

Radon Has Been Found In Homes All Over the United States



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 also can enter your home through well water. The 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, because 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 across the country.

DEP, EPA, and the Surgeon General Recommend That You Test Your Home

Testing is the only way to know if you and your family are at risk from radon. DEP, as well as EPA and the Surgeon General, recommend testing all homes below the third floor for radon.

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.”

January 2005



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 that are next to each other can have different indoor radon levels. **Testing is the only way to find out your home's radon level.**

SELLING A HOME—WHAT SHOULD I DO?



If Home Has Been Tested for Radon...

If you are thinking of selling your home and you already have 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 (see pg. 15);
- ▶ 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 live in a lower level of the house than was tested, such as a basement suitable for occupancy but not currently lived in.

A buyer also may ask for a new test if your local government requires disclosure of radon information to buyers. Pennsylvania law requires that the seller disclose the results of any known radon testing (Real Estate Seller Disclosure Act).

If Home Has Not 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 which is suitable for occupancy. This means testing in the lowest level that you currently live in or a lower level not currently used, but which a buyer could use for living space without renovations.



The radon test result is important information about your home's radon level. Radon measurement testers are required to follow a specific testing protocol. If you do the test yourself, you should carefully follow the testing protocol for your area or the radon testing checklist. If you hire a contractor to test your residence, they are required to be a Pennsylvania-certified individual or company.

Pennsylvania law requires all radon service providers, such as radon testers, radon mitigators and radon laboratories to be certified by DEP. You can determine a service provider's certification to perform radon measurements or to mitigate your home in several ways. The list of Pennsylvania certified radon service providers is updated monthly. This list can be obtained by visiting our website at www.dep.pa.gov. You can also obtain a hard copy of this directory or verify a certification by calling 800-23RADON. You also can verify certification by asking the contractor for a DEP-certified photo ID card. If you have property or are relocating to another state, check with that state's radon office. For your convenience, a link to a list of these state radon offices, as well as EPA regional offices, can be found at the end of this document. In states that don't regulate radon services, ask the contractor if they hold a professional proficiency or certification credential, or if they have successfully completed formal training appropriate for testing or mitigation.

- * You should first call your state radon office for information on qualified radon service providers and state-specific radon measurement or mitigation requirements. For up-to-date information on state radon program offices, visit www.epa.gov/indoor-air-quality-iaq.html. EPA's detailed and technical guidance on radon measurement and mitigation is listed on pg. 24; however, state requirements or guidance may be more stringent. Visit www.epa.gov/radon.html for links to private sector radon credentialing programs.

BUYING A HOME—WHAT SHOULD I DO?

If Home Has 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 someone else;

- ▶ 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 Home Has Not 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 suitable for occupancy. This means the lowest level that you are going to use as living space which is finished or does not require major structural renovations prior to use. A state or local radon official or Pennsylvania-certified 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.

BUYING OR BUILDING, HOW CAN I PROTECT MY FAMILY?

Buying a Radon-Resistant Home

Radon-resistant techniques work. When installed properly and completely, these simple and inexpensive passive techniques can help to reduce radon levels. In addition, installing them at the time of construction makes it easier to reduce radon levels further if the passive techniques don't reduce radon levels to below 4 pCi/L. Radon-resistant techniques may also help to lower moisture levels and those of other soil gases. Radon-resistant techniques:

- ▶ **Make Upgrading Easy:** Even if built to be radon-resistant, every new home should be tested for radon after occupancy. If you have a test result of 4 pCi/L or more, a vent fan can easily be added to the passive system to make it an active system and further reduce radon levels.
- ▶ **Are Cost-Effective:** Building radon-resistant features into the house during construction is easier and cheaper than fixing a radon problem from scratch later. Let your builder know that radon-resistant features are easy to install using common building materials.
- ▶ **Save Money:** When installed properly and completely, radon-resistant techniques can also make your home more energy efficient and help you save on your energy costs.

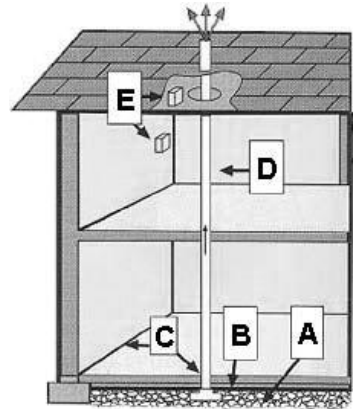


In a **new home**, the cost to install passive radon-resistant features during construction is usually between \$350 and \$500. A qualified mitigator can add a vent fan to a passive system, making it an active system and further reducing radon levels. In an **existing home**, it usually costs between \$500 and \$2,000 to install a radon mitigation system.

Radon-Resistant Features

Radon-resistant techniques (features) may vary for different foundations and site requirements. If you're having a house built, you can learn about EPA's model standards (and architectural drawings) and explain the techniques to your builder. If your new house was built (or will be built) to be radon-resistant, it will include these basic elements.

- A. Gas-Permeable Layer:** This layer is placed beneath the slab or flooring system to allow the soil gas to move freely underneath the house. In many cases, the material used is a four-inch layer of clean gravel. This gas-permeable layer is used only in homes with basement and slab-on-grade foundations; it is not used in homes with crawlspace foundations.
- B. Plastic Sheeting:** Plastic sheeting is placed on top of the gas-permeable layer and under the slab to help prevent the soil gas from entering the home. In crawl spaces, the sheeting (with seams sealed) is placed directly over the crawlspace floor.
- C. Sealing and Caulking:** All below-grade openings in the foundation and walls are sealed to reduce soil gas entry into the home.
- D. Vent Pipe:** A three- or four-inch PVC pipe (or other gas-tight pipe) runs from the gas-permeable layer through the house to the roof, to safely vent radon and other soil gases to the outside.
- E. Junction Boxes:** An electrical junction box is included in the attic to make the wiring and installation of a vent fan easier. For example, you decide to activate the passive system because your test result showed an elevated radon level (4 pCi/L or more). A separate junction box is placed in the living space to power the vent fan alarm. An alarm is installed along with the vent fan to indicate the vent fan is not operating properly.



HOW CAN I GET A RELIABLE RADON TEST?

Radon testing is easy and the only way to find out if you have a radon problem in your home.

Types of Radon Devices

Since you cannot see or smell radon, special equipment is needed to detect it. When you're ready to test your home, you can order a radon test kit by mail from a qualified radon measurement services provider or laboratory. You can also hire a Pennsylvania-certified radon tester, very often a home inspector, who will use a radon device(s) suitable to your situation. The most common types of radon testing devices are listed below.

PASSIVE DEVICES

Passive radon testing devices do not need power to function. These include **charcoal canisters**, **alpha-track detectors**, **charcoal liquid scintillation devices**, and **electret ion chamber detectors**, which are available in home centers and other stores; they also can be ordered by mail or phone through a certified laboratory. These devices are exposed to the air in the home for a specified period of time and then sent to a laboratory for analysis. Both short-term and long-term passive devices are generally inexpensive. Some of these devices may have features that offer more resistance to test interference or disturbance than other passive devices.

ACTIVE DEVICES

Active radon testing devices require power to function. These include continuous radon monitors and continuous working-level monitors. They continuously measure and record the amount of radon or its decay products in the air. Many of these devices provide a report of this information which can reveal any unusual or abnormal swings in the radon level during the test period. A qualified tester can explain this report to you. In addition, some of these devices are specifically designed to deter and detect test interference. Some technically advanced active devices offer anti-interference features. Although these tests may cost more, they may ensure a more reliable result.

General Information

Make sure to use a radon measurement device from a DEP-certified laboratory. Certain precautions should be followed to avoid interference during the test period; see the radon testing checklist for more information on how to get a reliable test result.

Radon Test Device Placement

DEP recommends that testing device(s) be placed in the lowest level of the home suitable for occupancy. DEP considers the basement to be the lowest livable level if it can be used as a living space without major structural changes even if it has not been renovated into a finished living space. The buyer may want to renovate and use the basement as living space such as a bedroom, family room or office. Naturally, areas such as basements with ground floors or low ceilings, etc. need major structural changes before they can be a livable area. These areas are not considered to be a lowest livable area. Further, DEP recommends testing in two or more locations, including the lowest livable area if the house has separate structural zones such as a family room above a crawl space or on a slab-on-grade. A buyer and seller should explicitly discuss and agree on the test locations to avoid any misunderstanding. Their decision should be clearly communicated to the person performing the test.

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 DEP-certified 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 two 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 (preferably 365 days). **Alpha track** and **electret ion chamber detectors** commonly are 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, DEP recommends fixing the home.

Whether you test for radon yourself or hire a Pennsylvania-certified 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 seven-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 for 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.

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.

| Short-Term Testing Options | What to do Next |
|--|---|
| Passive: Take two short-term tests at the same time in the same location for at least 48 hours. or Take an initial short-term test for at least 48 hours. Then, do a second test using an identical device in the same location as the first test. | Fix the home if the average of the two tests is 4 pCi/L or more. |
| Active: Test the home with a continuous monitor for at least 48 hours. | Fix the home if the average of two tests is 4 pCi/L or more. Fix the home if the average radon level is 4 pCi/L or more. |

Using Testing Devices Properly

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 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 also can:

- ▶ Verify that the tester is DEP-certified by asking for a certified DEP ID card or call 800-23RADON;
- ▶ 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.

Interpreting Radon Test Results

The national 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.

Radon Test Results Reported in Two Ways

Your radon test results may be reported in either picocuries per liter of air (pCi/L) or working levels (WL). If your test result is in pCi/L, DEP recommends you fix the home if the radon level is 4 pCi/L or higher. If your test result is in WL, DEP recommends you fix the home if the working level is 0.016 WL or higher. Some states require WL results to be converted to pCi/L to minimize confusion.

Radon Risk If You Smoke

| Radon Level | If 1,000 people who smoked were exposed to this level over a lifetime* ... | The risk of cancer from radon exposure compares to**... | WHAT TO DO: Stop smoking and... |
|-------------|--|---|--|
| 20 pCi/L | About 260 people could get lung cancer | 250 times the risk of drowning | Fix your home |
| 10 pCi/L | About 150 people could get lung cancer | 200 times the risk of dying in a home fire | Fix your home |
| 8 pCi/L | About 120 people could get lung cancer | 30 times the risk of dying in a fall | Fix your home |
| 4 pCi/L | About 62 people could get lung cancer | 5 times the risk of dying in a car crash | Fix your home |
| 2 pCi/L | About 32 people could get lung cancer | 6 times the risk of dying from poison | Consider fixing between two and 4 pCi/L |
| 1.3 pCi/L | About 20 people could get lung cancer | (Average indoor radon level) | (Reducing radon levels below 2 pCi/L is difficult) |
| 0.4 pCi/L | About 3 people could get lung cancer | (Average outdoor radon level) | |

Radon Risk If You've Never Smoked

| Radon Level | If 1,000 people who never smoked were exposed to this level over a lifetime* ... | The risk of cancer from radon exposure compares to**... | WHAT TO DO: |
|-------------|--|---|--|
| 20 pCi/L | About 36 people could get lung cancer | 35 times the risk of drowning | Fix your home |
| 10 pCi/L | About 18 people could get lung cancer | 20 times the risk of dying in a home fire | Fix your home |
| 8 pCi/L | About 15 people could get lung cancer | 4 times the risk of dying in a fall | Fix your home |
| 4 pCi/L | About 7 people could get lung cancer | The risk of dying in a car crash | Fix your home |
| 2 pCi/L | About 4 people could get lung cancer | The risk of dying from poison | Consider fixing between 2 and 4 pCi/L |
| 1.3 pCi/L | Less than 2 people could get lung cancer | (Average indoor radon level) | (Reducing radon levels below 2 pCi/L is difficult) |
| 0.4 pCi/L | | (Average outdoor radon level) | |

Note: If you are a former smoker, your risk may be higher.

* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).

** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

*** Assuming constant lifetime exposure at a given radon level.

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 as well as DEP 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 on groups like underground miners. Additional studies on more typical populations are ongoing.

The 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*, will invalidate the test results. If the seller or qualified tester cannot confirm that all items have been completed, take another 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 two to four 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 two to 90 days, DEP requires that closed-house conditions be maintained.
- ✓ If you conduct the test yourself, use a qualified radon measurement device and ensure the laboratory is certified by calling DEP at 800-23RADON.
- ✓ If you hire someone to do the test, verify that the tester is Pennsylvania certified. Ask to see a current DEP-certified photo ID card and check the expiration date.
- ✓ 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.
- ✓ Maintain closed-house conditions* during the entire duration of a short-term test.

DURING A RADON TEST

- ✓ Operate the home's heating and cooling systems normally during the test. For a test 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 DEP-certified 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 DEP-certified 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.

HIGH RADON LEVEL

High Radon Levels Can Be Reduced

DEP, as well as EPA, recommends that you take action to reduce your home's indoor radon level 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 you have more time to address a radon problem.

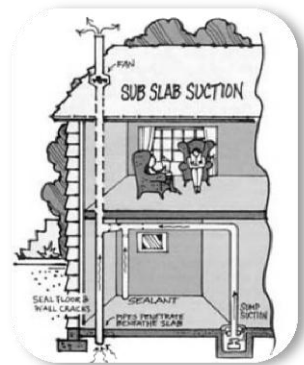
If elevated levels are found during the real estate transaction, the buyer and seller should discuss the timing and costs of radon reduction. The cost of making repairs to reduce radon levels depends on how your home was built and other factors. Most homes can be fixed for about the same costs as other common home repairs, like painting or having a new hot water heater installed. The average cost for a contractor to lower radon levels in a home can range from \$500 to \$2,000.

Lowering the Radon Level

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. DEP 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. DEP-certified 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 Pennsylvania'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.



Radon and 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-remediation 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 also should 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 beneficial to retest your home sometime in the future to be sure radon levels remain low.

Selecting a Radon-Reduction (Mitigation) Contractor



Select a DEP-certified radon-reduction contractor to reduce the radon level in your home. Any mitigation measures taken or system installed in your home must conform to the Pennsylvania radon mitigation standards and local codes.

DEP recommends that the mitigation contractor review the radon measurement results before beginning any radon-reduction work. Test again after the radon mitigation work has been completed to confirm that previous elevated levels have been reduced.

DEP-Certified Radon-Reduction Contractor

A certified radon-reduction (mitigation) contractor should be able to:

- ▶ Review testing guidelines and measurement results and determine if additional measurements are needed;
- ▶ Evaluate the radon problem and provide you with a detailed, written proposal on how radon levels will be lowered;
- ▶ Design a radon-reduction system;
- ▶ Install the system according to Pennsylvania radon mitigation standards and state and local codes; and
- ▶ Ensure the finished system effectively reduces radon to acceptable levels.

Choose a DEP-certified radon mitigation contractor to fix your radon problem just as you would for any other home repair. You may want to get more than one estimate and ask for and check their references. To verify certification, see www.dep.pa.gov, or call DEP at 800-23RADON.

Radon in Water

The radon in your home's indoor air can come from two sources: the soil or your water supply. Compared to radon entering your home through the soil, radon entering your home through the water is a much smaller risk. If you've tested for radon in air **and** have elevated radon levels and your water comes from a private well, have your water tested. The devices and procedures for testing your home's water supply are different from those used for measuring radon in air.

The radon in your water supply poses an inhalation risk and an ingestion risk. Research has shown that your risk of lung cancer from breathing radon in air is much larger than your risk of stomach cancer from swallowing water with radon in it. Most of your risk from radon in water comes from radon released into the air when water is used for showering and other household purposes.

Radon in your home's water is not usually a problem when its source is surface water. A radon in water problem is more likely when its source is groundwater, e.g., a private well or a public water supply system that uses groundwater. Some public water systems treat their water to reduce radon levels before it is delivered to your home. If you are concerned that radon may be entering your home through the water and your water comes from a public water supply, contact your water supplier.

If you've tested your private well and have a radon in water problem, it can be fixed. Your home's water supply can be treated in one of two ways. **Point-of-entry** treatment can effectively remove radon from the water before it enters your home. Point-of-entry treatment usually employs either granular activated carbon (GAC) filters or aeration devices. While GAC filters usually cost less than aeration devices, filters can collect radioactivity and may require a special method of disposal. **Point-of-use** treatment devices remove radon from your water at the tap, but only treat a small portion of the water you use, e.g., the water you drink. Point-of-use devices are not effective in reducing the risk from breathing radon released into the air from all water used in the home.

For information on radon in water, testing and treatment, and existing or planned radon in drinking water standards, or for general help, call EPA's Drinking Water Hotline at 800-426-4791.



RADON MYTHS AND FACTS

MYTH #1: Scientists are not sure that radon really is a problem.

FACT: Although some scientists dispute the precise number of deaths due to radon, all the major health organizations, such as the Centers for Disease Control, the American Lung Association, and the American Medical Association agree with estimates that radon causes thousands of preventable lung cancer deaths every year. This is especially true among smokers because the risk to smokers is much greater than to non-smokers.

MYTH #2: Radon testing devices are not reliable and are difficult to find.

FACT: Reliable radon tests are available from DEP-certified radon testers and companies. Active radon devices can continuously gather and periodically record radon levels to reveal any unusual swings in the radon level during the test. Reliable testing devices are also available by phone or mail-order and can be purchased in hardware stores and other retail outlets as long as the laboratory is DEP-certified. To verify DEP-certification, call DEP at 800-23RADON.

MYTH #3: Radon testing is difficult and time-consuming.

FACT: Radon testing is easy. You can test your home yourself or hire a DEP-certified radon test company. Either approach takes only a small amount of time and effort.

MYTH #4: Homes with radon problems cannot be fixed.

FACT: There are solutions to radon problems in homes. Thousands of home owners already have lowered their radon levels. Radon levels can be readily lowered for between \$500 and \$2,000. Call 800-23RADON for a list of DEP-certified mitigation contractors or refer to the “Radon Services Directory” on DEP’s website.

MYTH #5: Radon only affects certain types of homes.

FACT: Radon can be a problem in all types of homes, including old homes, new homes, drafty homes, insulated homes, homes with basements, and homes without basements. Local geology, construction materials, and how the home was built are among the factors that can affect radon levels in homes.

MYTH #6: Radon is only a problem in certain parts of the country.

FACT: High radon levels have been found in every state. Radon problems vary from area to area, but the only way to know a home’s radon level is to test.

MYTH #7: A neighbor’s test result is a good indication of whether your home has a radon problem.

FACT: It is not. Radon levels vary from home to home. The only way to know if your home has a radon problem is to test it.

MYTH #8: Everyone should test their water for radon.

FACT: While radon gets into some homes through the water, it is important to first test the air in the home for radon. If your water comes from a public water system that uses groundwater, call your water supplier. If high radon levels are found and the home has a private well, call the Safe Drinking Water Hotline at 800-426-4791 or 800-23RADON for information on testing your water.

MYTH #9: It is difficult to sell a home where radon problems have been discovered.

FACT: Where radon problems have been fixed, home sales have not been blocked. The added protection will be a good selling point.

MYTH #10: I have lived in my home for so long that it does not make sense to take action now.

FACT: You will reduce your risk of lung cancer when you reduce radon levels, even if you have lived with an elevated radon level for a long time.

MYTH #11: Short-term tests cannot be used for making a decision about whether to reduce the home's high radon levels.

FACT: Short-term tests can be used to decide whether to reduce the home's high radon levels. However, the closer the short-term testing result is to 4 pCi/L, the less certainty there is about whether the home's year-round average is above or below that level. Keep in mind that radon levels below 4 pCi/L still pose some risk and that radon levels can be reduced to 2 pCi/L or below in most homes.

MORE INFORMATION ABOUT RADON

If you have a radon-related question, you should contact the Pennsylvania state radon office at 800-23RADON (Pennsylvania only) or visit DEP's website at www.dep.pa.gov. Here you also will find information on radon testing, Pennsylvania radon mitigation standards, Pennsylvania radon certification requirements, Pennsylvania radon results by zip code, and links to research papers, scientific reports, and national radon proficiency programs.

You also can find indoor air quality information and publications on EPA's many websites.

Websites (EPA)

These are EPA's most important websites for information on radon and indoor air quality in homes. All the EPA publications listed in this section are available on EPA's websites.

- ▶ www.epa.gov/radon EPA's main radon page. Includes links to radon-resistant new construction, the map of radon zones, radon publications, hotlines and more.

- ▶ www.epa.gov/iaq/wheretheyoulive.html Provides detailed information on contacting your state's radon office, including links to some state websites. State indoor air quality contacts are also included.
- ▶ www.epa.gov/radon/pubs/index.html Offers the full text version of EPA's most popular radon publications, including the Home Buyer's and Seller's Guide to Radon, the Consumer's Guide to Radon Reduction, the Model Standards and Techniques for Control of Radon in New Residential Buildings and others.
- ▶ www.epa.gov/iaq EPA's main page on indoor air quality. Includes information on indoor risk factors, e.g., asthma, second hand smoke, carbon monoxide, duct cleaning, ozone generating devices, indoor air cleaners, flood cleanup, etc.

Radon Hotlines (Toll-Free)

EPA supports the following hotlines to serve consumers with radon-related questions and concerns.

- ▶ 800-SOS-RADON (767-7236).
- ▶ Order low-cost radon test kits by phone. Operated by the Kansas State University (K-State) in partnership with EPA.
- ▶ 800-55RADON (557-2366). For live help with your radon questions. Operated by K-State in partnership with EPA.
- ▶ 800-644-6999. Radon Fix-it Hotline. For help with your radon mitigation questions. Operated by K-State in partnership with EPA.
- ▶ 866-528-3187. Línea directa de Información sobre radón en Español. Hay operadores disponibles desde las 9:00 a.m. hasta las 5:00 p.m. para darle información sobre radón y como ordenar un kit para hacer la prueba de radón en su hogar.
- ▶ 800-426-4791. Safe Drinking Water Hotline, privately operated under contract to EPA. For general information on drinking water, radon in water, testing and treatment, and radon drinking water standards.



Printed Documents

Radon Risk and Testing

Home Buyer's and Seller's Guide to Radon (EPA 402-K-006-093, November 2006).

Everything you need to know about effectively dealing with radon during a residential real estate transaction. This publication can be viewed at

<http://www.epa.gov/radon/pubs/hmbyguid.html> and is available as a portable document format (pdf) file. The publication is in the public domain and may be reproduced or reprinted in its entirety and without charges. A franking/imprint space for organizations and businesses is available on the lower half of the back cover. This publication was prepared by EPA's Indoor Environments Division, Office of Radiation and Indoor Air (6609-J), 1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460.

Single copies are available **free** from the following sources (multiple copies may be available in some instances; ask for details):

- ▶ State radon offices; see <http://www.epa.gov/iaq/whereyoulive.html>
- ▶ National Service Center for Environmental Publications at 800-490-9198
- ▶ Any one of EPA's 10 regional offices

Single or multiple copies are available for a **fee** from the following sources (as for details):

- ▶ The Conference of Radiation Control Program Directors at 502-227-4543 (multiple copy orders only)
- ▶ U.S. Government Printing Office at 202-512-1800
- ▶ The American Association of Radon Scientists and Technologists at 800-484-7551; code 5130 (multiple copy orders only)
- ▶ The National Radon Safety Board at 866-329-3474 (multiple copy orders only)
- ▶ AARST/NRPP at 800-269-4174

A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family From Radon (EPA 402-K-05-008, September 2005). Provides basic information on

radon, sources of radon, radon health risks and how to test when you're not in a real estate transaction.

A Radon Guide For Tenants (EPA 402-k98-004, August 1998). Provides tenants with basic information about radon, testing, and fixing. It also contains information directed to building owners and landlords.

Reducing Radon Levels In a Home

Consumer's Guide to Radon Reduction (EPA 402-K-06-094, December 2006). The consumer's basic source of information on how to reduce radon levels in a home's indoor air. It includes information about the key mitigation system components, installation and operating costs, radon health risks, and testing (when not in a real estate transaction).

Building a New Home to Be Radon-Resistant

Building Radon Out, EPA 402-K-01-002, is a step-by-step guide on how to build radon-resistant homes. This publication provides the background information as to why building radon-resistant is a good idea, and it gives the five basic steps to employ during the home building process to accomplish this task.

Model Standards and Techniques for Control of Radon in New Residential Buildings (EPA 402-R-94-009, March 1994). These model standards were developed by EPA in conjunction with the home building industry. They provide technical details on how to make radon-resistant features an integral part of a new home during construction. A must for builders or anyone building a new or custom home.

One- and Two-Family Dwelling Code, Appendix F. The Council of American Building Code Officials (CABO) One-and Two-Family Dwelling Code, Appendix F includes radon-resistant techniques. CABO International can be reached at 708-799-2300 for information.

Radon Technical Guidance

EPA has recommended that **ASTM E2121-09, Standard Practice for Radon Mitigation Systems in Existing Low-Rise Residential Buildings**, replace their previous standard, EPA Radon Mitigation Standards (EPA 402-R-93-078, Revised April 1994). This ASTM standard provides the professional radon mitigation contractor with the best practices for installation of mitigation systems in existing attached and detached residential buildings three stories or less in height.

Protocols for Radon and Radon Decay Product Measurements in Homes (EPA 402-R-92-003, June 1993). This document is intended for use by qualified radon measurement technicians and testers, and laboratories that analyze radon devices and prepare radon test results reports. These protocols were written to guide routine radon measurements (Citizen's Guide) and those made in conjunction with real estate transactions (Home Buyer's and Seller's Guide).

Indoor Radon and Radon Decay Product Measurement Device Protocols (EPA 402-R-92-004, July 1992). This document is intended for use by qualified radon measurement technicians and testers. It contains detailed technical information on the types of radon measurement devices, their proper use and maintenance, and quality assurance procedures. These protocols were written to guide routine radon measurements (Citizen's Guide) and those made in conjunction with real estate transactions (Home Buyer's and Seller's Guide).

STATE RADON OFFICES

www.epa.gov/radon/find-information-about-local-radon-zones-and-radon-programs#stateradon

Up-to-date information on how to contact your state radon office is available at the website listed above. You will also find a list of state hotlines, state indoor air coordinators and state websites (if available). Some states can also provide you with a list of qualified radon service providers. Native Americans living on Tribal Lands should contact their Tribal Health Department or Housing Authority for assistance.

RADON TESTING & MITIGATION SERVICES

Pennsylvania law requires that ALL third-party contractors who perform radon-related services MUST BE CERTIFIED by DEP, Bureau of Radiation Protection. EPA, NEHA or NRSB listings by themselves DO NOT constitute PENNSYLVANIA CERTIFICATION. For your safety and protection, make certain the radon testing or mitigation company you use is PENNSYLVANIA-CERTIFIED.

You can test your own home using a radon detector from a PENNSYLVANIA-CERTIFIED laboratory. However, when you need the services of a third-party professional tester, such as in a real estate transaction, make certain they are PENNSYLVANIA-CERTIFIED.

**CALL 800-237-2366
(800-23RADON)**

or

**For the Hearing Impaired
800-654-5984
AT&T Relay Service**

To obtain:

- A List of Pennsylvania-Certified radon testers, mitigators or laboratories; lists are updated monthly;
- Easy to follow checklists regarding radon testing and radon mitigation standards that all certified contractors must, at a minimum, follow when providing services to you;
- Free information packs on radon; or
- If you have any questions regarding radon or certified contractors.

Notes



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.”

January 2005

Consumer Federation of America strongly urges consumers to have elevated radon levels in their homes reduced. Pennsylvania’s *Consumer’s Guide to Radon Reduction* will assist these individuals and offers very good advice for selecting and working with a qualified radon contractor.





pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

PENNSYLVANIA RADON INFORMATION CENTER

**Bureau of Radiation Protection
Department of Environmental Protection
P.O. Box 8469
Harrisburg, PA 17105-8469**

**PENNSYLVANIA RADON INFORMATION
HOT LINE: 1-800-237-2366
OR
For the Hearing Impaired
1-800-654-5984
AT&T Relay Service**

Environmental information is available electronically via the Internet. For more information, visit www.dep.pa.gov.

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2900-BK-DEP1544 Rev. 3/2016