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of Public Health  
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Dealing With  
RADON  
in  
Real Estate Transactions



More and more, informed buyers are having radon tests performed when considering the purchase of a home or office building.

Finding elevated concentrations of radon doesn't mean you should walk away from your dream home!

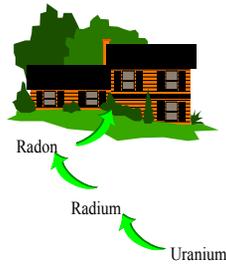
Radon reduction technology has improved so much over the last few years that reducing radon is easy and affordable.

*If you like a home,  
buy it -  
radon can be reduced!*

## What is radon?

**R**adon is an invisible, radioactive gas created from *natural* deposits of uranium and radium in the soil. Radon gas can be drawn into a building and accumulate to concentrations that can increase the potential for contracting lung cancer.

Although there are rare cases where the source of the radon has come from building materials created from spent-uranium processing plants, the major source of radon in Colorado homes comes from the natural deposits of uranium commonly found in Colorado geology. It is seldom caused by human intervention like other environmental concerns.

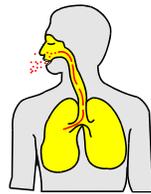


*Radon comes from natural deposits of uranium*

## Why should I be concerned?

**O**nce created in the underlying soil or geology, radon is easily drawn into a home through its foundation. Radon is a radioactive gas that decays into a series of solid particles known as radon decay products. Since these particles are formed from radon in the air, they represent a fine aerosol that can be inhaled into your lungs. The solid decay products of radon are radioactive and can release alpha radiation while in your lungs, leading to an increased potential of lung cancer.

Carefully controlled studies on animals and hard-rock miners, as well as residential case-control studies have shown that prolonged exposure to radon decay products can significantly increase the potential for lung cancer.



Radon is regarded as a Group A carcinogen; that is, it is known to cause cancer in humans with prolonged exposure. Many buyers are concerned about their health risk as well as property resale value and want to test for and correct radon concerns. The United States Environmental Protection Agency and Surgeon General recommend that people avoid long-term exposures in excess of 4.0 pico Curies per liter (pCi/L).

***Radon can be easily reduced!***

## Special note to sellers and listing agents

**S**ection F of the Environmental Conditions portion of the Colorado Seller's Property Disclosure Form specifically lists radon as a hazard that, if known by the seller to exist or ever have existed, must be disclosed. This would be true even if previous test results were less than 4.0 pCi/L. In all cases, sellers should provide copies of any test results. If a radon mitigation system exists, it also must be disclosed, as it is presumed that radon had existed previously, and that if the system were to fail, the radon level would return to its original level.

If radon concerns are discovered during the inspection process, understand that they can be remedied through mitigation and that normal real estate negotiation techniques can be used to resolve the costs associated with radon reduction.

## How do I find qualified radon measurement and mitigation contractors?

**T**he State of Colorado recognizes qualified credentialing organizations that certify radon measurement and mitigation professionals. Lists of these certified individuals can be found at [www.coloradoradon.info](http://www.coloradoradon.info)

In addition to these educational credentials, homeowners should always:

1. Ask for references;
2. Require proof of certification, including agreement to follow protocols and codes of ethics;
3. Ask for proof of insurance including workers' compensation; and
4. Ask for a clear contract with details of guarantee and warranty.

## Resources

**T**here are many publications and resources available from the Colorado Department of Public Health and Environment, the United States Environmental Protection Agency, local health departments and county extension offices. These publications can be provided to citizens, realtors, builders and any other interested parties at no cost.

***Our goal is to reduce exposure to indoor radon in Colorado homes, schools and workplaces.***

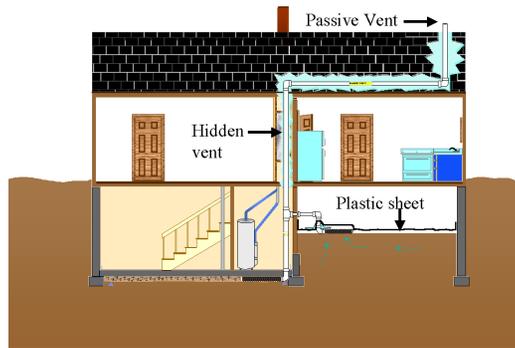
## Do new homes have radon systems?

A considerable number of homebuilders routinely add features to new homes that can reduce radon. Some go so far as to install an active system with a fan. In most parts of Colorado, this is not a code requirement, but rather a value-added feature that a large number of homebuyers are requesting.

There are a lot of advantages to installing a system as a house is built:

- ◆ The piping can be easily concealed;
- ◆ The vent pipe can exit the roof and appear as a normal roof penetration; and
- ◆ The sub-grade can be prepared to collect radon easily.

During construction of a home, it is easy to treat several foundations connecting each area to a single vent, which also can be concealed in walls. When done properly, the system often works without the need to install and operate a fan.



A contractor will route the vent pipe in such a manner that if, after the home is tested and the levels are not acceptable, a fan can easily be installed in the vent pipe within the attic to make the system more effective.

There are some areas of Colorado with building codes that require the installation of systems in new homes. Check with your local building department and your builder.

*Always ask your builder about radon resistant features.  
Always test the home to be sure it reduces the radon to levels .*

## How common is radon in Colorado?

Surveys conducted by the Colorado Department of Public Health and Environment indicate that five out of 10 Colorado homes have the potential for radon concentrations exceeding the EPA guideline of 4.0 pCi/L. That is why the number of people testing their homes, schools and office buildings is continually increasing. These studies also provide some other useful facts:

### Colorado Radon Facts

- Elevated levels of radon are found in both new and old buildings.
- Radon can be found in buildings other than homes.
- Radon can be found in homes built on all types of foundations, including crawlspaces and slab-on-grade basements.
- Radon is not just a concern in Colorado. Many other states have a high percentage of homes with elevated radon levels.
- Radon can vary from house to house. The only way to know how much radon may be in the house you are buying is to have it tested.

### If I find a home with a radon problem, should I look for another home?

If a properly performed test indicates an elevated level of radon in the home you wish to purchase, it is likely other homes in the same area will have elevated radon. So, if you like the house, consider taking a reasoned approach that will confirm levels and reduce the radon. Perhaps the best news about radon is that **radon can be reduced**, either before you buy the home, or after you buy it and move in. 



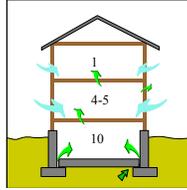
*Of all the problems a house may have, radon is one of the easiest to identify and fix!*

## How do I test for radon?

Over the last 15 years, reliable testing devices and methods have been developed to determine indoor radon exposures. When using approved measurement devices, you can either determine the radon potential of the home, or what your exposure likely will be after you move in.

## How do I determine radon potential in my home?

At the time of resale, it often is desirable to know what the potential radon exposures could be, independent of how a person operates or lives in a building. Radon enters a building through its foundation - the basement, crawlspace, or slab. As the radon moves up in the building, it is diluted with air that leaks through exterior walls and openings from the outside air. Consequently, radon levels typically are the highest in the lowest portion of the home suitable for occupancy.



*Radon concentrations typically are the highest in the lowest occupiable portion of a home*

If a test is conducted in the lowest level of the home with all the exterior doors and windows closed, one would be able to say with reasonable assurance that the exposures in upper levels of the home are less than the reading obtained in lower levels. It also can be assumed the exposure would be less when fresh outdoor air is allowed into the home. Short-term tests typically are conducted over a two- to three-day period, and the results represent the radon potential of the home.

## What a short-term test tells me

If a short-term radon test is conducted in the lowest portion of a home while all exterior doors and windows are closed for a minimum of two days, one can reasonably say:

- Radon concentrations are less on upper floors.
- If the result is less than 4.0 pCi/L, the annual average of the home, under normal lived-in conditions, also is likely to be less than 4.0 pCi/L.
- If the level is at or above 4.0 pCi/L, the annual average of the house has the potential for being above 4.0 pCi/L and you should consider follow-up testing or taking action to reduce (mitigate) the radon in the home.

## Some key elements to radon mitigation

The first consideration is to use a qualified contractor who will install the system in accordance with the U.S. EPA's Radon Mitigation Standards and local building codes. A list of certified mitigation contractors is available at [www.coloradoradon.info](http://www.coloradoradon.info)

Contained in these standards are several of the following points to consider:

- ◆ The discharge point of the system must be:
  - At least 10 feet above grade;
  - At least 10 feet away from an opening that is two feet below the discharge; and
  - Above the eave of the roof.
- ◆ System fans should not be located inside the home or in a crawlspace. They can be in an attic, on the outside of the house, or in a garage, provided there is no living space above the garage.
- ◆ There should be an indicator located in a prominent location that will easily show the occupant that the system is functioning properly.
- ◆ Power to the fan should be run in accordance with local electric codes; including permits where required.
- ◆ All portions of the system are to be labeled and a simple instruction manual, with warranties, provided to the homeowner.
- ◆ All homes with mitigation systems should be retested no sooner than 24 hours (nor later than 30 days) after installation to verify reduction. The home should also be retested every two years.

## What affects the cost of mitigation?

The cost of a mitigation system is a function of the extra effort taken by the contractor to conceal the system and to maintain the aesthetic value of your home. Although a system routed up the outside of the house will reduce radon quite well, it may not be as aesthetically pleasing as one that was routed through the interior of the house with trim installed to conceal it.

An increasing number of buyers are getting involved in how these systems will be installed, or waiting until they occupy the house to better control the manner in which their system will be installed.

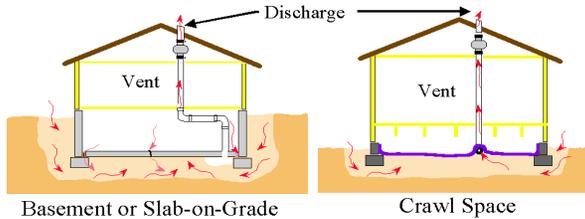
## How do I treat radon?

Considerable research conducted by government agencies, educational institutions and private industry in Colorado and elsewhere forms a very strong foundation for properly mitigating radon in homes, schools and commercial buildings. The techniques are straightforward, reliable and typically can be done in one day by a qualified contractor.

However, simple radon reduction requires more than trying to seal openings in the foundation. *In fact, caulking and sealing of foundation openings, on its own, has proven NOT to be a suitable technique.*

Radon is mitigated by installing a system that will draw the radon-laden soil gas from beneath the foundation and exhaust it outside of the building, far enough away from windows and other openings that it will not re-enter.

A reduction system typically consists of a plastic pipe connected to the soil either through a hole in a slab, via a sump lid connection or access beneath a plastic sheet in a crawl space.



Attached to the pipe is a quiet, continuously operating fan that discharges the radon outdoors.

How this is done is a function of the construction of the home, rather than the radon concentrations that exist. A home with more than one foundation can present challenges to collecting the soil gas from under all portions of the building. However, talented mitigation contractors typically can connect multiple systems together so that only one fan system is required.

Crawlspace foundations can be more costly, since the contractor needs to install a high density plastic sheet over the soil, seal it to the walls and then route the piping to the fan. However, the added benefit of reducing moisture in the crawlspace, in addition to reducing radon, can be a real plus.

- Average U.S. installation cost: \$1,200
- Average operating cost in Colorado: \$3/month
- Expected life span of fan: 11 years
- Fan replacement cost: \$145-300
- Periodic maintenance: none

## How do I determine what my exposure will be in my new home?

The amount of radon you may be exposed to depends on where you will spend time in the home and how much fresh air you are likely to bring in. Since this is up to you, the only reliable way of measuring your actual radon exposure is to conduct a long-term test for a minimum of 91 days after you move into the home.

In the past, people have been reluctant to purchase a home and perform a long-term test for fear of not being able to correct a radon problem once it is confirmed. Now that the technology and durability of radon mitigation has been well established, buyers need not be reluctant to buy a home, or to test it to their satisfaction and take action to reduce radon after they move in.

This does not mean that you should avoid having a short-term test done as part of your home inspection process, but rather, if the results of that test show a potential radon concern, you may wish to consider a long-term test after you move in. By performing a long-term test after you move in, you can control test conditions and, if needed, make decisions on how the mitigation system will be installed to accomplish the best reduction and to increase the value of your new home.

### The test purpose will dictate test conditions

Radon Potential:	Occupant Exposure:
• Short-term test	• Long-term test
• Typically 2 - 5 days	• Typically 91 days — one year
• Closed-building conditions 12 hours prior to and all during test	• Normal lived-in conditions
• Device deployed on lowest level of home	• Device deployed on lowest level of home
• Commonly used at time of resale	• Commonly used outside of a real estate transaction, or used as basis of escrow fund release

Radon decay products (actual health risk of radon) also can be measured using special equipment that reports in Working Levels (WL). This typically is done after initial measurements have identified a potential concern in commercial buildings or homes with relatively low initial radon readings. The EPA guidance for radon decay products (comparable to 4.0 pCi/L of radon) is that people should avoid long-term exposures in excess of 0.02 WL of radon decay products.

## Key points about testing

First, it is strongly recommended that you use a qualified radon measurement professional who has been trained in the proper placement of radon measurement devices and the interpretation of their results. A list of certified individuals can be obtained from the Colorado Department of Public Health and Environment's website at [www.coloradoradon.info](http://www.coloradoradon.info)

Here are some tips for testing and for reducing radon:

- ◆ Radon tests are to be placed in livable areas — not crawlspaces or attics.
- ◆ Radon tests are to be placed no closer than 20 inches to the floor, and no closer than three feet from openings in exterior walls, such as windows and doors.
- ◆ Collecting data for less than 48 hours is not valid for determining the need to mitigate, or reduce, radon in a home.
- ◆ When doing a short-term test, all exterior doors and windows are to be closed (other than normal exit and entry) and the device is to be placed in the lowest level of the home.
- ◆ If the radon measurement professional performs two short-term tests at the same location and under the same conditions, the results should be averaged. It is not acceptable to continue to test until a preferred result is obtained.
- ◆ Radon test results obtained from different parts of the home are NOT averaged.
- ◆ During short-term tests, evaporative coolers (swamp coolers) and other devices that exchange considerable air to the outside should be shut off.
- ◆ Continuous monitors often are used to detect occupant tampering of test conditions.
- ◆ If a continuous monitor (which measures radon hourly) is used, the average of the measurements is used, rather than the highest reading observed.
- ◆ Radon levels vary from season to season and long-term tests are the preferred method for determining health risk.
- ◆ When doing a long-term test of more than 90 days, no special conditions are required for exterior doors and windows, and the device typically is placed in the lowest level of a home that is frequently occupied.
- ◆ Only one room on the selected level of the home needs to be tested.
- ◆ Test devices should not be placed in locations with temperature differences of  $\pm 10^{\circ}$  F from room temperature, on hot surfaces or in areas of elevated humidity.

## How should I approach radon testing in my search for a new home?

Radon testing is simple. Here is a common approach:

1. Find the house you want to buy.
2. As part of the home inspection process, request a short-term radon test, using a qualified radon measurement professional. Your home inspector may or may not be qualified to conduct radon testing.
3. If the short-term test result is less than 4.0 pCi/L, the EPA would not recommend any follow-up action, although there still is some risk at exposures less than 4.0 pCi/L.
4. If the short-term test result is 4.0 pCi/L or higher, then consider asking the seller to pay for a mitigation system, or consider purchasing the home and performing a long-term test to determine what the actual exposure is.
5. Once you decide to reduce the radon in the house, seek bids from qualified contractors who are willing to guarantee and warranty results.
6. Use bids from contractors as a basis for negotiations with the seller.
7. If the seller is willing to pay for a mitigation system, work with your realtor to determine the best way to obtain the funding from the seller and have the system installed after taking possession of the property.

*All homes can be fixed!*

## Could there be radon in my water?

Yes, radon can dissolve in the groundwater and be released into the air of the home when it is used for showers, laundry, and other purposes. The concern with radon in water is not widespread and is primarily associated with homes whose water supplies are from wells or public water supplies that use groundwater.

The major concern is not with drinking the water, but rather the additional amount of radon added into the breathing space beyond that which comes from the soil. Normal radon-in-air tests will measure this contribution, if the house is occupied during testing. It takes a lot of radon in the water to have a measurable effect in the indoor radon concentrations. As a rule of thumb, it takes 10,000 pCi/L in the water to add one additional pCi/L of radon in the air. So always test the air first, before testing or becoming concerned with radon in the water. Your radon testing professional should be able to provide guidance.