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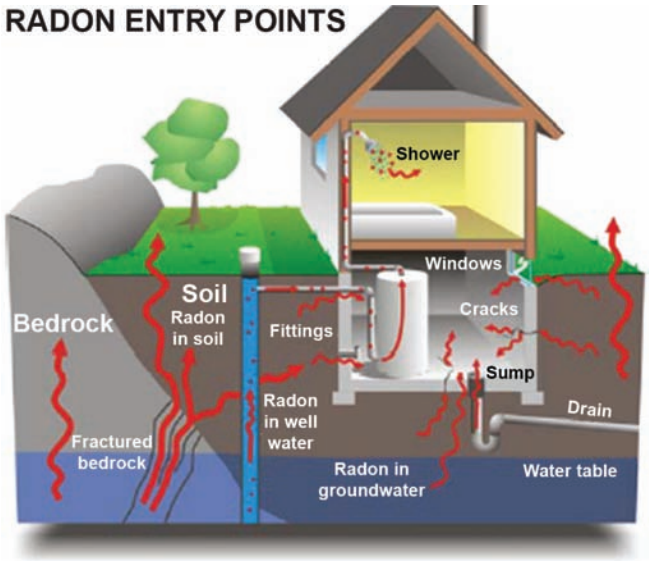
TECHNICAL BULLETIN
RADON

WHAT IS RADON?

Radon is a naturally occurring radioactive gas that is formed by the breakdown of uranium in soil, rock, and groundwater. It is a colourless and odorless gas and moves freely through the soil. In outdoor air, radon is typically not a health concern as it mixes with this outdoor air resulting in very low concentrations. However, in enclosed spaces, such as buildings, it can accumulate resulting in high concentrations. The source of radon is the soil on which the building is constructed and has the ability to enter the building through cracks in foundation walls and floors, and any gaps around pipes and cables. Just because a building doesn't have a basement doesn't mean radon cannot enter. Slab on grade buildings and buildings over crawl spaces are also susceptible. In addition, buildings can create vacuums that can draw radon in through natural causes, such as the stack effect, and also from mechanical causes that can include exhaust fans.



Radon is heavier than air, resulting in higher radon concentrations being detected at lower levels, however, as a result of these vacuums, it is possible that higher concentrations of radon can be detected at higher levels within a building.

HEALTH RISKS

The known health risk associated with radon exposure is an increased risk of developing lung cancer. Radon is the second leading cause of lung cancer behind smoking. It is a Group A carcinogen and 16% of all lung cancer deaths are attributed to radon exposure. As radon gas breaks down, it releases radon decay products (RDPs) which attach to lung tissue where they breakdown further, releasing alpha particles. These alpha particles are absorbed by this lung tissue resulting in lung cell death, or damage/ mutations leading to lung cancer.

RADON GUIDELINES

It was always thought that there were only specific areas across the country where radon was prevalent, however a two-year study conducted by Health Canada's National Radon Program in 2012 summarized results from the testing of 14,000 homes across Canada, resulting in 7% of these homes having radon concentrations above the allowable Canadian National Guideline. It also concluded that there were no areas of the country that are free of radon. In addition, it was found that there were some known "hotspots" for radon with increase potential for elevated radon levels and that radon levels can vary greatly between buildings. The only way to know what the radon level is within a building is to test.

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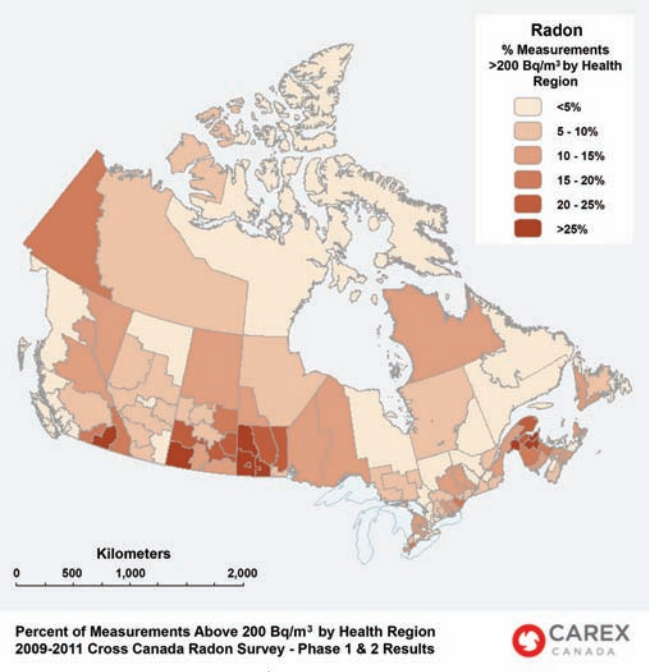

CAREX Canada Map from Health Canada Cross Canada Radon Survey results. 2011. Available from: http://www.carexcanada.ca/en/announcements/radon_resources/

The question that comes up is, what is this guideline? Back in 1988, Health Canada had established a guideline of 800 Bq/m3* which was based on data from studies of uranium miners exposed to elevated radon levels. Since then, evidence has shown that the development of lung cancer from exposure to radon is far reaching and has been found in buildings. Due to these additional findings, Health Canada reviewed the health risks and revised the exposure guideline to radon in indoor air to 200 Bq/m3. In comparison to other guidelines around the world, Canada has a higher allowed exposure guideline. In the United States, the Environmental Protection Agency (EPA) has an action level of 4 pCi/L, which is equal to 148 Bq/m3, and globally, the World Health Organization recommends 100 Bq/m3.

MITIGATION TECHNIQUES

As building codes and standards continue to develop to establish minimum construction standards for radon resistant construction, techniques have currently been established for existing and new construction to provide protection against radon gas infiltration.

There are two types of depressurization systems that have been deemed effective, passive and active. A passive system is one where the installed pipe is used along with the natural ventilation to allow movement of the radon to the outside of the building. If this is not effective in reduction below the guideline, then an active system is required to be installed.

EXISITING CONSTRUCTION

In an exisiting structure, if the radon levels are found to be in excess of the guideline, the most common method for radon reduction is active soil depressurisation (ASD). This involves the drilling of a hole in the concrete floor slab, installation of a pipe with a fan that will draw the radon gas from under the building and force it outside. The installation of this system is typically performed by a contractor certifed by C-NRPP.

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NEW CONSTRUCTION

Use a clean coarse granular material below the floor slab to allow the gases to move freely underneath the building. Granular material at the rough-in should be 150 mm (6") minimum for a radius of 300 mm (12") from the centre of the pipe.

Seal all openings, penetrations, and cracks in the concrete foundation floor (including the perimeter), and walls with sealant to prevent radon from entering the building.

Install a soil gas/vapour retarder membrane on top of the gravel to prevent soil gases from entering the building. It is imperative that this material be of sufficient strength to resist puncture and maintain the integrity of the soil gas barrier. Seal all overlap, joints, and terminations of this membrane to provide a continuous barrier.

Run a 100 mm (4") minimum PVC pipe vertically from the gravel layer under the floor slab, through the concrete floor slab, and cap and seal the pipe. This is the rough-in for an active soil depressurization system if required.

Building is to be positively pressurized (especially areas adjacent to walls, floors and roofs in contact with the soil) when all ventilation and exhaust systems are operational.

Long term testing of building is needed, and if the radon concentration levels exceed the guideline, installation of a full active soil depressurization system would be required.

The above information has been developed to provide an overview of radon, the effects that it has on our population, as well as the current techniques being used to measure the radon concentration and construction methods to be able to control the exposure to radon within in a building. Radon mitigation systems require a soil gas barrier and current new construction requirements do allow a polyetheylene sheet to be used. It has been shown that standard polyethylene can have a relatively low puncture resistance, as well as having the potential to degrade when in contact with the soil, both characteristics causing the gas barrier to be discontinuous. W. R. MEADOWS manufactures PERMINATOR® and PRECON underslab barriers that have superior puncture resistance and have been designed and tested to meet the industry standards for underslab construction. In addition, these products have been tested for radon resistance and can be part of an effective radon mitigation system. For information on how W. R. MEADOWS can contribute to a radon mitigation system, please visit our website at www.wrmeadows.com, or contact your local technical representative.

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