

# READ ON ABOUT RADON

PROTECT YOUR HOME, YOUR HEALTH, AND YOUR FAMILY



THE CITY OF ASPEN

## 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 your home. Radon then decays into particles that are in the air you breathe. When inhaled, these radioactive particles get trapped in your lungs and damage the cells that line the lungs.

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

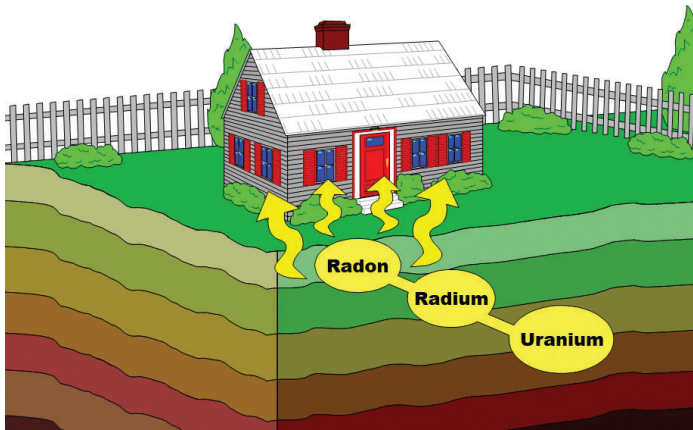
The City of Aspen Environmental Health and Sustainability Department has created this guide to explain the health risks of radon and why it is important for every home in Aspen to be tested. In this guide, you will learn,

- 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 Aspen?

**Radon is a national environmental health problem.** The U.S. EPA estimates that as many as 8 million homes throughout the country have elevated levels of radon. In Colorado, ALL counties are rated as high risk for high radon. In the last five years in Aspen, around 50% of the homes tested for radon were above the Environmental Protection Agency's action level of 4 pico curies per liter (pCi/L). Aspen's 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?

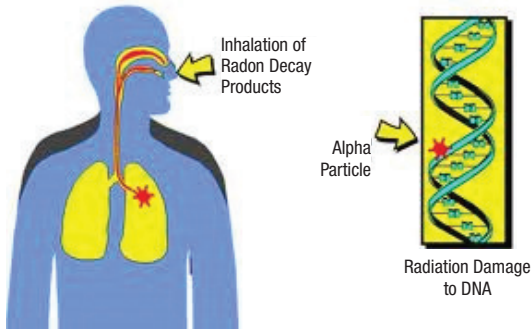
**Radon is present everywhere, both indoors and outdoors.** There is no known safe level. According to the EPA, the average indoor radon level is about 1.3 pCi/L, and the average levels of radon outdoors are about 0.4 pCi/L. Outdoors, radon generally disperses and does not reach high levels.

Your greatest exposure to radon is inside. This is because radon becomes concentrated inside buildings where you spend the most time. Your home can have radon whether it is old or new, well-sealed or drafty, and with or without a basement. **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.

The US 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

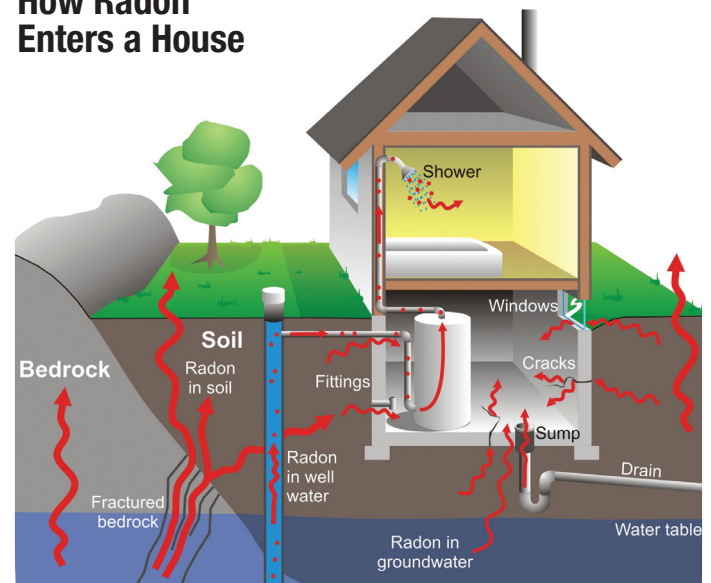
This table estimates your lifetime risk of lung cancer death due to long-term exposure to radon.

# 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 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.

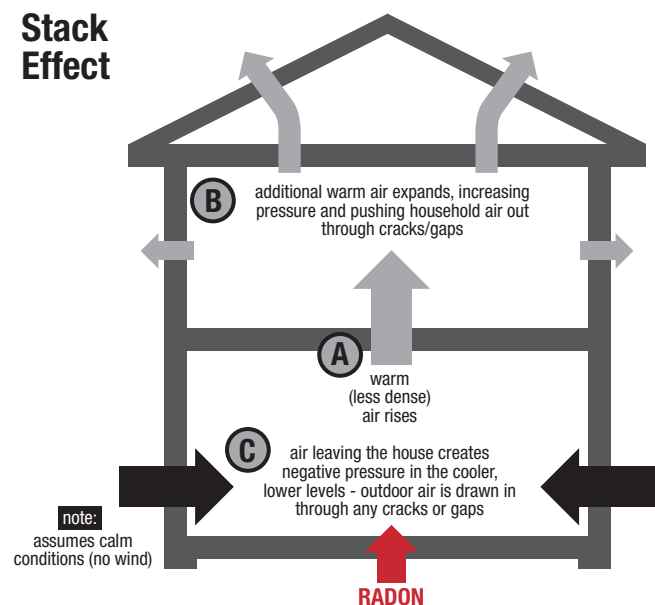
Other factors also contribute to air pressure changes in a home, including the stack effect and vacuum effect.

**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. The City of Aspen recommends that each part of the home that has a different foundation be separately tested for radon.

## 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. The City of Aspen recommends that if your lowest living area has high radon that, as part of follow-up testing, each floor be tested for radon.

## 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

**The City of Aspen recommends that everyone test their home 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 available to Aspen residents for free:** 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 a 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



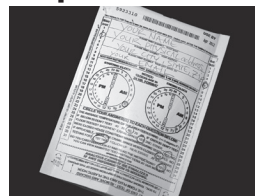
Long-Term Test



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



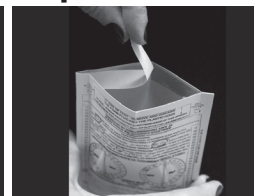
Fill it out.

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 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.

**Weather patterns:** Short-term tests should not be conducted during severe weather such as snow storms or high winds.

**Test location:** Test the lowest part of the home you regularly use. For example, if you only use your basement once a week to do laundry, then it is better to test the next level of your home where you spend at least 8-10 hours a week.

**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?

**The City of Aspen recommends 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 the City of Aspen 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 Know which Mitigation System is Right for Me?

**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 go to [www.colorado.gov/cdphe](http://www.colorado.gov/cdphe) and search for radon mitigation. Contractors on the City and Colorado lists 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.

The City of Aspen can also provide assistance for Aspen residents to ensure that successful mitigation is done.

## Prevent the Entry of Radon

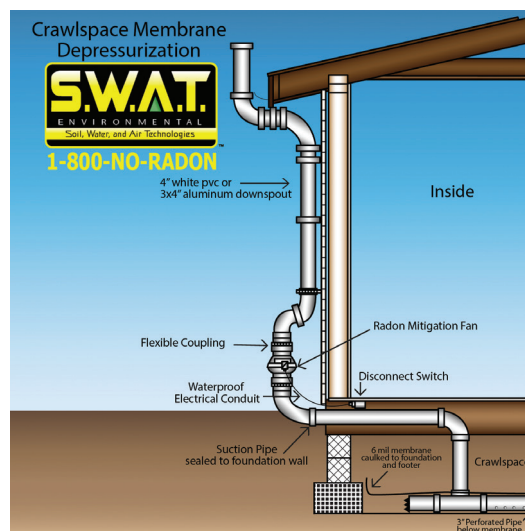
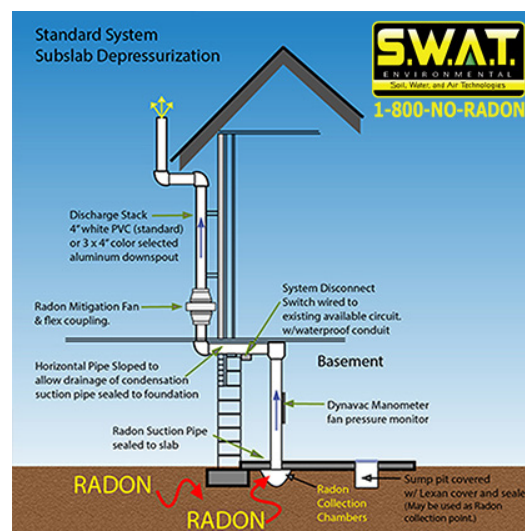
Houses are generally categorized by their foundation design for radon mitigation: basement, slab-on-grade or crawl space. The foundation determines the radon reduction system that will work best to prevent gases from entering your home. Some homes can have more than one foundation design, requiring a combination of systems be used. Below are the two main types of radon mitigation systems used in 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?
- Will the contractor guarantee that radon levels will be brought to below EPA recommended action level of 4.0 pCi/L?
- Who will do the licensed electrical work?
- What will the contractor do if post mitigation radon levels are not below the EPA's recommended action level?
- Is there a warranty on materials or the workmanship? If so, for how long? Do they warranty system performance?

**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 residents, contact Jannette Whitcomb at 970-920-5069, Pitkin County contact Kurt Dahl at 970-920-5438, Eagle County contact Ray Merry at 970-328-8757, and Garfield County contact Morgan Hill at 970-665-6383. You can also find information at [www.aspenpitkin.com](http://www.aspenpitkin.com).