

RADON

Exposure to Radon Causes Lung Cancer In Non-smokers and Smokers Alike

Lung cancer kills thousands of Americans every year. The untimely deaths of Peter Jennings and Dana Reeve have raised public awareness about lung cancer, especially among people who have never smoked. Smoking, radon, and secondhand smoke are the leading causes of lung cancer. Although lung cancer can be treated, the survival rate is one of the lowest for those with cancer. From the time of diagnosis, between 11 and 15 percent of those afflicted will live beyond five years, depending upon demographic factors. In many cases lung cancer can be prevented; this is especially true for radon.

Smoking is the leading cause of lung cancer. Smoking causes an estimated 160,000* deaths in the U.S. every year (American Cancer Society, 2004). And the rate among women is rising. On January 11, 1964, Dr. Luther L. Terry, then U.S. Surgeon General, issued the first warning on the link between smoking and lung cancer. Lung cancer now surpasses breast cancer as the number one cause of death among women. A smoker who is also exposed to radon has a much higher risk of lung cancer.

Radon is the number one cause of lung cancer among non-smokers, according to EPA estimates. Overall, radon is the second leading cause of lung cancer. Radon is responsible for about 21,000 lung cancer deaths every year. About 2,900 of these deaths occur among people who have never smoked. On January 13, 2005, Dr. Richard H. Carmona, the U.S. Surgeon General, issued a national health advisory on radon.

Why is radon the public health risk that it is?

EPA estimates that about 20,000 lung cancer deaths each year in the U.S. are radon-related. Exposure to radon is the second leading cause of lung cancer after smoking. Radon is an odorless, tasteless and invisible gas produced by the decay of naturally occurring uranium in soil and water. Radon is a form of ionizing radiation and a proven carcinogen. Lung cancer is the only known effect on human health from exposure to radon in air. Thus far, there is no evidence that children are at greater risk of lung cancer than are adults.

Radon in air is ubiquitous. Radon is found in outdoor air and in the indoor air of buildings of all kinds. EPA recommends homes be fixed if the radon level is 4 pCi/L (pico Curies per Liter) or more. Because there is no known safe level of exposure to radon, EPA also recommends that Americans consider fixing their home for radon levels between 2 pCi/L and 4 pCi/L. The average radon concentration in the indoor air of America's homes is about 1.3 pCi/L. It is upon this level that EPA based its estimate of 20,000 radon-related lung cancers a year upon. It is for this simple reason that EPA recommends that Americans consider fixing their homes when the radon level is between 2 pCi/L and 4 pCi/L. The average concentration of radon in outdoor air is .4 pCi/L or 1/10th of EPA's 4 pCi/L action level.

For smokers the risk of lung cancer is significant due to the synergistic effects of radon and smoking. For this population about 62 people in a 1,000 will die of lung-cancer, compared to 7.3 people in a 1,000 for never smokers. Put another way, a person who never smoked (never smoker) who is exposed to 1.3 pCi/L has a 2 in 1,000 chance of lung cancer; while a smoker has

a 20 in 1,000 chance of dying from lung cancer. Figure A compares the risks between smokers and never smokers; smokers are at a much higher risk than never smokers, e.g., at 8 pCi/L the risk to smokers is six times the risk to never smokers.

The radon health risk is underscored by the fact that in 1988 Congress added Title III on Indoor Radon Abatement to the Toxic Substances Control Act. It codified and funded EPA's then fledgling radon program. Also that year, the Office of the U.S. Surgeon General issued a warning about radon urging Americans to test their homes and to reduce the radon level when necessary (U.S. Surgeon General).

Unfortunately, many Americans presume that because the action level is 4 pCi/L, a radon level of less than 4 pCi/L is 'safe'. This perception is altogether too common in the residential real estate market. In managing any risk, we should be concerned with the greatest risk. For most Americans, their greatest exposure to radon is in their homes; especially in rooms that are below grade (e.g., basements), rooms that are in contact with the ground and those rooms immediately above them.

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 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.

Radon Risk If You've Never Smoked

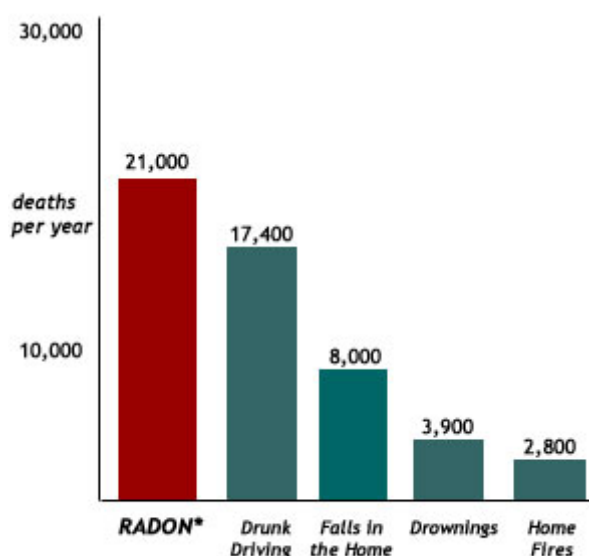
Radon Level	If 1,000 people who never smoked were exposed to this level over a lifetime*...	The risk of cancer from radon exposure compares to**...	WHAT TO DO:
20 pCi/L	About 36 people could get lung cancer	35 times the risk of drowning	Fix your home
10 pCi/L	About 18 people could get lung cancer	20 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 person could get lung cancer	The risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 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.

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 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 1999-2001 National Center for Injury Prevention and Control Report and 2002 National Safety Council Reports.

[Top of page](#)

Overview

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 result in a high indoor radon level. But you and your family are most likely to get your greatest exposure at home, 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 [How to Test Your Home](#)).

Any home may have a radon problem.

You can fix a radon problem.

Radon reduction systems work and they are not too costly. Some radon reduction systems can reduce radon levels in your home by up to 99%. 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. 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 qualified mitigator](#) install a vent fan.

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.

Radon from soil gas is the main cause of radon problems. Sometimes radon enters the home through well water (see "[Radon in Water](#)" below). 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](#) for

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

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 also be a problem in schools and workplaces. Ask your [state radon office](#) about radon problems in schools, daycare and childcare facilities, and workplaces in your area.

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.

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 in Water



There are two main sources for the radon in your home's indoor air, the soil and the 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 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 ground water, e.g. a private well or a public water supply system that uses ground

water. 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 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.

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.

There are several proven methods to reduce radon in your home, but the one primarily used is a vent pipe system and fan, which pulls radon from beneath the house and vents it to the outside. This system, known as a soil suction radon reduction system, does not require major changes to your home. Sealing foundation cracks and other openings makes this kind of system more effective and cost-efficient. Similar systems can also be installed in houses with crawl spaces. Radon contractors can use other methods that may also work in your home. The right system depends on the design of your home and other factors.

The cost of reducing radon in your home 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. The average house costs about \$1,200 for a contractor to fix, although this can range from about \$800 to about \$2,500. The cost is much less if a passive system was installed during construction.

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.

Radon Myths

MYTH: 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 (like the Centers for Disease Control and Prevention, 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 testing devices 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.*

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 problems in their homes. Radon levels can be readily lowered for \$800 to \$2,500 (with an average cost of \$1,200).*

MYTH: Radon affects only 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 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 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, test 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 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* 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.*