

PLANNING & DEVELOPMENT SERVICES ADVISORY

Radon Gas

Question

What is radon? Why is it a concern?

Answer

Radon is a radioactive, colourless and odourless gas that is naturally emitted from the soil. It is present throughout much of Canada, with the western prairies and Regina having some of the highest levels in the country (and in the world)¹. Radon gas emits radiation which can damage DNA and lead to cell mutations that cause cancer. The risk of developing lung cancer due to the inhalation of radon gas increases with prolonged exposure and an increased concentration of the gas.

Question

What does this have to do with the National Building Code?

Answer

Radon gas can infiltrate into buildings and may accumulate to levels that are unacceptable in accordance with Health Canada's recommendations. Therefore, the NBC includes requirements to reduce the ability for radon gas to enter a building, along with requirements for systems to be "roughed-in" to allow for future radon gas extraction.

Note that the depressurization rough-in does not actively reduce radon levels. It simply makes it easier and less costly to implement radon extraction in the future should the owner choose to do so. Similar to a rough-in for a basement bathroom, it is not a complete working system until the toilet and sink fixtures are installed. A radon rough-in system will need the installation of a fan that will continuously pull air from the rough-in so radon is removed prior from it entering the property. This would be done by the homeowner or contractor after testing confirms that radon levels are not suitable for them.

¹ Stanley, F., Irvine, J., Jacque, W., Salgia, S., Innes, D., Winquist, B., Torr, D., Brenner, D., & Goodarzi, A. (2019). Radon exposure is rising steadily within the modern North American residential environment, and is increasingly uniform across seasons. *Scientific Reports*, 9(18472). <https://doi.org/10.1038/s41598-019-54891-8>.

Question

What are Health Canada's recommendations for remediating radon gas concentrations in homes?

Answer

The following table was obtained from Health Canada and details the timelines recommended for remediating high levels of radon in homes. While Health Canada states that no level of radon is considered safe, they state that if the radon concentration is below 200 Bq/m³, then further measurements are not needed. However, they recommend that each homeowner determine what level of radon exposure they are willing to accept².

Table 1: Health Canada Remediation Recommendations³

Radon Concentration	Recommended Remedial Action Time
Greater than 600 Bq/m ³	In less than 1 year
Between 200 Bq/m ³ and 600 Bq/m ³	In less than 2 years

Health Canada recommends that long-term tests be conducted (test times greater than 3 months). The test should be conducted in the lowest lived-in level of the home (areas where humans would be present for more than 4 hours per day). Health Canada recommends that every homeowner test their home for radon and further recommends that new homes or homes that have had significant renovations be tested during the first heating season⁴ (winter months). An internet search reveals many organizations that sell these long-term radon tests that are approved by Health Canada, including organizations based in Saskatchewan. *These radon levels are guidelines only, as there is no legislated maximum level or enforceable level.*

More information from Health Canada regarding radon can be found on [their website](#).

Question

What are the requirements from the National Building Code with regards to radon?

Answer

As mentioned above, the NBC has requirements to reduce the ability for radon gas to enter a building, along with requirements for systems to be "roughed-in" to allow for future radon gas extraction. The following are the requirements from NBC 2020:

² Health Canada (2017, June 1). *Guide for Radon Measurements in Residential Dwellings (Homes)*. <https://www.canada.ca/en/health-canada/services/publications/health-risks-safety/guide-radon-measurements-residential-dwellings.html#a6>

³ Health Canada (2017, June 1). *Guide for Radon Measurements in Residential Dwellings (Homes)*. <https://www.canada.ca/en/health-canada/services/publications/health-risks-safety/guide-radon-measurements-residential-dwellings.html#a6>

⁴ Ibid.

NBC Requirements for Part 9 Buildings:

- **Sentence 9.13.4.2.(1):** requires a tight building envelope to separate indoor space from the soil. By providing a tight building envelope, the infiltration of soil gas to the inside of the building will be minimized. This is most commonly done with sealed polyethylene.
- **Sentence 9.13.4.2.(2):** requires that dwelling units and buildings with residential occupancy be provided with a rough-in system for subfloor depressurization. Most commonly, this is achieved with a 100 mm diameter pipe below the basement floor where the inlet is near the center of the floor within the granular layer, and the top of the pipe is sealed and labelled above the basement floor to allow for future installation of a depressurization fan.
- **Sentence 9.13.4.2.(3):** specifies that other Part 9 buildings (buildings that do not have residential occupancies) should follow the Part 9 prescriptive requirements in Article 9.13.4.3, or they can follow the requirements of Article 5.4.1.1 (building envelope requirements) and Article 6.2.1.1 (good engineering practice for HVAC systems). As these Articles from Parts 5 and 6 are beyond the scope of Part 9, a professional designer(s) would be required for those designs.

NBC Requirements for Part 3 Buildings:

The requirements in regard to radon for buildings falling within the scope of Part 3 are found in Part 5 (Environmental Separation) and Part 6 (Heating, Ventilating and Air-conditioning).

- **Article 5.4.1.1:** requires the building envelope to control air leakage for a number of reasons, including the minimization of radon gas infiltration.
- **Article 6.2.1.1:** requires that good engineering practice for HVAC systems being used. EPA 625/R-92/016, “Radon Prevention in the Design and Construction of Schools and Other Large Buildings” is specifically mentioned in Clause 6.2.1.1.(1)(i).
 - **Note:** this EPA standard is available for free online and focuses on three strategies for reducing radon⁵:
 1. Providing an active soil depressurization system
 2. Pressurizing the building using the HVAC system
 3. Sealing the building envelope

These strategies are illustrated in the following figure, taken from the [EPA guide](#).

⁵ Leovic, K. & Craig, A.B. (1994). *Radon Prevention in the Design and Construction of Schools and Other Large Buildings (Third Printing with Addendum, June 1994)*. United States Environmental Protection Agency.

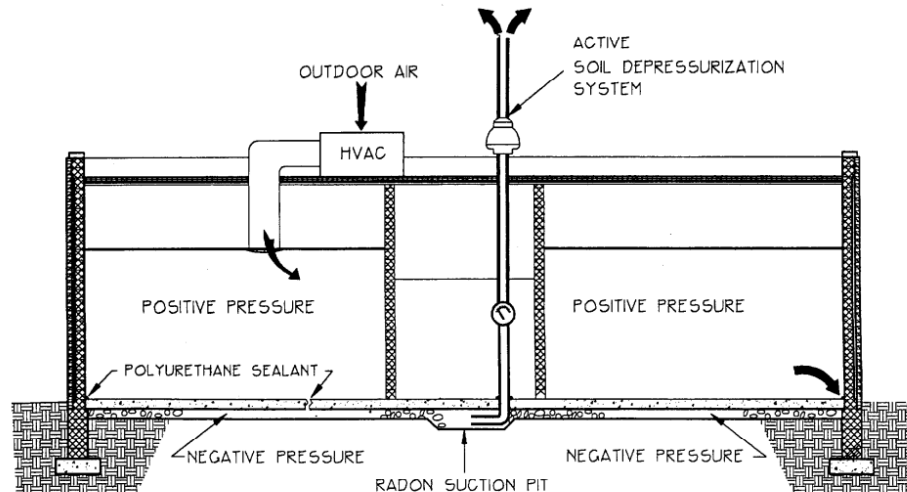


Figure 1: Illustration of the EPA Strategies for Controlling Radon Gas⁶

As per the Building Code Regulations in Saskatchewan, Subsection 15(1), buildings within the scope of Parts 3 to 7 require professional designer(s). Therefore, the designs based on the requirements of Part 5 and 6 must be sealed by a professional engineer or architect licensed in Saskatchewan.

Question

What does this mean for designers and building owners?

Answer

The City of Regina is presenting this information in an effort to educate both owners and designers about the potential for elevated radon levels within buildings in Regina. This advisory also points out the design requirements of the NBC in relation to minimizing radon gas. While the NBC and the City of Regina do not require mandatory testing for radon gas or require the connection of mitigating systems, we hope this information will encourage building owners to test buildings based on the recommendations from Health Canada, and to install/connect mitigation systems as needed.

During the design for new buildings or, for alterations to existing buildings, designers shall incorporate the NBC requirements for minimizing radon gas. If plans do not clearly show that these Code requirements have been incorporated into the design, it may be noted as a deficiency during plan review, which may slow down the permit process.

For more information on Building Permits, Building Safety or Zoning Information, please visit Regina.ca or contact [Service Regina](#).

⁶ Ibid.

Appendix A – Supplemental Information

Question

How was it determined that the western prairies have some of the highest levels of radon concentration in Canada and in the world?

Answer

The following information is from Stanley, F., Irvine, J., Jacque, W., Salgia, S., Innes, D., Winkvist, B., Torr, D., Brenner, D., & Goodarzi, A. (2019). Radon exposure is rising steadily within the modern North American residential environment, and is increasingly uniform across seasons. *Scientific Reports*, 9(18472). <https://www.nature.com/articles/s41598-019-54891-8.pdf>

The group who published the referenced journal article analyzed US Geological Survey data and found that much of Alberta and Saskatchewan had a high potential for radon based on soil composition (see Figure 2).

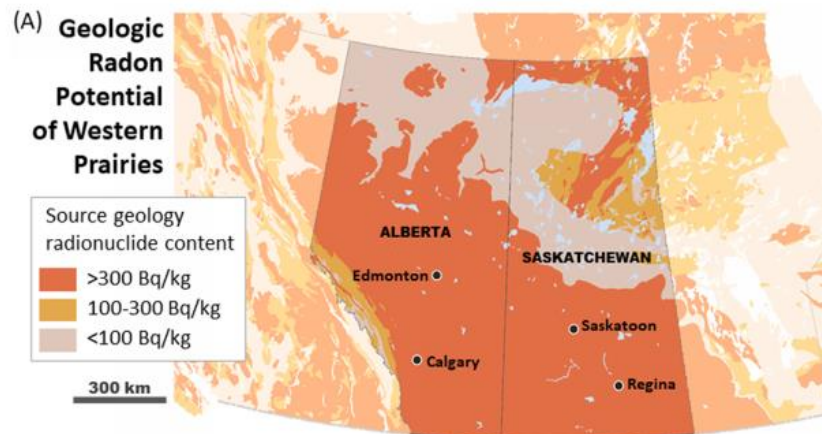


Figure 2: Radon Potential in Soil

The study then conducted 11,727 residential, long-term radon tests (samples greater than 3 months) in Alberta and Saskatchewan between 2010 and 2018. Within Regina, 493 residential tests were conducted. The following results were obtained:

- **AB and SK Combined (11,727 tests)**
 - Geometric mean = 108 Bq/m³
 - Arithmetic mean = 146 Bq/m³
- **Regina (493 tests)**
 - Geometric mean = 203 Bq/m³
 - Arithmetic mean = 296 Bq/m³

When the geometric means of indoor air radon concentrations were compared to known values from around the world, it was noted that the western prairies had the second highest concentrations of 67 regions in the world (see Figure 3). The residential testing also showed that Regina had the highest levels of the major cities in the two provinces (see Figures 4 & 5).

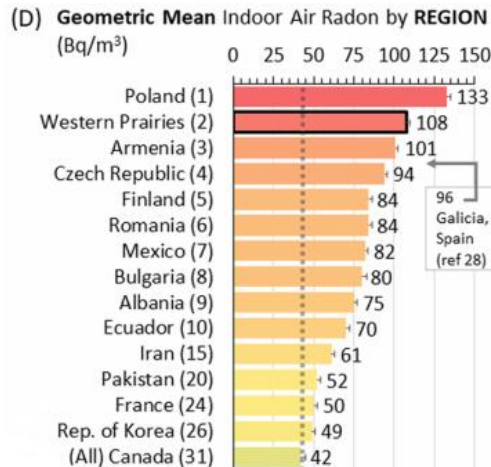


Figure 3: Indoor Air Radon Concentrations from around the World Comparison

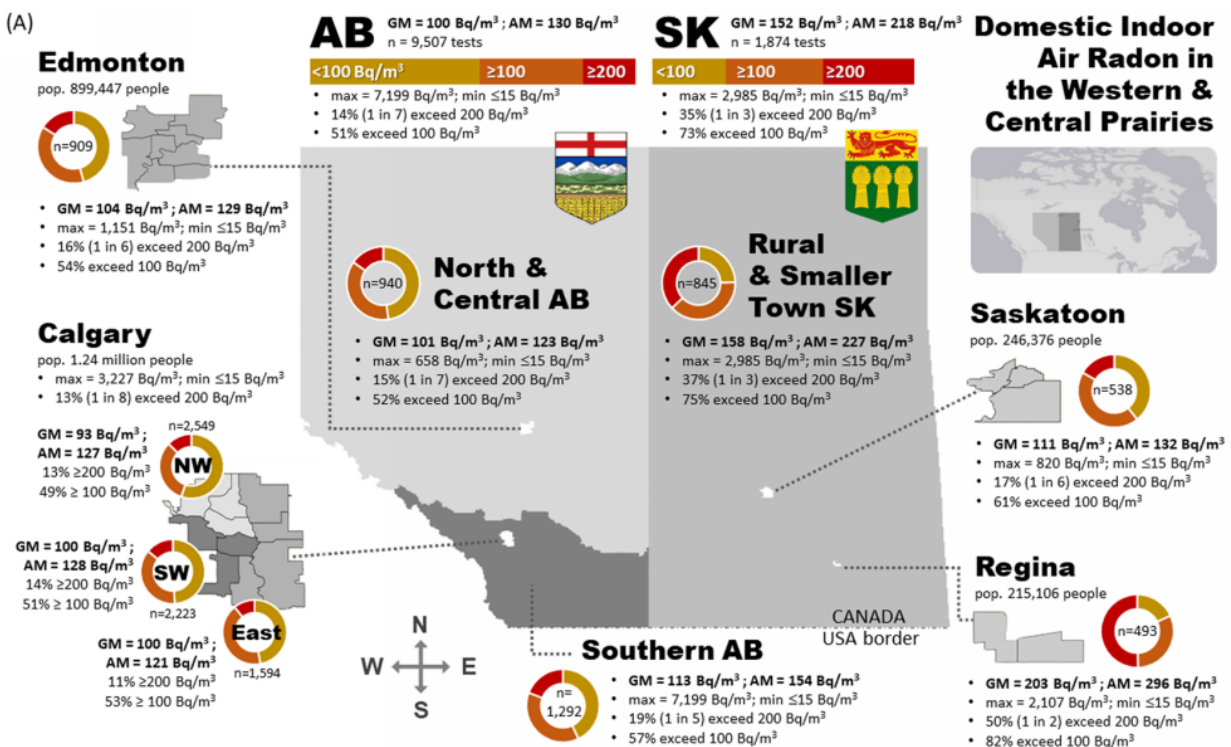


Figure 4: Indoor Air Radon Results for AB and SK

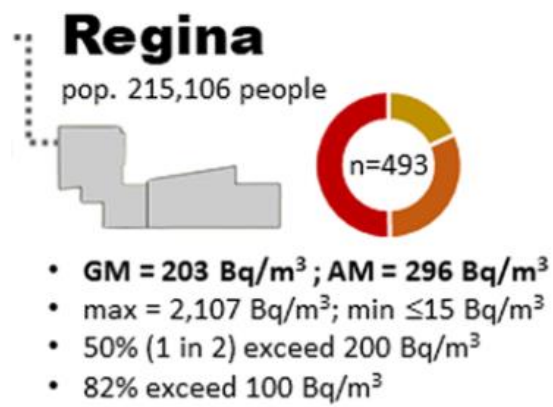


Figure 5: Enlarged Radon Results for Regina

Figure 5 shows that **50% of homes tested in Regina exceeded 200 Bq/m³**, which is the level at which Health Canada recommends remedial measures be taken.

Frequently Asked Questions

Does the City provide radon testing?

No. The City enforces new residential and commercial construction to meet the minimum radon related standards of the National Building Code of Canada. Testing and ensuring radon is managed appropriately is up to the property owner.

Does my house/business have radon?

Testing for radon is the only way to understand if radon level in your home or business is at a level suitable to you. Although the Government of Canada has provided recommended levels, there is no legislated limit and it is up to the property owner to assess what risk they are comfortable with.

[The lung association](#) is a great resource for information on radon facts, radon mitigation and radon testing. There are a few companies that provide testing and mitigation in Regina. These can be found online.

What is the City's role and what do they enforce?

The City enforces new residential and commercial construction to meet radon-related requirements of the National Building Code of Canada. Testing and ensuring radon is managed appropriately is up to the owner of the property.

What if I live in a property that I do not own and I want it tested?

The City is not able to enforce radon testing/mitigation or act as a liaison between a tenant and an owner. A tenant could consult their landlord should they choose to do so.