Information Bulletin
Building and Safety Standards Branch
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Radon Rough-in Requirements

This bulletin provides information about changes in the British Columbia Building Code (Building Code) 2024 regarding the new requirements relating to radon rough-in provisions for Part 9 buildings. These new Building Code 2024 requirements apply to projects for which a building permit is applied for on or after March 8, 2024.

Background

Radon is an invisible, odorless gas that exists in various levels in the ground because of the breakdown of uranium within soil, rock, and water. When radon enters and is contained in a building, it can present serous health risks if exposed to the occupants. Health Canada recommends radon mitigation based on the levels of radon measured within the building.

An effective method for protecting houses from elevated indoor levels of radon is to incorporate a subfloor depressurization system consisting of a gas-permeable layer under a continuous and sealed air barrier, and a radon vent pipe with a fan that exhausts soil gases from the gas-permeable layer to the exterior of the home. A rough-in consists of a gas-permeable layer, separated from the conditioned space, connected to a pipe that is ready for the installation of a fan.

Radon concentration levels in finished houses cannot be accurately predicted at the time of design and construction. Radon concentration levels in one house may be different than those of a neighbouring house.

The Building Code 2024 includes updates to British Columbia's requirements for homes to be built with a rough-in for a subfloor depressurization system.

Rough-ins for Subfloor Depressurization Systems Required Province-wide

The first update addresses locations where rough-ins are required. Previously, British Columbia data suggested that there were areas of the province with low probability to experience elevated indoor radon levels. Based on this information, certain areas of the Province only required a soil gas barrier to protect homes but did not have to provide a rough-in for a subfloor depressurization system.

New data shows that radon exists in many areas of British Columbia where it was not previously known to result in elevated indoor levels. There is no longer reliable evidence to justify exempting certain areas from the radon rough-in requirement. The National Building

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Code of Canada (NBC), upon which the Building Code is based, requires a radon rough-in be installed in all small (Part 9) residential buildings.

The 2024 edition of the Building Code eliminates the exemption for certain areas in British Columbia from the requirement for a radon rough-in for a subfloor depressurization system. Unless the house has been designed using Parts 5 and 6 for the protection from radon, **new houses are required to provide a rough-in.**

Design and Installation of Subfloor Depressurization Systems Rough-ins

Conditioned space must be protected with an air barrier system. Even if only a portion of a wall, roof, or floor assembly separates conditioned space from the ground, an air barrier system conforming to Subsection 9.25.3. must be provided. The air barrier system must be continuous, including along the radon vent pipe where it passes through conditioned space.

Between the air barrier system and the ground, a gas-permeable layer must be installed. The gas-permeable layer allows soil gases to move which, when connected to a radon vent pipe, facilitates the venting of the gases to the exterior. The gas-permeable layer is described using performance language and also prescriptive language to allow designers' choice.

> Performance language is that the gas-permeable layer consist of material or materials that **allow effective depressurization** of the space. Materials should be inert, non-toxic, and non-biodegradable. A dimpled membrane or post-consumer materials such as crushed glass may be considered.
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> Prescriptive language states 100 mm of coarse, clean granular material that doesn't include more than 10 percent of material that would pass a 4 mm sieve is acceptable.

Other properties of the material or materials used for the gas-permeable layer must also be considered such as the requirement for drainage in Sentence 9.16.2.1.(1). The material should minimize blockage of the radon vent pipe opening so that a subfloor depressurization system could maintain a negative pressure throughout the gas-permeable layer.

A radon vent pipe may have more than one inlet, or opening, in the gas-permeable layer to ensure effective depressurization. Distributing openings in the centre and throughout the area covered or using lengths of perforated pipe **below the air barrier system** are effective ways to ensure effective depressurization. Where portions of the gas-permeable layer are separated by footings (for example), the portions could be interconnected so that only one radon vent pipe is required.

The radon vent pipe will typically pass through conditioned space on its route to the exterior. The pipe must be sealed so that soil gases do not leak into the conditioned space. **Perforated pipe cannot be used on the conditioned side of the air barrier system.**

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Routing the radon vent pipe vertically through the conditioned space and out through the roof can leverage the stack effect of the house and help the flow of radon and other soil gases up from the gas-permeable layer and out to the exterior. (Stack effect, or chimney effect, is the thermal difference which causes a buoyancy force that moves air through a space.) As radon-laden air warms, it rises, causing a pressure differential with a low pressure at the opening below the air barrier system and high pressure at the exhaust outlet. As such, where the radon vent pipe passes through conditioned space, it needs to be inborne of insulation so that the temperatures of the conditioned space contribute to the warming and buoyancy of the radon-laden air passing through the pipe. Keeping the radon vent pipe nominally vertical allows for effective air flow but also minimizes risk of condensation.

The termination to the exterior must not pose a hazard. For example, a termination adjacent an openable window or another air inlet could pose unacceptable risk of radon-laden air re-entering the home. The termination should not be closer than 3 m from a window or other inlet and should not be closer than 1.8 m to a property line. The CAN/CGSB-149.11-2019, “Radon control options for new construction in low-rise residential buildings,” standard includes specific dimensions in 7.2.4.6 and 7.3.4 for a safe and acceptable discharge point. It is also important that the termination to the exterior avoid the accumulation of moisture, snow, and ice. The termination should be fitted with a corrosion-resistant screen or grille for the protection against the entry of animals. The screen or grille should have a mesh opening size of 10 mm to 12.5 mm or be capable of an equivalent air flow performance.

The radon vent pipe, which includes pipe and fittings, must comply with 7.1.3 of the CAN/CGSB-149.11 standard. CAN/CGSB-149.11 requires the pipe to have an internal diameter of 100 mm and comply with Schedule 40[1] specifications for wall thickness and pressure ratings. The material must be suitable for its use, including being resistant to its environment, and the pipe should be insulated where is passes through unconditioned space. The pipe needs to be protected from accidental damage by adding a hidden steel shield plate where the pipe penetrates the top and bottom plates of a wall assembly. If the pipe penetrates a fire separation, it requires an intumescent collar to maintain the fire resistance of the fire separation. All pipes, fittings, primers, and cement products must be compatible and be installed according to the manufacturer’s requirements. The radon vent pipe must be labelled every 1.8. m and at every change of direction so it there is no mistake that the pipe is intended only for the future removal of radon from below the floor-on-ground. It is preferable to have the radon vent pipe be a different colour than other pipes in the house.

[1] Additional information on Schedule 40 pipe can be found in the ASTM E1465, “Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings (Withdrawn)” and ANSI/AARST CCAH-2013, “Reducing Radon in New Construction of One & Two Family Dwellings and Townhouses” standards.

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The radon vent pipe needs to have a portion that is accessible for the connection of a fan. A cylindrical space 1.2 m high and 500 mm in diameter around the pipe provides sufficient space for installation and maintenance of a fan. It is helpful during construction to provide a dedicated electrical receptacle or electrical box that could be fitted with a receptacle within 1.8 m of the fan location. The fan should be located as close to the exhaust outlet as practical to minimize the positive pressurized portion of the radon vent pipe in conditioned space.

Active Subfloor Depressurization Systems

The Building Code does not require active subfloor depressurization systems (a fan installed), however it can be prudent to install one as part of a new house build. The CAN/CGSB-149.11 standard proves direction on how to design and install active subfloor depressurization systems, however it is important to recognize that the CAN/CGSB-149.11 standard is intended for contractors and management teams with people specifically trained in the technology of radon reduction. Organizations such as the Canadian National Radon Proficiency Program (C-NRPP) can provide information on radon mitigation training for new construction.

Testing for Radon

BC Lung, Health Canada, and radon advocates broadly, recommend occupants test the levels of radon in their house in the lived-in conditions and follow Health Canada's guidelines for action based on the results. Radon levels can vary throughout the year, so it is recommended to deploy a 3-month test during the heating season (when windows are likely closed) to capture concentrations likely at their highest.

Testing is also recommended following an alteration to a home, especially where the building envelope and/or ventilation system is changed in a way that may affect indoor radon concentrations. An alteration shall not decrease the level of life safety and building performance below the level that already exists, so diligence is required to ensure new work on existing buildings does not result in increased concentrations of indoor radon.

The Building Code applies to the design and construction stage but no longer applies once construction is complete and the house is occupied. As such, there is no BC Code requirement for testing, nor for what choice an owner makes based on test results. Testing is the responsibility of the building owner after the building occupancy has taken place.

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Frequently Asked Questions (FAQs)

Are these requirements going to change again?

Yes. British Columbia participates in the national code development system and as of the drafting of this bulletin, there is a Code Change Request related to radon under development. British Columbia is supporting efforts to update radon requirements in the National Model Codes with the intent for subsequent adoption into the Building Code. National code development was not complete in time for adoption of the 2024 edition of the Building Codes, so the 2024 edition revised British Columbia's previous variation for greater alignment with where national development is headed. Anyone interested in participating in national code development is encouraged to visit: https://cbhcc-cchcc.ca/en/get-involved/.

What else does the Building Code do to protect from radon?

Protection from radon is done in a number of direct and indirect ways. There are many occurrences in the Building Code where air tightness of the air barrier system is emphasized, such as for seals on sump pit covers in Article 9.14.5.2. of Division B. Attention to detail when installing the air barrier system, particularly below the slab where repair and maintenance are likely impractical, is a first line of defence against indoor radon. Meeting and exceeding air-tightness testing targets not only improves energy efficiency performance of the building but can lead to healthier indoor environments.

A balanced ventilation system (Section 9.32. of Division B) can minimize pressure differentials in the home. Lower levels of homes with negative pressure and upper levels of homes with positive pressure is an example of stack effect. Soil gases can build in pressure below the air barrier system and if not managed properly, a basement with negative pressure can work like a vacuum to pull radon-laden air though deficiencies in the air barrier.

Do all crawlspaces need a rough-in?

It depends. If the crawl space is conditioned and the air barrier system is below the crawlspace ground cover, then a rough-in is required. In this case, radon-laden air entering the crawlspace could pose a risk to the living space. "Conditioning" a space that has a wall, roof, or floor assembly in contact with the ground triggers the requirement for a rough-in.

If the crawl space is not conditioned and the air barrier system is installed on the underside of the floor assembly, then a rough-in is not required. Venting the crawlspace can be an effective solution. The vented crawlspace can manage pressure differentials and the air barrier system would protect the conditioned space above.

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What about Parts 5 and 6?

Part 5 is concerned with the transfer of air through building assemblies that are environmental separators. Part 5 uses performance language to allow design choice as long as the Building Code's objective is met. Designers need to ensure that assemblies separating conditioned space from the ground minimize the ingress of airborne radon (and other soil gases) from the ground with the aim to controlling the indoor concentrations (of these gases) to an acceptable level. (See Section 5.4.)

Part 6 applies to systems and equipment for heating, ventilation, and air-conditioning services. Designers are to follow good engineering practice, and a number of good engineering practice documents are listed as examples. Risks of radon are described in those and other good engineering practice documents.

Part 5 and Part 6 design allows for radon mitigation solutions not limited to subfloor depressurization systems.

What about existing houses?

It is recommended that homeowners test their homes and follow Health Canada's guidelines for action based on the results. (Testing is the responsibility of the building owner after the building occupancy has taken place.) Existing homes can have unique challenges and some solutions such as installing a gas-permeable layer below the entire slab are not realistic.

Contractors and management teams with people specifically trained in the technology of radon reduction are best equipped to advise on mitigation solutions for existing houses.

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