What is Radon?

Radon is a naturally occurring radioactive gas that enters buildings from the surrounding soil. It is colorless, odorless and tasteless. Radon is also the main source of ionizing radiation that most of us are exposed to. It is the second leading cause of lung cancer in the United States -- second only to smoking and is responsible for more than 20,000 deaths annually in the United States.

Radon is a preventable health threat to many Minnesotans. MDH estimates that one in three (1/3) existing Minnesota homes have radon levels that may pose a large health risk over many years of exposure. Fortunately, radon problems in existing homes can be fixed. However, when building a new home, it is more cost effective to prevent a radon problem by building to keep radon out.

The Fan makes the difference between a minimal reduction in radon, that is required by the building code, to a maximum reduction of your lung cancer risk due to radon.

MINNESOTA MDH DEPARTMENT OF HEALTH

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MN Department of Health

MDH Gold Standard - Buyers Guide

Radon Resistant New Construction - Best Practices

RADON RESISTANT NEW CONSTRUCTION

How can radon resistant construction protect my family?

Radon-resistant construction combines common building techniques and sealing of soil gas entry points to help keep radon from entering the home and route it outdoors instead.

It may help control basement moisture.

One common source of basement moisture, the entry of water vapor through the slab, may also be reduced by radon-resistant techniques. Therefore, a radon-resistant home may have less basement moisture than if it had been built without these features.

It may add value when you sell.

Potential buyers can be reassured that a home is built radon-resistant. Informed shoppers should view this as a positive feature in the Minnesota housing market, since 1 in 3 homes in MN have tested high for radon.

MDH Gold Standard - What to look for:

- Gold Standard Check List is located on the Vent Pipe and all boxes checked. The builder should be able to explain all of the components listed on the list.

- Size of fan listed on or near system warning monitor label. This will tell you how big your fan is to estimate the energy usage of the fan.

- Verify the pipe is 3"- 4" Schedule 40 pipe and that it does not go through any exterior walls.
- Verify that the sump basket is sealed. And any penetrations through the cover are caulked air tight.

- Verify the joint where the basement floor meets the foundation wall is sealed with caulk.

Building Code Requirements

Homes built using radon-resistant construction techniques usually rely on "passive" radon control. These systems reduce soil gas entry points and provide a route to vent the gases to the outdoors. A fan may need to be installed to further reduce the radon level.

THEY INCLUDE THE FOLLOWING:

Aggregate: Four inches of clean aggregate; soil-gas collection mats or drainage mats may also be used instead.

Soil-gas retarder: 6 mil thick polyethylene sheeting, overlapped 12 inches at the seams and fitted closely around all penetrations, is placed over the aggregate. In crawlspaces, it is sealed to the foundation walls and interior piers.

Sealing: All potential soil gas entry points are sealed with caulking or expanding foam. Sump baskets must have a sealed cover.

Vent pipe "T": A "T" fitting made of 3 to 4 inch diameter PVC piping is inserted into the aggregate under the basement slab or under a crawl space's vapor barrier.

Vent pipe: The vent pipe is a 3 to 4 inch diameter schedule 40 PVC pipe that is connected to the "T" in the aggregate. If the home has a sump pit or drain-tile system, the vent pipe can instead be inserted directly into the sump pit or connected to the drain-tile loop. The vent pipe runs vertically up to and through the roof.

Electrical junction box: An electrical junction box is roughed in the attic near the vent pipe. The power supply can be used if the radon control system needs to be "activated" by installing a fan in the future.

Roof flashing: Flashing must be installed around the vent pipe where it exits the roof to prevent leakage.

MINNESOTA MDH DEPARTMENT OF HEALTH

Indoor Air Unit

GOLD STANDARD BUILDER

"Partnering with builders to improve public health"

This house is built with Radon Resistant New Construction practices

"Actively control your radon"

House Built By:

(YARD SIGN – PLACE HOLDER FOR BUILDER INFO)

MINNESOTA MDH DEPARTMENT OF HEALTH

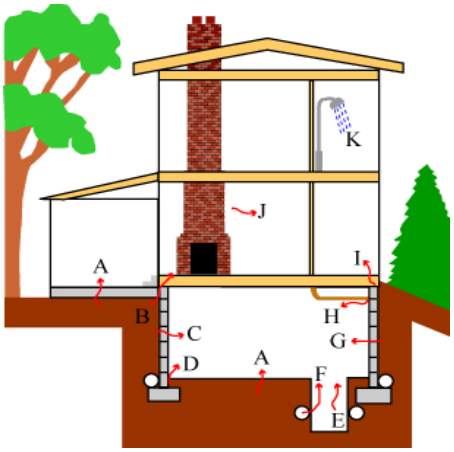
Indoor Air Unit

Gold Standard Radon Resistant New Construction Practices

Radon Health Effects:

- Radon is a radioactive gas that can enter a home, decay and attach to particles in the air that can be breathed into the lungs. As the radioactive particles break down further, they release bursts of energy which can damage the DNA in lung tissue leading to lung cancer.[1]
- Radon has been classified as a Group A or Class 1 carcinogen (known to cause cancer in humans). [2,3]
- The U.S. Environmental Protection Agency estimates that each year 21,000 people die of lung cancer as a result of being exposed to elevated levels of radon. [4]
- The evidence that radon causes lung cancer is extensive and based on: human data taken from studies of underground minors over a period of more then 50 years; human data from studies in residential settings; and biological and molecular studies.

1. Environmental Protection Agency (EPA) (2001) Building Radon Out, A Step-by-step Guide On How To Build Radon-Resistant Homes. USEPA: 402-K01-002
2. Report on Carcinogens (RoC), 11th Edition.
3. International Agency for Research on Cancer (IARC) (2001) Some internally deposited radionuclides. Vol 78.
4. EPA (2003) Assessment of Risks from Radon in Homes. Washington, DC, USEPA: 1-88.



How does radon enter your home?

MAJOR RADON ENTRY ROUTES

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, such as brick, concrete, rock.

Radon Risk If You've Never Smoked

Radon Level	If 1,000 people who never smoked were exposed to this level over a lifetime*...	WHAT TO DO:
20 pCi/L	About 36 people could get lung cancer	Fix your home
10 pCi/L	About 18 people could get lung cancer	Fix your home
8 pCi/L	About 15 people could get lung cancer	Fix your home
4 pCi/L	About 7 people could get lung cancer	Fix your home
2 pCi/L	About 4 people could get lung cancer	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 2 people could get lung cancer	(Reducing radon levels below 2 pCi/L is difficult.)
0.4 pCi/L		

Note: If you are a former smoker, your risk may be higher.
pCi/L (pico Curies per Liter)
* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).

Why Build to the MDH Gold Standard:

State Building Code only requires that a vent pipe be put in that would allow for an easy and cost effective radon mitigation system. Testing must be done by every homeowner to verify if the radon levels in the home are high.

The MDH gold standard requires a full mitigation system to be installed that will not only reduce the radon levels but will reduce the likelihood of other indoor contaminants, that he building code does not consider.

Gold Standard Builder Contact Info:

Indoor Air Unit

GOLD STANDARD CHECK LIST

RADON MITIGATION SYTEM

- ☐ Radon Mitigation System installed according to IRC Appendix F
- ☐ No dirt crawl spaces
- ☐ Radon Vent Stack must be run through an interior wall or chase, not the exterior walls
- ☐ Design for sub-slab pressure extension
- ☐ Passive system MUST BE ACTIVATED
- ☐ Fan must be selected based on pressure extension and fan curve characteristics
- ☐ Ensure max depressurization will not cause back drafting of combustion appliances
- ☐ The short-term test shall be preformed before closing
  Date: _____
  Level: _____
- ☐ Long-term test deployed at closing for a length of one year
  Date: _____
  Level: _____
- ☐ Follow up testing by occupant. Every 2 years or after building alteration

Follow-Up Testing

Test Date:	Level:	Test Date:	Level:
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Radon Resistant New Construction (RRNC) Energy Calculations:

Average RRNC Fan*	20 Watts	X	24 hrs	=	480 watt-hours/day
	480 watt-hours/day	X	7 days/wk	=	3360 watt-hours/wk
	3360 watt-hours/wk	÷	1000 watts/kilowatt	=	3.36 kwh/wk
	3.36 kwh/wk	X	$0.07 /kwh	=	**$0.24/wk**
	$0.24 /wk	X	4.25 wk/mo	=	**$1.02/mo**
	$1.02 /mo	X	12 mo/yr	=	**$12.24/yr**

Average Mitigation Fan*	100 Watts	X	24 hrs	=	2400 watt-hours/day
	2400 watt-hours/day	X	7 days/wk	=	16800 watt-hours/wk
	16800 watt-hours/wk	÷	1000 watts/kilowatt	=	16.8 kwh/wk
	16.8 kwh/wk	X	$0.07 /kwh	=	**$1.15/wk**
	$1.15 /wk	X	4.25 wk/mo	=	**$4.87/mo**
	$4.87 /mo	X	12 mo/yr	=	**$58.44/yr**

Average TV with Power OFF	10 Watts	X	24 hrs	=	240 watt-hours/day
	240 watt-hours/day	X	7 days/wk	=	1680 watt-hours/wk
	1680 watt-hours/wk	÷	1000 watts/kilowatt	=	1.68 kwh/wk
	1.68 kwh/wk	X	$0.07 /kwh	=	**$0.11/wk**
	$0.11 /wk	X	4.25 wk/mo	=	**$0.49/mo**
	$0.49 /mo	X	12 mo/yr	=	**$5.84/yr**

Average Computer Left ON	135 Watts	X	24 hrs	=	3240 watt-hours/day
	3240 watt-hours/day	X	7 days/wk	=	22680 watt-hours/wk
	22680 watt-hours/wk	÷	1000 watts/kilowatt	=	22.68 kwh/wk
	22.68 kwh/wk	X	$0.07 /kwh	=	**$1.55/wk**
	$1.55 /wk	X	4.25 wk/mo	=	**$6.57/mo**
	$6.57 /mo	X	12 mo/yr	=	**$78.90/yr**

* The difference in fan size is due to the gravel required in the RRNC building practices.

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System Warning Device
U-Tube

The U-tube manometer is a device to measure pressure differences. A U-tube is a vertical U of bent plastic tubing, the bottom half of which is filled with water. When there is a pressure difference between the two ends of the tube the water is forced to move in the U-tube. This movement is an indication of the changes in pressure. The change or pressure is due to the air being drawn up the radon pipe by the fan.

If the fan stops working the U-tube water level on both sides will be at the same height. If this happens the fan is no longer drawing the radon out of the home and action should be taken to fix the problem.

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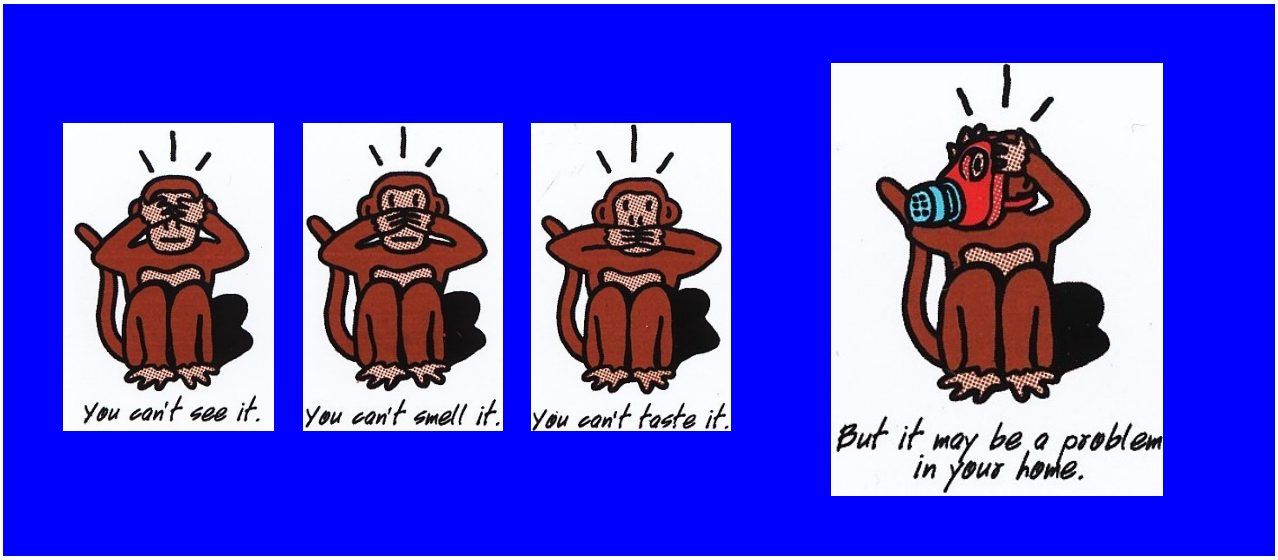
Radon, is believed to be one of the leading causes of lung cancer.



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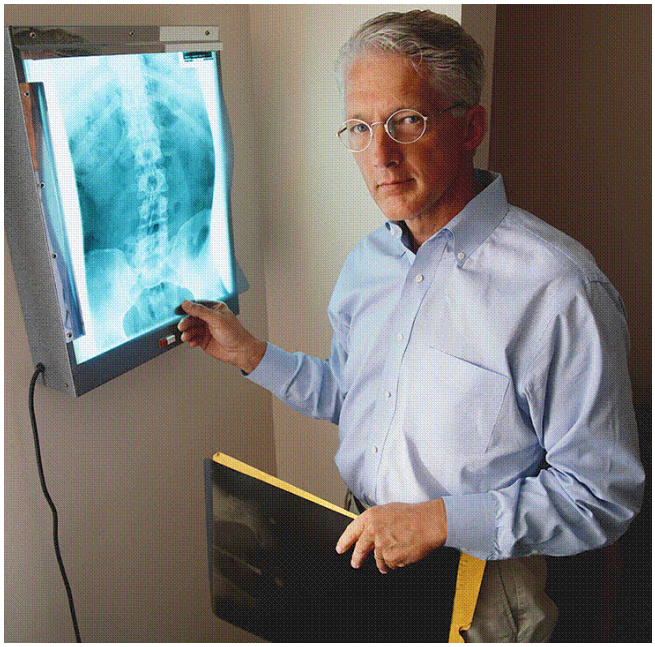
The fan used to "activate" the radon system makes the transition between a minimal reduction in radon, that is required by the building code, to a maximum reduction of your lung cancer risk due to radon.



What is your risk?

Radon (Annual Average) Level	Additional Lung Cancer Risk for People Who Never Smoked
20 pCi/L	36 out of 1,000
10 pCi/L	18 out of 1,000
8 pCi/L	15 out of 1,000
4 pCi/L	7 out of 1,000
2 pCi/L	4 out of 1,000

This table shows the level of risk from radon at several different levels. These are estimates of lung cancer risk due to long-term exposure to radon. The risk estimates were derived from the EPA's *Assessment of Risks from Radon in Homes*, June 2003. They show that there is no "safe" level of radon and that risk increases with higher levels of radon. The risk to smokers from radon is significantly higher than for non-smokers.

Radon Testing

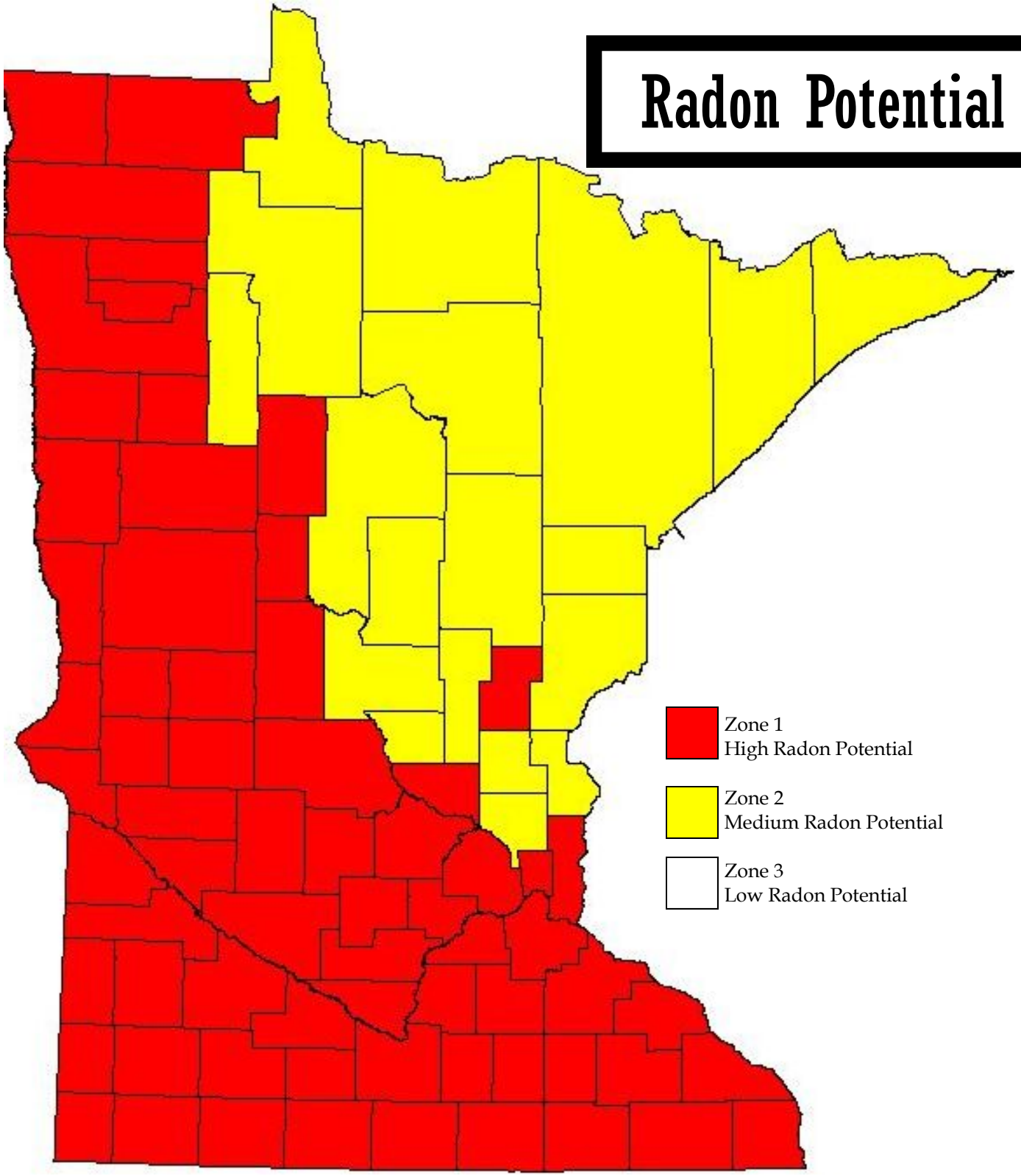
Should I test my home for radon?

Yes. Testing is the only way to find out how much radon is in your home. The Minnesota Department of Health estimates that one in three Minnesota homes has radon levels above the EPA's recommended action level.

How much radon in a home is safe?

Any amount of radon carries some risk, even at or below the EPA recommended action level. The risk of lung cancer increases with higher long-term average radon levels. Because it isn't possible to reduce radon to zero, the best approach is to lower it as much as possible. In Minnesota there are no regulations for radon, so people must decide for themselves how much radon they feel is acceptable in their home.

Radon Potential



This map is not intended to if a home in a given zone should be tested for radon. Homes with elevated radon have been found in all three zones. **All homes should be tested regardless of geographic location.** This map is based of information provided by the Environmental protection Agency (EPA).

*** Minnesota does not have any low radon potential areas.**

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