

# **Pennsylvania Citizen's Guide To Radon**



**The Guide To Protecting  
Yourself And Your Family  
From Radon**



# Pennsylvania Citizen's Guide to Radon

## EPA Recommends:



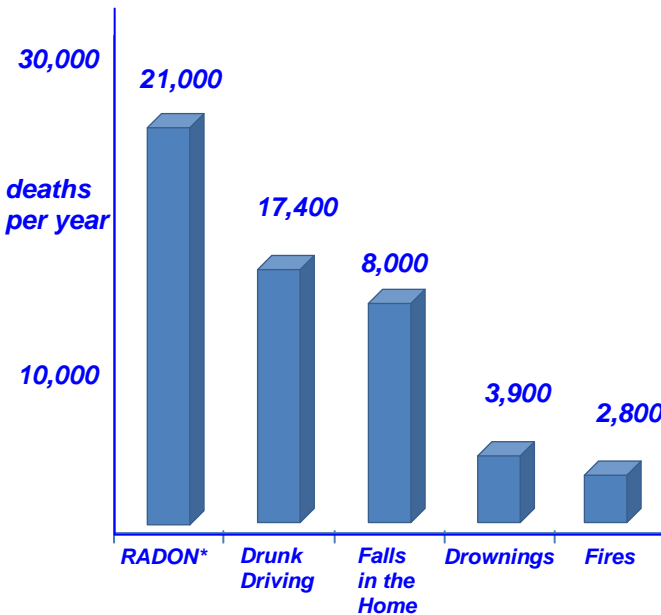
**Test your home for radon – it is easy and inexpensive.**



**Fix your home if your 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.**



Radon is estimated to cause 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 the Environmental Protection Agency's (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.

### ***Radon is a cancer-causing, radioactive gas.***

You can't see radon. And you can't smell it or taste it. But it may be a problem in your home.

Radon is estimated to cause many thousands of deaths each year. That's because when you breathe air containing radon, you can get 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. Only smoking causes more lung cancer deaths. **If you smoke and your home has high radon levels, your risk of lung cancer is especially high.**

### ***Radon can be found all over the U.S.***

Radon comes from the natural (radioactive) breakdown of uranium in soil, rock, and water and gets into the air you breathe. Radon can be found all over the U.S. It can get into any type of building – homes, offices, and schools — which results in a high indoor radon level, but you and your family are most likely to get your greatest exposure at home. That's where you spend most of your time.

### ***You should test for radon.***

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. EPA also recommends testing in schools.

Testing is inexpensive and easy — it should only take a few minutes of your time. Millions of Americans have already tested their homes for radon (see page 4).

### ***You can fix a radon problem.***

There are simple ways to fix radon problems that aren't too costly. Even very high levels can be reduced to acceptable levels.

### ***New homes can be built with radon-resistant features.***

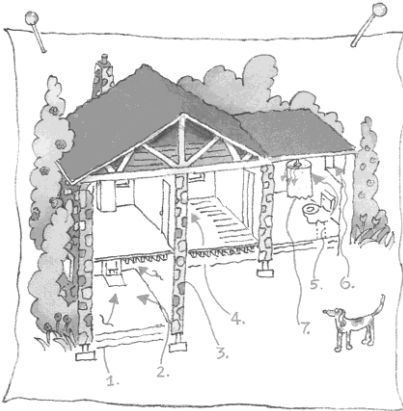
Radon-resistant construction techniques can be effective in preventing radon entry. When installed properly and completely, these simple and inexpensive techniques can help reduce indoor radon levels in homes. These techniques comprise a passive radon system. In addition, installing them at the time of construction makes it easier and less expensive to reduce radon levels further if these passive techniques don't reduce radon levels to below 4 pCi/L. Every new home should be tested after occupancy, even if it was built radon-resistant. If radon levels are still in excess of 4 pCi/L, the passive system should be activated by having a certified mitigator install a vent fan. For more explanation of radon-resistant construction techniques, refer to EPA's *Building Radon Out: A Step-by-Step Guide on How to Build Radon-Resistant Homes*.

## HOW DOES RADON GET INTO YOUR HOME?

Radon is a radioactive gas. It comes from the natural decay of uranium that is found in nearly all soils. It typically moves up through the ground to the air above and into your home through cracks and other holes in the foundation. Your home traps radon inside, where it can build up. Any home may have a radon problem. This means new and old homes, well-sealed and drafty homes, and homes with or without basements.

***Any home may have a radon problem.***

Radon from soil gas is the main cause of radon problems. Sometimes radon enters the home through well water (see page 9). In a small number of homes, the building materials can also give off radon. However, building materials rarely cause radon problems by themselves.



### **RADON ENTERS THROUGH:**

- **Cracks in solid floors**
- **Construction joints**
- **Cracks in walls**
- **Gaps in suspended floors**
- **Gaps around service pipes**
- **Cavities inside walls**
- **The water supply**

An estimated 40 percent of the homes in Pennsylvania are believed to have elevated radon levels. While radon problems may be more common in some areas, any home may have a problem. The only way to know the radon levels in your home is to test.

Radon can also be a problem in schools and workplaces. Contact DEP at 800-23RADON about radon problems in schools, daycare and childcare facilities, and workplaces in your area.

## HOW TO TEST YOUR HOME

You can't see radon, but it's not hard to find out if you have a radon problem in your home. All you need to do is test for radon. Testing is easy and only takes a few minutes to do.

The amount of radon in the air is measured in "picocuries per liter of air," or "pCi/L." Sometimes test results are expressed in working levels rather than picocuries per liter (pCi/L) (see page 6).

**Pennsylvania law requires that all third-party persons performing radon testing, mitigation, or laboratory analysis in Pennsylvania be certified.**

An exemption to this law allows the homeowner or occupant to test his or her own home without being certified. Test kits may be purchased from a Pennsylvania-certified laboratory or a local home center or hardware store. The homeowner or occupant should verify that analysis of the device is performed by a Pennsylvania-certified laboratory.

*Testing is easy and should only take a few minutes of your time.*

If you prefer, or if you are buying or selling a home, you can hire a certified tester to do the testing for you.

To verify Pennsylvania certification, please contact DEP's Radon Division at 800-237-2366 (800-23RADON) or visit [www.dep.pa.gov](http://www.dep.pa.gov).

### ***There are Two General Ways to Test for Radon***

#### ***SHORT-TERM TESTING:***

The quickest way to test is with short-term tests. Short-term tests remain in your home for two days to 90 days, depending on the device. Charcoal canisters, alpha track, 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 is less likely than a long-term test to tell you your year-round average radon level. If you need results quickly, however, a short-term test followed by a second short-term test may be used to decide whether to fix your home (see also page 8 under Home Sales).

### **LONG-TERM TESTING:**

Long-term 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 will give you a reading that is more likely to tell you your home's year-round average radon level than a short-term test.

### **How To Use a Test Kit:**

Follow the instructions that come with your test kit and ensure that the laboratory analyzing the test kit is Pennsylvania-certified by calling DEP at 800-23RADON or visit our website at [www.dep.pa.gov](http://www.dep.pa.gov).

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. Heating and air conditioning system fans that re-circulate air may be operated. Do not operate fans or other machines which bring in outside air. Fans that are part of a radon-reduction system or small exhaust fans operating only for short periods of time may run during the test. If you are doing a short-term test lasting just two or three days, be sure to close your windows and outside doors at least 12 hours **before** beginning the test, too. You should not conduct short-term tests lasting just two or three days during unusually severe storms or periods of unusually high winds.

The test kit should be placed in the lowest lived-in level of the home (for example, the basement if it is frequently used, otherwise the first floor). **Please be aware that should you sell your home, the buyer will probably base their mitigation decision on the radon levels found in the basement of the home.** 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 – away from drafts, high heat, high humidity, and exterior walls. Leave the kit in place for as long as the package indicates. Once you've finished the test, reseal the package and send it to the Pennsylvania-certified lab specified on the package right away for analysis. You should receive your test results within a few weeks.

## Pennsylvania Citizen's Guide to Radon

### *EPA Recommends the Following Testing Steps:*

**Step 1.** *Take a short-term test. If your result is 4 pCi/L or higher\*, take a follow-up test (Step 2) to be sure.*

**Step 2.** *Follow up with either a long-term test or a second short-term test:*

- *For a better understanding of your year-round average radon level, take a long-term test.*
- *If you need results quickly, take a second short-term test.*

*The higher your initial short-term test result, the more certain you can be that you should take a short-term rather than a long-term follow up test. If your first short-term test result is more than twice EPA's 4 pCi/L action level, you should take a second short-term test immediately.*

**Step 3.** *If you followed up with a long-term test: Fix your home if your long-term test result is 4 pCi/L or more\*.*

- *If you have followed up with a second short-term test: The higher your short-term results, the more certain you can be that you should fix your home. Consider fixing your home if the average of your first and second test is 4 pCi/L or higher\* (see also page 8 under Home Sales).*

\* 0.016 Working Levels (WL) or higher.





## **WHAT YOUR TEST RESULTS MEAN**

The average indoor radon level is estimated to be about 1.3 pCi/L, and about 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 in all cases, most homes today can be reduced to 2 pCi/L or below.

Sometimes short-term tests are less definitive about whether or not your home is above 4 pCi/L. This can happen when your results are close to 4 pCi/L. For example, if the average of your two short-term test results is 4.1 pCi/L, there is about a 50 percent chance that your year-round average is somewhat below 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, and you can reduce your risk of lung cancer by lowering your radon level.

***Test your home now and save your results. If you find high radon levels, fix your home before you decide to sell it.***

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.

Even if your test result is below 4 pCi/L, you may want to test again sometime in the future.



### ***RADON AND HOME SALES***

More and more, home buyers and renters are asking about radon levels before they buy or rent a home. Because real estate sales happen quickly, there is often little time to deal with radon and other issues. The best thing to do is to test for radon and save the results in case the buyer is interested in them. Fix a problem if it exists so it won't complicate your home sale. If you are planning to move, call DEP at 800-23RADON for a copy of "Pennsylvania's Home Buyer's and Seller's Guide to Radon," which addresses some common questions. You can also use the results of two short-term tests done side-by-side (four inches apart) to decide whether to fix your home.

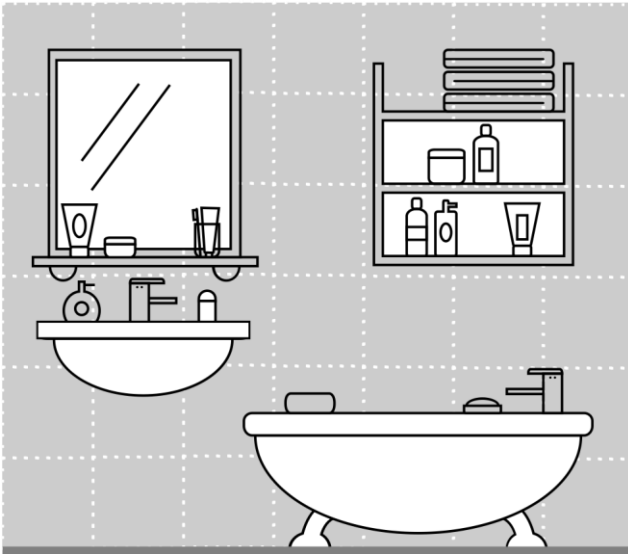
During home sales:

- If your home has been tested for radon, the test results must be disclosed when the home is sold.
- Buyers often ask if a home has been tested, and if elevated levels were reduced.
- Buyers frequently want tests made by someone who is not involved in the home sale. Visit [www.dep.pa.gov](http://www.dep.pa.gov) to identify a qualified tester.
- Buyers might want to know the radon levels in areas of the home (like a basement they plan to finish) that the seller might not otherwise test.

Today many homes are built to help prevent radon from coming in. Your state or local area may require these radon-resistant construction features. Radon-resistant construction features usually keep radon levels in new homes below 2 pCi/L. If you are buying or renting a new home, ask the owner or builder if it has radon-resistant features. Even if built radon-resistant, every new home should be tested for radon after occupancy. For more information on radon-resistant new construction, contact 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 the home through water, radon entering your home through the soil is usually a much larger risk.



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 the 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. Having radon in your water is more likely when its source is ground water (e.g., a private well or a public water supply system that uses ground water). 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 the air in your home and found a radon problem, and your water comes from a well, have your water tested.***

## ***Pennsylvania Citizen's Guide to Radon***

If you've tested your private well and have a radon-in-water problem, it can be easily fixed. Your home's water supply can be treated in two ways. Point-of-entry treatment can effectively remove radon from the water before it enters your home. Point-of-use treatment devices remove radon from your water at the tap, but only treat a small portion of the water you use, and are not effective in reducing the risk from breathing radon released into the air from all water used in the home.

**For more information, call EPA's Drinking Water Hotline at 800-426-4791. If your water comes from a private well, you can also contact DEP at 800-23RADON.**



## **HOW TO LOWER THE RADON LEVEL IN YOUR HOME**

Since there is no known safe level of radon, there can always be some risk. But the risk can be reduced by lowering the radon level in your home.

A variety of methods are used to reduce radon in your home. In some cases, sealing cracks in floors and walls may help to reduce radon. In other cases, simple systems using pipes and fans may be used to reduce radon. Such systems, known as soil suction, do not require major changes to your home. These systems remove radon gas from below the concrete floor and the foundation before it can enter the home. Similar systems can also be installed in houses with crawl spaces. Radon contractors use other methods that may also work in your home. The right system depends on the design of your home and other factors.

**Most homes can be fixed for about the same cost as other common home repairs.**

### **RADON AND HOME RENOVATIONS**

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

Ways to reduce radon in your home are discussed in "Pennsylvania Consumer's Guide to Radon Reduction." You can get a copy from DEP or view it online at [www.dep.pa.gov](http://www.dep.pa.gov).

The cost of making repairs to reduce radon depends on how your home was built and the extent of the radon problem. Most homes can be fixed for about the same cost as other common home repairs like painting or having a new hot water heater installed. The average house costs about \$1,000 for a contractor to fix, although this can range from about \$500 to about \$2,000. The cost is much less if a passive system was installed during construction.

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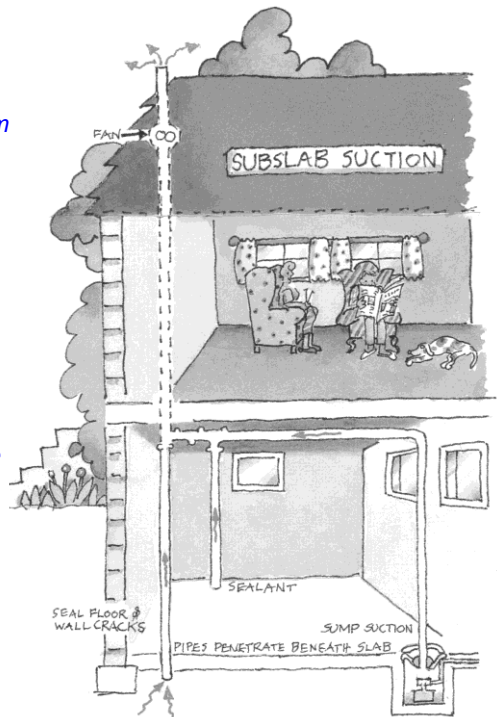
Pennsylvania law requires that all third-party persons performing radon testing, mitigation or laboratory analysis in Pennsylvania be certified.

An exemption to this law allows the homeowner or occupant to lower the levels in his or her own home without being certified. To verify Pennsylvania certification, please contact DEP's Radon Division at 800-237-2366 or visit [www.dep.pa.gov](http://www.dep.pa.gov).

*If you are considering fixing your home's radon problem yourself, you should first contact DEP at 800-23RADON for a free do-it-yourself packet of information to help with your system installation.*

You should also test your home again after it is fixed to be sure that radon levels have been reduced. Most soil suction radon reduction systems include a monitor that will indicate whether the system is operating properly. In addition, it's a good idea to retest your home every two years to be sure radon levels remain low.

*Note: This diagram is a composite view of several mitigation options. The typical mitigation system usually has only one pipe penetration through the basement floor; the pipe may also be installed on the outside of the house.*



## **THE RISK OF LIVING WITH RADON**

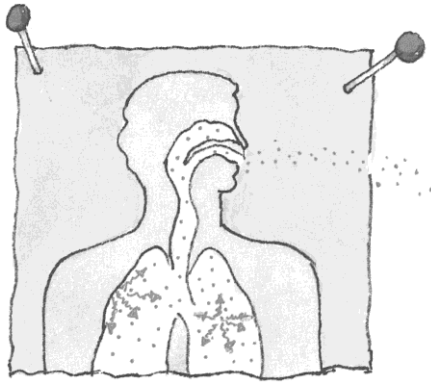
Radon gas decays into radioactive particles that can get trapped in your lungs when you breathe. As they break down further, these particles release small bursts of energy. This can damage lung tissue and lead to lung cancer over the course of your lifetime. Not everyone exposed to elevated levels of radon will develop lung cancer, and the amount of time between exposure and the onset of the disease may be many years.

Like 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 studies of cancer in humans (underground miners).

**Scientists are more certain about radon risks than risks from most other cancer-causing substances.**

Smoking combined with radon is an especially serious health risk. If you stop smoking, and lower your home's radon level, you can reduce your lung cancer risk.

Children have been reported to have greater risk than adults of certain types of cancer from radiation, but there are currently no conclusive data on whether children are at greater risk than adults from radon.



***Your chances of getting lung cancer from radon depend mostly on:***

- ***How much radon is in your home.***
- ***The amount of time you spend in your home.***
- ***Whether you are a smoker or have ever smoked.***

**RADON RISK IF YOU SMOKE**

<b>Radon Level</b>	<b><i>If 1,000 people who smoked were exposed to this level over a lifetime*...</i></b>	<b><i>The risk of cancer from radon exposure compares to**...</i></b>	<b><i>WHAT TO DO: Stop smoking and...</i></b>
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 2 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)	

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

\* 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.

***It's never too late to reduce your risk of lung cancer. Don't wait to test and fix a radon problem. If you are a smoker, strongly consider smoking cessation.***



## Pennsylvania Citizen's Guide to Radon

### RADON RISK IF YOU'VE NEVER SMOKED

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

**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.

***It's never too late to reduce your risk of lung cancer. Don't wait to test and fix a radon problem. If you are a smoker, strongly consider smoking cessation.***

## **RADON MYTHS AND FACTS**

**MYTH:** Scientists aren't sure radon really is a problem.

**FACT:** *Although some scientists dispute the precise number of deaths due to radon, all 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, since the risk to smokers is much greater than to non-smokers.*

**MYTH:** Radon testing is difficult, time consuming, and expensive.

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

**MYTH:** Radon test kits are not reliable and are difficult to find.

**FACT:** *Reliable testing devices are available from qualified radon testers and companies. Reliable testing devices are also available by phone or mail-order and can be purchased in hardware stores and other retail outlets. Call DEP at 800-23RADON for a list of Pennsylvania-certified radon testing companies.*

**MYTH:** Homes with radon problems can't be fixed.

**FACT:** *There are simple solutions to radon problems in homes. Hundreds of thousands of homeowners have already fixed radon problem in their homes. Radon levels can be readily lowered for about \$500 to \$2,000 (with an average cost of \$1,000). Call DEP at 800-23RADON for a list of Pennsylvania-certified mitigation contractors.*

## Pennsylvania Citizen's Guide to Radon

**MYTH:** Radon only affects certain kinds of homes.

**FACT:** *House construction can affect radon levels. However, radon can be a problem in homes of all types: 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:** 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 your radon level is to test.*

**MYTH:** A neighbor's test result is a good indication of whether your home has a problem.

**FACT:** *No. Radon levels can vary greatly from home to home. The only way to know if your home has a radon problem is to test it.*

**MYTH:** Everyone should test their water for radon.

**FACT:** *Although radon gets into some homes through water, it is important to first test the air in the home for radon. If your water comes from a public water supply that uses ground water, 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 for information on testing your water.*

**MYTH:** It's difficult to sell homes where radon problems have been discovered.

**FACT:** *Where radon problems have been fixed, home sales have not been blocked or frustrated. The added protection is sometimes a good selling point.*

## **Pennsylvania Citizen's Guide to Radon**

**MYTH:** I've lived in my home for so long, that it doesn't make sense to take action now.

**FACT:** *You will reduce your risk of lung cancer when you reduce radon levels, even if you've lived with a radon problem for a long time.*

**MYTH:** Short-term tests can't be used for making a decision about whether to fix your home.

**FACT:** *A short-term test followed by a second short-term test\* can be used to decide whether to fix your home. However, the closer the average of your two short-term tests is to 4 pCi/L, the less certain you can be about whether your year-round average is above or below that level. Keep in mind that radon levels below 4 pCi/L still pose some risk. Radon levels can be reduced in most homes to 2 pCi/L or below.*

*\*If the radon test is part of a real estate transaction, the result of two short-term tests can be used in deciding whether to mitigate. For more information, refer to the "Pennsylvania Home Buyer's and Seller's Guide to Radon."*

**FOR FURTHER INFORMATION**

**DEP Radon website**

[www.dep.pa.gov](http://www.dep.pa.gov)

**DEP Radon Hotline**

**800-23RADON or**

**717-783-3594**

**OTHER HOTLINES**

**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.*

**866-528-3187**

*Línea Directa de Información sobre Radón en Español. Hay operadores disponibles desde las 9:00 a.m. hast las 5:00 p.m. para darle información sobre radón y como ordenar un kit para hacer la prueba de radón en su hogar.*

**800-438-4318**

*Indoor Air Quality Information Clearinghouse, operated by an EPA contractor. For general radon and indoor air quality information and copies of EPA publications.*

**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.*

**800-644-6999**

*Radon Fix-It Hotline for help with your radon mitigation questions. Operated by K-State in partnership with EPA.*

**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



### **U.S. EPA Assessment of Risks from Radon in Homes**

In June 2003, the EPA revised its risk estimates for radon exposure in homes. EPA estimates that about 21,000 annual lung cancer deaths are radon related. EPA also concluded that the effects of radon and cigarette smoking are synergistic, so that smokers are at higher risk from radon. EPA’s revised estimates are based on the National Academy of Sciences 1998 BEIR VI (Biological Effects of Ionizing Radiation) Report which concluded that radon is the second leading cause of lung cancer after smoking.

**Pennsylvania Radon Information Center**

Bureau of Radiation Protection  
Department of Environmental Protection  
P.O. Box 8469  
Harrisburg, PA 17105-8469  
800-23RADON  
800-237-2366

or

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