UNDERSTANDING RADON

Building Inspections Department | 6000 McColl Drive, Savage, MN 55378
Office: 952-882-2650 | Fax: 952-882-2656 | savageinspections@cityofsavage.com

What is Radon?

Radon is a colorless, odorless, tasteless radioactive gas. Produced by a breakdown of uranium and radium, radon naturally occurs in most rocks and soil. Much of the soil in the upper Midwest contains widespread uranium and radium. Radon is harmless when dispersed in the outdoor air, but when trapped indoors, it has been found to increase the risk of lung cancer.

Why is it a Problem?

Prolonged exposure to high levels of radon is the second leading cause of lung cancer in the United States, and smokers are at an even higher risk of developing radon-induced lung cancer. 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.

Buildings create vacuums that draw in soil gas. The level of radon is often highest in the lower part of a building. This is important since many Minnesota homes have basements that are used as living spaces. The Minnesota Department of Health estimates that about one in three Minnesota homes have enough radon to pose a significant risk to the occupants' health over many years of exposure.

Any home, regardless of age, energy-efficiency, or foundation type, could have a radon problem. Radon can enter a home through the floor and walls – anywhere there is an opening between the home and the soil. Cracks in the foundation, floor or walls, hollow-block walls, and openings around pipes, sump pumps and floor drains are all areas of concern.

What Can we do About it?

The U.S. Surgeon General, the U.S Environmental Protection Agency and the Minnesota Department of Health all recommend that every Minnesota home be tested for radon. The goal of testing is to estimate the amount of radon in a home. Testing is done in the lowest level of the home that is regularly used. There are two types of test kits available; short-term tests and long-term tests. You can also hire a radon measurement professional, although this would be more expensive. Short-term tests are quick and inexpensive. They are left in place for 3 – 7 days.

Long-term tests are left in place for a minimum of 90 days and more accurately reflect the average amount of radon in the home during the year. Test kits are sold at hardware or home supply stores and Minnesota residents can purchase discounted radon test kits through Air Chek, Inc. at http://www.mn.radon.com. The amount of radon in the air is measured in "picocuries per liter of air, or pCi/L." The Environmental Protection Agency (EPA) has set a recommended action level for radon at 4.0 pCi/L. If the annual average level of radon in a home is above this action level, the EPA and MDH recommend that steps be taken to lower it. MDH recommends that if the annual average level of radon is between 2 and 4 pCi/L to consider taking action to lower radon levels. While it isn't possible to reduce radon to zero, the best approach is to lower it as much as possible. In Minnesota there are only regulations for new construction, so people must decide for themselves how much radon they feel is acceptable in their home.

How to Lower Radon Levels

If you have found unacceptable levels of radon in your home, the most effective way to lower it is with a radon reduction or mitigation system. This is done with a vent pipe system and fan, which pulls radon from beneath the house and vents it to the outside. Sealing foundation cracks and other openings can make this system more effective. You should use a qualified contractor who is trained to fix radon problems. If you are planning to finish your basement, it is especially important to test the area for radon before you begin. You should also test your home again after it is fixed to be sure the radon levels have been reduced. Radon monitors can also be purchased to monitor the radon levels, similar to monitoring for carbon monoxide.

In Minnesota, there are only regulations for new construction and radon-resistant construction techniques now being utilized. It is more cost effective to include radon-resistant features when building a home rather than retrofitting an existing home. Having a radon reduction system in place can add resale value to your home as radon testing and mitigation are more frequently a part of real estate transactions. There are two common types of systems:

Passive Subslab Depressurization System

A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a vent pipe routed through the home, connecting the sub-slab area with the outdoor air. This system relies on the convective flow of air upward in the vent to draw air from beneath the slab.

Active Subslab Depressurization System

A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a continuously exhausting, fan-powered vent drawing air from beneath the slab. This system requires a monometer or other system monitoring device.

Subfloor Preparation

A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces and conditioned crawl spaces, of the building, to facilitate the installation of an active sub-slab depressurization system if needed.
The gas-permeable layer shall consist of one of the following:

- A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a ¼ inch (6.4 mm) sieve.
- A uniform layer of sand (native or fill), a min. of 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.
- Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire sub-floor area.

Soil-Gas Retarder

- A continuous membrane of 6-mil (0.15 mm) polyethylene, 3 mil (0.075 mm) cross-laminated polyethylene, or other equivalent material used to retard the flow of soil gases into a building.
- Install prior to casting the concrete slab
- Cover the entire floor area
- Seams lapped at least 12 inches.
- The sheathing shall fit closely around any pipe, wire or other penetration of the material.
- All punctures, tears or cuts shall be sealed or covered with additional sheathing.

Entry Routes

- Potential radon entry routes shall be closed or sealed.
- **Floor openings:** Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.
- **Sump pumps:** Sump pumps must be sealed.
- **Foundation Walls:** Hollow block masonry foundation walls shall be constructed with either; a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished grade. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed.
- **Unconditioned Crawl Space Floors:** Openings around all penetrations through floors above unconditioned crawl spaces shall be caulked or otherwise filled to prevent air leakage.
- **Unconditioned Crawl Space Access:** Access doors and other openings or penetrations between basements and adjoining unconditioned crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.

Passive System Concept for Crawl Spaces

- Suction point is under plastic sheet placed over exposed soil or rock.
- Radon is collected and exhausted outdoors.
- Seams and edges are sealed with polyurethane caulk and duct tape.

Vent Pipe

A plumbing tee or other approved connection with one ten foot section of a perforated pipe connected to each side shall be inserted horizontally beneath the sheeting and connected to a 3" or 4" vertical pipe extended up through the building floors and terminate at least 12" above the roof in a location at least 10 feet away from any window or other opening into the conditioned space.

- **Multiple vent pipes:** In buildings where interior footings or other barriers separate the sub slab aggregate or other gas permeable material, each area shall be fitted with an individual vent pipe.
- **Vent pipe drainage:** All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil gas retarder.
- **Vent pipe accessibility:** Radon vent pipes shall provide enough space around the pipe for future installation of a fan system. This space shall be a minimum of 24" in diameter, centered on the axis of the vent stack, extending a minimum vertical distance of 3 feet.
- **Vent pipe Identification:** All radon vent pipes shall be identified with a least one label on each floor and in accessible attics. The label shall read: "Radon Reduction System."

Warning System

In case of failure in the active system, an audible or visible warning system should be installed in a frequently visited area.

Combination Foundations

- Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area.
- Exception: A single vent pipe is allowed in a building with a combination foundation as long as soil gasses can flow freely between the areas of the combination foundations and it is connected to an approved vent pipe.

Power Source

- To provide for future installation of an active sub-membrane or sub-slab depressurization system, an electrical circuit terminated in an approved box shall be installed during construction in the attic or other anticipated location of vent pipe fans.

Installing a Fan

- When a fan is added in the radon vent pipe, the fan shall be placed outside the habitable spaces, such as in an attic.

Incorporation by Reference:

Appendix F, Radon Control Methods, of the 2006 edition of the International Residential Code.
Amended by the State of Minnesota in Minnesota Rules, chapter 1300, in parts 1322.2101 to 1322.2103
Pursuant to Minnesota Statues 2006 16B.61 section 1 subd. 3b

Helpful links

For more information, please see the following sites:
www.epa.gov/radon
http://www.health.state.mn.us/communities/environment/air/radon/index.html
www.mn-radon.info
www.bamn.org/energycode