



Radon (Rn)

A Citizen's Guide to Radon

The Guide to Protecting Yourself and Your Family From Radon

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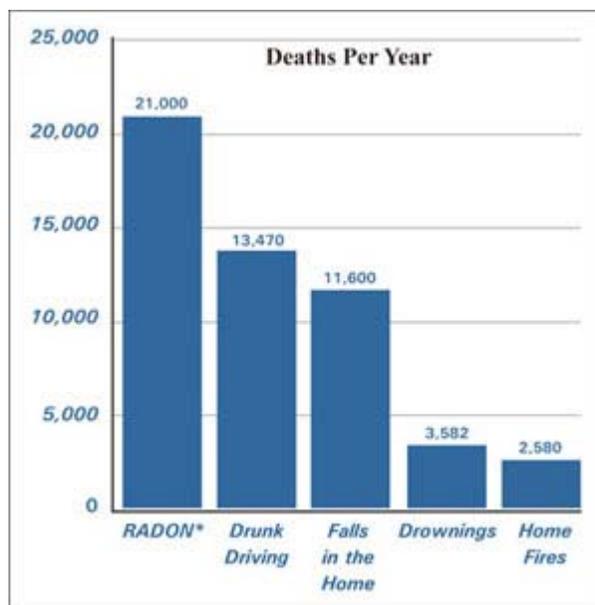
Manual Informativo Sobre El Radón, La Guía para proteger a su familia y a usted del radón

[PDF Versión](#) (16 pp., 1.5 M, [acerca de en formata PDF](#))

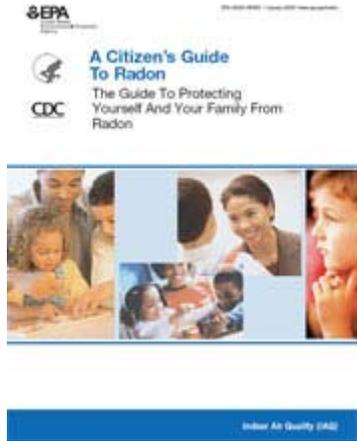
EPA Recommends

- Test your home for radon — it's easy and inexpensive.
- Fix your home if your radon level is 4 picocuries per liter, or pCi/L, or higher.
- Radon levels less than 4 pCi/L still pose a risk, and in many cases may be reduced.

EPA estimates that radon causes thousands of 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.



Indoor Environments Division (6609J)
EPA 402-K-09-001, January 2009

How to Order Publications

You can order Indoor Air Quality publications from EPA's **National Service Center for Environmental Publications (NSCEP)**
P.O. Box 42419,
Cincinnati, OH 45242-0419
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E-mail: nscep@bpa-lmit.com

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 get lung cancer. In fact, the Surgeon General has warned that radon is the second leading cause of lung cancer in the U.S. today. Only smoking causes more lung cancer deaths. **If you smoke and your home has high radon levels, your risk of 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 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 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](#)).

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 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, 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. For more information on radon resistant construction techniques, refer to EPA publication, *Building Radon Out: A Step-by-Step Guide to Build Radon-Resistant Homes* (see www.epa.gov/radon/rrnc).

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 "[Radon in Drinking 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 general information about radon in your area. While radon problems are 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, day care 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. It's 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." There are many kinds of low-cost "do-it-yourself" test kits you can get through the mail and in hardware stores and other retail outlets. If you prefer, or if you are buying or selling a home, you can hire a [qualified tester](#) to do the testing for you. You should first contact your [state radon office](#) about obtaining a list of qualified testers. You can also contact a private radon proficiency program for lists of privately certified radon professionals serving your area. For links and information, visit www.epa.gov/radon/radontest.html.

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 counter" 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, a short-term test followed by a second short-term test may be used to decide whether to fix your home (see [Home Sales](#)).

How To Use a Test Kit:

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

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 as much as possible during the test. Heating and air-conditioning system fans that re-circulate air may be operated. Do not operate fans which bring in air from outside. Fans that are part of a radon-reduction system or small exhaust fans operating only for short time may run 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 **before** beginning the test, too. You should not conduct short-term tests lasting just 2 or 3 days during unusually severe storms or 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 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 location specified on the package right away for analysis. You should receive your test results within a few weeks.

LONG-TERM TESTING:

Long-term tests remain in your home for more than 90 days. "Alpha track" and "electret" detectors are commonly used for long-term 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.

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 long-term rather than a second short-term test. If your first short-term test result is more than twice EPA's 4 pCi/L action level, you should take a second 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. (see also [How to Fix Your Home](#))

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.

Test your home now and get your results. If you find high radon levels in your home before you do

Sometimes short-term tests are less definitive about whether or not your home is above 4 pCi/L. This can happen when your test 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 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 transactions close 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 buyer the trouble of testing later. Fix a problem if it exists so it won't complicate your home sale. If you are planning to test, contact your [state radon office](#) for EPA's pamphlet "[Home Buyer's and Seller's Guide to Radon](#)," which addresses some common questions. 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:

- 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 radon office](#) can assist in identifying 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 prevent radon from coming in. Your state or local area may require these radon-resistant construction features. If you are buying or renting a new home, ask the owner or builder if it has radon-resistant features. The EPA recommends testing new homes with radon-resistant features in high radon potential (Zone 1) areas. Even if built radon-resistant, every new home should be tested for radon after occupancy. If you have a test result of 4 pCi/L or more, you can have a [qualified mitigator](#) easily add an existing passive system for about \$300 and further reduce the radon level in your home. For more information, refer to [EPA Radon Zones](#) and other useful EPA documents on radon-resistant new construction (see [publications](#)).

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.

If you've tested the air in your home and found a radon problem, radon in water comes from a well or a public water supply. If you have a well, you should have the water tested.

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 from water 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 the 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 is 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 with point-of-entry treatment that can effectively remove radon from the water before it enters your home. Point-of-use treatment devices can 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 of 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 or visit www.epa.gov/safewater/radon.html. If you have a private well, you can also contact your [state radon office](#).

How to Lower the Radon Levels 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 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 draws 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 efficient. Similar systems can also be installed in houses with crawl spaces. Radon contractors can use other methods that may also be effective. 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](#)." See [radon publicat](#)

The cost of reducing radon in your home depends on how your home was built and the extent of the radon problem. Most systems are fixed for about the same cost as other common home repairs. The cost to fix can vary widely; consult with your state radon office or more estimates from qualified mitigators. 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.

Lowering high radon levels requires technical knowledge and special skills. You should use a contractor who is trained to fix radon problems. A qualified contractor can study the radon problem in your home and help you pick the right treatment method.

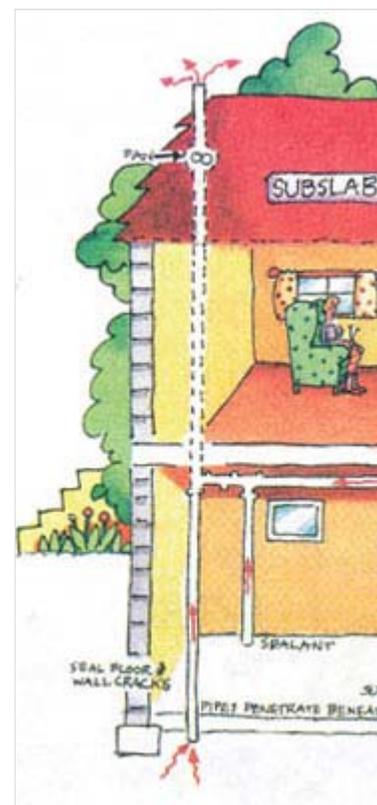
Check with your [state radon office](#) for names of qualified or state certified radon contractors in your area. You can also contact private radon proficiency programs for lists of privately certified radon professionals in your area. For more information on private radon proficiency programs, visit www.epa.gov/radon/radontest.html. 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 are considering fixing your home's radon problem yourself, you should first contact your state radon office for guidance and assistance (see www.epa.gov/radon/whereyoulive.html).

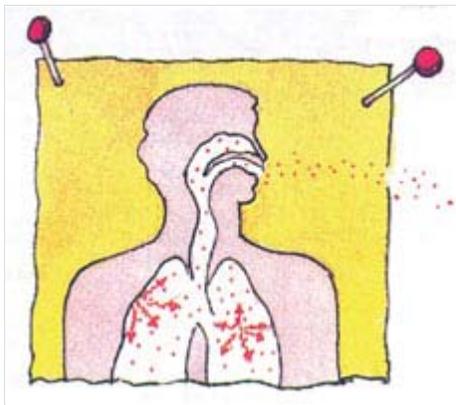
Most homes can be fixed for about the same cost as other common home repairs.

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: The diagram is a composite view of several mitigation options. The typical mitigation system usually has only one pipe 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 as you breathe. As they break down further, these particles release small bursts of energy that damage lung tissue and lead to lung cancer over the course of your lifetime. If you are exposed to elevated levels of radon, you will develop lung cancer. And the amount of exposure and the onset of the disease may be many years.

Like other environmental pollutants, there is some uncertainty about the magnitude of health risks. However, we know more about radon risks than risks from most other environmental causing substances. This is because estimates of radon risks are based on studies of humans (underground miners).

Smoking combined with radon is an especially serious health risk. Stop smoking and test 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 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
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 and 4 pCi/L
1.3 pCi/L	About 20 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 1.3 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
20 pCi/L	About 36 people could get lung cancer	35 times the risk of drowning	Fix your hc
10 pCi/L	About 18 people could get lung cancer	20 times the risk of dying in a home fire	Fix your hc
8 pCi/L	About 15 people could get lung cancer	4 times the risk of dying in a fall	Fix your hc
4 pCi/L	About 7 people could get lung cancer	The risk of dying in a car crash	Fix your hc
2 pCi/L	About 4 person could get lung cancer	The risk of dying from poison	Consider fi and 4 pCi/l
1.3 pCi/L	About 2 people could get lung cancer	(Average indoor radon level)	(Reducing below
0.4 pCi/L		(Average outdoor radon level)	2 pCi/L is c

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 and Control Reports.

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.

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 Disease Control and Prevention, the American Lung Association and the American Medical Association) agree with estimate causes thousands of preventable lung cancer deaths every year. This is especially true among smokers, since the risk to s 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 take amount of time and effort.

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 in their homes. Most homes can be fixed for about the same cost as other common home repairs; check with one or more c mitigators. Call your state radon office for help in identifying qualified mitigation contractors.

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, insulated homes, homes with basements, and homes without basements. Local geology, construction materials, ar 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 the radon level in your home 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.

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 you get water from a public water supply that uses ground water, call your water supplier. If high radon levels are found and the home has a well, call the Safe Drinking Water Hotline at 1 800-426-4791 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 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 many years.

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 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 at 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 below 4 pCi/L.

* 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 purchase or sell. For more information, see EPA's "[Home Buyer's and Seller's Guide to Radon](#)".

For Further Information

www.epa.gov/radon EPA's main radon page. Includes links to [publications](#), [Hotlines](#), [private radon proficiency programs](#) and [radon testing](#).

If you need further information about radon or would like to ask a question, see our Frequently Asked Questions system at <http://iaq.supportportal.com> and select the topic area radon. You can use this interface to submit questions and subscribe to radon information.

Radon Hotlines

1-800-SOS-RADON (1-800-767-7236)*

National Radon Hotline Purchase radon test kits by phone.

1-800-55RADON (1-800-557-2366)*

National Radon Helpline Get live help for your radon questions.

1-800-644-6999*

National Radon Fix-It Line For general information on fixing or reducing the radon level in your home.

1-800-426-4791

<http://www.epa.gov/radon/pubs/citguide.html>

Safe Drinking Water Hotline, operated under contract to EPA. For information on testing, treatment, radon in water, and c standards.

*Operated by [Kansas State University](#) in partnership with EPA

EPA Regional Office, State Radon Coordinators, Tribal Program Offices

Call your state office for additional help with any of your radon questions. Up-to-date information on how to contact your sta your EPA Regional Offices and Tribal Coordinators is available at www.epa.gov/radon/whereyoulive.html (just click on your regional office). Visit www.epa.gov/iaqtribal for information specifically presented for Tribal Partners.

Publications

Radon publications in print can be downloaded, most are in HTML and as PDF files. You can request a print-quality versior document, see www.epa.gov/radon/pubs

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 assessment 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 1999 BEIR IV (Biological Effects of Ionizing Radiation) Report which concluded that radon is the second leading cause of lung cancer after smoking. See www.epa.gov/radon/risk_assessment.html

[Health Risks](#)
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[Kids, Students & Teachers](#)

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