

READ ON ABOUT RADON

PROTECT YOUR HOME, YOUR HEALTH, AND YOUR FAMILY

What is radon?

Radon is a colorless, odorless radioactive gas that is produced from the natural decay of uranium that is found in nearly all soils. As radon gas moves up through the soil it enters into your home. Radon then decays into particles that are in the air you breathe.

Long term exposure to radon can lead to lung cancer. Over 21,000 lung cancer deaths in the U.S. each year are attributed to radon, making it a serious health concern in the U.S.

About this guide

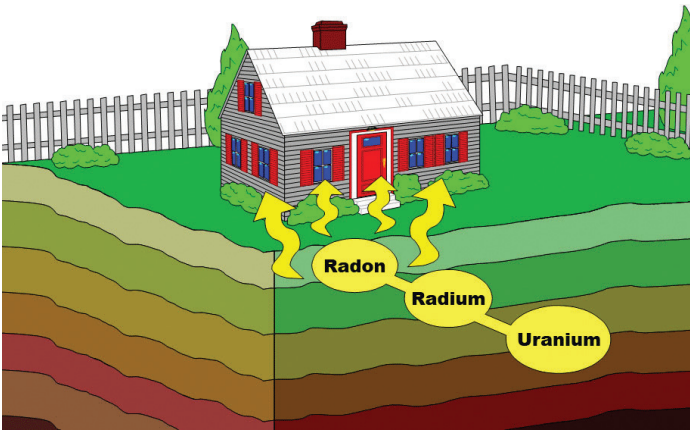
This guide is presented to you by Garfield County, Pitkin County and the City of Aspen. This guide explains the health risks of radon, and why it is important for every home to be tested. In this guide, you will learn:

- Why radon is a concern
- How you are exposed to radon
- How to test for radon
- What you should do if you have a radon problem.

This guide is designed to help protect your biggest investment, your home; and to keep those you cherish most healthy and safe.

How serious a problem is radon in Western Colorado?

Radon is a national environmental health problem. The US Environmental Protection Agency (EPA) estimates that as many as 8 million homes throughout the country have elevated levels of radon. In Colorado, ALL counties are rated as a high risk for high radon. In the last five years, approximately 50 percent of the homes tested for radon from Aspen to Rifle were above the EPA's action level of 4 pico curies per liter (pCi/L). The risk for high levels of radon is partly due to our soils and rocks having a higher than average content of uranium – such as granites, dark shales, and sedimentary rocks.



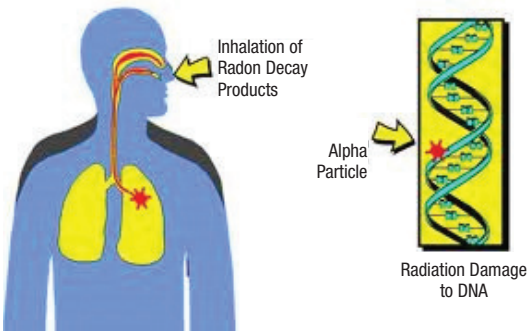
Where is your greatest exposure to radon?

Radon is present everywhere, both indoors and outdoors. There is no known safe level. Outdoors, radon generally disperses and does not reach high levels. Your greatest exposure to radon is inside. This is because radon becomes concentrated inside buildings where you spend most of your time. Your home can have radon whether it is old or new, well-sealed or drafty, and with a basement or a crawlspace. **The U.S. Surgeon General says that people should take action to lower radon levels in the home if the level is 4.0 pCi/L or higher.**

Radon is a lung cancer risk

Exposure to radon over a long period of time can lead to lung cancer. Radon gas in the air breaks down into tiny radioactive elements. These radon decay products can lodge in the lining of the lungs where they can give off radiation. This radiation can damage lung cells and eventually lead to lung cancer.

EPA states, “Any radon exposure has some risk of causing lung cancer. The lower the radon levels in your home, the lower your family’s risk of lung cancer.” The average person receives a higher dose of radiation from the radon levels in their home than from their combined exposure to all other radiation sources, natural or man-made. To learn more about the evidence and research on radon lung cancer risks check out Iowa State’s research at <http://www.cheec.uiowa.edu/misc/radon.html>.



Radon Level Annual Average	Lung Cancer Risk for people who Never Smoked	Lung Cancer Risk for people who Smoke
20 pCi/L	36 out of 1,000	260 out of 1,000
10 pCi/L	18 out of 1,000	150 out of 1,000
8 pCi/L	15 out of 1,000	120 out of 1,000
4 pCi/L	7 out of 1,000	62 out of 1,000
2 pCi/L	4 out of 1,000	32 out of 1,000

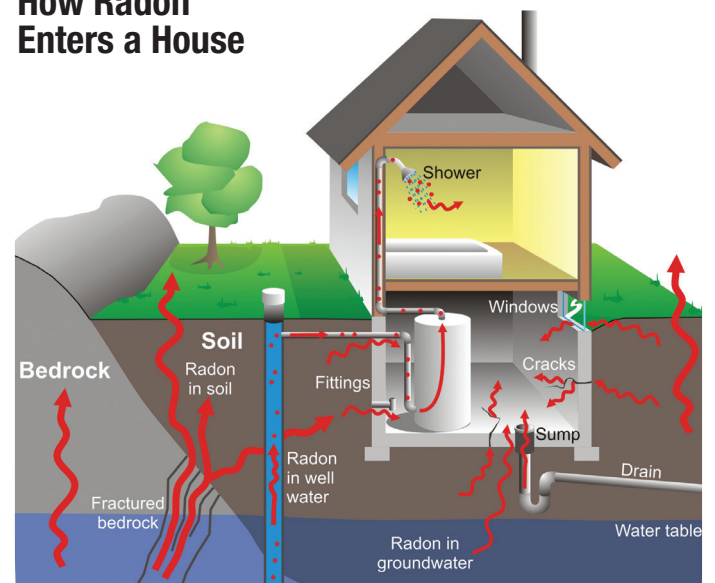
This table estimates your lifetime risk of lung cancer death due to long-term exposure to radon.

RADON IN YOUR HOME

How does radon enter a home?

Radon is emitted from soil and is present nearly everywhere. Because soil is porous, radon gas is drawn into the home through the dirt and rocks due to a difference in air pressure between inside the home and the surrounding soil. There are many pathways for radon to enter a home's foundation, such as small holes, cracks, plumbing penetrations and sump pumps. If allowed to accumulate in the home, radon becomes a health concern.

How Radon Enters a House



Dynamic forces with radon entry

Two components that affect how much radon will accumulate in a home are pathways and air pressure. These components will differ from home to home.

Pathways are any openings in the home's exterior that allows radon gas to enter the home. Radon enters through: Cracks in otherwise solid floors, gaps in suspended floors, cracks in walls, cavities inside walls, gaps around service pipes, construction joints, and the water supply.

Air pressure is the difference in pressure between inside the home and the outside air and soil. Homes commonly operate under a negative air pressure, especially during the winter. This means the air pressure inside your home is typically lower than the surrounding air and soil. This creates a vacuum that pulls radon and other soil gases into the home via these pathways. Even if the ground around the house is frozen or covered in snow, the gravel and disturbed ground underneath the home remains warm and permeable, pulling radon gas from the surrounding soil.

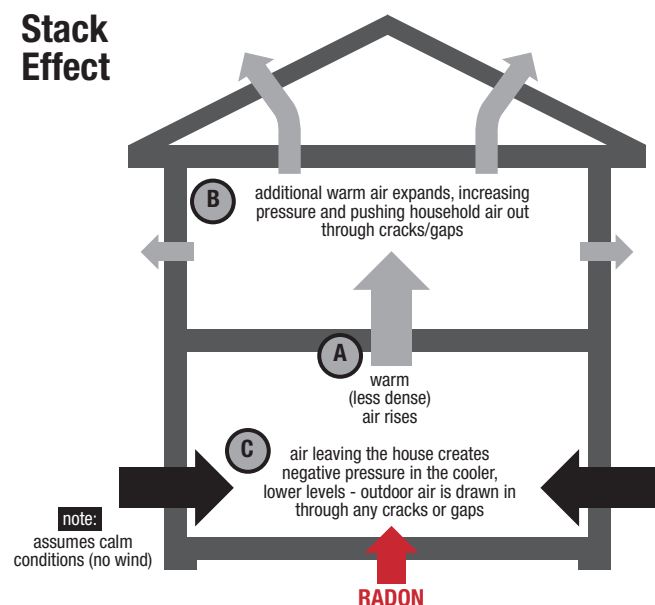
Other factors also contribute to air pressure changes in a home, including the stack effect and vacuum effect.

The stack effect: As warm air rises to the upper portions of a home, it is displaced by cooler, denser outside air. Some of that displaced air comes from the soil.

The downwind draft effect: Strong winds can create a vacuum as they blow over the top of and around the home.

The vacuum effect: Combustion appliances (like furnaces, hot water heaters, and fireplaces) as well as exhaust fans and vents can remove a considerable amount of air from a home. Air enters the home to replace it. Some of this replacement air comes from the underlying soil.

Stack Effect



A home's foundation

Any home can have a radon problem no matter what type of foundation it has.

Basements and Slab-On-Grade Foundations: Slabs built on grade can have many openings that allow radon to enter. Radon gas can come in through the smallest crack in a slab or basement wall.

Crawl Space Foundations: Homes with crawl spaces can also have elevated radon levels due to the exposed dirt found in most crawl spaces.

Multiple Foundations: Many homes have more than one type of foundation due to new additions, slope of the property, or other design or construction reasons. Testing should be done in the lowest foundation type that is livable.

What happens after radon gets into the home?

Radon levels are often highest at the entry point, typically in the lowest part of a building because radon is a heavy gas. As radon gas moves upward diffusion, natural air movements, and mechanical equipment (such as a forced-air ventilation system) distribute the radon through the home. Understanding how radon moves through your home environment helps when conducting radon testing. If initial testing in your lowest livable area shows high radon levels, your local health department may recommend testing on each floor of your home depending on the amount of time you spend in that part of the home.

REDUCE YOUR RADON RISK

In the U.S., radon is the number one cause of lung cancer in non-smokers and the second leading cause of lung cancer (after tobacco) in smokers. The good news is you can reduce the risk of radon induced lung cancer through three simple steps

Step 1
PICK UP
A RADON
TEST KIT

Step 2
DO THE
TEST

Step 3
FIX THE
PROBLEM
IF NEEDED
>4 pCi/L

RADON TESTING

Testing your home for radon

Local health departments recommend that everyone tests their homes for radon. A radon test is the only way to find out how much radon is in your home. Performing a radon test on your own is easy, inexpensive, and takes only a few minutes of your time. The results of a properly performed radon test will help you determine if you need to take further action to protect you and your family from the health risks of radon.

Radon levels vary from home to home. A neighbor's test result is a poor predictor of your radon risk, because each home can have different indoor radon levels. There are many instances of a house with over 35 pCi/L being right next to a house with less than 4 pCi/L. **The only way to know your radon level is to test.**

What type of radon test kit should I use?

There are two basic types of radon tests: short-term and long-term tests.

Short-term tests measure radon levels for 3 to 7 days. While short-term tests do not measure the annual average level of radon, they do offer a quick way to screen for radon in a home.

Long-term tests determine the average concentration for a minimum of 90 days up to one year. Long-term tests are the best way to determine the annual average of radon in the home. A year-long test is done to include both winter and summer.

Short-Term Test



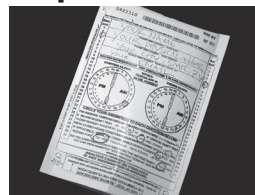
Long-Term Test



Contact your local environmental health department to find out how to get a test kit.

SIMPLE STEPS FOR USING A SHORT TERM RADON TEST KIT

Step 1



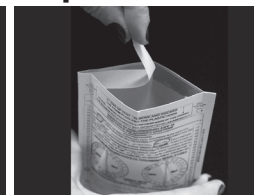
Fill it out.

Step 2



Hang it up.

Step 3



Close it up.

Step 4



Mail it in.

Radon test guidelines

It is important to follow the instructions that come with the radon test kit. Before performing a test, keep these five guidelines in mind:

Time of year to test: The best condition to test is when your house is under "closed house" conditions; meaning windows and doors are kept closed. Winter is the best time of year to test, as windows and doors are usually left closed.

Test location: Test the lowest livable part of the home you regularly use; the test kit should not be placed in a crawlspace. Test kits should be located on internal walls. Do not place the test kit in rooms that have a lot of moisture, such as kitchens, bathrooms, boiler rooms or laundry rooms.

Disturbances: Place the kit in the "breathing zone" or 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.

Timeliness of analysis: Once you've finished, reseal the package and put it in the mail. Short term radon test kits need to arrive at the lab within twelve days after opening.

Understanding your test results

The EPA set the recommended action level for radon at 4.0 pCi/L. This means if your home is greater than 4 pCi/L it is recommended to take action to reduce the radon in your home. Here are some recommendations on the action to take based on the type of radon test you used and the test results you received. Your local Environmental Health Department is available to assist you throughout the process.

Short-term test: 4 pCi/L to 8 pCi/L— Next step is to perform long-term test

Short term test: Greater than 8 pCi/L— Next step perform a second short-term test.

Second Short-term test: Less than 4 pCi/L— Retest in 2-5 years or retest if major changes made to home.

Second Short-term test: 4 pCi/L or greater — Radon mitigation strongly recommended if first test result was also 4 pCi/L or greater.

Long-term test: Less than 4 pCi/L— retest in 2-5 years or retest if major changes made to the home.

Long-term Test: 4 pCi/L or greater— Radon mitigation strongly recommended.

A short-term radon test should be done after any radon mitigation work to ensure the home is less than 4 pCi/L. Homes with radon mitigation systems should be tested every two years.

How often should I test for radon?

Local health departments recommend that every home be tested for radon. You should retest your home every 2 – 5 years and save your results.

Be sure to test before and after you make any major changes to the structure of the building, weatherization projects, and heating/cooling changes. Radon-resistant techniques can be inexpensively included as part of most renovation and whole house weatherization projects, if needed.

Radon and real estate transactions

Radon results must be disclosed during real estate transactions. It is a common occurrence during real estate transactions that radon testing is conducted during a home inspection. In Colorado, buyers and sellers in a real estate transaction are free to negotiate and respond as they choose. Ultimately, it is up to the buyer to decide what is an acceptable level of radon risk in their home.

RADON MITIGATION

How can I reduce the amount of radon in my home?

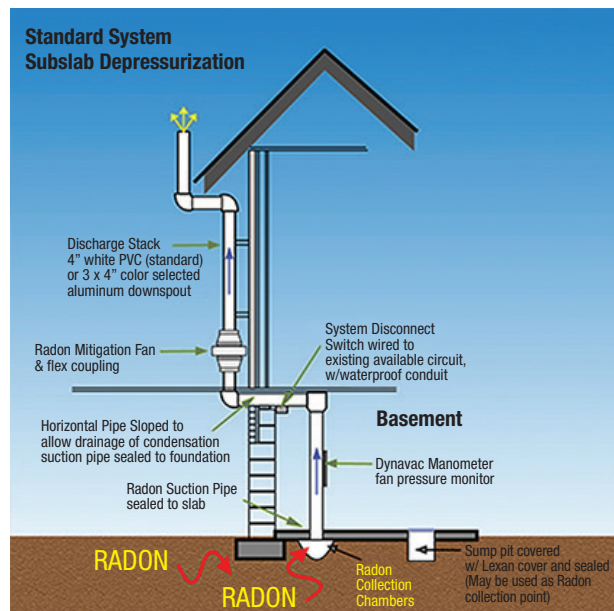
If your radon test result is above the action level of 4 pCi/L, the EPA and local health departments recommend you install a radon mitigation system in your home to reduce the level of radon. Radon mitigation is any process or system used to reduce radon concentrations inside buildings. The goal of a radon mitigation system is to reduce the indoor radon levels below the EPA action level of 4 pCi/L. A quality radon mitigation system is often able to reduce the annual average radon level to below 2 pCi/L.

There are several methods used to mitigate or reduce radon levels in your home. Some methods prevent the entry of radon, while others reduce radon levels after it enters the home.

How do I mitigate my home for radon?

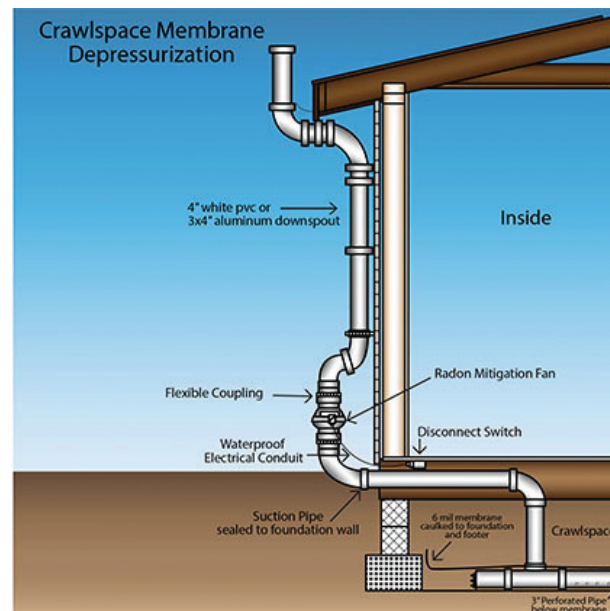
Lowering high radon levels requires technical knowledge and special skills. The right system will depend on a number of factors, including the design of your home. An experienced radon mitigation professional is your best resource to assess and advise you of your options. The City of Aspen maintains a list of certified radon professionals that routinely do work in the Roaring Fork Valley. If you would like a more extensive list, visit www.colorado.gov and search for radon mitigation. Contractors on the state list have taken a nationally-certified training course, passed the national certification exam, and retain their national certification through continuing education. The cost to mitigate radon depends on how your home was built and the extent of the radon problem. In general, costs can range from approximately \$1,500 to \$2,500 for a medium size home. Local health departments are available to answer questions throughout the radon mitigation process.

Houses are generally categorized by their foundation design for radon mitigation: basement, slab-on-grade or crawl space. The foundation determines the radon reduction system that will work best to prevent gases from entering your home. Some homes can have more than one foundation design, requiring a combination of systems be used. Below are the two main types of radon mitigation systems used in the Roaring Fork Valley.



Active Sub-slab Depressurization Systems

These systems are used for homes with basements or that are slab-on-grade. With this method, a hole is drilled into the concrete slab, several gallons of soil are removed, and then a PVC pipe is inserted in the hole and it is sealed to the slab. The pipe is routed to the outside of the house where a fan then draws the radon air from under the slab to the outside and above the roofline.



Active Crawl Space Depressurization Systems

These systems are used on homes with crawlspaces. With this method, a plastic membrane covers the dirt of the crawl space floor with perforated PVC pipe running along the perimeter under the membrane. A solid PVC pipe is then connected and routed to the outside of the house, where a fan then draws the radon air from under the membrane to the outside and above the roofline.

Questions to ask a mitigation contractor

- Will the contractor perform diagnostics to determine the suction point location and correct pipe and fan sizes?
- Who will do the licensed electrical work?
- Is there a warranty on materials or the workmanship? If so, for how long? Do they warranty system performance?
- Will the contractor guarantee that radon levels will be brought to below EPA recommended action level of 4.0 pCi/L?
- What will the contractor do if post mitigation radon levels are not below the EPA's recommended action level?

Be aware of un-certified installers, super cheap mitigation rates, free fan upgrades, or upgraded materials.

For more information on radon, please contact your local Environmental Health Department. For Aspen, contact Jannette Whitcomb at 970-920-5069, for Pitkin County, contact Kurt Dahl at 970-920-5438, for Eagle County, contact Ray Merry at 970-328-8757, and in Garfield County, contact Morgan Hill at 970-665-6383.

