United States Environmental Protection Agency | U.S. Department Of Health and Human Services | U.S. Public Health Service

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EPA

CDC
CENTERS FOR DISEASE CONTROL

A Citizen's Guide To Radon (Second Edition)

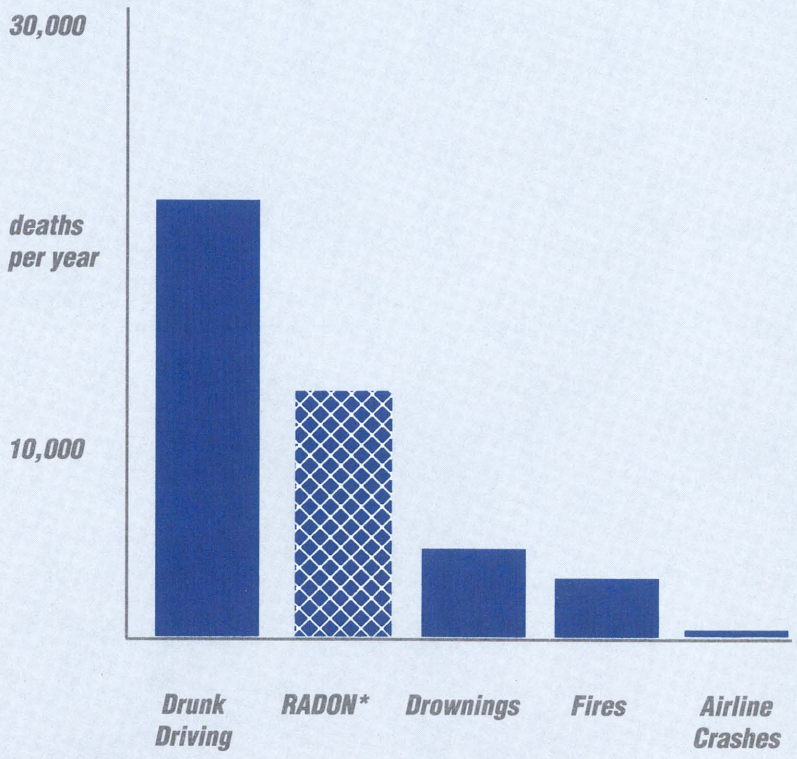
The Guide To Protecting Yourself And Your Family From Radon

Printed on Recycled Paper

EPA Recommends:

- **Test your home for radon–it's 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 cancer deaths in the U.S. each year.



* Radon is estimated to cause about 14,000 deaths per year–however, this number could range from 7,000 to 30,000 deaths per year. The numbers of deaths from other causes are taken from 1990 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 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 – and build up to high levels. 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.

You can fix a radon problem.

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

OVERVIEW

HOW DOES RADON GET INTO YOUR HOME?

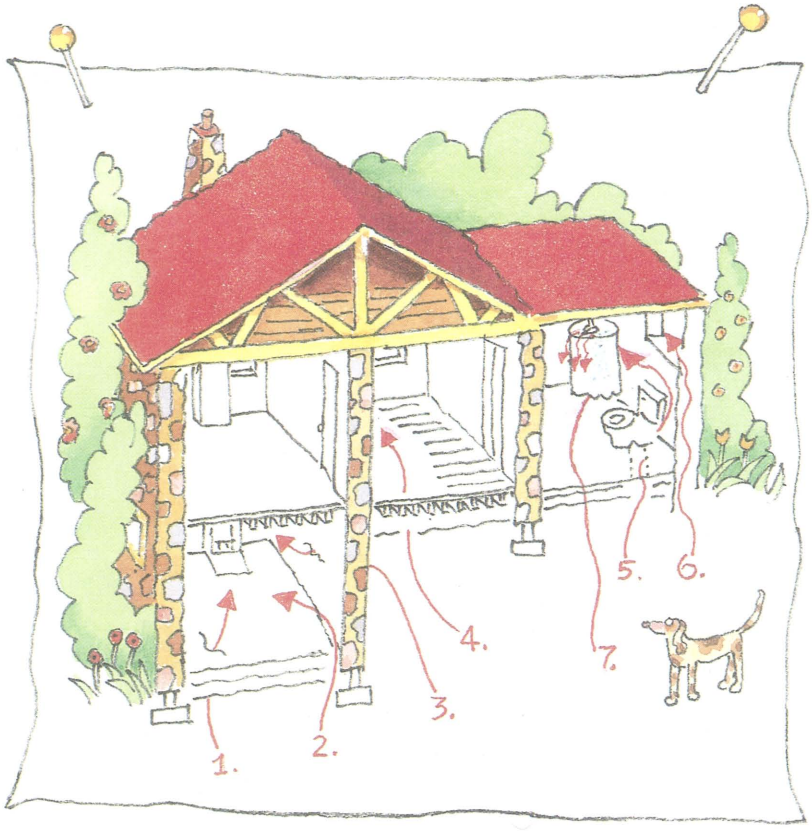
Any home may have a radon problem.

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.

Radon from soil gas is the main cause of radon problems. Sometimes radon enters the home through well water (see page 8). In a small number of homes, the building materials can give off radon, too. However, building materials rarely cause radon problems by themselves.

RADON GETS IN THROUGH:

1. ***Cracks in solid floors.***
2. ***Construction joints.***
3. ***Cracks in walls.***
4. ***Gaps in suspended floors.***
5. ***Gaps around service pipes.***
6. ***Cavities inside walls.***
7. ***The water supply.***



Nearly 1 out of every 15 homes in the U.S. is estimated to have elevated radon levels. Elevated levels of radon gas have been found in homes in your state. Contact your state radon office (see page 15) for general information about radon in your area. While radon problems may be more common in some areas, any home may have a problem. The only way to know about your home is to test.

Radon can be a problem in schools and workplaces, too. Ask your state radon office (see page 15) about radon problems in schools 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 should only take a few minutes of your time.

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 (WL) rather than picocuries per liter (pCi/L). There are many kinds of low-cost "do it yourself" radon test kits you can get through the mail and in hardware stores and other retail outlets. Make sure you buy a test kit that has passed EPA's testing program or is state-certified. These kits will usually display the phrase "Meets EPA Requirements." If you prefer, or if you are buying or selling a home, you can hire a trained contractor to do the testing for you. Make certain you hire an EPA-qualified or state-certified radon tester. Call your state radon office (see page 15) for a list of these testers.

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.

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.

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

How To Use a Test Kit:

Follow the instructions that come with your test kit. If you are doing a short-term test, close your windows and outside doors and keep them closed as much as possible during the test. (If you are doing a short-term test lasting just 2 or 3 days, be sure to close your windows and outside doors at least 12 hours **before** beginning the test, too. You should not conduct short-term tests lasting just 2 or 3 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). 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 says. Once you've finished the test, reseal the package and send it to the lab specified on the package right away for study. You should receive your test results within a few weeks.

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:***

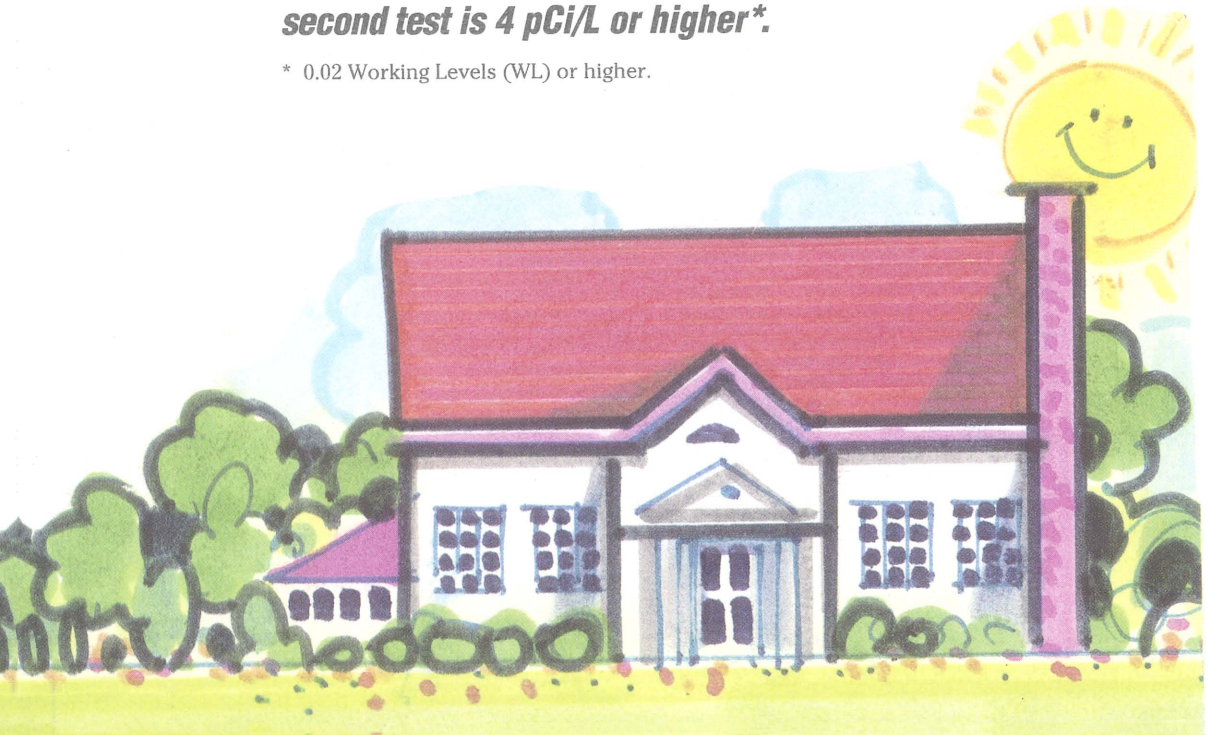
- ***For a better understanding of your year-round average radon level, take a long-term test.***
- ***If you need results quickly, take a second short-term test.***

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 several times the action level—for example, about 10 pCi/L or higher—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 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*.***

* 0.02 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% 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.

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 NOW 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 your state radon office (see page 15) for EPA's pamphlet "Home Buyer's and Seller's Guide to Radon," which addresses some common questions. During home sales:

- *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. Your state office (see page 15) has a list of qualified testers.*
- *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 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.

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

RADON IN WATER

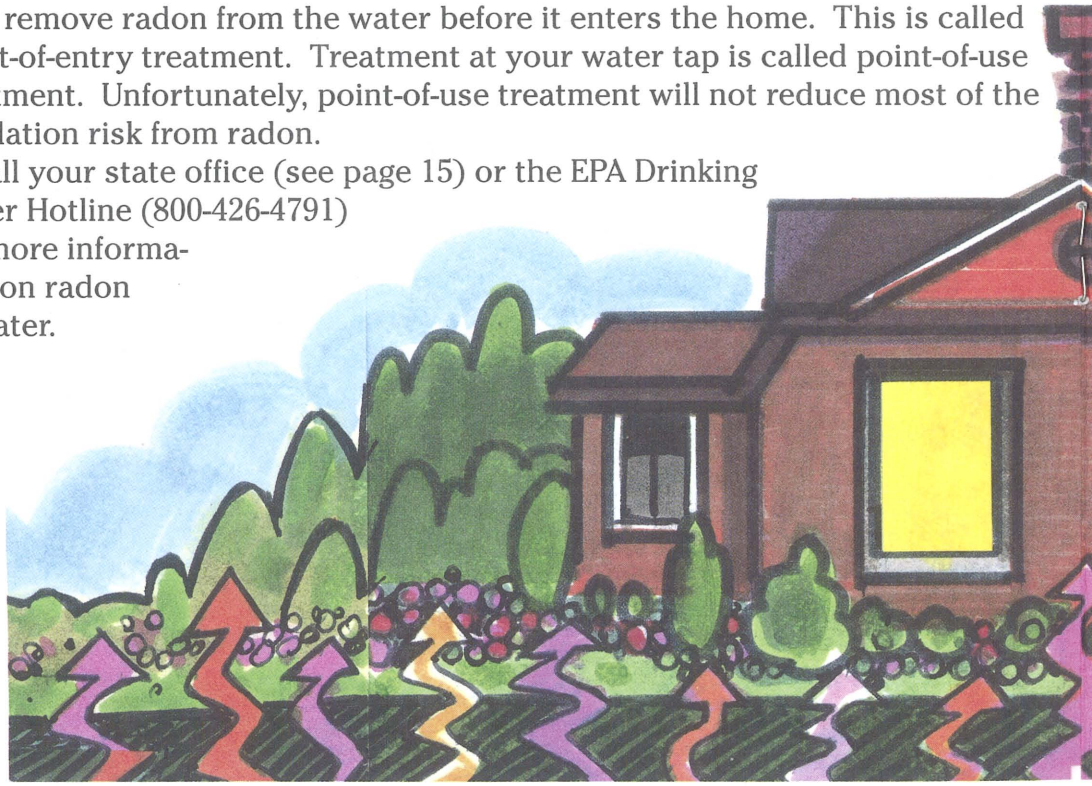
Compared to radon entering the home through soil, radon entering the home through water will in most cases be a small source of risk. Radon gas can enter the home through well water. It can be released into the air you breathe when water is used for showering and other household uses. Research suggests that swallowing water with high radon levels may pose risks, too, although risks from swallowing water containing radon are believed to be much lower than those from breathing air containing radon.

While radon in water is not a problem in homes served by most public water supplies, it has been found in well water. If you've tested the air in your home and found a radon problem, and your water comes from a well, contact a lab certified to measure radiation in water to have your water tested. If you're on a public water supply and are concerned that radon may be entering your home through the water, call your public 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.

Radon problems in water can be readily fixed. The most effective treatment is to remove radon from the water before it enters the home. This is called point-of-entry treatment. Treatment at your water tap is called point-of-use treatment. Unfortunately, point-of-use treatment will not reduce most of the inhalation risk from radon.

Call your state office (see page 15) or the EPA Drinking Water Hotline (800-426-4791) for more information on radon in water.



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 are called "sub-slab depressurization," and 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.

Ways to reduce radon in your home are discussed in EPA's "Consumer's Guide to Radon Reduction." You can get a copy from your state radon office.

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 $1,200 for a contractor to fix, although this can range from about $500 to about $2,500.

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.

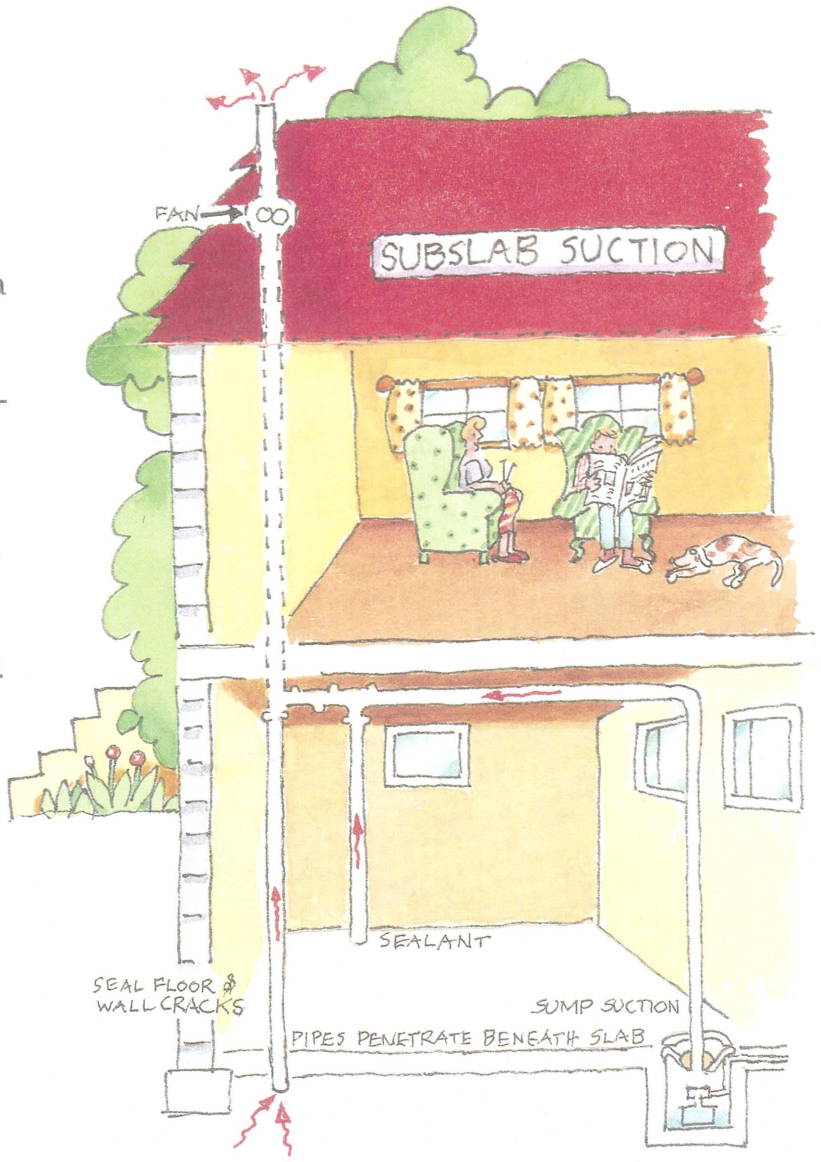
Most homes can be fixed for about the same cost as other common home repairs.

Lowering high radon levels requires technical knowledge and special skills. You should use a contractor who is trained to fix radon problems. The EPA Radon Contractor Proficiency (RCP) Program tests these contractors. EPA provides a list of RCP contractors to state radon offices (see page 15). A contractor who has passed the EPA test will carry a special RCP identification card. A trained RCP contractor can study the radon problem in your home and help you pick the right treatment method.

Check with your state radon office for names of qualified or state certified radon contractors in your area. Picking someone to fix your radon problem is much like choosing a contractor for other home repairs – you may want to get references and more than one estimate.

If you plan to fix the problem in your home yourself, you should first contact your state radon office (see page 15) for EPA's technical guide, "Radon Reduction Techniques for Detached Houses."

You should also test your home again after it is fixed to be sure that radon levels have been reduced. Most radon reduction systems include a monitor that will alert you if the system needs servicing. In addition, it's a good idea to retest your home sometime in the future to be sure radon levels remain low.



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). Additional studies on more typical populations are under way.

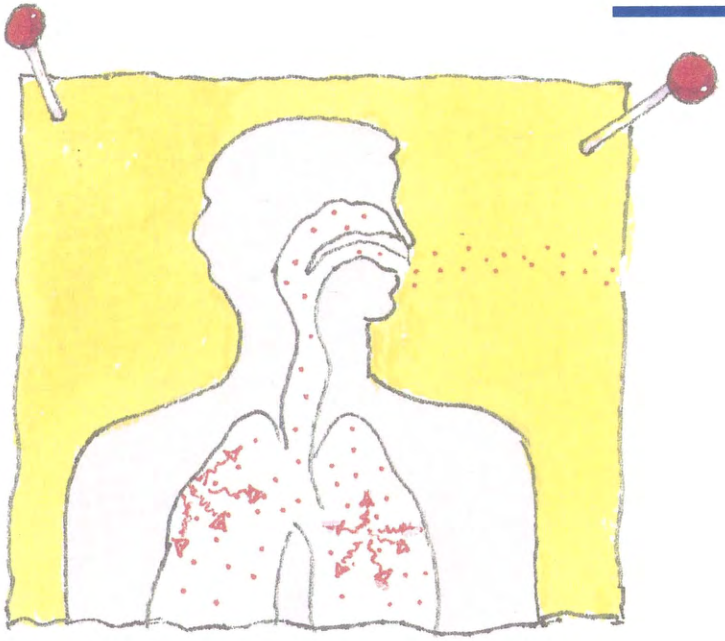
Smoking combined with radon is an especially serious health risk. Stop smoking and lower your radon level to reduce your lung cancer risk.

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.

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

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

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 135 people could get lung cancer	← 100 times the risk of drowning	Fix your home
10 pCi/L	About 71 people could get lung cancer	← 100 times the risk of dying in a home fire	Fix your home
8 pCi/L	About 57 people could get lung cancer		Fix your home
4 pCi/L	About 29 people could get lung cancer	← 100 times the risk of dying in an airplane crash	Fix your home Consider fixing between 2 and 4 pCi/L
2 pCi/L	About 15 people could get lung cancer	← 2 times the risk of dying in a car crash	
1.3 pCi/L	About 9 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.

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, stop smoking.

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 8 people could get lung cancer	← The risk of being killed in a violent crime	Fix your home
10 pCi/L	About 4 people could get lung cancer		Fix your home
8 pCi/L	About 3 people could get lung cancer	← 10 times the risk of dying in an airplane crash	Fix your home
4 pCi/L	About 2 people could get lung cancer	← The risk of drowning	Fix your home Consider fixing between 2 and 4 pCi/L
2 pCi/L	About 1 person could get lung cancer	← The risk of dying in a home fire	
1.3 pCi/L	Less than 1 person could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult)
0.4 pCi/L	Less than 1 person could get lung cancer	(Average outdoor radon level)	

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

RADON MYTHS

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 (like 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 inexpensive and easy--it should take only a little of your time.***

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

FACT: ***Reliable test kits are available through the mail, in hardware stores and other retail outlets. Call your state radon office (see page 15) for a list of test kit companies that have met EPA requirements for reliability or are state certified.***

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

FACT : ***There are simple solutions to radon problems in homes. Thousands of homeowners have already fixed radon problems in their homes. Radon levels can be readily lowered for about $500 to $2,500. Call your state radon office (see page 15) for a list of contractors that have met EPA requirements or are state certified.***

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, homes without basements.***

MYTH: *Radon is only a problem in certain parts of the country.*	***FACT:*** ***High radon levels have been found in every state. Radon problems do 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:*** ***It's 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: *Everyone should test their water for radon.*	***FACT:*** ***While radon gets into some homes through the water, you should first test the air in your home for radon. If you find high levels and your water comes from a well, contact a lab certified to measure radiation in water to have your water tested.***
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 some times a good selling point.***
MYTH: *I've lived in my home for so long, 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 may 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.***

STATE RADON CONTACTS

Alabama ***800/582-1866***
Alaska ***800/478-4845***
Arizona ***602/255-4845***
Arkansas ***501/661-2301***
California ***800/745-7236***
Colorado ***800/846-3986***
Connecticut ***203/566-3122***
Delaware ***800/554-4636***
District of Columbia ***202/727-5728***
Florida ***800/543-8279***
Georgia ***800/745-0037***
Hawaii ***808/586-4700***
Idaho ***800/445-8647***
Illinois ***800/325-1245***
Indiana ***800/272-9723***
Iowa ***800/383-5992***
Kansas ***913/296-1560***
Kentucky ***502/564-3700***
Louisiana ***800/256-2494***
Maine ***800/232-0842***
Maryland ***800/872-3666***
Massachusetts ***413/586-7525***
Michigan ***517/335-8190***
Minnesota ***800/798-9050***
Mississippi ***800/626-7739***
Missouri ***800/669-7236***
Montana ***406/444-3671***
Nebraska ***800/334-9491***
Nevada ***702/687-5394***
New Hampshire ***800/852-3345 x4674***
New Jersey ***800/648-0394***
New Mexico ***505/827-4300***
New York ***800/458-1158***
North Carolina ***919/571-4141***
North Dakota ***701/221-5188***
Ohio ***800/523-4439***
Oklahoma ***405/271-5221***
Oregon ***503/731-4014***
Pennsylvania ***800/237-2366***
Puerto Rico ***809/767-3563***
Rhode Island ***401/277-2438***
South Carolina ***800/768-0362***
South Dakota ***605/773-3351***
Tennessee ***800/232-1139***
Texas ***512/834-6688***
Utah ***801/538-6734***
Vermont ***800/640-0601***
Virginia ***800/468-0138***
Washington ***800/323-9727***
West Virginia ***800/922-1255***
Wisconsin ***608/267-4795***
Wyoming ***800/458-5847***

FOR FURTHER INFORMATION

For more information on how to reduce your radon health risk, ask your state radon office to send you these guides:

- ***Home Buyer's and Seller's Guide to Radon***
- ***Radon in Schools***
- ***Radon: A Physician's Guide***
- ***Consumer's Guide to Radon Reduction***
- ***Technical Support Document***

If you plan to make repairs yourself, be sure to contact your state radon office (see above) for a current copy of EPA's technical guidance on radon mitigation, "Application of Radon Reduction Techniques for Detached Houses."

SURGEON GENERAL HEALTH ADVISORY:

"Indoor radon gas is a national health problem. Radon causes thousands of deaths each year. Millions of homes have elevated radon levels. Homes should be tested for radon. When elevated levels are confirmed, the problem should be corrected."

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