



radon

Keeping your home safe from radon



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RADON is a colorless, odorless radioactive gas that seeps up from the earth. When inhaled, it gives off radioactive particles that can damage the cells that line the lung.

Long-term exposure to radon can lead to lung cancer. In fact, over 21,000 lung cancer deaths in the US each year are from radon, making it a serious health concern for all Minnesotans.

The Minnesota Department of Health (MDH) has created this guide to explain the health risks of radon and why it is important for every home in Minnesota to be tested.

In this guide, you will learn:

- **how you are exposed** to radon
- **how simple it is to test** for radon, and
- **what you should do** if you have a radon problem, whether you live in an existing home, plan to build a new one, or are considering buying or selling a home.

Most of all, this guide is designed to help **protect your biggest investment... your home.**

And to **keep** your greatest treasure, **your family's health...safe.**



important facts about radon

Where does radon gas come from?

The **soil**. Radon is produced from the **natural decay of uranium** that is found in nearly all soils. Uranium breaks down to radium.

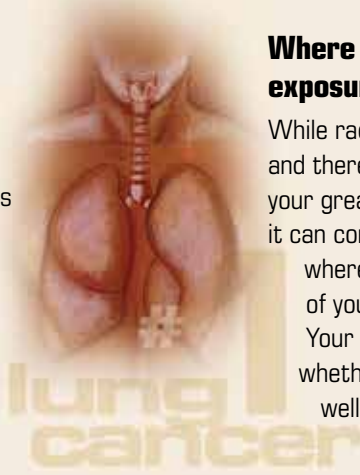
As radium disintegrates it turns into a **radioactive gas...radon**.

As a gas, radon moves up through the soil and into the air you breathe.



How dangerous is radon?

Radon is **the number one cause of lung cancer** in non-smokers and the second leading cause of lung cancer (after tobacco) in smokers. Thankfully, this risk should be entirely preventable through awareness and testing.



Where is your greatest exposure to radon?

While radon is present everywhere, and there is **no known, safe level**, your greatest exposure is where it can concentrate— **indoors**, where you spend most of your time— **at home**.

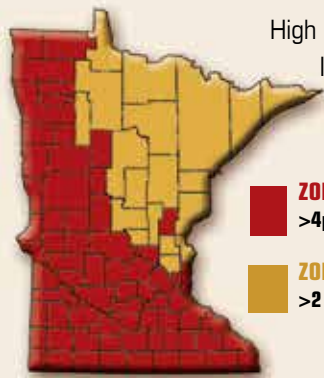
Your home can have radon whether it be old or new, well-sealed or drafty, with or without a basement.

How does radon enter a home?

Since radon is produced from soil, it is present nearly everywhere. Because soil is porous, radon gas is able to move up through the dirt and rocks and into the air we breathe. If allowed to accumulate, **radon becomes a health concern**.

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.

How serious a problem is radon in Minnesota?



High radon levels exist in every state in the US. In Minnesota, **two in five homes have radon** levels that pose a significant health risk, and nearly 80% of counties are rated **High Radon** zones.

- ZONE 1:**
>4pCi/L
- ZONE 2:**
>2 <4pCi/L

Some factors that further contribute to Minnesota's high radon levels include:

- Minnesota's geology produces an ongoing supply of radon.
- Minnesota's climate affects how our homes are built and operate.



pathways

are routes the gas uses to enter your home and found anywhere there is an opening between the home and the soil.



air pressure

between your home's interior and the exterior soil is what helps to draw radon gas into the home via the pathways.

radon's pathways

into your home



Radon can enter your home via a number of **entry points** or pathways...

- A** Cracks in concrete slabs
- B** Spaces behind brick veneer walls that rest on uncapped hollow-block foundations
- C** Pores and cracks in concrete blocks
- D** Floor-wall joints
- E** Exposed soil, as in a sump or crawl space

- F** Weeping (drain) tile, if drained to an open sump
- G** Mortar joints
- H** Loose fitting pipe penetrations
- I** Open tops of block walls
- J** Building materials: brick, concrete, rock
- K** Well water (not commonly a major source in Minnesota homes)

foundations

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

If you have a basement...

A basement provides a large surface area in contact with soil material. Radon can enter through cracks in the concrete, or through floor-to-wall joints or control joints. Since many Minnesota homes use their basements as living space, exposure to radon can be further increased.

But radon can enter a home regardless of whether or not there is a basement.

Slab-On-Grade: Slabs built on grade can have many openings that allow radon to enter, just as in a basement.

Crawl Space: Homes with crawl spaces can also have elevated radon levels. The vacuum effect can draw radon gas from a crawl space into the home (see page 6).

Manufactured Homes: Unless these buildings are placed on supports without skirting around them, interior air pressure vacuums can cause radon to enter manufactured homes, as well.

radon and your home's air pressure

Minnesota homes commonly operate under a **negative air pressure**, especially during the heating season. What this means is, the **air pressure inside your home is typically lower than the surrounding air and soil**. This creates a **vacuum that pulls soil gases, such as radon**, into the home via pathways (for more on Pathways, see page 4). Even if the ground around the house is frozen or soaked by rain, the gravel and disturbed ground underneath the house remains warm and permeable, **attracting radon gas** from the surrounding soil.

Other factors also contribute to **air pressure changes** in a home, including:

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.

Down Wind Draft EFFECT



Strong winds can create a vacuum as they blow over the top and around the home.

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. When air is exhausted, outside air enters the home to replace it. Some of this replacement air comes from the underlying soil.

In general, **whenever air enters a home** from the underlying soil, **some radon** will likely **come with it**.

What happens *after* radon gets into the home?

Radon levels are often highest at the entry point—typically in the lower part of a building. 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. Radon gas becomes more diluted in the upper levels of the home because there is more fresh air for it to mix with.

Greater dilution and less house vacuum effect occur when the house is more open to the outdoors, as during the non-heating season. This generally results in lower indoor radon levels in the summer compared to the winter.

Understanding how radon moves through the home environment helps to explain why **timing** and **location** are important factors to consider when **conducting a radon test** (for more on radon testing, see page 8).

how to perform a radon test

MDH recommends that **all Minnesota homeowners test their homes for radon.** A radon test is the only way to find out how much radon is in your home and if you and your family are at risk. 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 yourself from the health risks of radon.

Can a neighbor's test results be an indication of whether my home has a problem?

A neighbor's test result is a poor predictor of your radon risk because each home can have different indoor radon levels. Furthermore, previous test results may not reflect current or future radon levels if the home has been remodeled, weatherized or had changes to its heating, air conditioning or other ventilation systems (such as exhaust fans).

What type of radon test kit should I use?

There are two basic types of radon tests available to the public, **short-term** and **long-term** tests.

Short-term tests measure radon levels for 2 to 7 days, or use a continuous monitor for a minimum of 48 hours, depending on the device. While short-term tests do not measure the annual average level of radon, they do offer a **quick and inexpensive** way to "screen" for radon in a home.

Long-term tests determine the average concentration for a minimum of 90 days. Long-term tests are the best way to estimate the **average amount of radon** in the home during the year, particularly if a year-long test is done to include both heating and cooling seasons.

How much will it cost?

A radon test kit should cost between \$5 and \$25, depending on the type of kit. Make sure the price includes laboratory analysis.

If you choose to hire someone to test your home, it will be more expensive. Radon measurement professionals are often used when an unbiased, third party is needed, such as in real estate transactions (see page 20).

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 amount of radon in homes is usually highest during the heating season. Long-term tests should span both the heating and non-heating seasons.

Weather patterns: Weather patterns can influence how radon gets into your home. Short-term tests should not be conducted during severe weather or unusually high winds.

Test location: Test the lowest level of the home that is regularly used. For example, if you spend more than 8 to 10 hours a week in the basement, MDH recommends testing the basement.

Disturbances: 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. Test kits that are disturbed or moved during a test may provide inaccurate results.

Timeliness of analysis: Once you've finished, reseal the package and send it to the lab specified on the package. Radon test results may not be accurate if the test kits are not sent to the laboratory as soon as possible after completing the test.

How often should I test for radon?

- MDH recommends every Minnesota home, even those built radon-resistant, 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 structural renovations such as building an addition or finishing a basement. Radon-resistant techniques can be inexpensively included as part of the renovation, if needed.
- You should also perform a radon test after buying a new heating system or adding central air conditioning.

Where can I get a radon test kit?

Radon test kits are available on the MDH website for a discount and your local health department may also offer test kits at reduced prices. For information on where to obtain low cost radon test kits, visit the MDH radon program website.

understanding radon test results

The table below provides recommendations on the **action to take** based on the **type of radon test** you used and the **test results** you received. These recommendations are different than test results during a real estate transaction. To learn more about real estate testing, see page 23 or the MDH “Radon in Real Estate Transactions” publication.

Initial Short-term Test+



Less than 2	Consider performing a long-term test.+
2 to 8	Perform long-term test.+
Greater than 8	Perform a second short-term test. Contact MDH at 651-201-4601 before buying a second test kit.

Second Short-term Test+



Less than 4	Perform long-term test.+
4 or greater	Mitigation* strongly recommended if first test result was also 4 pCi/L or greater.

Long-term Test+



Less than 2	Retest if major changes made to the home (see page 9 on how often to test).
2 to less than 4	Consider performing mitigation.*
4 or greater	Mitigation strongly recommended.*

* For information on **radon mitigation**, see page 12.

+ For information on **short-term** and **long-term radon tests**, see page 8.

These recommendations assume that the radon tests were conducted properly.

What are the units of radon?

Picocuries per liter (pCi/L) which is a unit that measures levels of radon/radioactive gas.

What is the recommended action based on my results?

The Environmental Protection Agency and Minnesota Department of Health set the recommended **action level for radon at 4.0 pCi/L**.



Above 4 pCi/L Fix your house *

2 pCi/L to 4 pCi/L Consider fixing your house*

To apply the recommended action level correctly, the results should be based on the **annual average level of radon** measured in a home. If the annual average **level of radon is above 4 pCi/L**, EPA and MDH recommend that **steps be taken to lower it**. While it isn't possible to reduce radon to zero, the best approach is to lower the radon level as much as possible. Any amount of radon, even at or below the recommended action level, carries some risk.

How much radon is safe?

There is **no safe level of radon**. Your risk for lung cancer increases with higher levels of radon gas and increased exposure.

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

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

lowering radon in existing homes

Radon mitigation is any process or system used to **reduce radon concentrations** in the breathing zones of occupied buildings. The goal of a radon mitigation system is to reduce the indoor radon levels to **below** the EPA action level of **4 pCi/L**. A quality radon reduction (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.

Prevent the entry of radon

Houses are generally categorized by their foundation design, **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.



Basement
SUCTION SYSTEM

Slab-on-Grade
SUCTION SYSTEM

Crawl Space
VENTILATION SYSTEM

Some homes can have more than one foundation design, requiring a combination of systems be used.

Crawl Space Ventilation

Ventilation can sometimes lower indoor radon levels in crawl spaces by reducing the home's suction on the soil and by diluting the radon beneath the house.

Passive ventilation is achieved by opening or installing vents. **Active ventilation** uses a fan to blow air through the crawl space. To be effective, ventilation is often used with **sub-membrane depressurization**, which covers the dirt of the crawl space floor with a plastic sheet. A pipe then draws the radon air from under the sheet to the outside.

Suction System

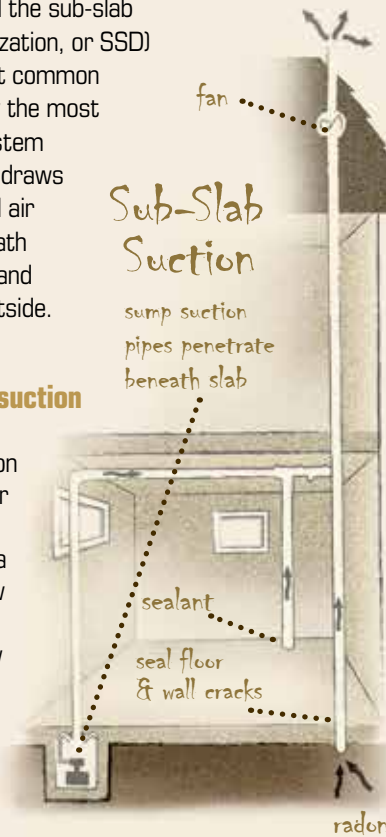
There are **four types** of soil suction systems: **sub-slab, drain tile, sub-membrane** and **block wall**.

The active sub-slab suction

(also called the sub-slab depressurization, or SSD) is the most common and usually the most reliable system because it draws radon-filled air from beneath the house and vents it outside.

Passive sub-slab suction

in new construction relies on air currents instead of a fan to draw radon up from below the house and is not as effective.



If a home uses drain tiles to direct water away from the foundation, **suction on the drain tiles** can help reduce radon levels.

In the **drain tile suction system**, caps are placed on the sump pump baskets. The pump continues to drain unwanted water.

Block wall suction systems are used in homes with hollow block foundations by using a system similar to the sub-slab suction, where radon is removed from the wall by depressurization.

Other methods to Reduce radon levels

Other radon reduction techniques may be considered to reduce the radon gas levels that are circulating within the home. Many of these methods are used **only as temporary measures**, or in **combination with other measures**, like the ventilation or suction system.

Sealing cracks and openings in the foundation is a basic step in radon mitigation. Sealing will limit the flow of radon, making other mitigation techniques more efficient. This is a temporary measure because normal settling of a home opens new entry routes and reopens old ones.

House pressurization uses a fan to blow air into the lower level of the home, creating enough pressure to prevent radon from entering. To maintain enough pressure, doors and windows at the lowest level must **not** be left open.

Heat recovery ventilator (HRV) (also called an air-to-air heat exchanger) is used to increase ventilation in all or part of a home. The HRV introduces outdoor air by using the heated or cooled exhausted air to warm or cool the incoming air.

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.

How do I find an experienced radon mitigation professional?

MDH has a list of contractors that specialize in radon mitigation. This list is a good place to start. Contractors on the MDH list have taken a nationally-certified training course, passed the national certification exam, and retain their national certification through continuing education.

The radon contractor listing can be found on our website at: www.health.state.mn.us/radon

Another benefit of selecting a listed contractor is that MDH can provide technical consultations to ensure that a successful mitigation is done.

For further assistance, call the Indoor Air Unit at **651-201-4601**.

What are some of the key questions to ask a mitigation contractor?

When discussing your needs with a mitigation contractor, here are a few important questions to ask:



- ✓ Will the contractor perform diagnostics to determine the suction point location and correct pipe and fan sizes?
- ✓ Who is responsible for obtaining permits, if required?
- ✓ Will a contract be provided?
- ✓ 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?
- ✓ How will the system be evaluated?
- ✓ Will the contractor offer the homeowner training in the radon mitigation system operations and/or troubleshooting?
- ✓ Will the contractor guarantee that radon levels will be brought to below the Environmental Protection Agency's (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?
- ✓ Can the contractor provide a list of references?
- ✓ Is the quoted price guaranteed?
- ✓ Be aware of un-certified installers, super cheap mitigation rates, free fan upgrades or upgraded materials.

10 Step Guide to the Radon Mitigation Process

1 HOMEOWNER'S radon test

reveals the home has a radon problem.

2 HOMEOWNER contacts certified mitigators to request bids.

*MDH has a list of mitigation contractors: www.health.state.mn.us/divs/eh/indoorair/radon/mitigation.html

3 CONTRACTOR does a walk-through

of the home to identify problems then outlines the mitigation system they recommend.

4 HOMEOWNER reviews key questions (page 14) with each CONTRACTOR requesting a proposal, bid and references.

5 HOMEOWNER evaluates and compares contractor recommendations, bids and contracts, selecting the contractor and scheduling the work.

6 CONTRACTOR may perform diagnostic testing

to ensure proper size and installation methods are applied.

7 CONTRACTOR seals required areas,

e.g., large cracks, crawl spaces, sumps, etc.

8 CONTRACTOR installs the mitigation system,

i.e., suction pit or ventillation, pipe routing, etc.

Electrical hook-up completed by licensed electrician, not a licensed contractor

9 CONTRACTOR provides full explanation of system's operation to HOMEOWNER

10 HOMEOWNER or CONTRACTOR Test the home to ensure the system is reducing radon to the desired level.

What does it cost to install a mitigation system?

The cost depends on how your home was built and the extent of the radon problem.

In general, costs can range from approximately \$1,100 to \$2,500, with the average reduction system costing approximately \$1,500.

radon-resistant new construction

If you plan to build a new home, it is required by code to **build it radon-resistant**. Radon-resistant construction combines common building techniques and materials to seal entry points and route the gases outdoors, helping to **prevent radon from entering the home**.

Is there a way to test the soil before building?

Testing the soil prior to building **cannot predict** what the radon levels will be once the house is completed. The impact that the site preparation will have on introducing radon **pathways** in the home, and the extent or affect **air pressure** will have in the finished home, can affect radon levels and your exposure.

Should I test for radon after my new home is finished?

Yes. MDH recommends every Minnesota home, even those built radon-resistant, be tested for radon. In Minnesota, **one in five homes** built with passive RRNC features has radon levels that pose a significant health risk. Repeat testing every 2-5 years, or after any remodeling or updates are made to the home's heating or cooling systems.

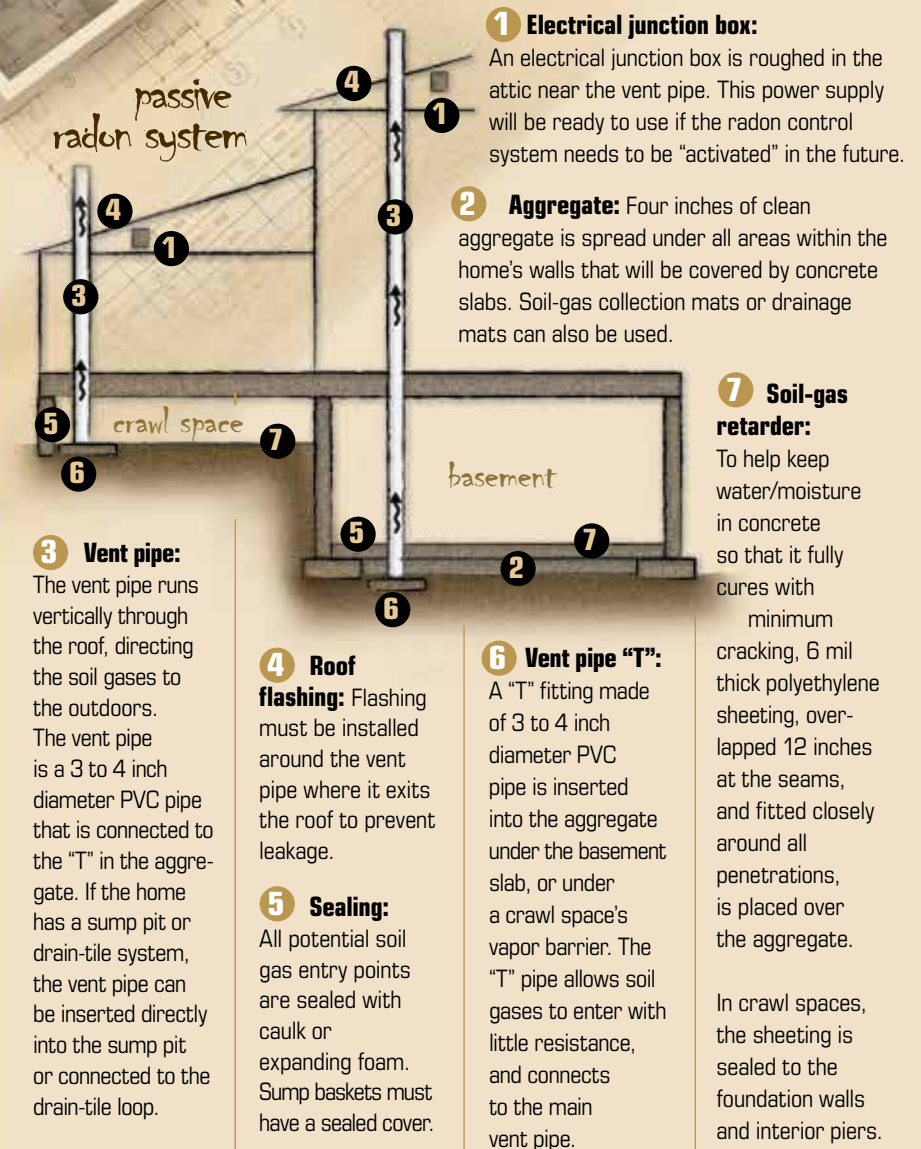
Are there different types of systems?

Yes, **passive** or **active** systems.

A **passive system** is a **minimal approach** to radon reduction that relies on the **convective flow of air** upward in a vent pipe to exhaust the radon gas. The State Building Code only requires a "passive" system be installed. However, a fan may need to be added at a later date if radon levels are still high.

An **active system** offers **maximum radon reduction** through the **use of a fan** that **continuously pulls radon-laden air from the soil** and exhausts it outdoors. The active system can make a big difference in reducing radon exposure. Minnesota contractors are required to install an active system for the home to receive the **Gold Standard** designation (see page 19).

features of radon-resistant construction





GOLD STANDARD

RADON RESISTANT BUILDER
MINNESOTA DEPARTMENT OF HEALTH DESIGNATION

What does the MDH Gold Standard designation mean?

Only Minnesota builders that have demonstrated the knowledge and experience to build a healthy, radon-safe home at the **maximum level** can earn MDH's **Gold Standard** designation. Hiring a contractor with the **Gold Standard** rating is a homeowner's assurance that the builder is qualified to install an **active radon-resistant system**.

How do I find a Gold Standard builder?

The Minnesota Department of Health has a list of contractors that have earned the **Gold Standard designation** for radon-resistant building. To verify your builder has met MDH's **Gold Standard** for radon, check the builders list at the Minnesota Department of Health site: www.health.state.mn.us/GoldStandard

What should I do if I don't have a Gold Standard home?

the radon fan is placed away from the lifting area

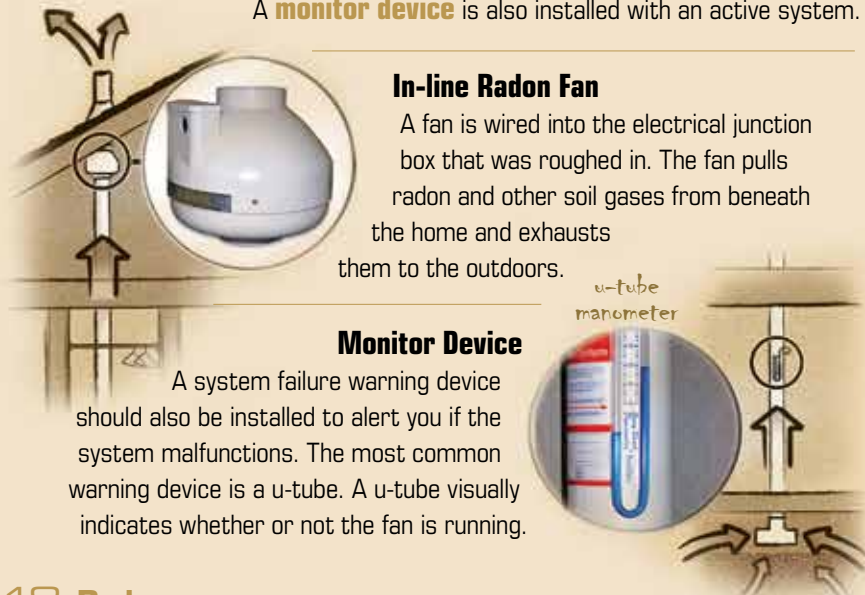
If unacceptable radon levels are present, and the home has a **passive** radon system in place, it can be upgraded to an **active system** by adding an **in-line radon fan**. A **monitor device** is also installed with an active system.

In-line Radon Fan

A fan is wired into the electrical junction box that was roughed in. The fan pulls radon and other soil gases from beneath the home and exhausts them to the outdoors.

Monitor Device

A system failure warning device should also be installed to alert you if the system malfunctions. The most common warning device is a u-tube. A u-tube visually indicates whether or not the fan is running.



radon & real estate Disclosure

The **Minnesota Radon Awareness Act** requires that a seller of a home disclose information about radon in the home. The act does not require that testing or mitigation work be conducted. However, many relocation companies and lending institutions, as well as home buyers, request a radon test when purchasing a house.

Effective **January 1, 2014**, the Minnesota Radon Awareness Act requires additional **disclosure and education be provided to potential home buyers** during residential real estate transactions in Minnesota. **Before signing a purchase agreement** to sell or transfer residential real property, the seller shall disclose in writing to the buyer any knowledge the seller has of radon concentrations in the dwelling.



The disclosure shall include:

- (1) whether a radon test or tests have occurred on the property;
- (2) the most current records and reports pertaining to radon concentrations within the dwelling;
- (3) a description of any radon concentrations, mitigation, or remediation;
- (4) information regarding the radon mitigation system, including system description and documentation, if such system has been installed in the dwelling; and
- (5) a radon warning statement meeting the requirements below
- (6) a copy of the Minnesota Department of Health publication entitled "Radon in Real Estate Transactions."

Radon Warning Statement

"The Minnesota Department of Health strongly recommends that ALL homebuyers have an indoor radon test performed prior to purchase or taking occupancy, and recommends having the radon levels mitigated if elevated radon concentrations are found. Elevated radon concentrations can easily be reduced by a qualified, certified, or licensed, if applicable, radon mitigator.

Every buyer of any interest in residential real property is notified that the property may present exposure to dangerous levels of indoor radon gas that may place the occupants at risk of developing radon-induced lung cancer. Radon, a Class A human carcinogen, is the leading cause of lung cancer in nonsmokers and the second leading cause overall. The seller of any interest in residential real property is required to provide the buyer with any information on radon test results of the dwelling."

real estate & radon

buying/selling

In Minnesota, 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 the home.



Role of the **real estate professional**

While real estate professionals address many aspects of buying and selling homes, their licensing prohibits them from offering technical advice regarding radon and health risks, unless qualified to do so. Instead, real estate professionals should advise their clients to consult with local health authorities who work on radon issues. Or, have the client contact the MDH Indoor Air Unit at 651-201-4601.

Relocation companies

Sellers and buyers who choose to work with a relocation firm should recognize that their options regarding radon testing and mitigation may be restricted by the terms of their agreement with the company.



recommendations to **Buyers**

If you are buying a home, ask if the home has any radon-resistant construction features and if the home has been tested. Prospective buyers should keep in mind that it is inexpensive and easy to measure radon, and radon levels can be lowered at a fairly reasonable cost.



If the home has been tested,

the buyer must decide if the results of past tests are acceptable. In making this decision, consider:

Level of radon found

If greater than 4 pCi/L consider mitigation by a radon contractor.

Duration of test

Long-term tests should span both heating and non-heating seasons.

Timing of test

Short-term tests performed during the heating season are more likely to overestimate the year-round average. Short-term tests performed during the non-heating season are more likely to underestimate the year-round average.

Area of home that was tested

Determine if the location tested reflects your anticipated use of the home.

Who performed the test

Although not a requirement in Minnesota, using a radon measurement professional certified by either NRPP or NRSB is recommended, a list of professionals is on the MDH radon website.



If the home has not been tested,

or if past testing is not satisfactory, the buyer should decide if they wish to request radon testing. If such a request is made, it is best to bring it up as early as possible.

Radon testing prior to a home purchase, MDH recommends specifying the conditions. Some points are noted below, and may be included in the sales contract:

- **Who** will perform the test.
- **Type** of test: short-term, long-term and/or continuous monitor.
- **Area** should be the lowest livable level to meet the Real Estate testing protocols.
- **When** the test will be done.
- **How** results will be shared between parties.
- Who will **pay** for testing.
- How the **results** will be used.
- At what radon **level** will mitigation be required and who will pay for it.

Finally, even if the home was built radon-resistant, it should still be tested for radon.

recommendations to **Sellers**

As a seller, consider the benefits of **testing your house well before you put it on the market**, as opposed to waiting until you are in the middle of the sale. If you find a problem that should be fixed, you will have time to get it corrected. You also may get a better price for the home because properly conducted radon tests can be used as a positive selling feature of the home.

Who should perform the test?

Radon measurement professionals

may be used when an unbiased third-party is desired. If a professional is hired, MDH recommends selecting a professional who is certified by the National Radon Proficiency Program (NRPP) or by the National Radon Safety Board (NRSB). A list of certified measurement professionals is available on the MDH web site at: www.health.state.mn.us/radon

If you plan to perform the test yourself, two basic types of radon tests are available to the public:

Short-term tests offer a quick and inexpensive way to “screen” for radon.

Long-term tests provide results that more accurately reflect the average amount of radon in the home during the year *(for more on radon testing see page 8)*.



What if there is not enough time to perform a long-term radon test?

A closing date may place practical constraints on performing a long-term test.

If time is a factor, there are **three approved short-term test methods**.



Continuous
Radon Monitor
(CRM)

Fastest



Simultaneous
Short term Testing

Second fastest



Sequential
Short Term Testing

Slowest

Test is completed by a certified contractor with a calibrated CRM for a minimum of 48 hours.

Test report is analyzed to ensure that it is a valid test.

Two short-term test kits are used at the same time, placed 6-12 inches apart, for a minimum of 48 hours.

Test kits are sent to the lab for analysis.

The two test results are averaged to get the radon level.

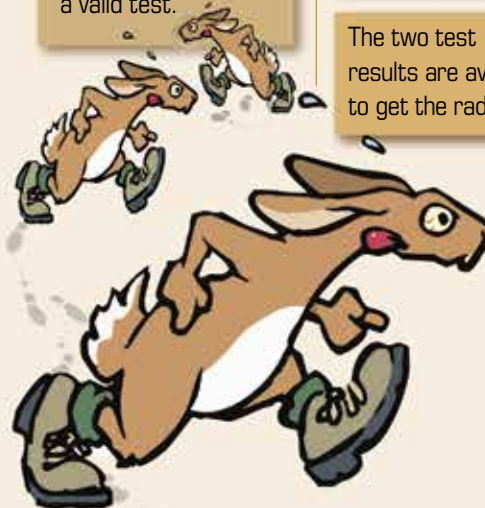
One short-term test is performed for a minimum of 48 hours.

Test kit is sent to lab for analysis.

Another short-term kit is used in the same place as the first, started right after the first test is taken down. Test is performed for a minimum of 48 hours.

Test kit is sent to the lab for analysis.

The two test results are averaged to get the radon level.



guide to radon terms glossary

abbreviations

EPA

Environmental Protection Agency
www.epa.com

MDH

Minnesota Department of Health
www.health.state.mn.us

NRSB

National Radon Safety Board
nrnb.org

NRPP

National Radon Proficiency Program
nrpp.info

pCi/L

picocuries per liter of air

(SSD)

sub-slab depressurization

terms

active system

process to reduce radon gas that uses a radon fan to exhaust the gas from a building

aggregate

mineral materials such as sand or stone

alpha-track detectors

a passive, long-term radon test device

basement

a building story which is wholly or less than half below ground

charcoal canisters

a passive, short-term radon test device

charcoal liquid scintillation device

a passive short-term radon test device

continuous monitor

one device or method used to perform a short-term radon test

convective air flow

air movement going from warm to cold

crawl space

a shallow area between the soil and the first floor of a house

drain tile

specialized pipe system used to pull water away from the footings and foundation of a structure

electret ion chamber detectors

a passive, short-term radon test device

Gold Standard

designation given only to Minnesota contractors that meet the highest requirement levels for radon-resistant, new construction

long-term tests

a more prolonged test used to determine the level of radon that is recommended for more detailed and accurate investigations of radon levels. Tests last 3 months to a year.

mitigation

a system that effectively removes radon gas from a building

mitigation professional

a qualified service professional hired to test or remove radon from a building

negative pressure

a situation in which an enclosed area has lower air pressure than the area around it

picocurie per liter (pCi/L)

a unit that measures levels of radon/radioactive gas

passive system

process used to reduce radon gas that depends on natural air current pathways

perforated pipe

a pipe laying horizontally under a crawl space's vapor barrier, perforated for soil gases to enter and connects to the vent pipe "T"

radioactive

containing radioactive substances which can be dangerous

radium

a radioactive metal of the alkaline earth series

radon

(pronounced RAY-dan) colorless, odorless, radioactive element in the noble gas groups

radon-resistant

building techniques used to prevent radon from entering a home

roof flashing

a piece of sheet metal placed over joints in roof and wall construction to prevent water from seeping into the house

short-term test

a fast test used to determine the level of radon that is not considered as accurate as a long-term method

slab-on-grade

concrete slab foundation that leaves no space between the ground and the structure

soil-gas retarder

polyethylene sheeting that is the primary soil gas barrier in a crawl space, also serves to bridge any cracks that may form after a basement slab has cured

stack effect

the movement of air into and out of buildings, driven by buoyancy, that helps drive natural ventilation

sump pit

a hole typically located in a basement that collects water, wicking it away from rest of the basement

sump pump

a pump designed to periodically remove liquid from the sump pit to ensure that it does not overflow

uranium

a chemically-reactive metal in the actinide series

vent pipe

a pipe used to direct gas out of the home, allowing it to escape outside

vent pipe "T"

PVC piping form that allows gases from the soil to enter with little resistance

credits

This booklet provides information from the Minnesota Department of Health (MDH) on radon and how to protect your family's health. The U.S. Surgeon General, the U.S. Environmental Protection Agency (EPA) and MDH recommend that every Minnesota home be tested for radon.



Indoor Air Unit

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www.health.state.mn.us/radon

For more on **MDH Gold Standard**, visit:

www.health.state.mn.us/GoldStandard



For more on MDH's **healthy home** programs that cover issues such as lead, carbon monoxide, mold, asbestos and more: www.health.state.mn.us/divs/eh/homes/index.html



GOLD STANDARD

More information on how to find a MDH Gold Standard Builder
can be found on our website at:

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