Sub-slab Soil Gas (RADON) Requirements
2015 MSBC Chapter 1303

Radon is a naturally occurring gas that occurs in the rocks and soil and is even present in the outdoor air we breathe. Because radon is a radioactive gas, it potentially poses a health risk to people and pets. The primary concern during new construction or remodel projects is to mitigate this gas to prevent it’s accumulation in higher than natural concentrations in the homes in which we live and breathe.

This portion of the Minnesota State Building code includes requirements that are intended to help control the accumulation of radon. These passive control provisions are required in the following types of construction projects:

A. One-family dwellings
B. Two-family dwellings
C. Townhouses
D. Apartment buildings
E. Condominiums
F. Multistory buildings that include any residential occupancy
G. Mixed-occupancy buildings that include any residential occupancy
H. Any addition to an existing dwelling that currently has a radon control system incorporated into the
existing building.

It should specifically be noted that hotels, motels as and additions to existing dwellings that do not currently have a radon control system incorporated into the existing dwelling are exempted from the requirements for passive control.

The following code excerpt outlines the construction materials and installations that are required for a code compliant passive radon control system:

1303.2402 REQUIREMENTS FOR PASSIVE RADON CONTROL SYSTEMS

A gas-permeable material shall be placed on the prepared subgrade under all floor systems.

"gas permeable material" means any of the following:
1. 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 1/4-inch (6.4 mm) sieve.
2. A uniform layer of sand, native or fill, a minimum 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.
3. Other materials, systems, or floor designs if the material, system, or floor design is professionally engineered to provide depressurization under the entire soil-gas membrane.

Subp. 2. Soil-gas membrane installation.
A soil-gas membrane shall be placed on top of the gas-permeable material prior to placing a floor on top of or above the soil. The soil-gas membrane shall cover the entire floor area. Separate sections of membrane must be lapped at least 12 inches (305 mm). The membrane shall fit closely around any penetration of the membrane to reduce the leakage of soil gases. All punctures or tears in the soil-gas membrane shall be repaired by sealing and patching the soil-gas membrane with the same kind of material, maintaining a minimum 12-inch (305 mm) lap.

"Soil-gas membrane" means a continuous membrane of 6-mil (0.15 mm) polyethylene, or 3-mil (0.075 mm) cross-laminated polyethylene.

Additional 1322.402.2.10 Requirements - Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder in accordance with the International Building Code or International Residential Code, as applicable. All joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

Subp. 3. "T" fitting.
A "T" fitting shall be installed beneath the soil-gas membrane with a minimum of 10 feet of perforated pipe connected to any two openings of the "T" fitting, or by connecting the two openings to the interior drain tile system. The third opening of the "T" fitting shall be connected to the vent pipe. The perforated pipe or drain tile and the "T" fitting shall be the same size as the vent pipe. All connections to the "T" fitting shall be tight fitting.

Subp. 4. Potential entry routes.
Potential entry routes for radon gas shall be sealed according to this subpart, as applicable.

A. Floor openings. Floor openings around bathtubs, showers, water closets, pipes, wires, or other objects that penetrate the soil-gas membrane and the concrete slab or other floor systems, shall be...
sealed.

B. Concrete joints. All control joints, isolation joints, construction joints, or any other joints in the concrete slab, or the joint between the concrete slab and a foundation wall, shall be sealed. All gaps and joints shall be cleared of all loose material prior to sealing.

C. Foundation walls. Penetrations of all foundation wall types shall be sealed. Joints, cracks, or other openings around all penetrations of both exterior and interior surfaces of foundation walls shall be sealed.

1. Hollow block masonry foundation walls shall be constructed with either:
   (a) A continuous course of solid masonry at or above the exterior ground surface;
   (b) One course of masonry grouted solid at or above the exterior ground surface; or
   (c) A solid concrete beam at or above the finished exterior ground surface.

2. When a brick veneer or other masonry ledge is installed, the masonry course immediately below the veneer or ledge shall be solid or filled.

D. Unconditioned crawl spaces. All penetrations through floors or walls into unconditioned crawl spaces shall be sealed. Access doors into unconditioned crawl spaces shall be gasketed. Crawl space ventilation shall be provided according to part 1303.2400.

E. Sumps. A sump connected to interior drain tile may serve as the termination point for the vent pipe, if the sump cover is sealed or gasketed and designed to accommodate the vent pipe. The sump pump water discharge pipe shall have a backflow preventer installed.

Subp. 5. Vent pipes.

A. Single vent pipe. The vent pipe shall be primed and glued at all fittings and shall extend up from the radon control system’s collection point to a point terminating a minimum of 12 inches (305 mm) above the roof. The vent pipe shall be located at least 10 feet (3,048 mm) away from any window or other opening into the conditioned spaces of the building. Vent pipes routed through unconditioned spaces shall be insulated with a minimum of R-4 insulation. Vent pipes within the conditioned envelope of the building shall not be insulated.

B. Multiple vent pipes. In buildings where interior footings or other barriers separate the gas-permeable material into two or more areas, each area shall be fitted with an individual radon control system in accordance with item A, or connected to a single radon gas vent pipe terminating above the roof in accordance with item A.

C. Vent pipe drainage. All components of the radon gas vent pipe system shall be installed to provide drainage to the ground beneath the soil-gas membrane.

D. Vent pipe accessibility. Radon gas vent pipes shall be provided with space around the vent pipe for future installation of a fan. The space required for the future fan installation shall be a minimum of 24 inches in diameter, centered on the axis of the vent pipe, and shall extend a minimum distance of 3 vertical feet.

Exception: Accessibility to the radon gas vent pipe is not required if the future fan installation is above the roof system and there is an approved rooftop electrical supply provided.

E. Vent pipe identification. All radon gas vent pipes shall be identified with at least 1 label on each story and in attics and crawl spaces. The label shall read: “Radon Gas Vent System.”

F. Combination foundations. Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate radon gas vent pipes installed in each type of foundation area. Each radon gas vent pipe shall terminate above the roof or shall be connected to a single vent pipe that terminates above the roof.

Subp. 6. Power source.

A power source consisting of an electrical circuit terminating in an approved electrical box shall be installed during construction in the anticipated location of the vent pipe fan to allow for the future installation of a fan into a passive radon control system to make the system an active radon control system. The power source shall not be installed in any conditioned space, basement, or crawl space.
In addition to the requirements for a passive system, if a fan is added to the system or if the system is required to be made active, the following requirements apply as well:

1303.2403 REQUIREMENTS FOR ACTIVE RADON CONTROL SYSTEMS.
When an active radon control system is installed, all the requirements for the passive radon control system in parts 1303.2400 to 1303.2402 shall be met. In addition, an active radon control system shall incorporate items A to C in this part.

A. Radon gas vent pipe fan. A radon gas vent pipe fan manufactured for radon control systems and rated for continuous operation that provides a minimum measurement of 50 cubic feet per minute at 1/2-inch water column shall be installed in the vertical vent pipe. The fan shall be attached to a radon gas vent pipe that connects the air below the soil-gas membrane with outdoor air and relies on the fan to provide upward air flow in the vent pipe. The radon gas vent pipe fan shall be installed outdoors, in attics, or in garages. The radon gas vent pipe fan shall not be installed in conditioned spaces of a building, basement, or crawl space. The radon gas vent pipe fan shall not be located where it positively pressurizes any portion of the vent pipe that is located inside conditioned space.

B. System monitoring device. An audible alarm, a manometer, or other similar device shall be installed to indicate when the fan is not operating.

C. Luminaire and receptacle outlet. A switch-controlled luminaire and the receptacle outlet near the fan shall be installed according to the Minnesota Electrical Code. The requirements of the International Mechanical Code, section 306, do not apply.

The following diagrams are intended to provide helpful direction for the proper installation of passive or active sub-slab soil-gas mitigation systems. While they may be helpful, they are not the actual code and may not include all code requirements. Refer to 2015 MSBC Chapter 1303.2400-2403 for all code requirements.
PASSIVE BASEMENT WITH SLAB APPLICATION

*VENT PIPE ACCESSIBILITY NOTE*

RADON GAS VENT PIPES SHALL BE PROVIDED WITH SPACE AROUND THE VENT PIPE FOR FUTURE INSTALLATION OF A FAN. THE SPACE REQUIRED FOR THE FUTURE FAN INSTALLATION SHALL BE A MINIMUM 24 INCHES IN DIAMETER, CENTERED ON THE AXIS OF THE VENT PIPE, AND SHALL EXTEND A MINIMUM DISTANCE OF 3 VERTICAL FEET.

1. MIN. 4" THICK LAYER OF GAS-PERMEABLE MATERIAL
2. SOIL-GAS MEMBRANE (MIN. 6-MIL POLYETHYLENE SHEETING OR EQUIVALENT): OVERLAP SEAMS 12" MIN.
3. PVC T FITTING WITH 10' PERFORATED PIPE IN EACH DIRECTION
4. SEAL ALL OPENINGS IN SLAB AND AROUND PENETRATIONS
5. 3"-4" DIA. VENT PIPE (PVC OR EQUIVALENT) (INSULATED IN UNCONDITIONED SPACE AND LABELED ON EACH FLOOR)
6. SUPPORT STRAPPING
7. RADER GAS VENT SYSTEM
8. RATER GAS VENT SYSTEM
9. MAIN LEVEL
10. JOIST
11. JOIST
12. RATER GAS VENT SYSTEM
13. POWER SOURCE CIRCUIT
14. FLASHING
15. ATTIC
16. RAFTER
17. 24"
18. 36"
VENT PIPE ACCESSIBILITY NOTE

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1. **NO GAS-PERMEABLE MATERIAL LAYER REQUIRED WITHOUT SLAB**

2. **SOIL-GAS MEMBRANE (MIN. 6-MIL POLYETHYLENE SHEETING OR EQUIVALENT): OVERLAP SEAMS 12" MIN.**

3. **3"-4" DIA. VENT PIPE (PVC OR EQUIVALENT) (INSULATED IN UNCONDITIONED SPACE AND LABELED ON EACH FLOOR)**

4. **CAP BLOCK OR OTHER SEAL ON HOLLOW BLOCK WALLS**

5. **SEAL ALL OPENINGS IN SLAB AND AROUND PENETRATIONS**

6. **PVC T FITTING WITH 10' PERFORATED PIPE IN EACH DIRECTION**

7. **SUPPORT STRAPPING**

8. **ATTIC**

9. **POWER SOURCE CIRCUIT**

10. **FLASHTING**

11. **RAFTER**

12. **TWO RADON GAS VENT SYSTEMS**

13. **EXHAUST (10' FROM OPENINGS INTO CONDITIONED SPACES OF BUILDING) 12" MIN. ABOVE ROOF**

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ACTIVE BASEMENT WITH SLAB APPLICATION

*ADDITIONAL ACTIVE SYSTEM REQUIREMENTS*

A) THE RADON VENT FAN SHALL BE INSTALLED OUTDOORS, IN ATTICS, OR IN GARAGES, AND MAY NOT BE INSTALLED IN A CONDITIONED BUILDING SPACE.

B) AN AUDIBLE ALARM, A MANOMETER, OR OTHER SIMILAR DEVICE SHALL BE INSTALLED TO INDICATE WHEN THE FAN IS NOT OPERATING.

C) A SWITCH CONTROLLED LUMINARIA SHALL BE INSTALLED NEAR THE FAN.

1. MIN. 4" THICK LAYER OF GAS-PERMEABLE MATERIAL
2. SOIL-GAS MEMBRANE (MIN. 6-MIL POLYETHYLENE SHEETING OR EQUIVALENT): OVERLAP SEAMS 12" MIN.
3. PVC T FITTING WITH 10' PERFORATED PIPE IN EACH DIRECTION
4. SEAL ALL OPENINGS IN SLAB AND AROUND PENETRATIONS
5. 3"-4" DIA. VENT PIPE (PVC OR EQUIVALENT) (INSULATED IN UNCONDITIONED SPACE AND LABELED ON EACH FLOOR)

EXHAUST (10' FROM OPENINGS INTO CONDITIONED SPACES OF BUILDING) 12" MIN. ABOVE ROOF

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