Radon-Resistant Construction In New Minnesota Homes

Environmental Health Division
Indoor Air Unit

Introduction

This fact sheet provides information from the Minnesota Department of Health (MDH) on the benefits of, and techniques for, building a home radon-resistant. Since radon is not regulated in Minnesota, prospective builders/buyers must decide for themselves if radon-resistant construction is a good idea for their family's new home.

What is radon and why is it important?

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 believed to be the second leading cause of lung cancer in the United States -- second only to smoking. You can read more in the fact sheets *Radon in Minnesota Homes* and *Minnesota Radon Testing and Use of Test Results*, available online or by calling MDH.

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, most 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.

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. The lower the amount of radon in your home, the lower the exposure and resulting risk to those living there.

What are the benefits of building a home radon-resistant?

- **It reduces your family's risk of lung cancer.** People who live in a radon-resistant home will breathe in less radon. The less radon your family is exposed to, the lower their risk of lung cancer from this form of radiation.
- **It can save you money.** Adding radon-resistant features to a new home will typically add between $350-$500 dollars to the cost of the home. Without these features, a radon problem will generally cost between $500 and $2500 to fix once the house is built. Since the chances are high that a new home in Minnesota will have an elevated radon level, investing in radon-resistant techniques up front can save money.
- **System components are incorporated into the building design.** When radon-resistant features are part of the home's design, they can easily be hidden from view. This may not be possible if a radon mitigation system has to be added after the house is finished.
- **It may help control basement moisture in some cases.** 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. To learn more about another indoor air problem caused by excess moisture, see the fact sheet *Mold in Homes* available by calling or visiting MDH online.

- **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. For more information on radon in real estate transactions see the MDH fact sheet *Radon and Real Estate in Minnesota*, available online or by calling.

Can a radon problem be predicted prior to construction?

No. It isn't possible to predict if a home will have elevated radon levels before it is finished and occupied. Testing soil before building would be very expensive and cannot reliably forecast how much radon will enter and accumulate in the home. Besides the amount of radon produced from the soil, many other factors that are unique to a specific house's construction and how it is operated also influence the amount of radon that is present in the home after it is built and occupied.

Geologic and home-testing data show that the potential for elevated radon in buildings is high throughout most of the entire state of Minnesota. The likelihood of having elevated radon in a home is especially great for areas covering roughly the western third and southern half of the state. However, every home in Minnesota has the potential for elevated indoor radon levels regardless of its location.

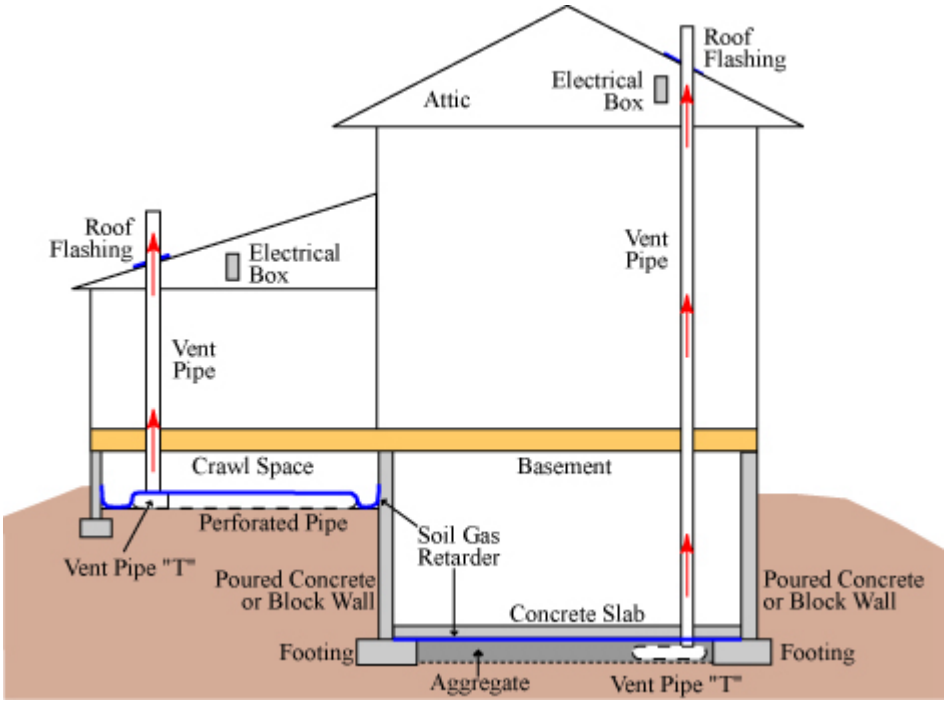
What makes a home radon resistant?

Homes built using radon-resistant construction techniques usually rely on "passive" radon control. So-called passive systems don't require energy or fans to move air. These systems reduce soil gas entry points and provide a route to vent the gases to the outdoors. They include all of the following:

- **Aggregate:** Four inches of clean aggregate (smaller than 2 inches in diameter but larger than ¼ inch in diameter) or four inches of sand overlain with drainage material is spread under all areas that will be covered by concrete slabs and are within the home's walls. Soil-gas collection mats or drainage mats may also be used instead. This layer allows soil gases to move freely under the slab and enter an exhaust vent pipe.
- **Soil-gas retarder:** 6 mil thick polyethylene sheeting, overlapped 12 inches at the seams and fitted closely around all pipe, wire or other penetrations, is placed over the aggregate in a basement or slab-on-grade prior to pouring the slab. In crawlspaces, the polyethylene sheeting is placed directly over the soil of the crawlspace floor and sealed to the foundation walls and interior piers. This is the primary soil gas barrier in a crawl space and serves to bridge any cracks that may form after the basement slab has cured.
- **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. The "T" allows soil gases to enter the vent pipe with little resistance.
- **Perforated pipe:** A 3 to 4 inch diameter perforated pipe is laid horizontally under a crawl space's vapor barrier and connects to the PVC vent pipe "T". The perforated pipe provides numerous openings for soil gases to enter the vent assembly.

- **Vent pipe:** The vent pipe is a 3 to 4 inch diameter 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 (and a sealed sump cover added) or connected to the drain-tile loop. The vent pipe runs vertically through the building and terminates at least 12 inches above the roof's surface in a location at least 10 feet from windows or other openings and adjoining or adjacent buildings. This pipe directs the soil gases to the outdoors. On each floor of the home, it should be labeled "Radon Reduction System".
- **Electrical junction box:** An electrical junction box is roughed in the attic near the vent pipe. It is easier and cheaper to install electrical wiring during construction rather than adding it later. The power supply can be used if the radon control system needs to be "activated" in the future.
- **Roof flashing:** Flashing must be installed around the vent pipe where it exits the roof to prevent leakage.

Components of a Passive Radon System



Additionally, all potential soil gas entry points are sealed with caulking or expanding foam and the basement walls are waterproofed. Common entry points that require sealing include floor/wall joints, gaps around pipes, plumbing, sump pits and the tops of block walls.

Should I test for radon after the home is finished?

MDH recommends every Minnesota home, even those built radon-resistant, be tested for radon. The only way to find out if the amount of radon in your home poses an unacceptable risk to your family is to test after you have moved in.

What can be done if the radon level is high?
If the home has a passive radon-control system already in place, it can be "activated" if unacceptable radon levels are present. The system is "activated" by installing an inline exhaust fan in the vent pipe, usually in the attic. The fan is wired into the electrical junction box that was roughed in. This pulls radon and other soil gases from beneath the home and exhausts them to the outdoors. A system failure warning device should also be installed to alert you if the system malfunctions.

Is radon-resistant construction required by code?
Under the Minnesota State Building Code, builders are not required to install a full radon-resistant new construction system. Therefore, if you wish to have your home built radon-resistant, you must specifically ask your builder for such a system.

What if my builder isn't familiar with radon-resistant construction?
Home builders can find technical information on radon-resistant techniques in the 2000 International Residential Code (Appendix F) from the International Code Council, the EPA, the National Association of Home Builders, the National Environmental Health Association, or other organizations. Radon-resistant publications available from MDH free of charge include:

- U.S. EPA, *Model Standards and Techniques for Control of Radon in New Residential Buildings*.

- U.S. EPA, *Building Radon Out: A Step-By-Step Guide On How To Build Radon-Resistant Homes.*

- National Forest Products Association (NFPA), *Radon Reduction in Wood Floor and Foundation Systems*.

Where can I get more information on radon or other indoor air quality issues?

MDH Indoor Air Unit
Phone: (651) 215-0909
(800) 798-9050
View the Air Quality web page at:
www.health.state.mn.us/divs/eh/air

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