RADON: HEALTH EFFECTS, SAFETY & PROTECTION



PRESENTED TO: MFL OCCUPATIONAL HEALTH CENTRE DECEMBER 19, 2023

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SANDY HUTCHISON, HEALTH CANADA

ADAM ANDERSON, MANITOBA LUNG ASSOCIATION

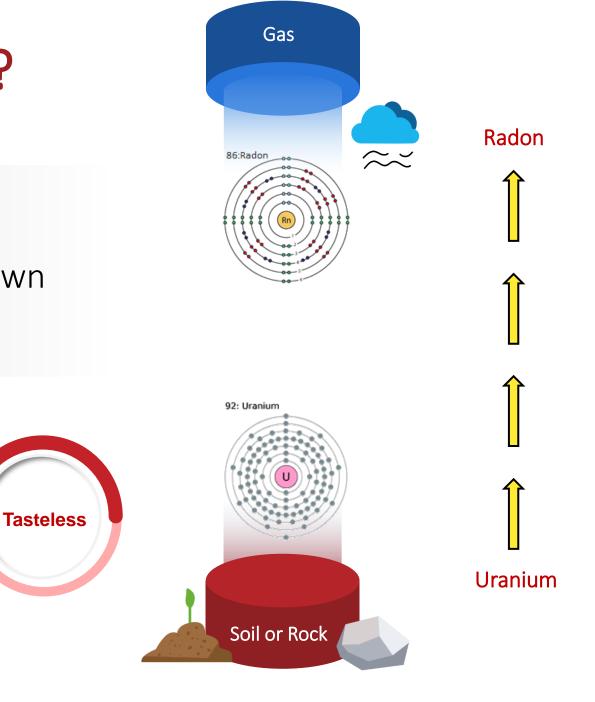
WHAT IS RADON?

Radon is a **radioactive gas** that is produced naturally by the breakdown of uranium in the ground

Colourless

Odourless

Radon is:



NATURAL RADIATION IS EVERYWHERE



Radioactive Soil & Rocks

HOW RADON ENTERS



Any cracks, opening or gaps in foundation walls or floors provide route(s) of entry into home



The air pressure inside a house is normally lower than the pressure underneath or around the foundation

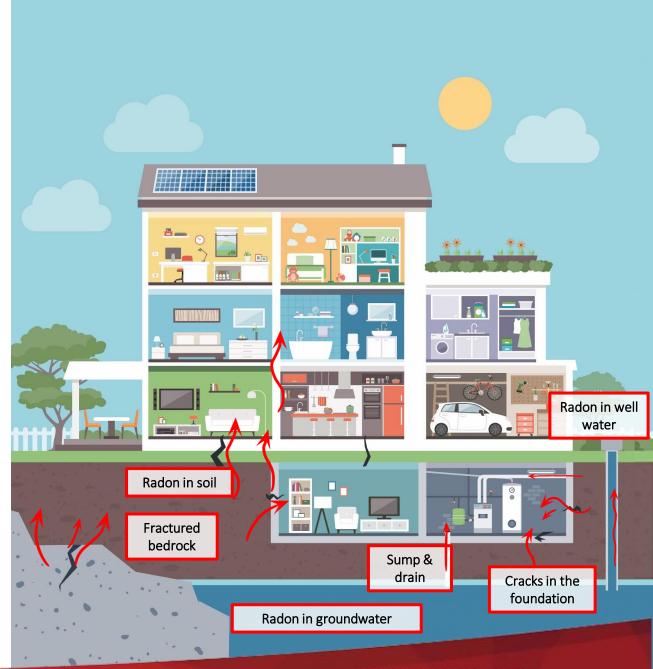
• Windows, wood stoves, fireplaces, ventilation units, can all affect the pressure differential



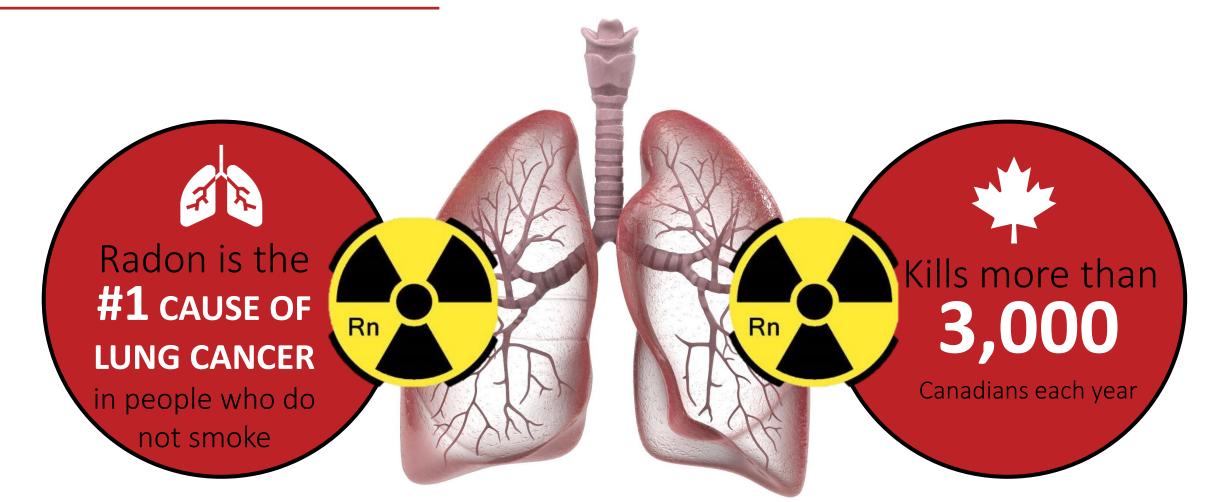
This difference in pressure acts like a vacuum drawing radon in through foundation cracks and other openings



Once inside the home, radon can build up to dangerous levels

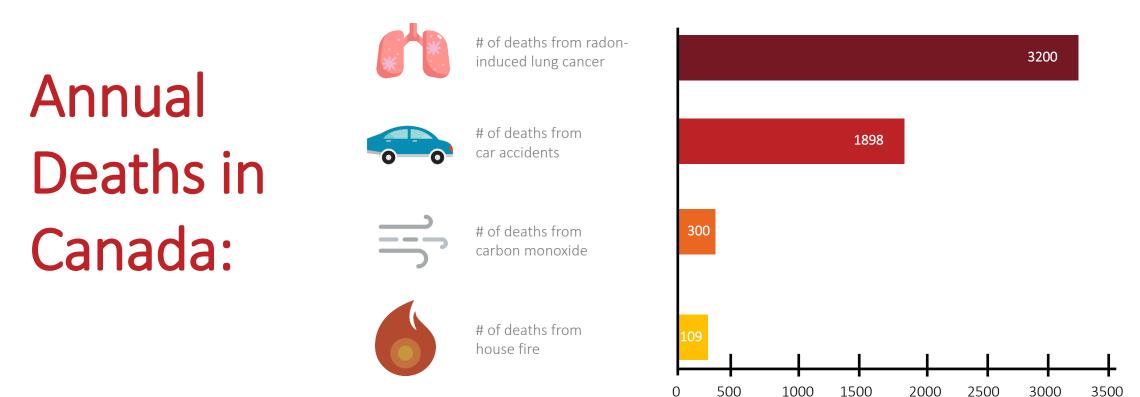


HEALTH RISK



Radon is a known carcinogen (Group 1)

RISK COMPARISON





The risk of lung cancer from radon is significant but preventable.

References:

www.tc.gc.ca/en/services/road/publications/canadian-motor-vehicle-traffic-collision-statistics-2016.html www.injuryresearch.bc.ca/wp-content/uploads/2017/10/Carbon-Monoxide-Oct-2017-Final-UFV.pdf www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3510019501

FEDERAL GUIDELINES

Radon Guideline in Canada

<u>200 Bq/m³</u>

Places where we spend more than 4 hours per day



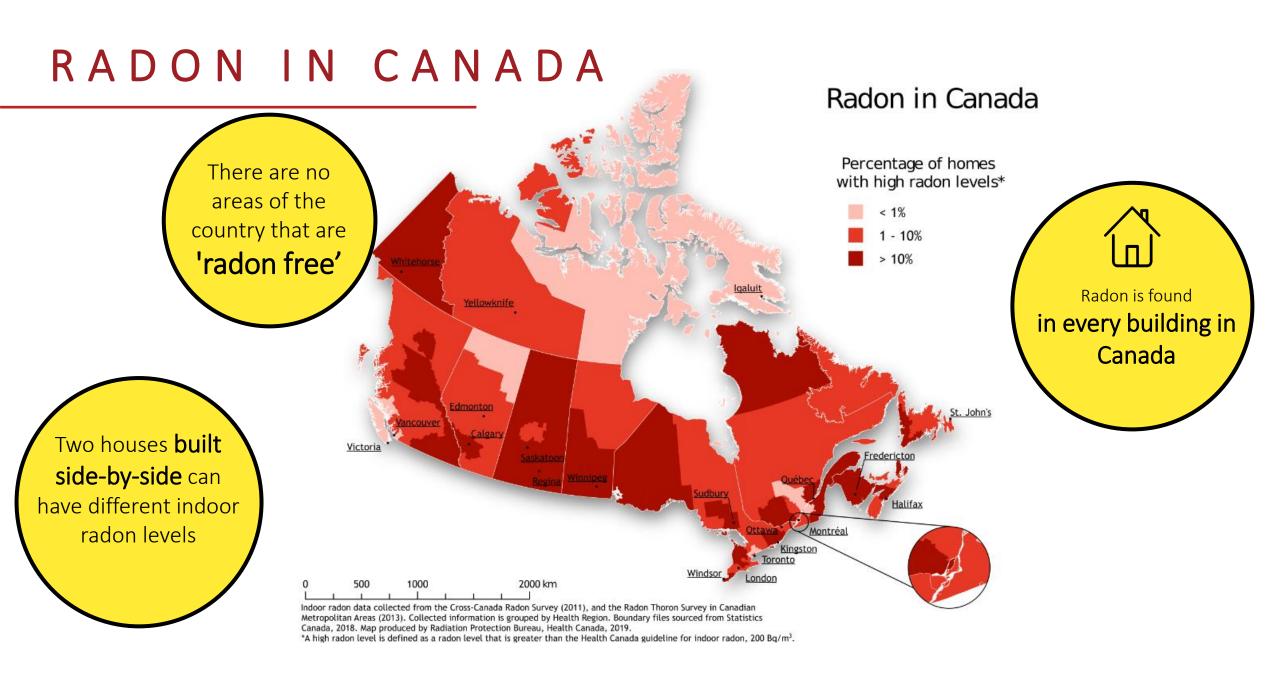
Remedial measures should be undertaken in a dwelling whenever the average annual radon concentration exceeds 200 Bq/m³



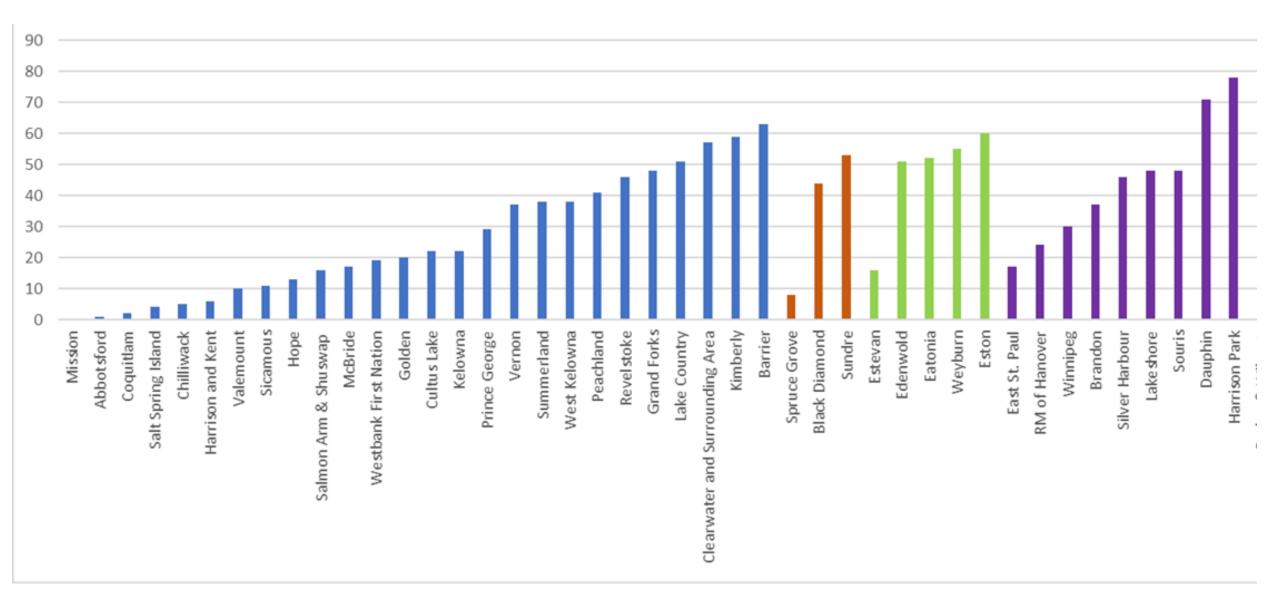
The higher the radon concentration, the sooner remedial measures should be undertaken



The corrective action should reduce the radon concentration as much as reasonably practicable



PREVALENCE BY COMMUNITY



TESTING YOUR HOME FOR RADON IS EASY!

- Place it in the lowest lived in level (such as a home office, bedroom or play-room.
- Choose a location which is away from a window and up off the floor.
- Leave it in place for 91 days or more before mailing it back to the lab.



TESTING OPTIONS

Option 1: Purchase a Do It Yourself kit



Option 2: Hire a certified radon measurement professional





To find a radon test kit or certified measurement professional go to: www.TakeActiononRadon.ca/test

WHY LONG-TERM TESTING?

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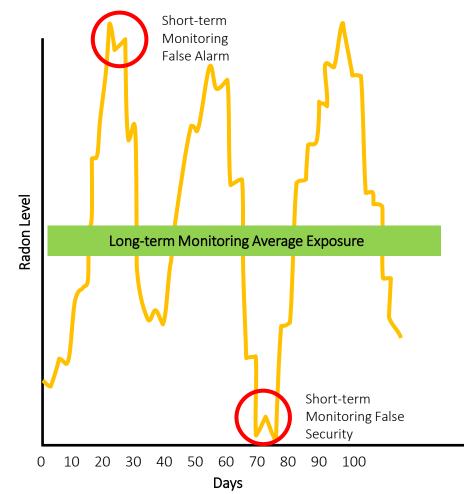
Indoor **radon levels vary greatly** even over a 24 hour period

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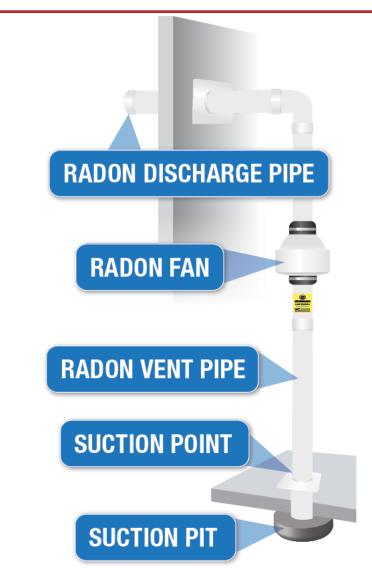
Measurements gathered over a longer period of time will provide a better estimate of the annual average exposure

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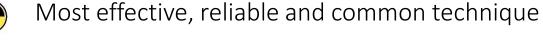
Several factors including building design, building condition, occupancy pattern etc. **influence radon levels** in a house



ACTIVE SOIL DEPRESSURISATION (ASD) SYSTEM









- A pipe is installed through the foundation and directed outside
- A fan is attached to the pipe that is continuously run to draw radon from beneath the home and vented outdoors, where it gets diluted
- ASD reverses the air pressure difference between the house and soil, reducing the amount of radon that is drawn into the home through the foundation



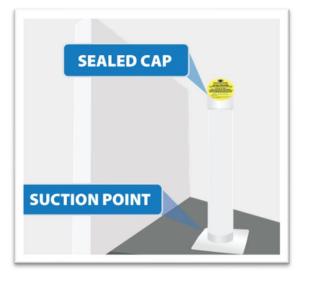
A C-NRPP certified professional can install an effective ASD system in 1 day.



NATIONAL BUILDING CODE INCLUDES RADON CONTROL MEASURES:

- Granular fill under the slab
- Well-sealed membrane air barrier
- Sump pit is sealed airtight
- Radon rough-in pipe for future installation





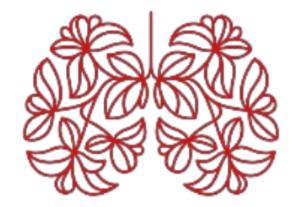
The radon rough-in pipe is not a completed mitigation system!



BREATHE the lung association



Home Radon Mitigation Grant Program



BREATHE the lung association

In Partnership with





<u>Our Goals</u>

Lungs Matter is the only national program available for eligible Canadians seeking financial assistance with radon mitigations.

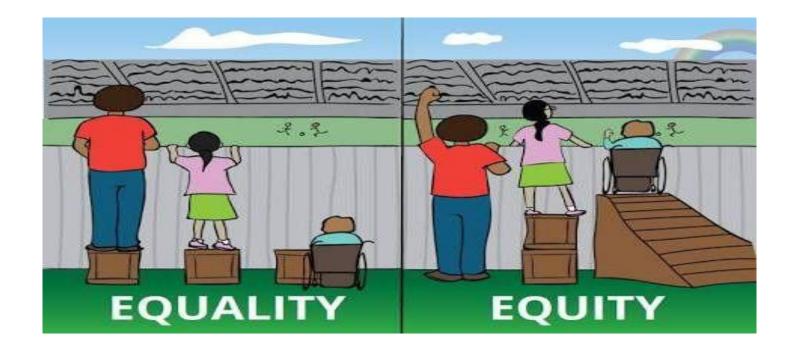
The grant program available by the Lung Association seeks to improve the health quality and outcomes of Canadians by increasing access to radon mitigations for low-income families, who might not otherwise be able to afford mitigations and would therefore continue to live at greater risk of lung cancer.

We also seek to provide mitigation assistance for those already diagnosed with Lung Cancer so they are not also burdened by worry for their family while dealing with their diagnosis.



Health Equity

Health equity is created when individuals have a fair opportunity to reach their fullest health potential. Achieving health equity requires reducing unnecessary and avoidable differences that are unfair and unjust. Many causes of health inequities related to social and environmental factors including: income, social status, race, gender, education, and physical environment. ⁽¹⁾





Programs across Canada addressing affordability for radon mitigations

Manitoba Hydro Energy Finance Plan

Qualifying Upgrade: Radon mitigation (through C-NRPP certified contractor) https://www.hydro.mb.ca/your_home/loans_financing/energy_finance_plan/

Lung Sask Caring Breathes Radon Reduction program

A maximum of \$500 reimbursement can be provided to an individual per calendar year.

Tarion Home Warranty in Ontario

Covers the cost of radon mitigation in new homes in Ontario that are 7 years old or less.

Ontario Renovates

The Ontario Renovates Program provides homeowners with forgivable loan assistance to low- and moderateincome households to assist them in performing eligible major repairs, renovations and accessibility modifications to their homes.

Various Quebec Municipalities

Vaudreille-Dorion and Victoriaville Habitation Durable. Provide \$500 grant for residents in their environmental grant programs

LUNGS MATTER Eligibility

- 1. Over 200 (Bq/m³) on a C-NRPP-approved 90-day test kit
- 2. Has been diagnosed with Lung Cancer or
- 3. Has an income below the <u>Median</u> income of their home province.
- 4. Has a quote to have the work done by a C-NRPP certified professional.



Program Delivery

The Lung Association has set up a simple online application form

www.lung.ca/lungs-matter-radon-mitigation-support

Grant applications then go through an approval committee made up of representatives from CARST and other health organizations with knowledge of radon.

Grant applications are assessed through a grading scale that determines the priority of mitigation cases based on; eligibility criteria and other application form criteria.



Testimonials

In early 2021, Thanks to breast screening I found out I had a small tumor in my right breast that was grade 1 breast cancer and so I had a lumpectomy in July.

I planned to have 5 days of radiation but the CT planning scan showed a tumor in my right lung. It was a massive shock and a very scary time for me and my family. Following a biopsy, PET, CT, and MRI scans, I was diagnosed with stage 4 lung cancer as lesions were also found in my vertebrae. We asked, "why and how did I get lung cancer?"

I learned that radon gas is the second leading cause of lung cancer so we tested our home where we have lived for 18 years, and found out that the radon levels were almost double the "safe" level of radon; we suspect this might be the cause of my lung cancer, and perhaps what caused the lung cancer of our family's dog 5 years ago.

We are incredibly grateful for the financial support from the lung association to help us pay for the cost of radon mitigation. I encourage everyone to test for radon levels in their home.



Testimonials

I decided to have my home tested for radon the winter of 2022. I had recently moved my two boys to the downstairs bedrooms and was curious about my radon levels.

Results came back to be over 1090 Bq/m³ very high.

I am a single mother and the cost to get the mitigation was just over \$3000. To find out I was eligible for the maximum grant of \$1500 made it easier to complete the process - without it- I would have done it (the safety of my family is a priority) however it would have impacted our household in other ways.

My whole experience with Radon has been scary (to find out our levels were so high) but rewarding knowing a specialist came in and made our home healthy again, and we are grateful to have some of the expenses covered. I urge everyone to get the test done you just never know.



Testimonials

Just wanted to say I am thankful for the grant and it would have been very tough financially to get a mitigation system due to the inflation. I have 4 kids and 2 of which have rooms in the basement. I've been pushing it off for almost 2 years and finally decided to try to do it because of the grant

To say that the lungs matter radon mitigation grant initiative, has been a huge positive development for our community, although true, would be a massive understatement. The importance of this program can only be described as tectonic, as it has drastically transformed the landscape for home owners who previously would be unable to afford radon mitigation. With the mb lung associations help, access to clean , healthy air to breathe is within reach for more Manitobans than ever before. I am so proud to be a contributing partner in this worthy program."

Eric Feuer Canadian Shield Radon Testing & Mitigation



Thank You to our Silver Sponsors





Thank You to our Mitigation Sponsors











<u>Thank you for attending</u> <u>&</u> <u>Thank you to our Lungs Matter</u> <u>Partners</u>





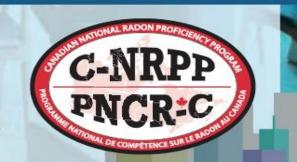
For more information contact: adam.anderson@mb.lung.ca Or info@mb.lung.ca

Radon and your workplace: **PROTECTING YOUR EMPLOYEES**

If **YOU** and **YOUR** employees **WORK** in an **INDOOR** environment, you should **TEST** your workplace **FOR RADON**.

Take the **FIRST** Step:

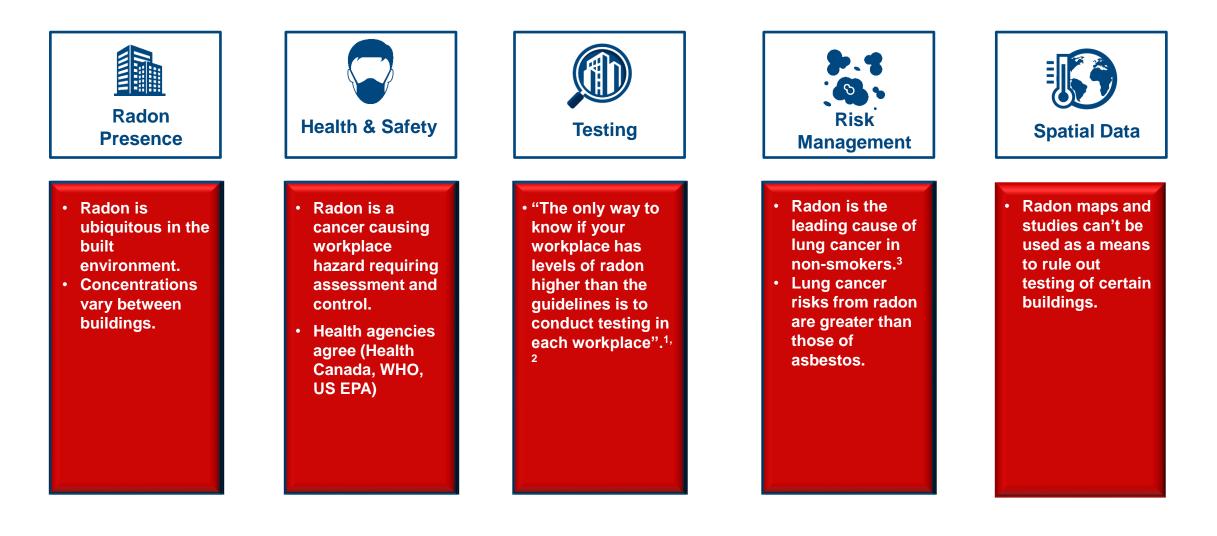
Find a professional to help you test your workplace at: **CNRPP.CA**



Canada has a national cert	ification program – li	st on <u>www.c</u>	-nrpp.ca
To locate a radon professional in yo provide the	ur area, please select a search me necessary search terms.	ethod below and	
 Search by postal code: Po Search by province: Pr 	ostal Code Distance 50 ovince Ontario	KM ¥	Find a Professional
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Canadian National Radon Proficiency Program

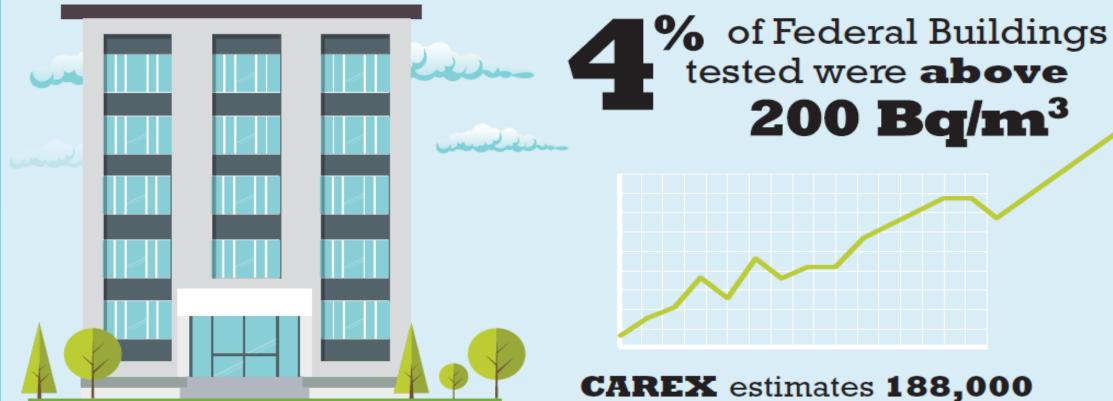


1. CCOHS (Canadian Centre for Occupational Health and Safety) https://www.ccohs.ca/oshanswers/phys_agents/radon.html

2. p50 Canadian Environmental Law Association (CELA) and CAREX Canada, Environmental Scan of Radon Law and Policy: Best Practices in Canada and the European Union. August, 2018 <u>3.</u> "Radon and Cancer" Canadian Cancer Society, www.cancer.ca, <u>www.cancer.ca/en/prevention-and-screening/reduce-cancer-risk/make-informed-decisions/know-your-environment/radon-and-cancer/?region=on</u>.

Protect Your Workplace from Radon

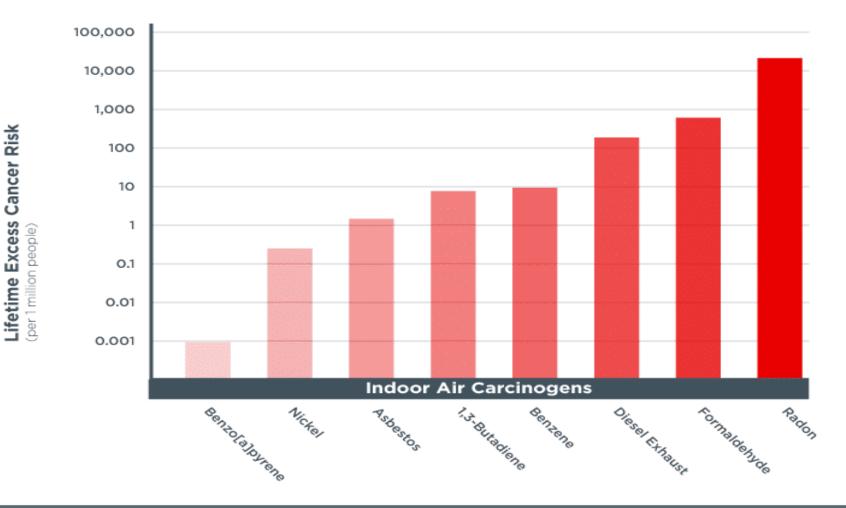
Radon is a gas that you can't **see**, **smell**, or **taste** — but it can be dangerous. It's the second leading cause of lung cancer in Canada.



Radon is in the ground naturally, and sometimes gets into workplaces through contact with the ground. **CAREX** estimates **188,000** Canadians are exposed to elevated radon levels at their workplace.

www.carexcanada.ca/en/radon/occupational_estimate/



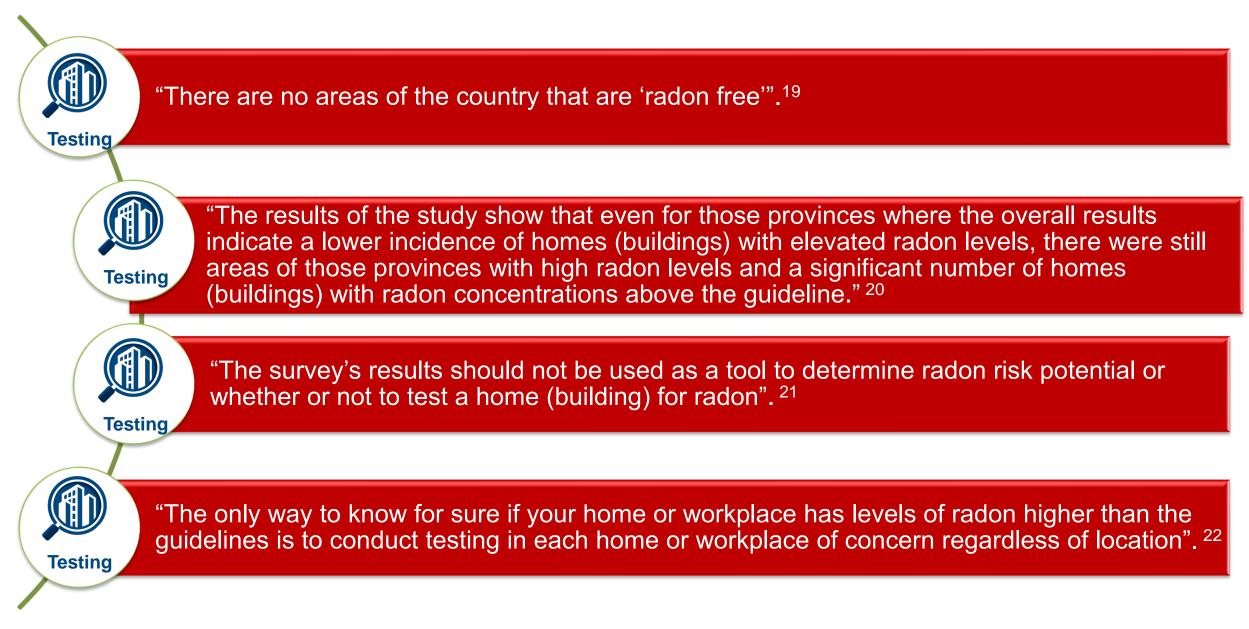


Lifetime excess cancer risk estimates for indoor air carcinogens show that radon gas is the highest priority exposure in Canadian settings.¹⁸

Radon cancer risk exceeds asbestos cancer risk in Canada.

CAREX Canada risk estimates for indoor air carcinogens show that radon gas is the highest priority exposure in Canadian settings.





^{19 -22.} CCOHS (Canadian Centre for Occupational Health and Safety) https://www.ccohs.ca/oshanswers/phys_agents/radon.html & Health Canada, Cross-Canada Survey of Radon Concentrations in Homes – Final Report, March 2012, p ii & iii ISBN: 978-1-100-20115-3

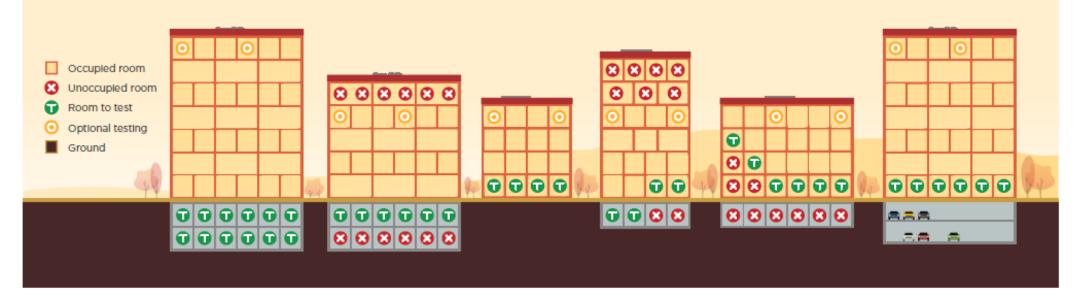


Figure 5. Recommended radon measurement locations in multi-storey buildings.

Radon is in the ground naturally, but it can get into buildings through contact with the ground.



Testing your WORKPLACE for radon takes some planning!

- Test all the occupied rooms in the lowest level of the building until the full footprint of the building is tested.

- Choose a location within each room which is away from a window and up off the floor.

- Properly track the serial numbers, locations and start and end dates.

- Leave it in place for 91 days or more before mailing it back to the lab.

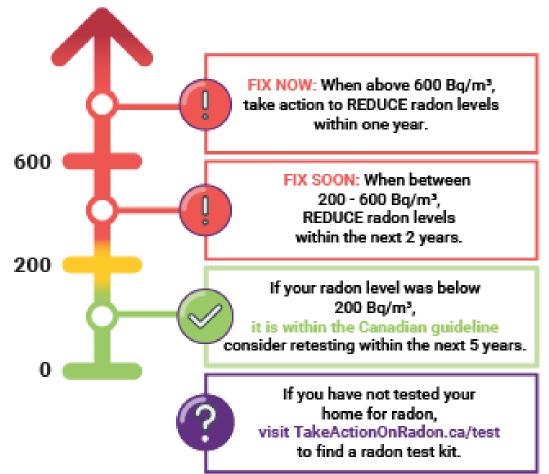




Figure 4. Potential testing locations in an office. Locations that are *appropriate* (S) for radon testing and locations that are not appropriate (S) for radon testing are indicated.

NEXT STEPS after 91 day test reports received:

- Follow up testing to ensure all occupied, ground-contact rooms are included
- Any rooms which are above 200 Bq/m³ should be re-tested for 7-10 days with a Continuous Radon Monitor(CRM) to determine if the high levels are during occupied time
- Reduce radon within Health Canada's recommended time frames



Worker Dose Management

Worker Dose Management Options



HEALTH CANADA >

Pros and Cons of Mitigation Methods

Principle	Pros	Cons
Eliminate openings	 Typically low to moderate cost Sealing large openings can reduce radon No energy or maintenance costs 	 Extremely tedious work All openings may not be accessible Virtually never fully effective
Active depressurization	 Extremely effective Typically provides large reductions in radon Controls radon at the source Energy consumption low to moderate Typically moderate installation cost 	 Requires power to operate Building loses some conditioned air Can be difficult in commercial buildings Requires piping installation to the outdoors
Increased ventilation	 Typically simple adaptation of existing HVAC Dynamic HVAC pilot systems (Radostat®) are available Typically a moderate installation cost Minimal disturbance to building interior 	 Significant implication to energy use Impractical for radiant heated buildings Can reduce lifespan of HVAC system Radostat[™] activates at 150 Bq/m³ which may be insufficient for 100 Bq/m³ action levels chosen by clients. Controls radon at the worker and not the source. Can be very expensive in some buildings.

Constant Dilution Ventilation

Increase ventilation rate and provide constant positive indoor pressure and dilution ventilation to reduce radon ingress and dilute indoor radon levels

Dynamic Dilution Ventilation

Combines continuous real-time indoor radon monitoring coupled with dynamic ventilation controls on existing HVAC systems. System calls for added ventilation when radon concentrations reach a peak set-point. Radon exposure in Canadian workplaces is governed by federal or provincial/territorial legislation.

- Federal workplaces are governed by:
 - Canada Occupational Health and Safety Act made under the Canada Labour Code (CLC).
- Provincial/Territorial workplaces are governed by:
 - Provincial/Territorial Occupational Health and Safety Acts.





- Radon is recognized by several cognizant agencies as a carcinogenic workplace hazard that requires assessment and control to ensure the health and safety of workers and building occupants.
- The Canadian Centre for Occupational Health and Safety (CCOHS) classifies radiation as a <u>physical agent and identifies radon in buildings</u> <u>as radiation.</u> Furthermore radon and its decay products are classified by the International Agency for Research on Cancer (IARC) as Group 1, carcinogenic to humans.²⁹







29. CCOHS https://www.ccohs.ca/oshanswers/phys_agents/radon.html

- https://open.alberta.ca/dataset/e589e36a-a1e8-440e-a059-e1244d34c56a/resource/c6e3f93f-f38e-453a-aca6-36fa73cb72bc/download/ohs-bulletin-rad007.pdf

- http://www.worksafesask.ca/prevention/environmental-risks/radon-gas/

- https://ohsguide.worksafenb.ca/topic/radon.html

- https://www.labour.gov.on.ca/english/hs/pubs/gl_radon.php

-https://www.worksafebc.com/en/health-safety/hazards-exposures/radon

All provinces have general duty clauses, that require employers to minimize hazards.³⁵ These clauses are broad enough to include radon, and in no case is radon specifically exempted. ³⁶

Legislation for radon related illness under workplace, safety and health compensation are also summarized.

The information presented is in the following tables was taken from Appendix 2: Workplace Legislation and Radon - by Province and Territory of the Canadian Environmental Law Association (CELA) and CAREX Canada, Environmental Scan of Radon Law and Policy: Best Practices in Canada and the European Union. August, 2018

The tables on the following slides are a summary of provincial and territorial occupational health and safety legislation and its applicability to radon assessment and control.

Summary: Appendix 2: Workplace Legislation and Radon - Manitoba Canadian Environmental Law Association (CELA) and CAREX Canada, Environmental Scan of Radon Law and Policy: Best Practices in Canada and the European Union. August, 2018

Province / Territory	Radon Legislation	Radon Compensation
Manitoba	<u>General Duty clauses</u> . Workplace Health and Safety Act, CCSM c. W210 at s. 4(1) provides that every employer shall ensure, so far as is reasonably practicable, the safety, health and welfare at work of all his workers.	<u>Compensation</u> : There is a general compensation clause in The Workers Compensation Act, CCSM c W200 at s. 4(1) which provides for compensation for personal injury by accident. Accident is defined to include events, and occupational diseases that happen at work (s. 1(1)).
	Indoor air quality. The Workplace Health and Safety Regulation, Part 4, General Workplace Requirements, provides for rules on air quality and ventilation. At s. 4.1 it states that an employer must, as much as is reasonably practicable, ensure that (a) a workplace has appropriate air quality and is adequately ventilated, and (b) contaminants and impurities are prevented from accumulating in the air at a workplace.	
	Radon specific provision. The Workplace Health and Safety Regulation requires employers to develop and implement safe work procedures respecting the use of radiation in the workplace and incorporates the ACGIH publication Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices (s. 18.2).When workers in a workplace are, or may be, exposed to levels of radiation in excess of the limits, an employer must implement procedures that control exposure to radiation in the workplace (18.3).	

The Canada Occupational Health and Safety Act

Part X Hazardous Substances Ionizing and Non-ionizing Radiation Section 10.26(4)



"No employee, other than a nuclear energy worker as defined in Section 2 of the Nuclear Safety and Control Act, shall be exposed in the course of any year to a concentration of radon that on average, over the year, is higher than 800 Bq/m³."

- Harmonization with Health Canada Guideline of 200 Bq/m³ is expected Spring 2024.
- The CLC or associated regulations make no legal requirement for employers to test for radon. However, as in all indoor environments, the only way for an employer to know if they are compliant with the CLC is to test. ³⁰

(2) Subsection 10.26(4) of the Regulations is replaced by the following:

(4) An employee, other than a *nuclear energy worker* as defined in section 2 of the *Nuclear Safety and Control Act*, must not be exposed in any year to a concentration of radon that, on average, over the year, is higher than 200 Bq/m³.

34 Section 11.28 of the Regulations is replaced by the following:

11.28 (1) If one of the following devices that is capable of producing and emitting energy in the form of electromagnetic waves or acoustical waves is used in a work place, the employer must apply the following document set out for that device:

(2) An employee, other than a *nuclear energy worker* as defined in section 2 of the *Nuclear Safety and Control Act*, must not be exposed in any year to a concentration of radon that on average, over the year, is higher than 200 Bq/m³.

HARMONIZATION

Health Canada, in consultation with the Federal Provincial Territorial Radiation Protection Committee, modified the guidelines to lower the threshold for acceptable levels of radon in a dwelling from 800 Bq/m³ to 200 Bq/m³ due to scientific studies that conclusively linked the risk of developing lung cancer to levels of radon.

The proposed Regulations would amend the acceptable level of radon and set it to 200 Bq/m³ in the COHSR to be consistent with Health Canada's guidelines and would add it to the OGOSHR. The radon requirement is not in the MOHSR or the AOHSR, as radon exposure is not an issue in these workplaces. The proposed Regulations would repeal the radon limit from the OBTOHSR, as radon exposure is not an issue on board trains.

The scope of the analysis is limited to the Canadian workplaces subject to Part II of the *Canada Labour Code*, which encompass approximately 1.3 million Canadian workers, including approximately 29 000 Indigenous workers on First Nation reserves and in Inuit and Metis communities.

REDUCTION IN EXPOSURE

A study by Darby et al. footnote14 found that the cumulative absolute risks for lung cancer by age 75

Radon	People Who Do Not Smoke	People Who Smoke
0 Bq/m ³	0.41%	10.1%
100 Bq/m ³	0.47%	11.6%
400 Bq/m ³	0.67%	16.0%
800 Bq/m ³	0.93%	21.6%

A Health Canada study found the average radon concentration for federal buildings with mean radon levels above 200 Bq/m³ was 399 Bq/m³. footnote15</sup> Extrapolation from the values in the Darby et al. study footnote15 found the overall reduction in lung cancer risk from a decrease in radon levels from 399 Bq/m³ to 200 Bq/m^{3*} was 0.13% for non-smokers and 2.9% for smokers.

This excess risk was then adjusted to 0.02% for non-smokers and 0.56% for smokers, in order to reflect actual time spent at the workplace.

*Radon levels post-mitigation can achieve 90%+ reduction, therefore greater reduction in exposure and less excess risk.

It is estimated that 3.56% of work sites (buildings) tested would have mean radon levels above 200 Bq/m³ and will require mitigation. This is based on radon testing findings by Health Canada.^{footnote19} Average costs to test are estimated at approximately \$534, and the costs of mitigation are estimated at approximately \$3,717 for the average workplace.^{footnote20}

Monetized costs

Costs are summarized in the following nine tables below:

Table 2: Radon provisions

Description of cost (affected stakeholders)	First year: 2023 (current dollars)	Final year: 2042 (current dollars)	Total (present value)	Annualized value
Cost of <mark>radon</mark> testing	\$12,414,610	\$51,297	\$12,901,547	\$1,217,815
Cost of <mark>radon</mark> mitigation	\$3,025,350	\$12,726	\$3,146,154	\$296,975
Radon testing and mitigation (all employers with offices)	\$15,439,960	\$64,024	\$16,047,701	\$1,514,789

HEALTH CANADA'S RESOURCES

Preview	Format	Title	Publish ed date	
	Infographic	Radon and energy retrofits	2023	Find them online at: <u>https://www.canada.ca/en/health-</u>
TAKE ACTION ON RADON	Infographic	Take action on radon	2016	canada/services/health-risks- safety/radiation/radon/resources.htm
	Brochure	<u>Radon gas: it's in your</u> <u>home</u>	2017	
REAL BOARD	Brochure	Radon in real estate	2021	



RESOURCES for order: DU RADON

* * *

Take Action!

WHEN WAS THE LAST TIME YOU TESTED YOUR HOME FOR RADON GAS?

YOU SPEND A LOT OF TIME AT HOME - ENSURE THE AIR IS SAFE TO BREATH

Get Results!

Postcard (French on

Order a te

ACTION

ONRADON

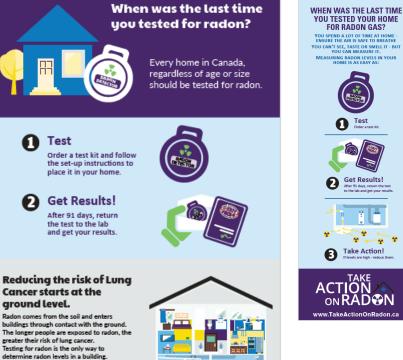
reverse)

YOU CAN'T SEE, TASTE OR SMELL IT - BUT YOU CAN MEASURE IT.

MEASURING RADON LEVELS IN YOUR HOME IS AS EASY AS:

Find a radon test kit provider at:

www.TakeActionOnRadon.ca



Get Results! Take Action! ΑϹΤΙΌΝ ONRADON www.TakeActionOnRadon.ca

YOU TESTED YOUR HOME

FOR RADON GAS?

YOU SPEND A LOT OF TIME AT HOME ENSURE THE AIR IS SAFE TO BREATHE

YOU CAN'T SEE, TASTE OR SMELL IT - BUT YOU CAN MEASURE IT.

MEASURING RADON LEVELS IN YOUR HOME IS AS EASY AS:

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If your radon levels are high - they can be lowered by installing a radon mitigation system.

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Order online: https://form.jotform.com/91975565858277



Window Clings

available

Reducing the risk of Lung Cancer starts at the ground level. Radon comes from the soil and enters buildings through contact with the ground. The longer people are exposed to radon, the greater their risk of lung cancer. Testing for radon is the only way to determine radon levels in a building. Free rodon tests are available for people who have been diagnosed with lung cancer and their family members.



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Poster (French on reverse)



Canadian Société canadienne Cancer Society du cancer

Information for Medical Practitioners (French on reverse)

Help patients

reduce their risk

Radon exposure is the leading cause of lung cancer for non-smokers and significantly increases risk for

of lung cancer.

people who smoke

Health Canada estimates that over 3,200 people die each yea

from exposure to radon gas

Pins

TESTED

RADTN

FOR

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C'EST MESURÉ

1 Test

Get Results!

Take Action!

When was the last time you tested for radon? Every home in Canada, recordless of are or siz

After 91 days, return the test to the lab and get your results

TESTED

RADON

RADON

MESURÉ

www.TakeActionOnRadon.ca

www.OccupeToiDuRadon.ca