



Maine Department of Human Services
Bureau of Health
Radiation Control Program

A Maine Citizen's Guide to Radon

The Guide to Protecting
Yourself and Your Family
from Radon





Radon is an odorless, invisible gas that can cause cancer in you or a family member.



Radon could be in your home right now.

Have your home tested for radon today! It's easy!

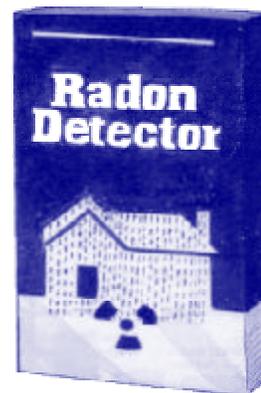




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Radon: Just the Facts

What is radon?

Radon is a cancer-causing, radioactive gas. Radon comes from the natural (radioactive) breakdown of uranium in soil, rock and water and gets into the air you breathe. Radon is estimated to cause many thousands of deaths each year. You can't see, smell or taste radon. But it may be a problem in your home. When you breathe air containing radon, you can get lung cancer. 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.**

Where do you find radon?

Radon can be found all over the U.S. However, the rocks and soils of Maine create more radon than the rocks and soils of most other States. Since Maine has so much radon, high levels are found in all types of buildings. Many schools and offices have high levels. However, you and your family are most likely to get exposed at home because that is where you spend most of your time.

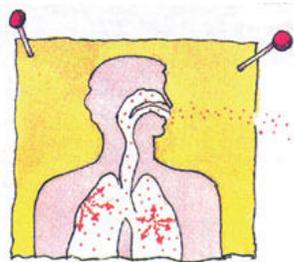
What should I do about radon?

You should **test** for radon. The US EPA, the Surgeon General, and the Maine Bureau of Health recommend testing all buildings for radon. Maine regulations require the lowest usable level of a building be tested - usually the basement - in addition to any other level of the building you want to test, such as the main living area. Maine also recommends that every well be tested for radon in water. Any homeowner can accurately test their home's air and water for radon. If you are selling your home, Maine law requires you to hire a Maine registered radon service provider as a guarantee to potential buyers that the test was

done under proper conditions. Contact the Maine Radon/IAQ Program at 207-287-5676 or 1-800-232-0842 (in Maine only) or on the web at www.maineradiationcontrol.org for more information on radon testing or Maine laws regarding radon testing. If your radon tests show your home has too much radon in the air or water, don't panic! The radon problem can be fixed easily and quickly.

You should **fix** a radon problem. There are simple ways to fix a radon problem that aren't too costly.

What Danger Does Radon Pose to Me and My Family?



Radon is a naturally-occurring radioactive gas that can cause lung cancer. Like all radioactive substances, radon decays into other substances and gives off radiation. Radon gas decays into radioactive elements that can get trapped in your lungs when you breathe. This can damage lung tissue and lead to lung cancer over the course of your lifetime. Not everyone exposed to high levels of radon will develop lung cancer. The amount of time between exposure and the onset of the disease may be many years.

Like other health hazards in the environment, there is some uncertainty about how big the health risks are from radon. 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 (in underground mines and in homes). Additional studies on radon in homes 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.

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

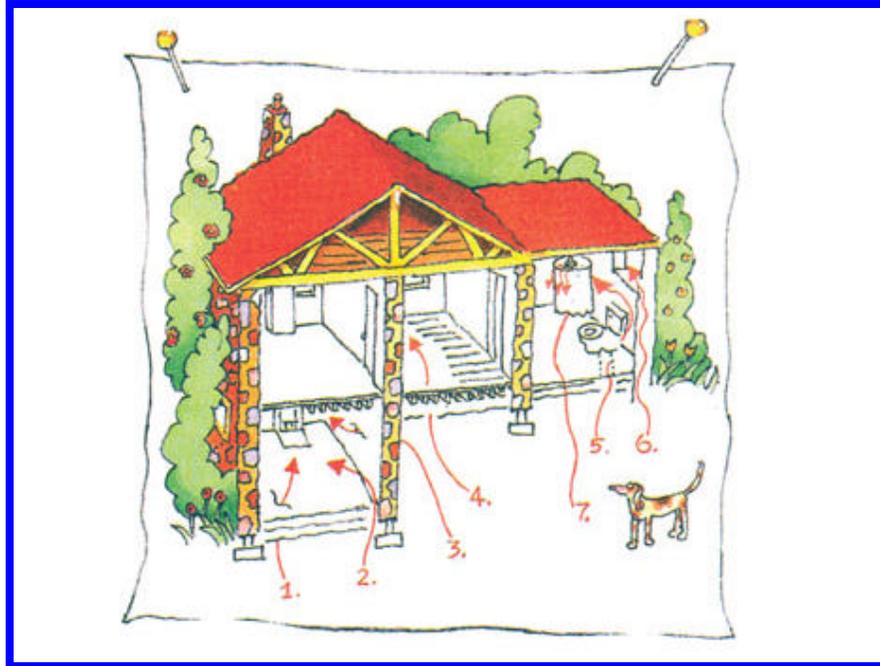
- How much radon is in your home.
- The amount of time you spend in your home.
- Whether you are a smoker or have ever smoked.

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

How Does Radon Get Into My 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, even ones you can not see. 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”, page 16). In a small number of homes, the building materials can give off radon, too (materials such as granite and cinder-



block or concrete made with uranium mill tailings, etc.). However, building materials rarely cause radon problems by themselves.

Maine has radon concentrations that are generally *higher* than much of the country. Approximately **one in three Maine homes** has air radon concentrations over four (4) picocuries per liter of air (pCi/L). If you have 4 pCi/l of radon in your air, you can and should reduce it. Levels between 2 pCi/l and 4 pCi/l can often be reduced, as well. 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 for radon.

Radon can be a problem in schools and workplaces, too. All public schools in Maine were tested several years ago, and many newer schools have since been tested. Many other types of workplaces have also been tested. Ask your school or workplace about

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Any home may have a radon problem from such sources as:

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

their radon levels.

How Do I Test My 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.

- There are many kinds of **"do-it-yourself"** radon test kits available through Maine registered testing labs. If you are not selling your home, and want to test for yourself, contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at *www.maineradiationcontrol.org* for a list of labs that have proven they can give accurate radon test results.
- If you are selling your home, or you want someone else to test

for you, you should hire a **trained testing contractor** to do the testing for you. Contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org for a list of these trained testers. Most of them are also trained home inspectors.

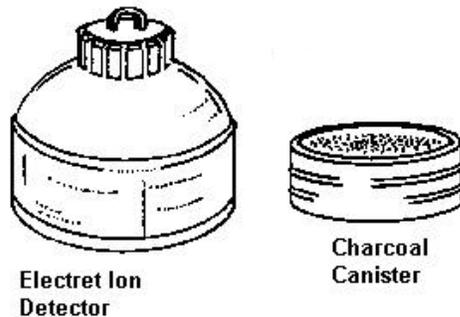
Maine regulates every person and company that conducts radon testing, analyzes radon test kits, or reduces radon levels. This is for both radon in air and radon in water. Additionally, Maine law requires that, if a house is for sale and the buyers or sellers want it tested for radon, the test must be done by a trained testing contractor. Currently Maine does not require radon testing during home sales, only that trained contractors do the test if it is for sale and a radon test (air or water) is requested.

Two 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, but are generally less than seven days. "**Charcoal canisters,**" "**electret ion chamber,**" "**continuous monitors,**" and "**charcoal liquid scintillation**"

detectors are most commonly used for short-term testing.



Any of these tests will accurately tell you what your radon levels are. However, some change in radon concentration is normal, so radon tests at different times can give slightly different results. For instance, a house with 3.5 pCi/l could have 4.2 pCi/l during a later test (or vice versa). It would be unusual for a house to test with 4.2 pCi/l, and have 2.0 during a later test unless actions had been taken to reduce the radon levels. Similarly, it would be unusual for a house with a valid test of 3.5 pCi/l to have a result of

8.0 pCi/l during a later test. In either of these cases, you should contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org to understand what these large differences could mean for your home.

Remember, some change in radon concentration is *normal*.

LONG-TERM TESTING:

Long-term tests remain in your home for more than 90 days, and are usually used to do a year-long test. An "**alpha track**" detector is 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. Long term tests are usually used as a follow up when a short term test result was just below 4 pCi/l and the test was done during the summer.

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 less than 4 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 during unusually severe storms or periods of unusually high winds.
- The test kit should be placed in the lowest livable level of the home as per Maine regulations (usually the basement).
 - A basement less than 6 ft. high, or that can not be accessed from the house would normally not be tested. A crawl space should never be tested.

- 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. You should receive your test results in a few days to a week.*

The Maine Radon/IAQ Program can help you decide where to get a test kit, where to place it, and can help you understand your test results. If you are buying or selling a home, they can help you find a trained testing contractor. (Turn to page 24 for more information.)

Recommended Testing Procedure If You Are NOT Buying or Selling a Home :

- 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.**
- 2. Follow up with either a long-term test or a second short-term test:**
 - If your first test came back well over 4 pCi/l, take a short term follow up test.**
 - If your first test came back just under or just over 4 pCi/l, take a long term follow up test; or if you want results quicker, take a short term test.**
 - If your first test was during summer, and was just below 4 pCi/l, consider taking a long-term follow up test because indoor radon levels are typically higher in colder months than warmer months.**

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.

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 Do My Test Results Mean?

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).



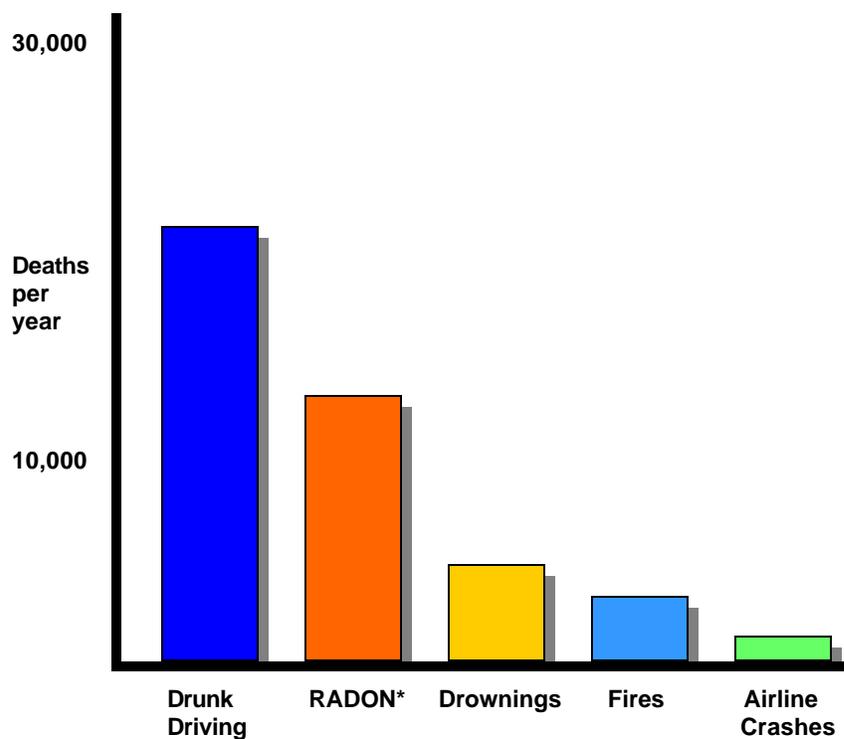
The U.S. average indoor radon level is estimated to be about 1.3 pCi/l. Studies have shown the average whole house indoor radon level in Maine is 4.1 pCi/l. Nationally, the outdoor air has about 0.4 pCi/l, while in Maine there is generally 0.5-0.8 pCi/l outdoors. The U.S. Congress has set a long-term 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.

(continued on page 16)



Radon Summary

- ▼ 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 can be reduced.



* Radon is estimated to cause about 14,000 deaths per year nationally, and about 165 deaths per year in Maine.

Radon is a cancer-causing, radioactive gas.

Radon is estimated to cause many thousands of deaths each year. You can't see radon. And you can't smell it or taste it. But it may be a problem in your home. When you breathe air containing radon, you can get lung cancer. 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. You and your family are most likely to get exposed at home because 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. 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.

Sometimes short-term tests are less clear 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 a chance that your year-round average is somewhat below 4 pCi/L. However, all health agencies believe 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.

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

If your living patterns change (such as moving a bedroom to the basement) or you modify your home (such as a new furnace or a new roof), you should retest your home. You should also test again before putting your home up for sale.

Is There Radon in My Water?

Radon gas can enter the home through well water. Compared with radon entering the home through soil, radon entering the home through water will in most cases be a smaller source of risk. 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. **Very high**

concentrations of radon can be found in Maine drinking water. The Maine Bureau of Health recommends radon concentrations in drinking water of 20,000 pCi/L or above be reduced. Studies have shown that nearly **one in five Maine wells** have radon concentrations this high or higher. Several in southern Maine have radon concentrations above *one million* pCi/L.

If your water comes from a private well, you should test the water for radon. You can buy a test kit from a lab approved to analyze radon in water (lists are available from the Maine Radon/IAQ Program at 1-800-232-0842 or on the web at www.maineradiationcontrol.org). If you are on a public water supply and are concerned that radon may be entering your home through the water, call your public water supplier.

Radon problems in water can be easily 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.

If you have a private well and you are concerned about radon, have your water tested now.

You can find more information about radon in water by contacting the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org. Additional information is also available at www.epa.gov/OGDW/radon/html

How Do I Lower the Radon Level in My 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.

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.

Several methods can be used to reduce radon in your home. The most reliable, most durable, and least expensive method is a simple system using pipes and fans. This system, called “sub-slab depressurization”, does not require major changes to your home. This type of system removes 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.

More information on radon reduction methods is available from the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at *www.maineradiationcontrol.org*.

The cost of making repairs to reduce radon depends on how your home was built and the size 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 \$900 to about \$2,500.

Lowering high radon levels requires technical knowledge and special skills. Maine requires anyone doing radon reduction work in someone else’s home or building to attend training, pass an

exam, and become registered with the Maine Radon/IAQ Program. A list of these approved contractors is available from the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org. 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 the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org for current guidance.

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

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. Moreover, the protocols for Real Estate testing differ from basic testing protocols.



If you are a home owner, the best thing to do is to test for radon NOW (before the home is for sale) and save the results in case a 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, contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org for more information about dealing

Today many homes are built to prevent radon from coming in. Your local area may require these radon-resistant construction features. Radon resistant construction features usually lower radon levels in new homes to half of what they would have been without the system. For this reason, every home built radon resistant needs to be tested and if radon is still high, the system needs to be activated. Contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org for more information on radon resistant construction.

If you are buying or renting a new home, ask the owner or builder if it has radon-resistant features.

Some Common Myths About Radon

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 inexpensive and relatively easy -- it should take only a little of your time. However, follow the directions carefully to assure an accurate, reliable measurement of radon.

MYTH: *Radon testing devices are not reliable and are*

difficult to find.

FACT: Reliable testing devices are readily available from the many Maine registered radon testing labs. Contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at *www.maineradiationcontrol.org* for the names of labs near you.

MYTH: Homes with radon problems can't be fixed, or can't be fixed economically.

FACT: There are solutions to radon problems in homes. Thousands of homeowners have already fixed radon problems in their homes. Radon levels can be readily lowered for \$900 to \$2,500. Contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at *www.maineradiationcontrol.org* for information on how to acquire the services of a qualified professional.

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.

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

FACT: High radon levels have been found in every state, including Maine. In fact, Maine has radon concentrations that are generally higher than much of the country. The average home radon concentration in Maine is 4.1 picocuries per liter (pCi/L). This is much higher than the national average of 1.4 pCi/L. Radon problems do vary from area to area, but the only way to know your home's radon level is to test.

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

FACT: Radon levels 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: While it is true that everyone with a well should test their water for radon, anyone who gets their water from a town/public water supply does not need to test the water. The people in charge of the town/public water supply are already taking care of radon, along with many other possible contaminants. If you have questions about your town's water, call your water supplier.

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

FACT: Many types of problems can hinder a home sale, but when the problems are fixed before the home is listed, the sales are not slowed down. It is the same for radon. All homes should be tested for radon, and those with problems fixed before being listed for sale.

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 cannot be used for making a decision about whether to fix your home.*

FACT: Short term tests can be used to decide whether to fix your home, and for higher radon levels (8 pCi/l or higher) that is all that should be used. Keep in mind that, even though the action level is 4 pCi/l, this is not a 'safe'

level and that radon levels below 4 pCi/l still pose some risk. Radon levels in most homes can be reduced to 2 pCi/l or less.

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.



**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."

To obtain a copy of this publication

Contact:

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Toll Free (in Maine only): 1-800-232-0842
Fax: 207-287-3059
<http://www.maineradiationcontrol.org>

For Further Information

For more information on how to reduce your radon health risk, call the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org. Other radon information is available from the US EPA at www.epa.gov/iaq/radon/pubs. Other Indoor Air Quality-specific publications are located at www.epa.gov/iaq/pubs/.





Hotlines:

Maine Radon Hotline: 1-800-232-0842

For other Indoor Air Hotlines: www.epa.gov/iaq/iaqline.html.

If you plan to make repairs yourself, be sure to contact the Maine Radon/IAQ Program (207-287-5698; toll free in Maine only: 1-800-232-0842) or on the web at www.maineradiationcontrol.org for current guidance.



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Contents of this booklet have been adapted from the
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