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The BC Radon Data Repository and BC Radon Map: Integrating Disparate Data Sources for Improved Public Health Communication

Dr. David McVea, MD PhD
Public Health Physician

Anne-Marie Nicol, PhD
Knowledge Mobilization Scientist

Jeffrey Trieu, MPH
Environmental Health and Knowledge
Translation Scientist

Public Health Ontario Rounds
Nov 28 2024



Disclosures

Our work is funded by provincial and federal governments

We have no commercial interest in the radon industry to declare

We do not sell radon test kits or mitigation services

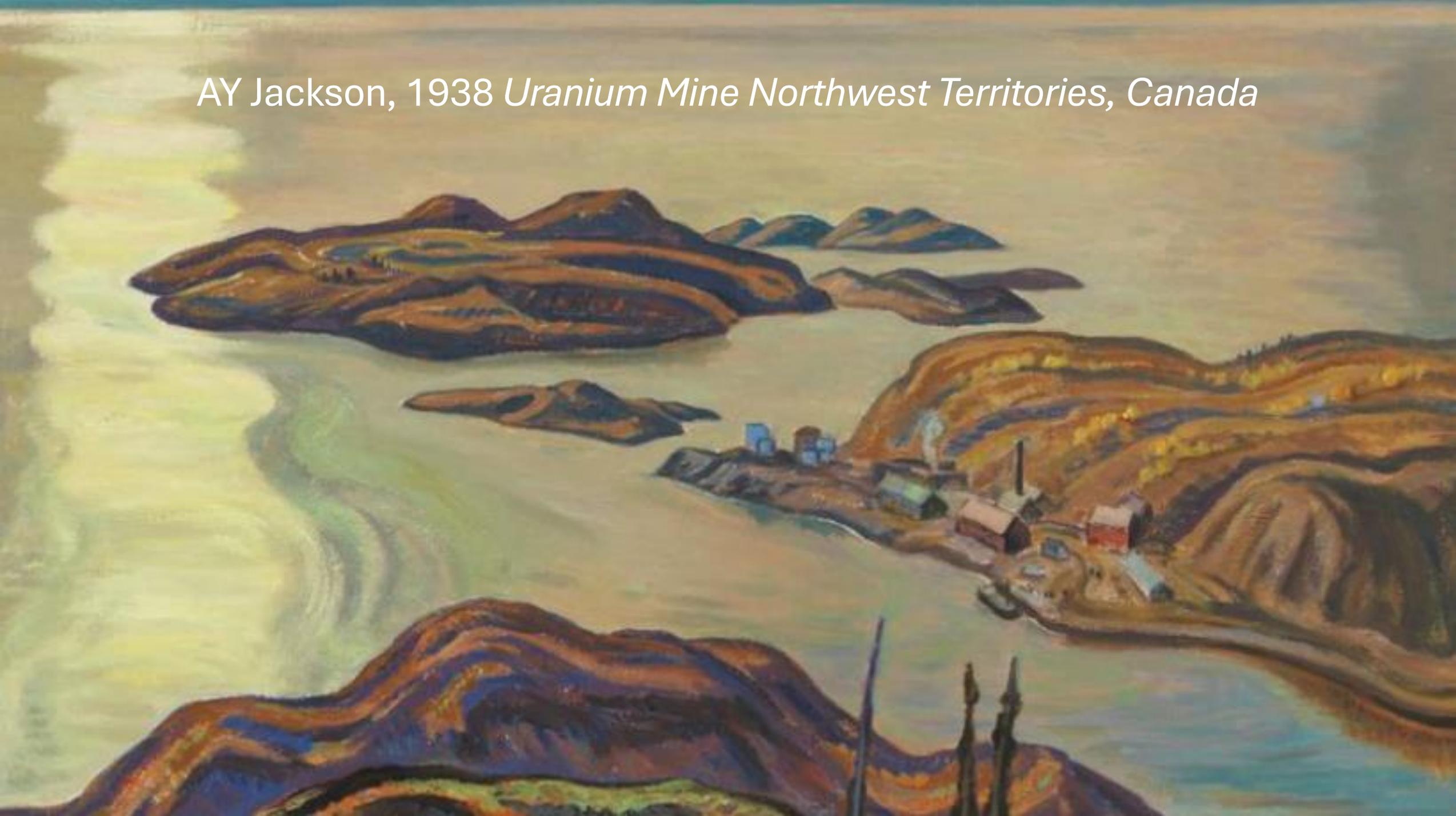
Learning objectives

1. Understand the etiology and epidemiology of radon-induced lung cancer in Canada.
2. Discuss programs that improve awareness of radon, promote action to reduce exposure, or reduce exposures directly.
3. Understand the BC Radon Data Repository and BC Radon Map, and how it could be translated to other jurisdictions.

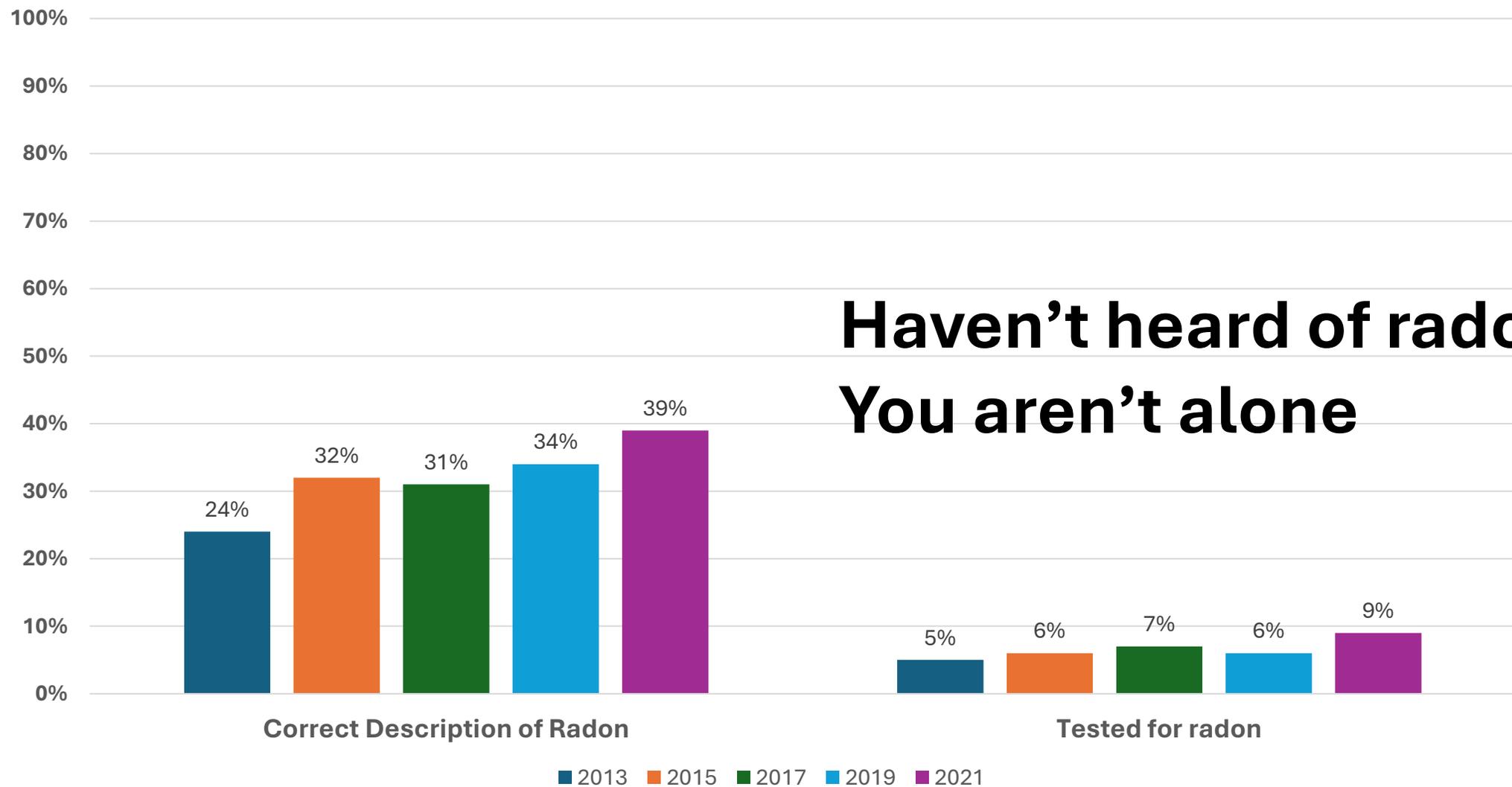


- First Nations territories stretch to every inch of this province, and across Canada
- Inherent rights, rooted in connection to lands and waters, have never been ceded or surrendered.

AY Jackson, 1938 *Uranium Mine Northwest Territories, Canada*



Statistics Canada Households and Environment Survey- 2021



**Haven't heard of radon?
You aren't alone**

Periodic Table: Radioactive Elements

1 H 1.008 Hydrogen																	2 He 4.003 Helium						
3 Li 6.94 Lithium	4 Be 9.012 Beryllium																	5 B 10.81 Boron	6 C 12.011 Carbon	7 N 14.007 Nitrogen	8 O 15.999 Oxygen	9 F 18.998 Fluorine	10 Ne 20.180 Neon
11 Na 22.990 Sodium	12 Mg 24.305 Magnesium																	13 Al 26.982 Aluminium	14 Si 28.085 Silicon	15 P 30.974 Phosphorus	16 S 32.06 Sulfur	17 Cl 35.45 Chlorine	18 Ar 39.948 Argon
19 K 39.098 Potassium	20 Ca 40.078 Calcium	21 Sc 44.956 Scandium	22 Ti 47.867 Titanium	23 V 50.942 Vanadium	24 Cr 51.996 Chromium	25 Mn 54.938 Manganese	26 Fe 55.845 Iron	27 Co 58.933 Cobalt	28 Ni 58.693 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.630 Germanium	33 As 74.922 Arsenic	34 Se 78.971 Selenium	35 Br 79.904 Bromine	36 Kr 83.798 Krypton						
37 Rb 85.468 Rubidium	38 Sr 87.62 Strontium	39 Y 88.906 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.906 Niobium	42 Mo 95.95 Molybdenum	43 Tc (98) Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.906 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.868 Silver	48 Cd 112.414 Cadmium	49 In 114.818 Indium	50 Sn 118.710 Tin	51 Sb 121.760 Antimony	52 Te 127.60 Tellurium	53 I 126.904 Iodine	54 Xe 131.293 Xenon						
55 Cs 132.905 Cesium	56 Ba 137.327 Barium	57 / 71	72 Hf 178.49 Hafnium	73 Ta 180.948 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	76 Os 190.23 Osmium	77 Ir 192.217 Iridium	78 Pt 195.084 Platinum	79 Au 196.967 Gold	80 Hg 200.592 Mercury	81 Tl 204.38 Thallium	82 Pb 207.2 Lead	83 Bi 208.980 Bismuth	84 Po (209) Polonium	85 At (210) Astatine	86 Rn (222) Radon						
87 Fr (223) Francium	88 Ra (226) Radium	89 / 103	104 Rf (267) Rutherfordium	105 Db (268) Dubnium	106 Sg (271) Seaborgium	107 Bh (270) Bohrium	108 Hs (269) Hassium	109 Mt (278) Meitnerium	110 Ds (281) Darmstadtium	111 Rg (282) Roentgenium	112 Cn (285) Copernicium	113 Nh (286) Nihonium	114 Fl (289) Flerovium	115 Mc (289) Moscovium	116 Lv (293) Livermorium	117 Ts (294) Tennessine	118 Og (294) Oganesson						
Lanthanide Series		57 La 138.905 Lanthanum	58 Ce 140.116 Cerium	59 Pr 140.908 Praseodymium	60 Nd 144.242 Neodymium	61 Pm (145) Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.925 Terbium	66 Dy 162.500 Dysprosium	67 Ho 164.930 Holmium	68 Er 167.259 Erbium	69 Tm 168.934 Thulium	70 Yb 173.045 Ytterbium	71 Lu 174.967 Lutetium							
Actinide Series		89 Ac (227) Actinium	90 Th 232.038 Thorium	91 Pa 231.036 Protactinium	92 U 238.029 Uranium	93 Np (237) Neptunium	94 Pu (244) Plutonium	95 Am (243) Americium	96 Cm (247) Curium	97 Bk (247) Berkelium	98 Cf (251) Californium	99 Es (252) Einsteinium	100 Fm (257) Fermium	101 Md (258) Mendelevium	102 No (259) Nobelium	103 Lr (266) Lawrencium							

Atomic Number

SYMBOL

Atomic Weight*

Name

Radon is an:

- Invisible
- Odorless
- Colorless
- Tasteless
- *Radioactive*

Gas

*() indicates the mass number of the longest-lived isotope.

Type of Radiation	Nuclide	Half-life
α	Uranium-238	4.5 billion years
α	Radium-226	1,590 years
α	Radon-222	3.825 days
α	Polonium-218	3.05 minutes
α	Lead-214	26.8 minutes
β	Bismuth-214	19.7 minutes
β	Polonium-214	.00015 seconds
α	Lead-210	22 years
β	Bismuth-210	5 days
β	Polonium-210	140 days
α	Lead-206	stable

Radon gas comes from the decay of radium (Uranium)

Uranium and its decay products present in soils across Canada

Some regions naturally have more uranium

- Northern Saskatchewan
- Bancroft, Elliot Lake ON
- Interior British Columbia

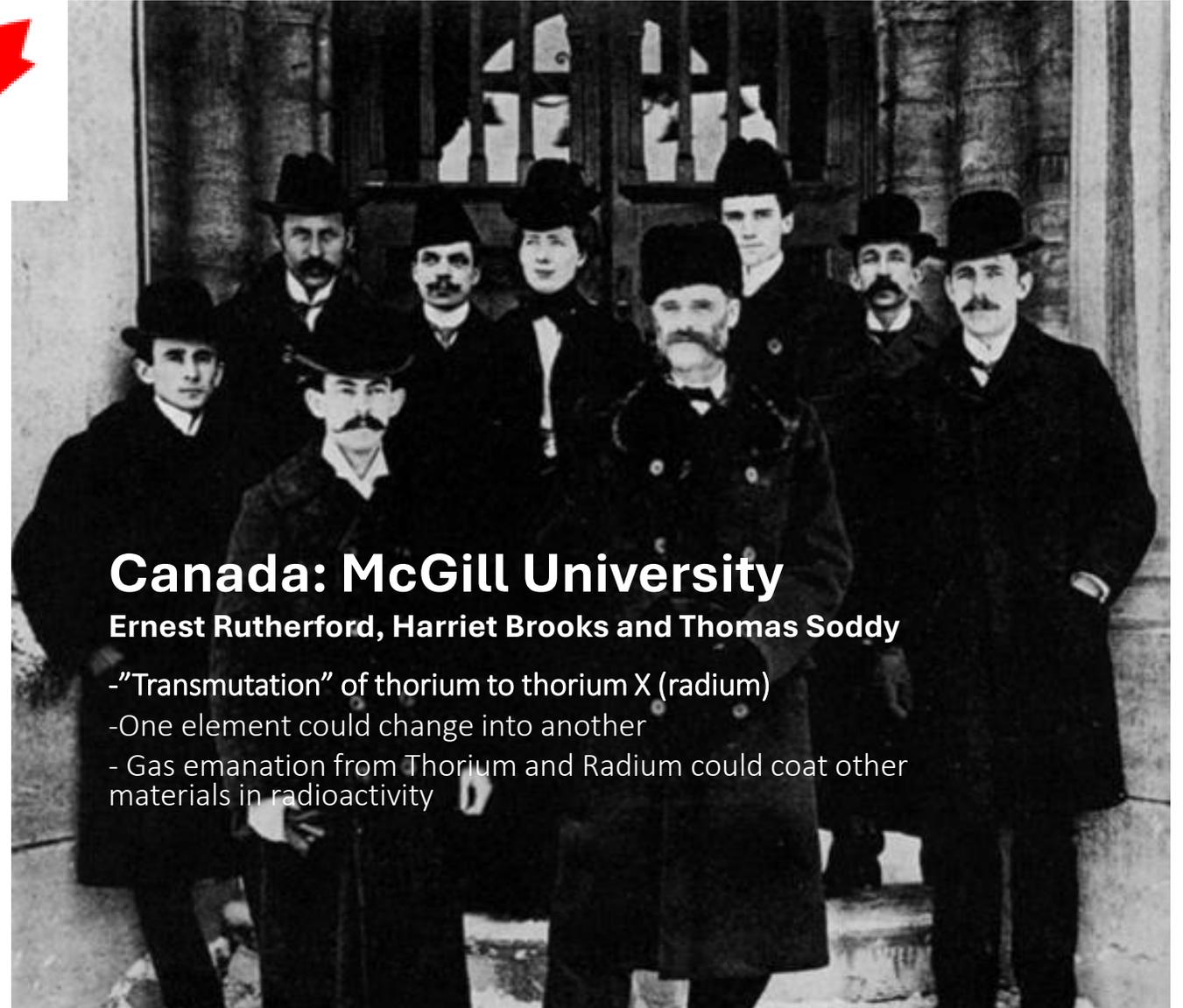
Radon is the only GAS phase of uranium decay

- Radon gas is *mobile*

Alpha particle radiation

- High LET (linear energy transfer) over a short distance

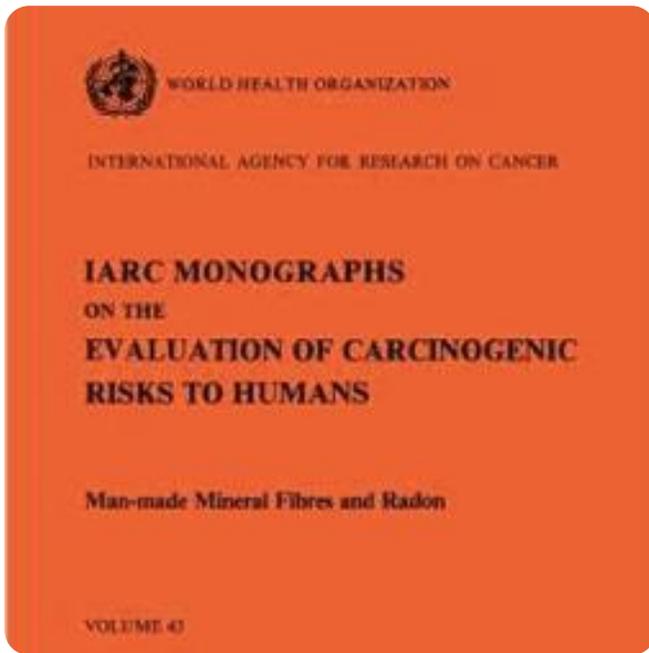
FUN FACT!



Canada: McGill University

Ernest Rutherford, Harriet Brooks and Thomas Soddy

- "Transmutation" of thorium to thorium X (radium)
- One element could change into another
- Gas emanation from Thorium and Radium could coat other materials in radioactivity

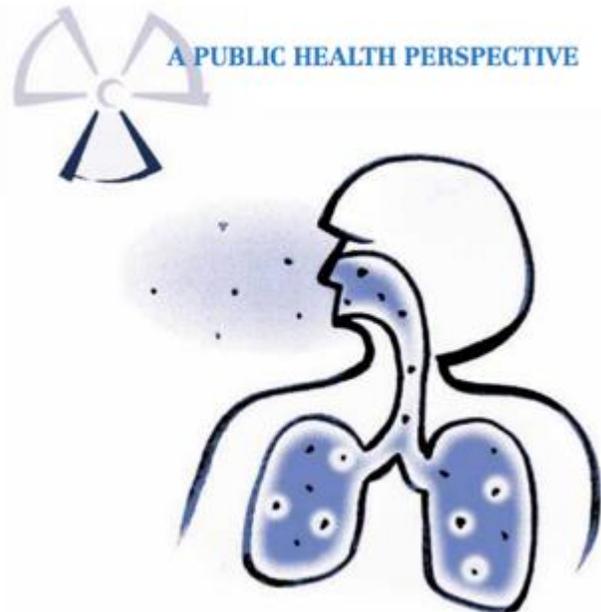


Radon is designated as a *known* human carcinogen

Evidence from occupational mining including men from Saskatchewan, Ontario, Newfoundland

WHO: “The risk of lung cancer increases by about 16% per 100 Bq/m³ increase in long time average radon concentration. The dose-response relation is assumed to be linear – i.e. the risk of lung cancer increases proportionally with increasing radon exposure.”

The higher the dose, the greater the risk



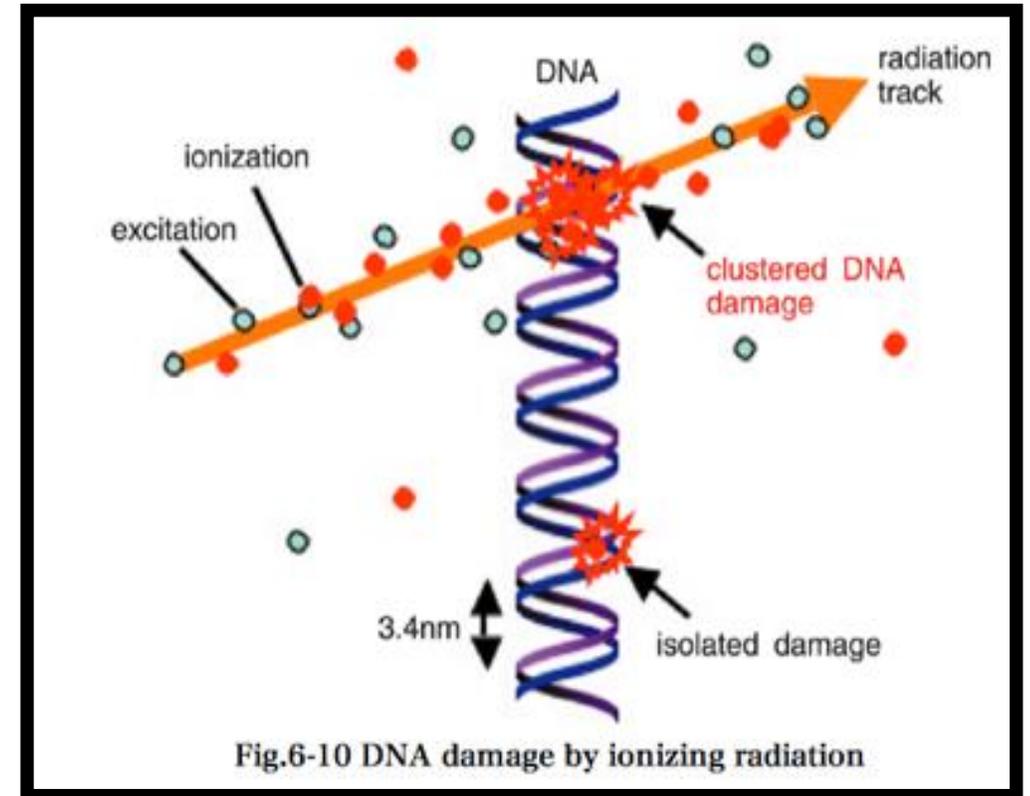
Radon and lung cancer con't

Active Canadian research on carcinogenic mechanisms, genomics, exposure biomarkers

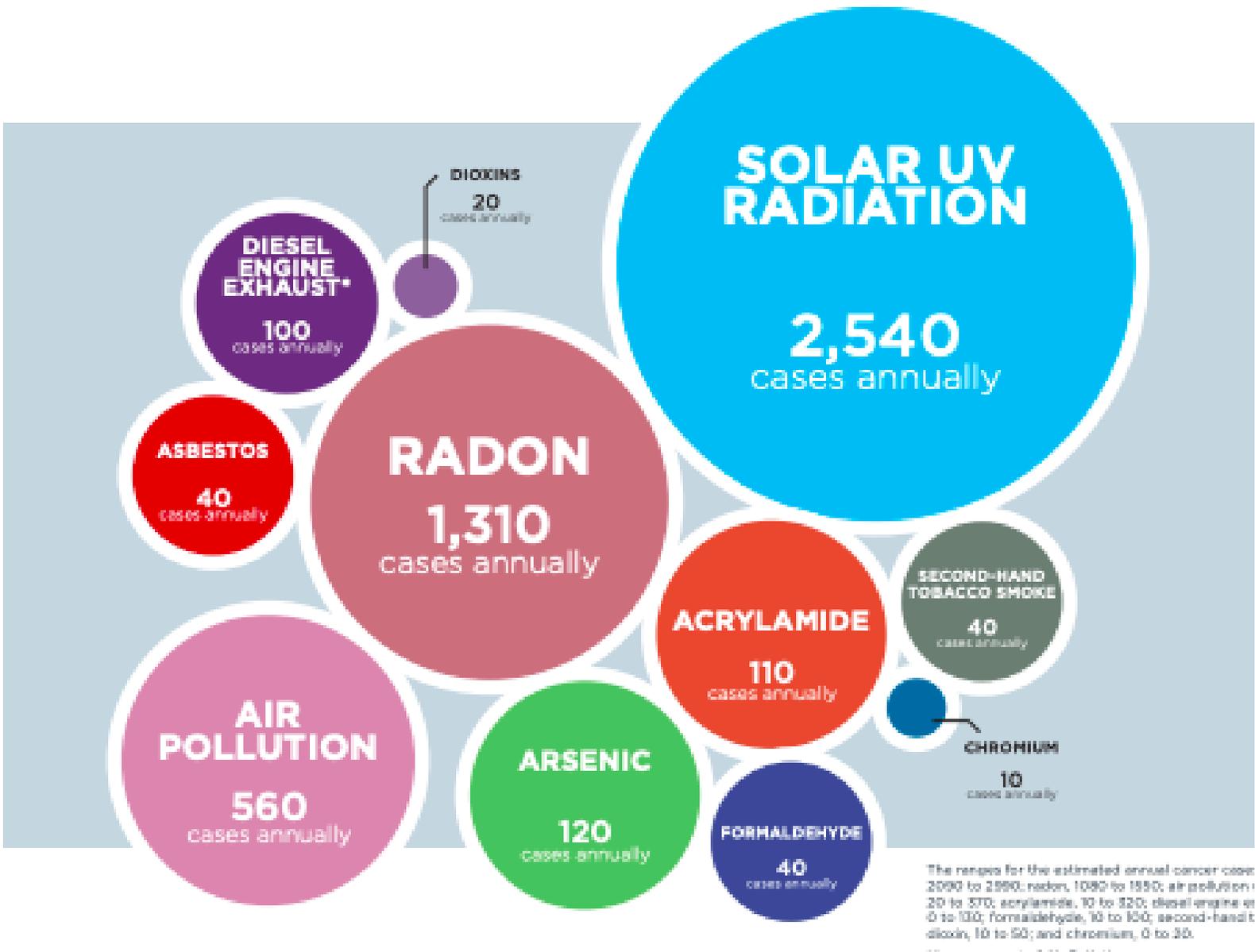
- Biological samples- blood, nails
- University of Calgary, Dalhousie
- NOSM- NSERC grant

Radon exposure can lead to:

- DNA double strand breaks
- Generation of Reactive Oxygen Species
- Hypomethylation- changes to mRNA



Impact: “Radon is estimated to cause 16% of all lung cancers in Canada, over 3000 deaths per year” – Health Canada



Ontario research shows that **Radon** is the most significant environmental exposure for *lung cancer (2016)*

The ranges for the estimated annual cancer cases: 2000 to 2500; radon, 1000 to 1550; air pollution, 20 to 570; acrylamide, 10 to 320; diesel engine, 0 to 100; formaldehyde, 10 to 100; second-hand tobacco smoke, 10 to 50; and chromium, 0 to 30.

*A component of Air Pollution.

Radon and health beyond lung cancer

Radon Exposure and other cancers?

- Leukemia
- Lymphoma
- Gastric Cancer (ingestion of water contaminated with radon)

Follow up of radon-exposed occupational cohorts

- Other lung diseases
- Cerebrovascular diseases

Exposure during pregnancy

- Outcome include low birth weight, other fetal outcomes
- Maternal outcomes



People are exposed via indoor air

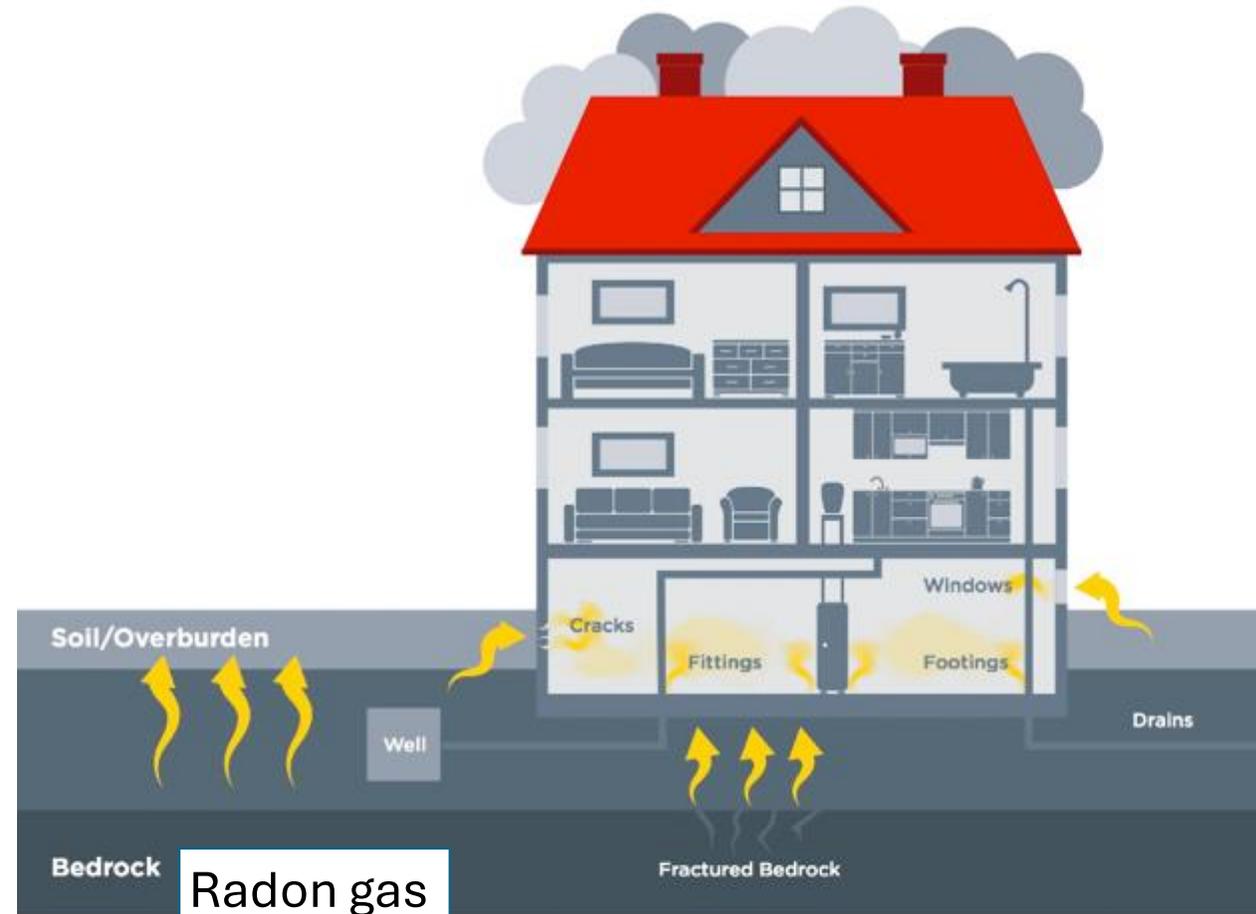
Gas enters buildings through

- cracks in floors or walls
- Sump pumps
- Around pipes, drains

Levels higher in basement and ground contact rooms

Radon testing necessary to know levels

- colorless, odorless, tasteless



Radon is a radioactive gas that is released when uranium breaks down in the ground. It can infiltrate our homes in the various ways pictured here but mitigation strategies can reduce this exposure in both new and existing structures.



Radon

Health Canada's regional radiation specialists educate Canadians about the health risks of long-term exposure to radon. We can answer your questions and advise you about:

- the health effects of radon
- how to test the radon level in your home
- how to reduce the radon level in a home or building

Most requested

- [Purchase a Radon test kit](#)
- [Find a radon measurement professional](#)
- [Hire a radon mitigation professional](#)

Radiation Health Assessment Division – Health Canada

775 Brookfield Road, A.L. 6302D
Ottawa, Ontario, K1A 1C1

E-mail: radon@hc-sc.gc.ca

Toll free: 1-833-723-6600

Related links

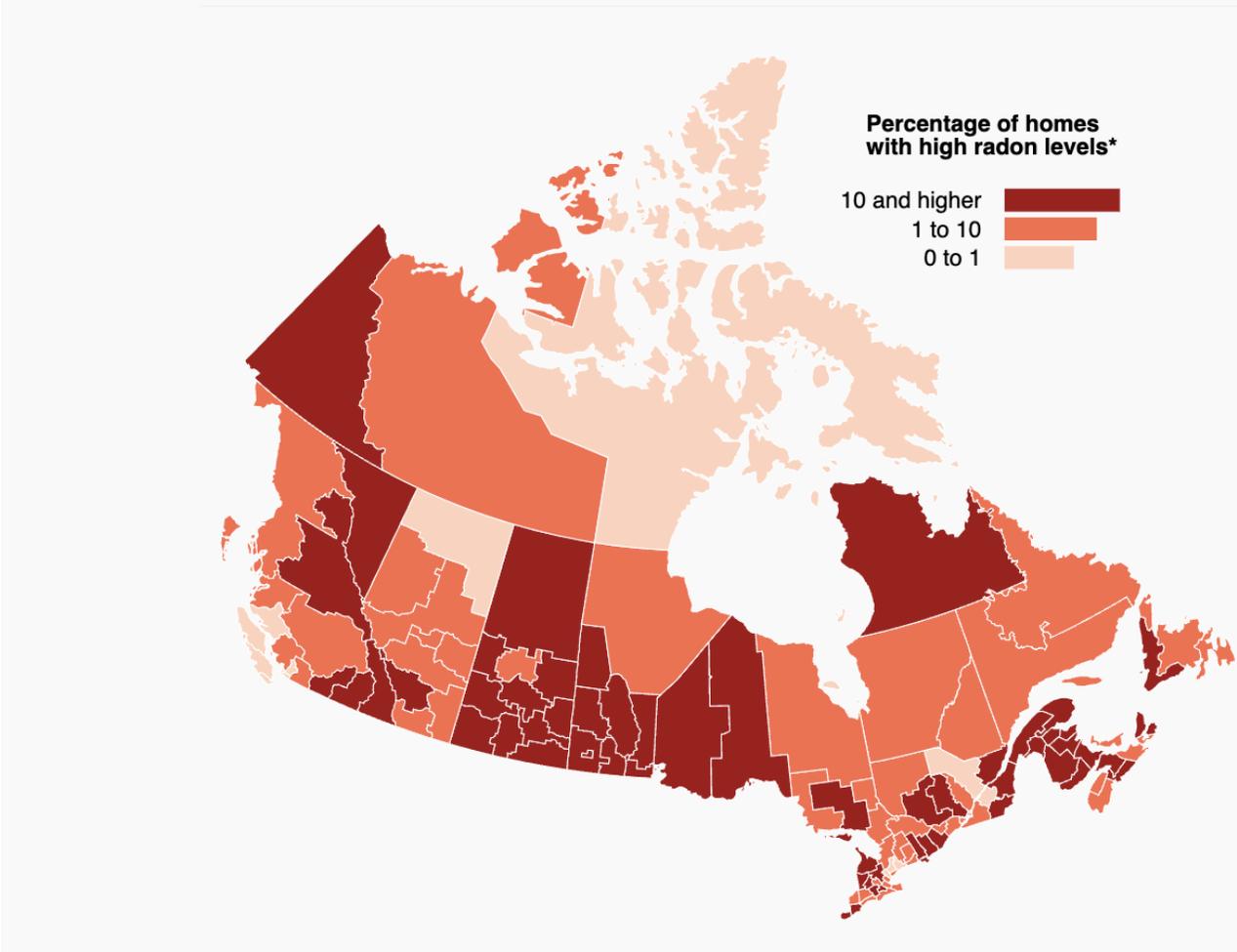
- [About radon](#)
- [Testing your home](#)
- [Reducing levels in your home](#)

In 2007- Radon Guideline dropped from **800 to 200 Bq/m³**

Occupational exposure limits (OEL) vary but are moving to 200 Bq/m³ across the country.

National radon testing 2009-2011

Cross-Canada Survey of Radon Concentrations in Homes Final Report

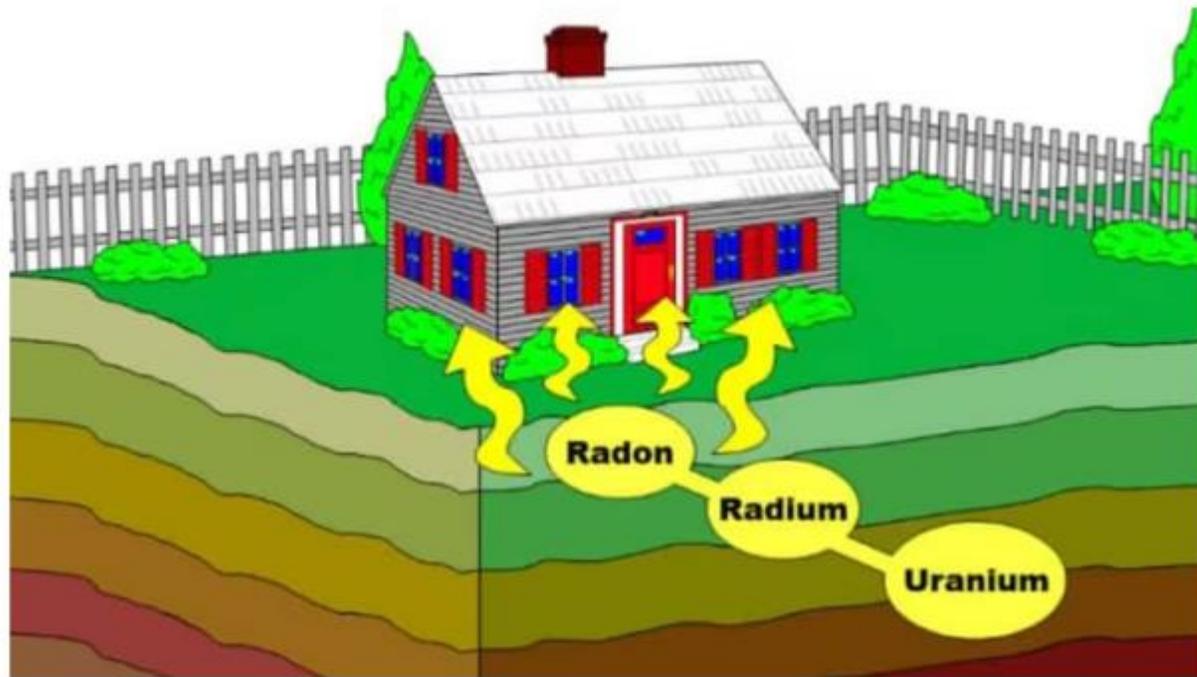


National radon study shows higher levels, exposure to radioactive gas in homes

An estimated 10.3 million Canadians living in houses with high radon, expert says



Bill Graveland · The Canadian Press · Posted: Oct 23, 2024 10:09 AM PDT | Last Updated: October 23



Radon gas, a radioactive element, seeps into the home from the surrounding rock and soil. (B.C. Centre for Disease Control)



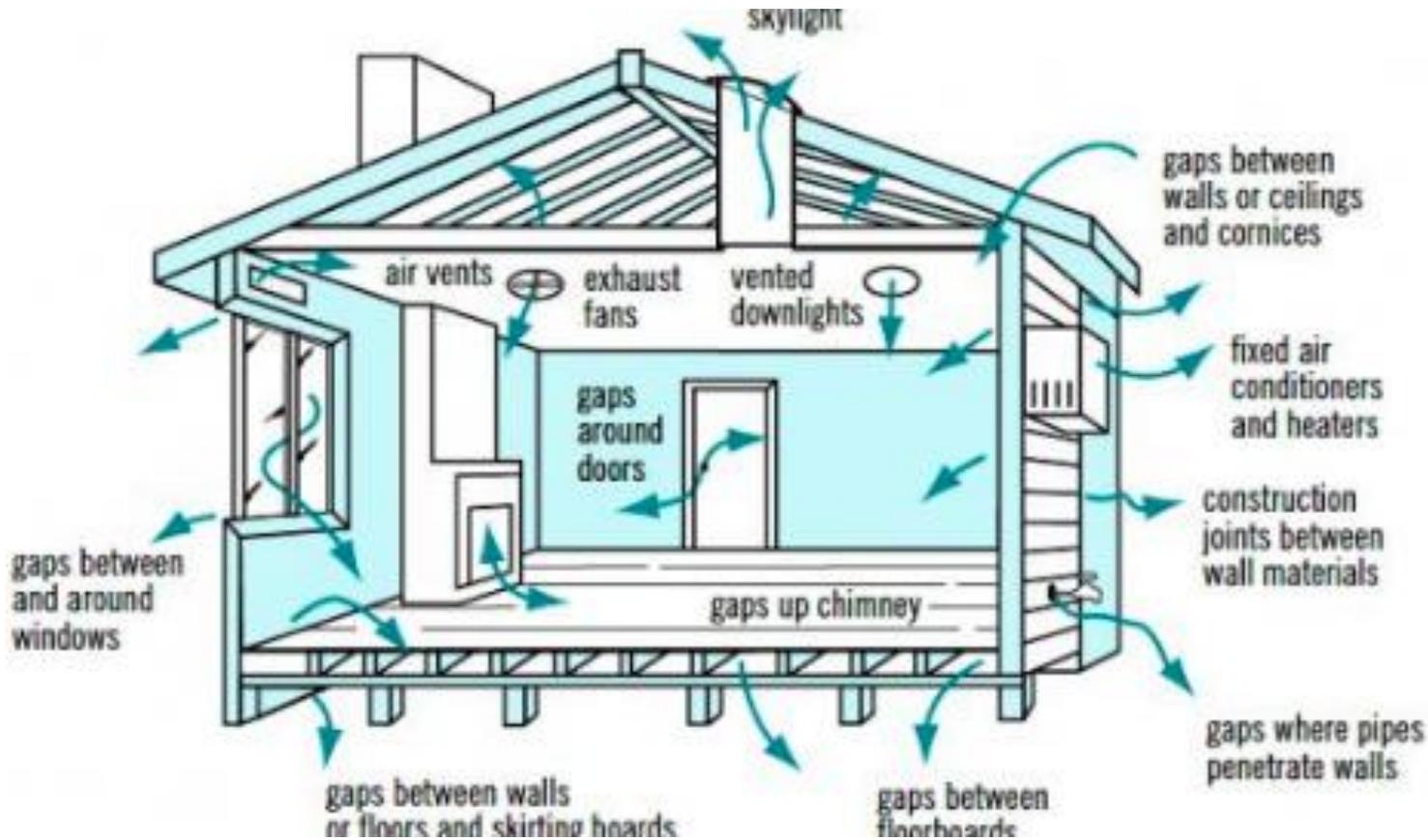
A countrywide study says radioactive radon exposure is on the rise and continues to be a critical public health concern.

2024 updated radon estimates

Radon levels likely higher than originally thought

Why?

- Broader housing types studies
- Poorer construction?
- Larger homes?
- More airtightness?



Various factors influence radon levels

- **Home-specific factors**
 - Air-tightness
 - Age of build
 - Size of footprint
 - Renovations
 - Design
- **Geology**
- **How a home is used (human factors)**

Radon levels are *increasing* in Canada

(Dr. Jing Chen, Health Canada 2021)

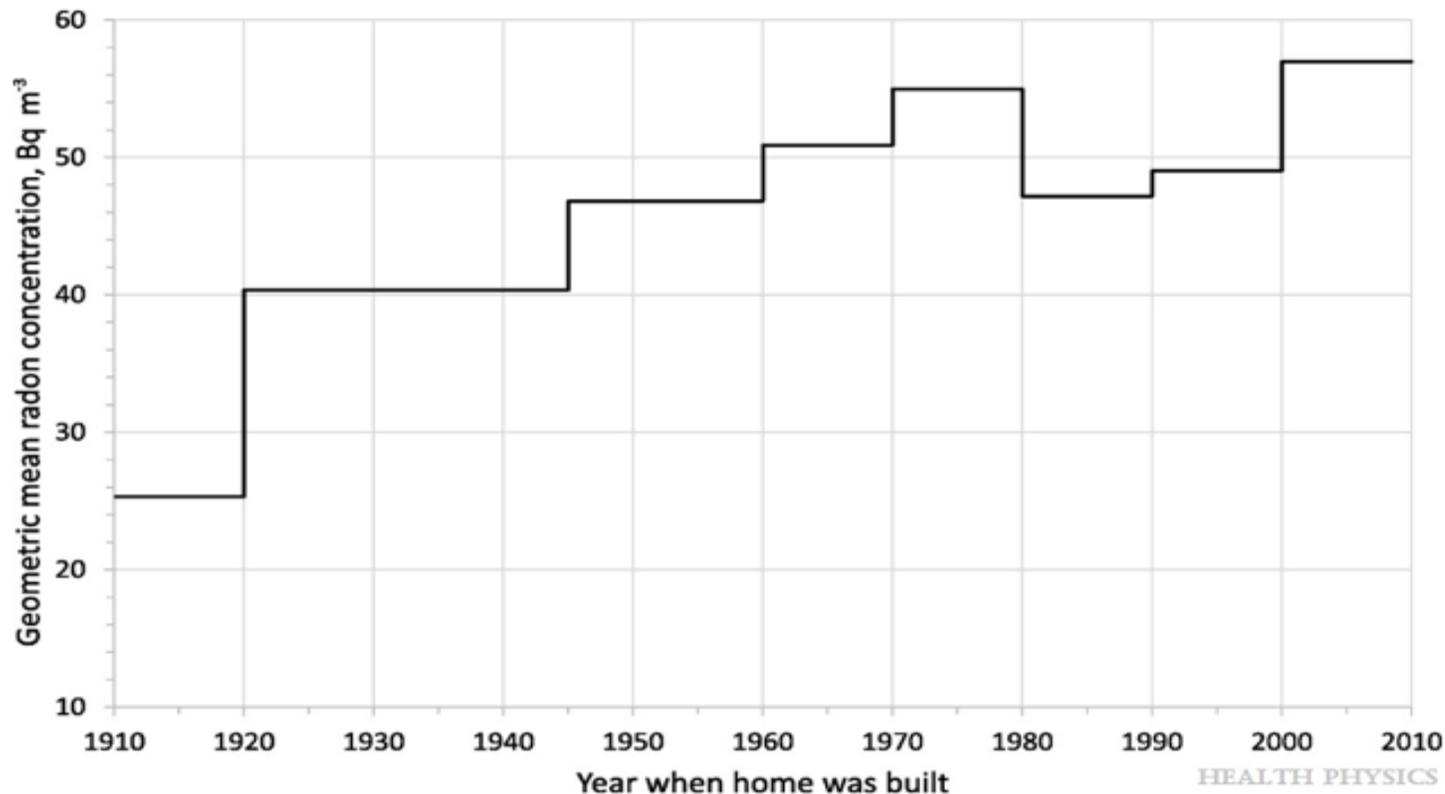


Fig. 2

Geometric mean radon concentrations in homes built in different years.

Source

[A Summary of Residential Radon Surveys and the Influence of Housing Characteristics on Indoor Radon Levels in Canada](#)

Health Physics 121(6):574-580, December 2021.

Similar results found in USA...

PAPER • OPEN ACCESS

Geologic, seasonal, and atmospheric predictors of indoor home radon values

Ellen J Hahn^{3,1}, William C Haneberg², Stacy R Stanifer¹, Kathy Rademacher¹, Jason Backus² and Mary Kay Rayens¹

Published 21 June 2023 • © 2023 The Author(s). Published by IOP Publishing Ltd

[Environmental Research: Health, Volume 1, Number 2](#)

VIRGINIA

Radioactive Gas Is Risk in Sealed Houses

RADON, From E1

For the most part, Washingtonians can breathe a sigh of relief, at least compared to people in other parts of the country.

Dr. John Harley, formerly of the Department of Energy and now associated with the National Council on Radiation Protection and Measurements, has been studying radon gas for some time. He says that other areas of the country, especially the Rocky Mountains, have high levels of radioactivity in the soil, while East Coast states, with the exception of Florida, have low levels.

Richard Guimond, director of the Criterion Standards Division at the Environmental Protection Agency, agrees. "In all likelihood, the Washington area is not that severely affected."

He had some advice, however, for those who want to be sure they are not at risk.

"We do a lot of testing in measuring levels [of radon gas] in homes," Guimond said. "Many universities are able to do the techniques." Most of the methods, he said, are not suitable for use by amateurs and are not commercially available.

A method known as "track-etch, which uses a material manufactured by Ter-radex Corp. in Walnut Creek, Calif., is sold to the public, he said.

For a price of around \$50, Terradex will send a homeowner a cup that is to be placed in the home for about three months. At the end of the specified time, the cup is to be mailed back to the company, which then will conduct a test to

see if the home contains unhealthy levels of radon gas.

Harley explained that radon gas levels can vary greatly from room to room, from day to evening and from winter to summer. So he favors a device such as the track-etch that will measure levels over a period of time.

Harley also suggested some preventive measures. "Radon gas can come out of the soil and into the house," he explained. While he noted that radioactivity can also be emitted by building material, the amount is usually very small.

He suggested that people check the soil for radioactivity levels before they build. For those who have already built, there are ways of limiting the amount that can enter a house. "Homeowners should look around to find leaky spots," said Harley. "A crack in the cellar floor should be sealed," he said. "If a pipe entrance is caulked, this can reduce the level significantly."

Guimond said the EPA is running a study in Butte, Mont., to detect radon levels in homes. EPA also conducted a study in central Florida in the 1970s after "the agency had found elevated radon decay product levels in buildings constructed on land reclaimed from old phosphate mining areas," he said.

An August 1980 task force report by the United States Radiation Policy Council stated, "Interest in indoor radon was first aroused more than 10 years ago when the use of uranium mill tailings in structures in Grand Junction, Colo., came to national attention." Concern has been growing ever since.

The Tennessee Valley Authority has taken a strong interest in it. "For years we operated a phosphorous furnace," said Lewis Wallace, deputy general counsel for TVA. "One of the byproducts was slag, which is melted rock."

He said the slag was sold and used for construction. "In recent years it was found to contain minute traces of radioactivity," Wallace added. So the TVA set out to find if the slag, now converted into cinder blocks and other building material, was emitting radon gas.

"We did find that some houses had high levels of radon gas," said Wallace. But after further studies were conducted, it was discovered that the slag had little to do with the radon gas level in the homes. "Some houses that had high levels of radon had nothing to do with the phosphate," he explained. "It was coming from other sources."

Wallace warned that one of the potentially worst places for a radon gas buildup is an air-tight room in the cellar such as a bomb shelter.

Because Canada has a far worse problem than the United States, the country has developed equipment to help reduce the gas level, such as a heat exchange device, Harley said. "The heat exchange ventilation exchanges inside air with air outside but keeps the heat inside. The only problem is it costs a couple of thousand dollars."

Before running out to buy such a costly device, Harley suggests that people determine first whether they need one—which he said is doubtful in the Washington area.

Risk of Cancer From Radon Gas Increases With Growth of Energy-Efficient Homes

By VIRGINIA INMAN Staff Reporter of THE WALL STREET JOURNAL Most people wouldn't do their bookkeep...

Wall Street Journal (1923-); Feb 23, 1984; ProQuest Historical Newspapers: The Wall Street Journal

pg. 31

Risk of Cancer From Radon Gas Increases With Growth of Energy-Efficient Homes

By VIRGINIA INMAN

Staff Reporter of THE WALL STREET JOURNAL

Most people wouldn't do their bookkeeping in a uranium mine.

Neither would William Orrick. But the air in the basement of his Schenectady, N.Y., home, where he keeps the books for his plumbing business, used to be several times more radioactive than a uranium mine.

Mr. Orrick's basement air contained a high concentration of radon, an invisible, radioactive gas formed by the decay of naturally occurring radium in the soil. Houses have always had some radon in them because the uranium that produces radium is relatively abundant. But in the past 10 years, scientists have become concerned that energy-efficient houses that restrict the exchange of indoor and outdoor air trap radon in dangerous concentrations. As more of these "tight" homes are built, radon presents an increasing health hazard.

Radon is dangerous because it decays into highly radioactive elements, called radon "daughters," that stick to dust particles and, if inhaled, can eventually cause lung cancer. Scientists say that between 2,000 and 20,000 Americans die each year from radon-related lung cancer. The number is difficult to pinpoint because estimates of the risk from low-level radiation have to be calculated from data on higher levels of exposure.

Reducing Life Expectancy

"If radiation is ever an important health problem, it's with radon," says Bernard L. Cohen, a physicist at the University of Pitts-

little plastic cups around a home. The particles that radon shoots off as it decays etch microscopic tracks on the inside of the cups. By counting the number of tracks after several months of exposure, scientists can tell how much radon a house has.

Radon levels vary from place to place, as well as from house to house, depending on the surrounding geology. High levels have been found along a geological formation in eastern Pennsylvania, in parts of New England and in upstate New York. In contrast, studies in northern California, Maryland and Minnesota have detected relatively low levels.

Homes in Sweden, especially those built over granite and shale, tend to have extremely high levels. The levels are in-

The average indoor radon dose does five times more damage than all other natural radiation combined, 10 times more than medical X-rays and thousands of times more than the nuclear industry, says a physicist.

Although radon can present a serious health hazard, the problem can often be eliminated easily. The radon level in Mr. Orrick's house dropped sharply after he plugged up the vent in his basement. Four \$30 fans installed in drainage pipes around the foundation of Joel Noble's house in Gladwynne, Pa., reduced its radon level by almost 90%. The fans pull radon-laden air out from under the house.

An Unsealed Foundation

Even so, the level in the Noble residence was 10 times the national average. A heat exchanger that lets inside air out without losing much heat finished the job.

Kathleen Johnston wasn't as lucky. The people who built her house in upstate New York four years ago didn't seal the outside of the foundation, so radon from the surrounding soil poured into the basement. General Electric Co. researchers studying radon levels in Schenectady found about 35 times the national average in the Johnstons' basement and about one-third that amount upstairs.

Opening doors and windows during the summer helps a little, but it isn't a real solution. The Johnstons might be able to keep some radon out of the house by painting their basement walls with an epoxy sealer. But Mrs. Johnston says her husband doesn't think the problem warrants spending lots of time and money. "To me, it's a distress. I don't like having that high a radon level," says Mrs. Johnston, who has three children at home. "I have no alternative but to live in this house. Oh, what can I do?"

Energy retrofits- 2022

More recent research confirms energy retrofits can increase radon levels

- doubled/triple glazed windows, doors
- added insulation
- sealing cracks, sumps

In Canada, **no requirements to test radon levels post- energy retrofits**



About

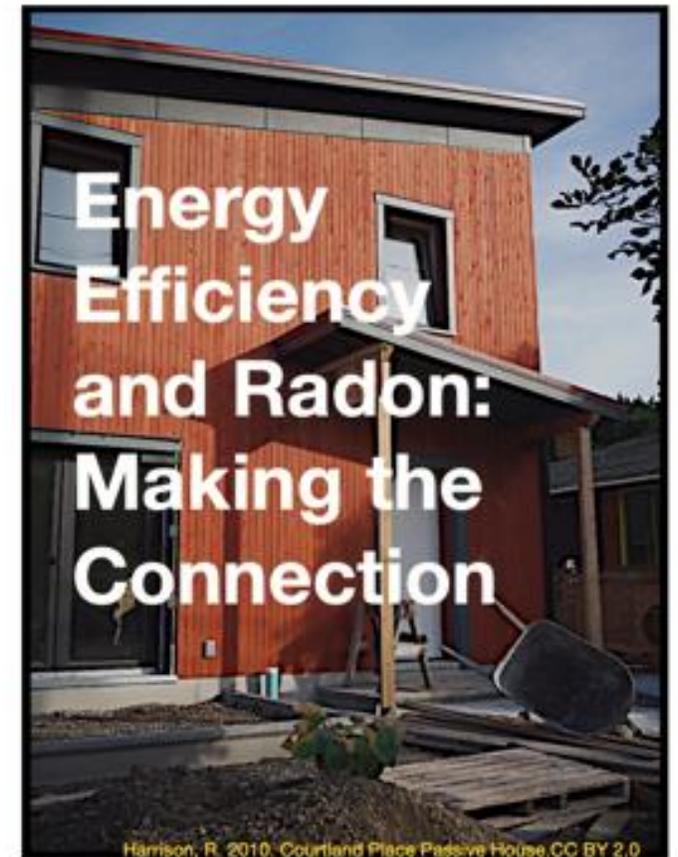
Better Homes

CleanBC Better Homes is helping B.C. switch to cleaner home energy.

On Better Homes, homeowners can access information, rebates and support for new and existing homes. Better Homes programs provide:

- Rebates and support to reduce energy use and greenhouse gas emissions
- Loans with interest rates as low as 0% for switching from fossil fuel heating systems to heat pumps
- Free energy coaches to help navigate the process

Explore Better Homes



Lead Author: Anne-Marie Nicol, MSc, PhD, Faculty of Health Sciences, Simon Fraser University. Completed pro bono for the Healthy Indoor Environments Program, British Columbia Lung Foundation.

Further contributions:

Dr Rodrigo Mora and Abila Hours, Building Sciences Program British Columbia Institute for Technology (BCIT).

Date: October 5, 2022

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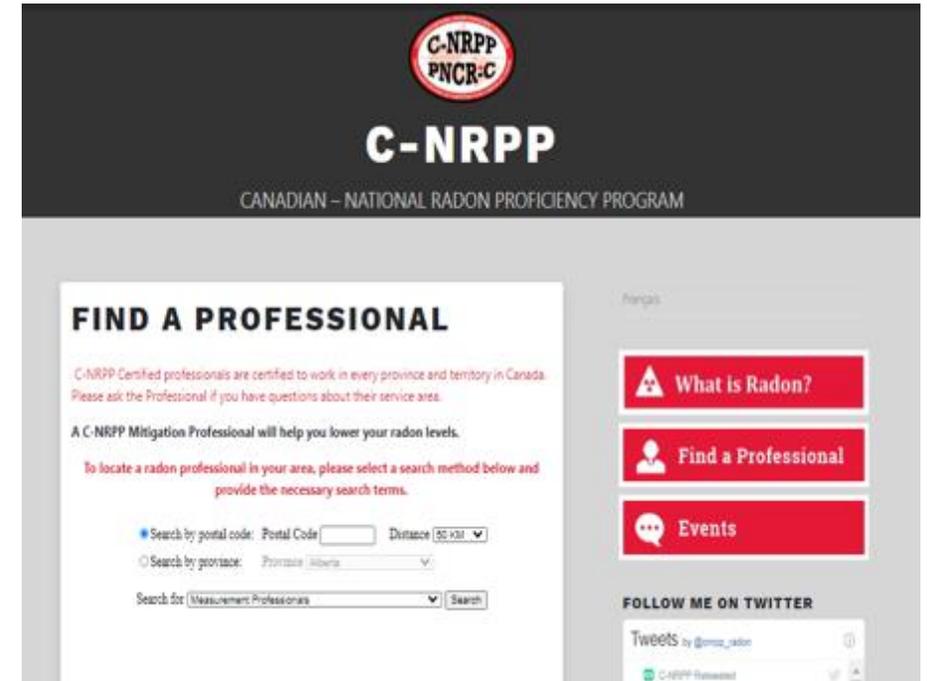
To find project documents, visit BC Lung's website on Radon and Energy Efficiency, at <https://bclung.ca/radon-and-energy-efficiency>

Canada has a national radon certification program

Radon Measurement Professional – deploys and retrieves radon detectors and provides a report of the associated measurement results

Radon Mitigation Professional – determines the most effective way to reduce radon concentrations within buildings

Controlling Radon in New Canadian Homes (CRNCH) Installer – designs and installs radon control systems within new constructed residential structures

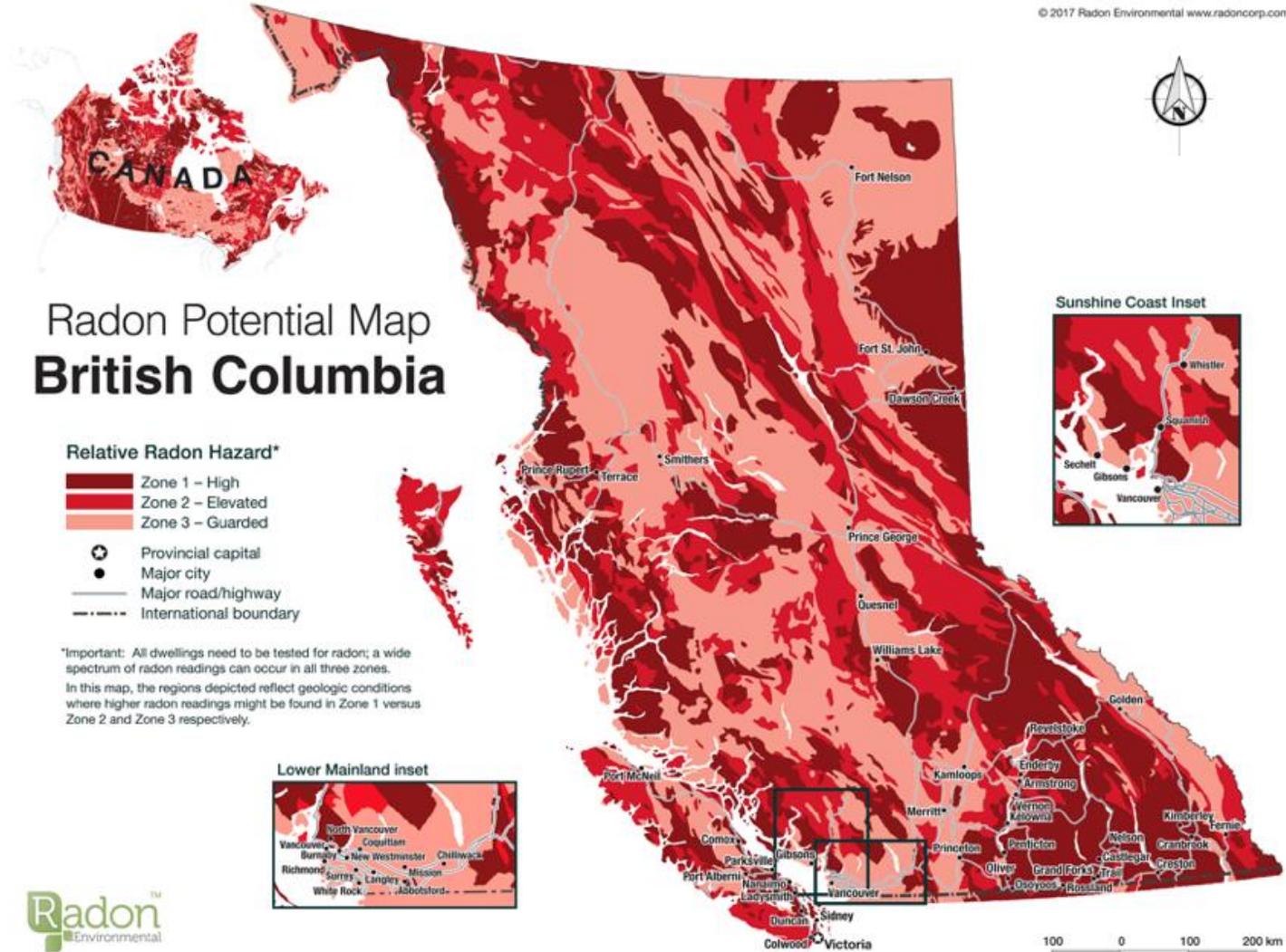


Canadian National Radon Proficiency Program (C-NRPP)



<https://c-nrpp.ca/>

Radon in BC - geology and the built environment



Indoor radon data at the BCCDC – the early days

Table 1: Radon in BC Homes - Main Floor

BC City	# Homes Tested	% of homes over 200 Bq/m ³	Avg. Radon on Main Floor in Bq/m ³
Atlin	15	14.4	118
Barriere	35	30	201
Blue River	2	0	153
Castlegar	71	30.9	240
Clearwater	50	40.3	447
Cranbrook	88	4.5	50
Creston	15	0	49
Fernie	10	10	78

Main Floor Radon Concentrations in British Columbia Communities

Average Radon Concentration (Bq/m³)



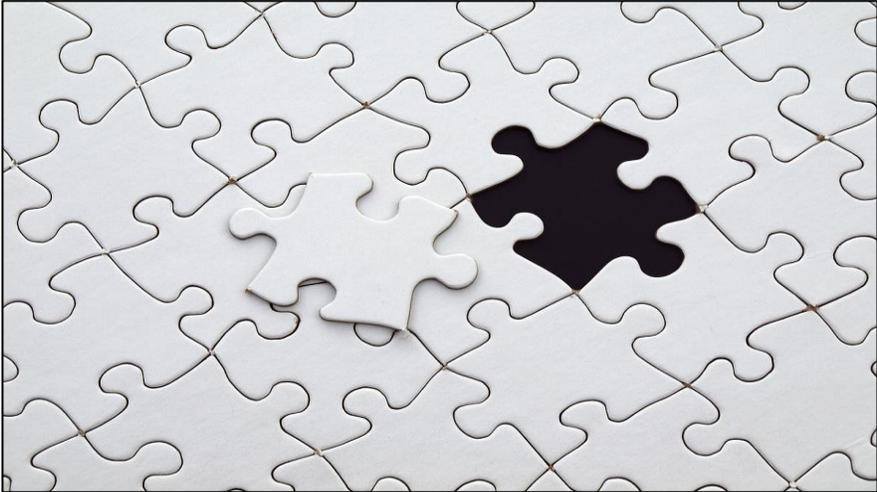
Map created Feb 14, 2007 by the British Columbia Centre for Disease Control

Lots of other separately held data around province

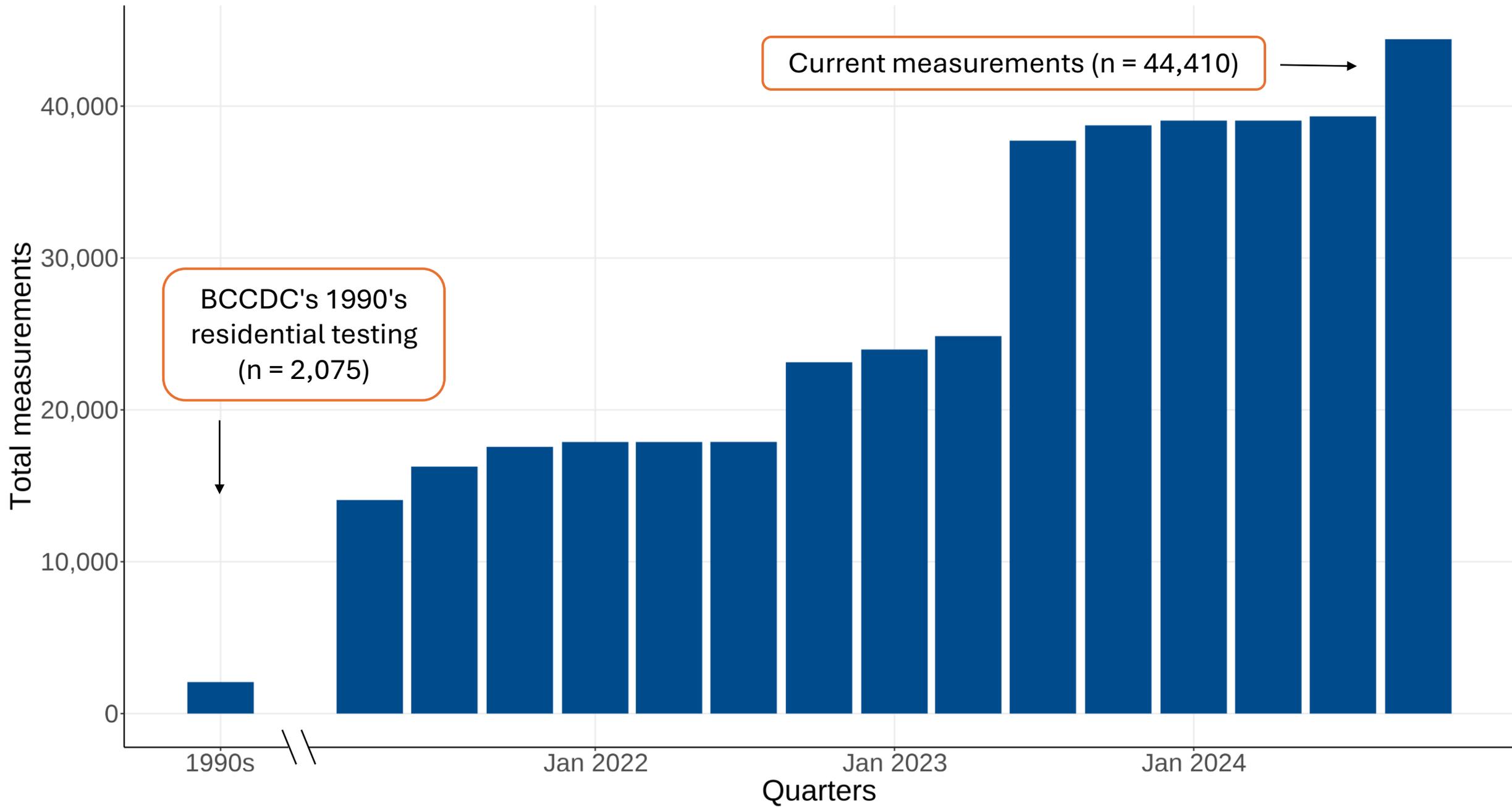
Industry, research groups,
government agencies, etc.



BC Radon Data
Repository (BCRDR)



Total measurements in the BC Radon Data Repository over time



At a glance...

19 external data providers

44,410 unique measurements

23,454 unique buildings

25,416 residential measurements

22,699 geocoded to points

6 external data requests



Health Canada



BC Centre for Disease Control
An agency of the Provincial Health Services Authority



Peter Chataway,
Fine Home Designs

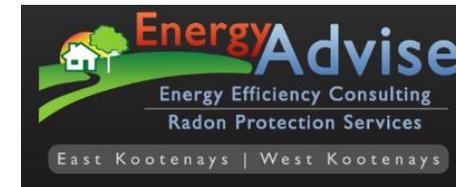


wildsight



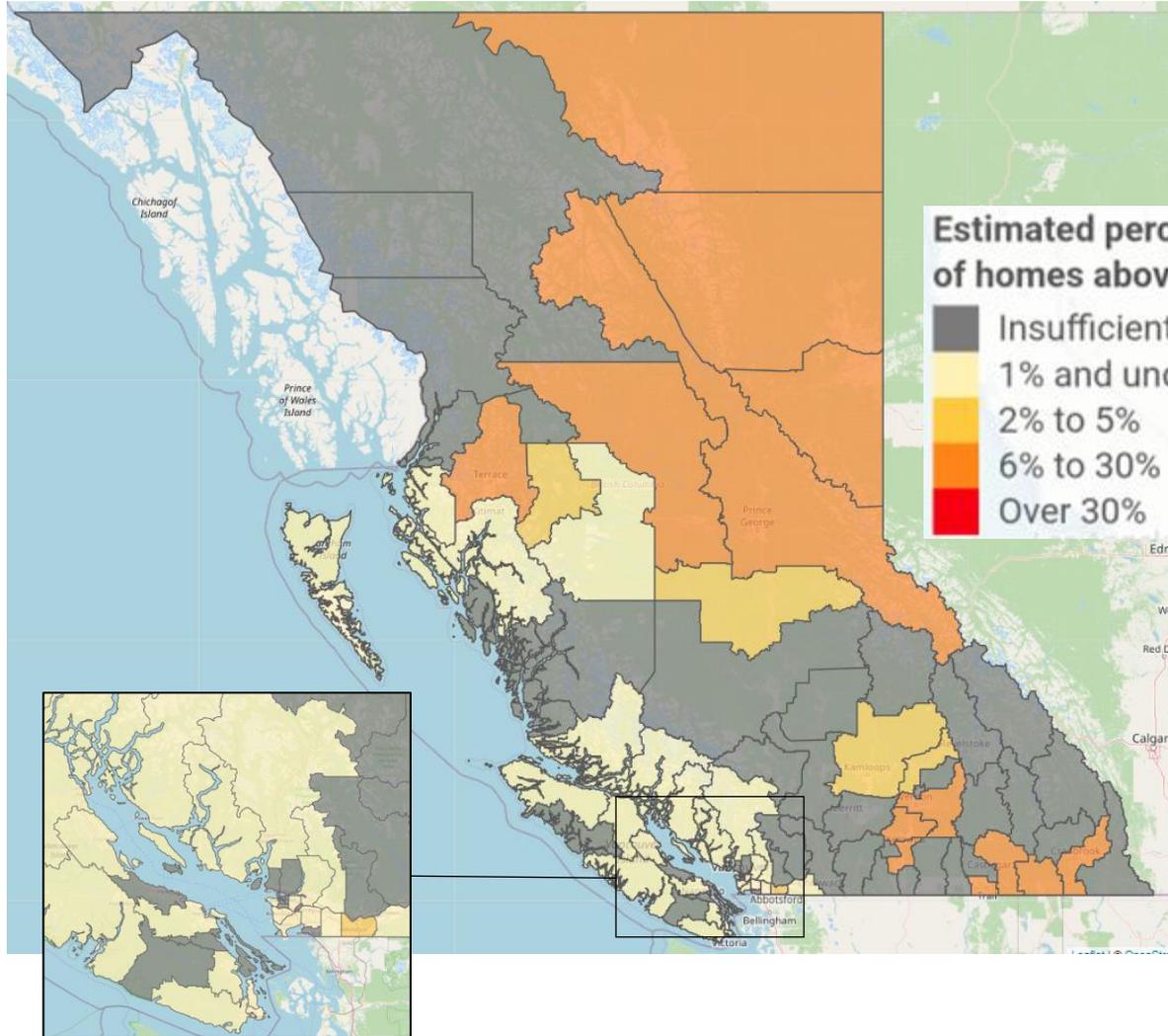
**Donna Schmidt
Lung Cancer
Prevention
Society**

Reducing Risk of Lung Cancer
from Radon

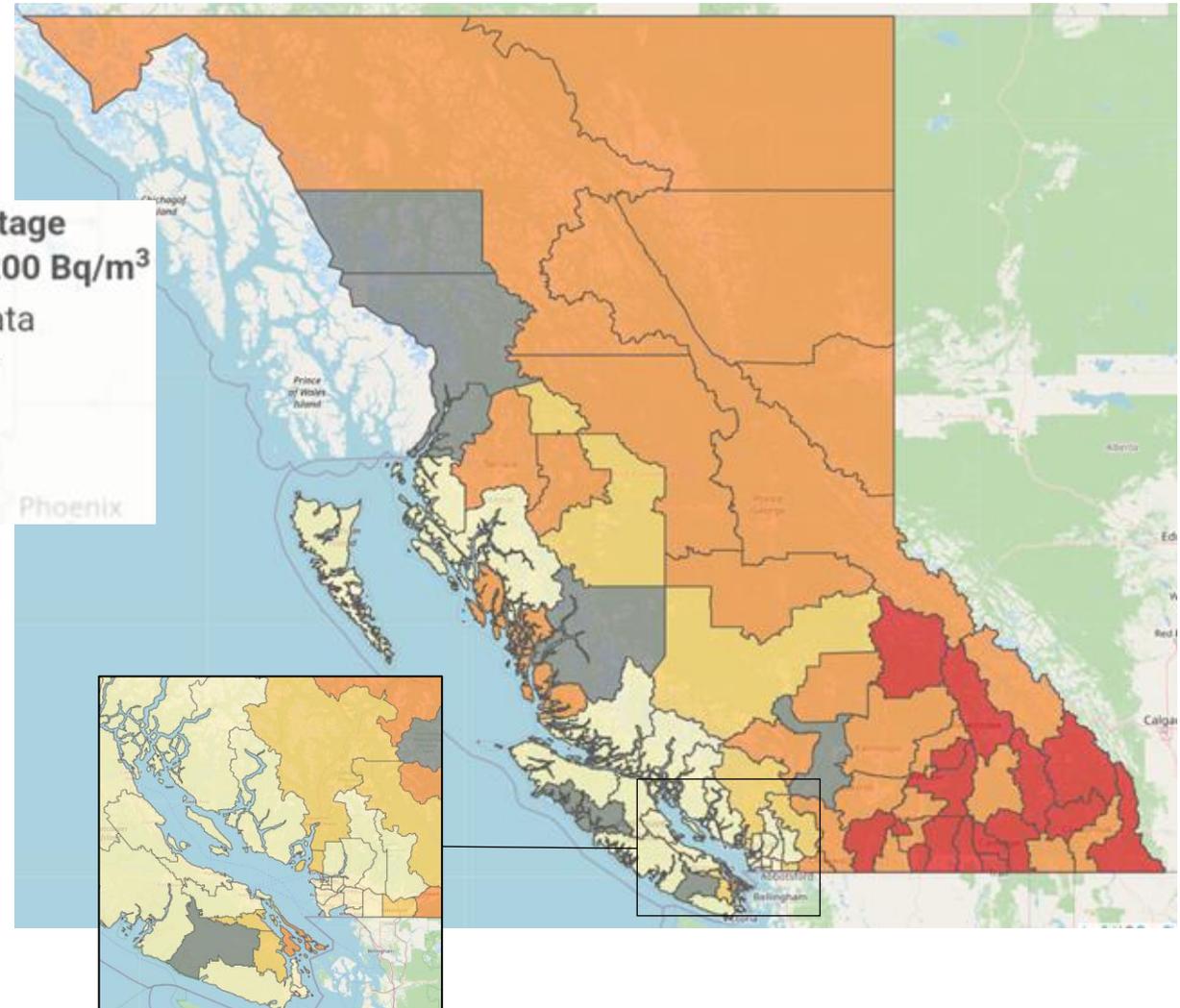


BCRDR reveals high radon levels otherwise missed

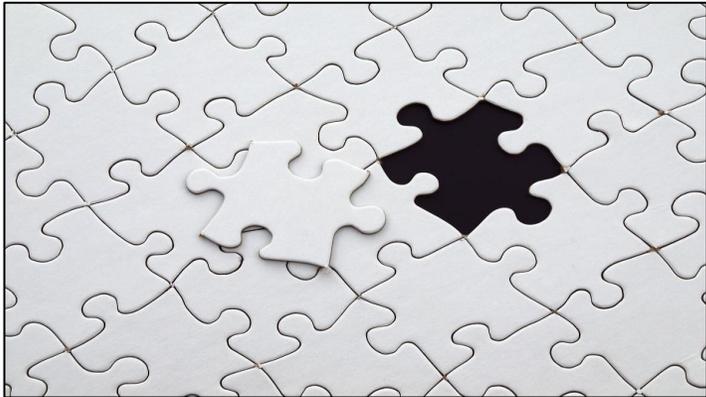
Cross-Canada survey data (n = 1,802)



All BCRDR residential data (n = 20,805)



Key features of the BC Radon Data Repository



- Voluntary participation
- Formalized with a data sharing agreement
- Data providers continue to own their data
- For research and health protection work
- External data request process
- No person-level data
- Anonymized spatial data

Technical details published in *CJPH*

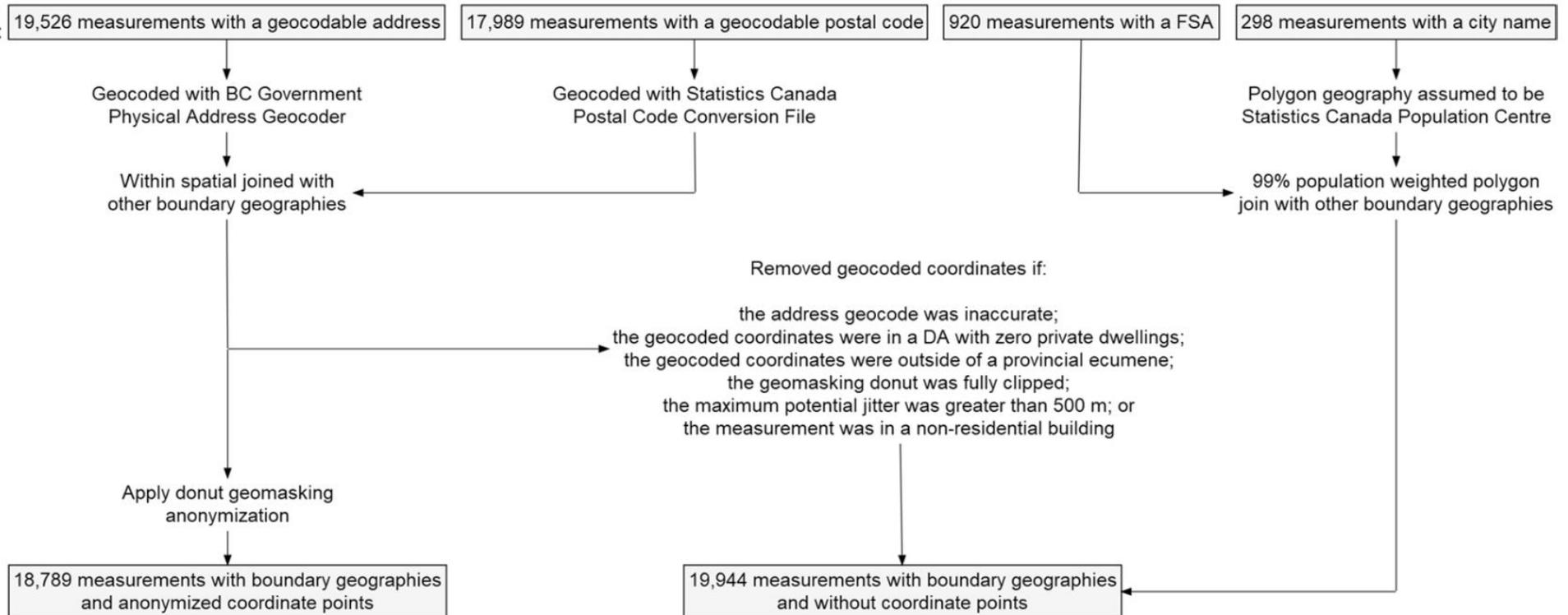
Home > [Canadian Journal of Public Health](#) > Article

The BC Radon Data Repository (BCRDR) and BC Radon Map: Integrating disparate data sources for improved public health communication

Innovations in Policy and Practice | [Open access](#) | Published: 28 May 2024

Volume 115, pages 680–687, (2024) | [Cite this article](#)

Most resolved spatial unit
in raw data from providers:

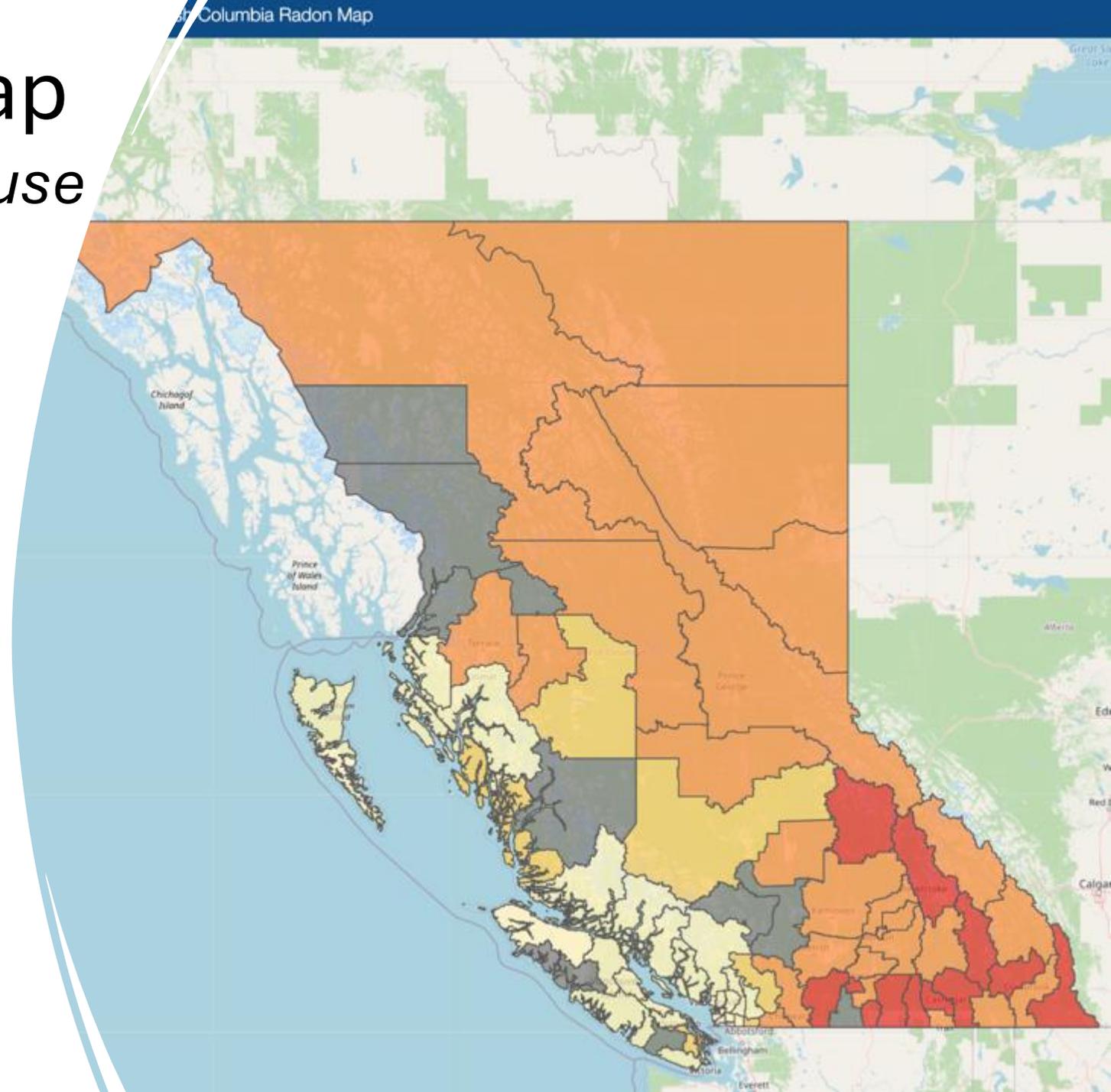


Interactive public map

Newly optimized for mobile use

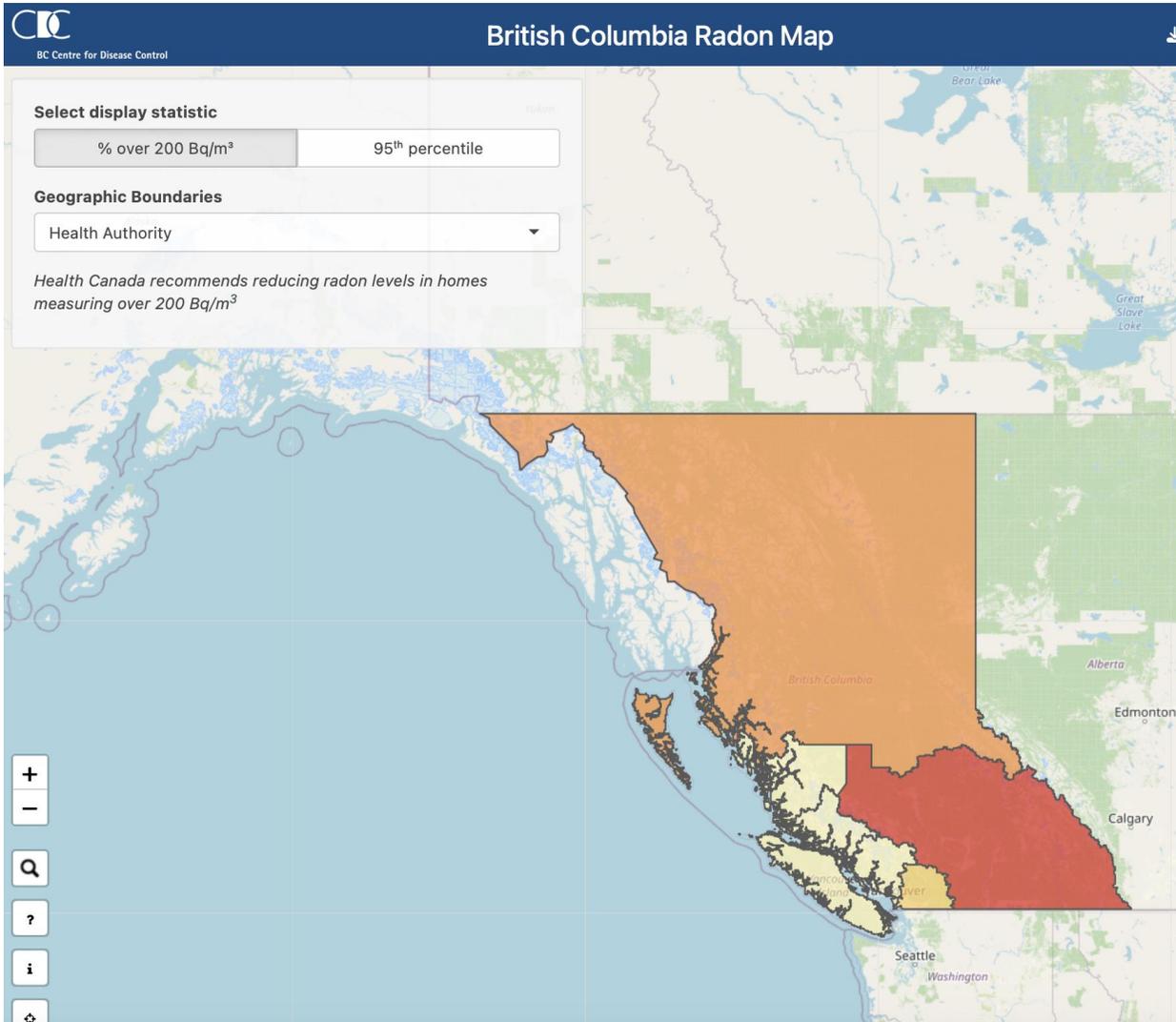
Scan the QR Code to view the BC
Radon Map and complete the survey!

<https://bccdc.shinyapps.io/bcradonmap/>



Interactive public map

Pop-out with details and context

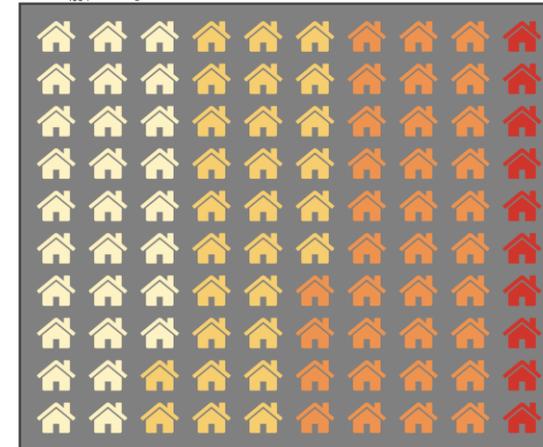


Indoor Radon Exposure in Kootenay Boundary

These coloured homes represent the estimated percentage of homes in this region that range in radon levels from 100 Bq/m³ and under to over 600 Bq/m³. These estimates are based on **2,968** samples taken in this region.

In this region, we estimate that **34%** of homes tested are in the 201-600 Bq/m³ range for radon levels and **10%** of homes tested are in the over 600 Bq/m³ range for radon levels.

Health Canada recommends to test every home for radon because levels can vary widely from house to house, even in the same neighborhood.

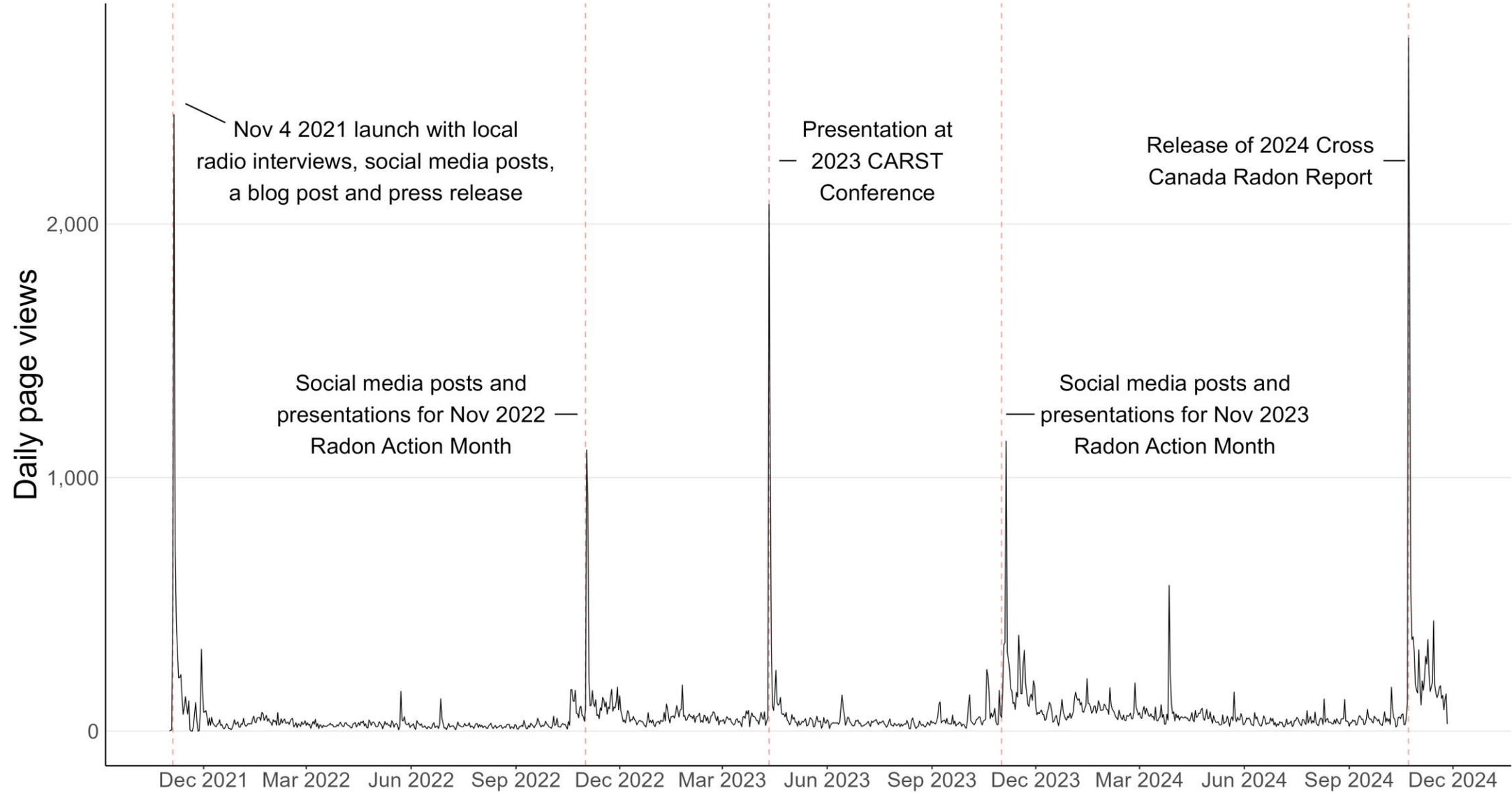


The table below shows you the **risk of developing lung cancer in your lifetime** from living in a home with different levels of radon.

Radon Level	Lifetime Risk of Lung Cancer	Lifetime Risk of Lung Cancer if you Smoke
🏠 100 Bq/m ³ and under	1%	12%
🏠 101-200 Bq/m ³	1.5%	15%
🏠 201-600 Bq/m ³	2%	17%
🏠 over 600 Bq/m ³	4%	26%

Consistent engagement

Let's get another spike!



BCRDR External Data Uses



Cross-Canada Survey of Radon Exposure in the Residential Buildings of Urban and Rural Communities

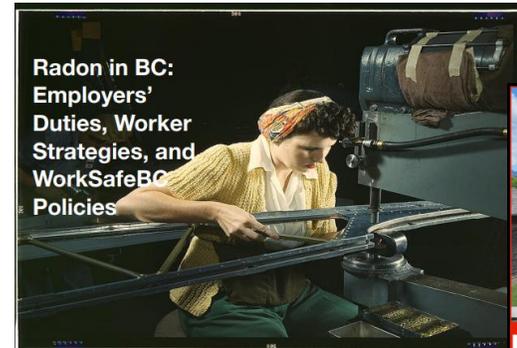


2024 REPORT

Version 1.1 (CCSR.24.1.1), released October, 2024

crosscanadaradon.ca

Density/proximity of oil and gas wells in Northeastern British Columbia (Canada) and indoor air radon concentrations



Ongoing externally led studies...

- to evaluate how different radon designs map impact users' risk comprehension and intent for risk-mitigating behavior
- to investigate radon concentrations across different building types

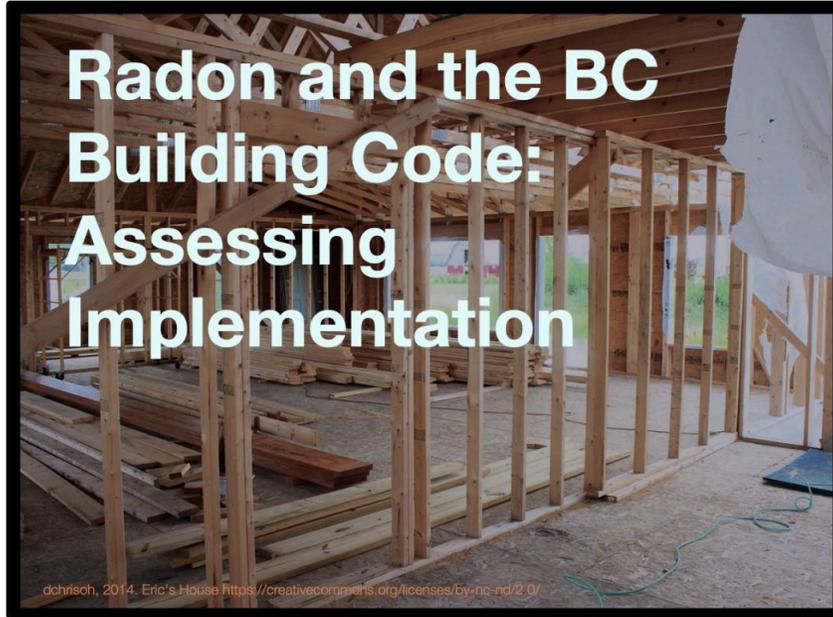
Example use – BC Building Code

Prior building code divided BC into two regions



Example use – BC Building Code

BC Lung Foundation pushed for universal radon rough-in using BC RDR



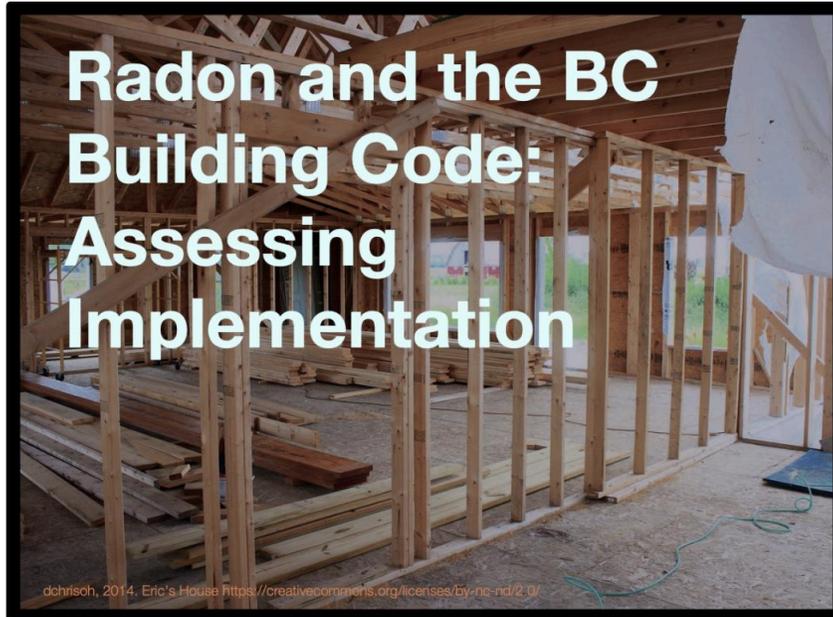
“...the BCCDC [has] released a new Radon Map for the public, based on data collected by the **British Columbia Radon Data Repository**. The BC Building Code 2018 list of communities is out of date in the sense that it is possible to see many communities on the map with an evident radon problem but which are not mentioned in the Code...”

The issue ... needs to be revisited and include data from the **BCCDC Radon Repository and Map.**”



Example use – BC Building Code

BC Lung Foundation pushed for universal radon rough-in using BC RDR



8. Conclusions and Recommendations

We recommend revisions to the Building Code as follows.

- Revise locations requiring radon resistant construction/passive systems by reference to updated BCCDC Radon Map.



Example use – BC Building Code

BCRDR data used to refine 2024 Building Code



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.

Information Bulletin

Building and Safety Standards Branch

PO Box 9844 Stn Prov Govt
Victoria BC V8W 9T2

Email: building.safety@gov.bc.ca

Website: www.gov.bc.ca/buildingcodes

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.**

Preliminary planning for a national data repository



Health
Canada

Jurisdictional scan of data holders and state of data compilation across Canada.

Pulling together national working group consisting of key data holders, data users, and other stakeholders representing regions across Canada.



Variety of radon testing devices available

Ensuring electronic devices are accurate



Canadian National Radon Proficiency Program

2023 Intercomparison Report

		Manufacturers stated Accuracy	Frequency of Reading	Digital Display or cell-phone app	Battery or Plug-in	Passed C-NRPP Performance Test For more details click here.
	Airthings Corentium Home	±10% (after 7 days at 200 Bq/m ³), ±5% after 2 months of monitoring	12 hours 24 hours 7 days (first reading will take 24 hrs)	Short-term and long-term average shown on monitor display.	Battery	✓
	Airthings Wave Plus	±10% (after 7 days at 200 Bq/m ³), ±5% after 2 months of monitoring	Hourly	Long-term average shown on cell phone app. Color-coded indication of levels on monitor.	Battery	✓
	Airthings View Plus	After 30 days at 200 Bq/m ³ , ±10% on the 7 day average and ±5% on the 2 month average	Hourly	Short-term average shown on monitor display; long-term average shown on app.	Battery or plug in (USB-C)	✓
	EcoSense EcoQube	+/-10% at 370 Bq/m ³ after 10 hours	Measures every 10 minutes and displays an hourly rolling average.	Hourly level shown on display, long term average available on the app.	Plug in	✓
	EcoSense EcoQube Blue	+/-14% at 370Bq/m ³	10 mins	Device displays 1 hour, 1 day, 1 week and 1 month rolling averages.	Plug in	✓
	EcoSense Radon Eye RD200	±10% at 370 Bq/m ³ after 10 hours	10 mins	Displays 1 hour rolling average; long-term display on app.	Plug-in	✓
	SunRadon Luft	±10% (after 7 days at 200 Bq/m ³)	Initial reading takes 90 mins, hourly.	Long-term and short-term averages shown on the app. Color coded indication of levels on monitor display.	Plug-in	✓

info@c-nrpp.ca

www.c-nrpp.ca

For recommended devices see: <https://c-nrpp.ca/wp-content/uploads/2023/10/Digital-Device-Report-Oct-2023.pdf>



Government of Canada

Gouvernement du Canada

Search website

Canada.ca > [Health](#) > [Recalls and safety alerts](#)

Recalls and safety alerts

Consumer product recall

Air Steward Portable Radon Monitor recalled due to Inaccurate Radon Detection

Last updated: 2022-09-13

Summary



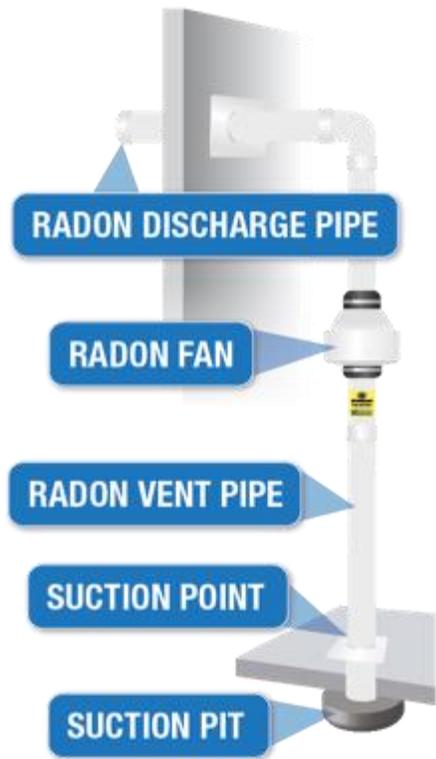
Product: Air Steward Portable Radon Monitor

Issue: Consumer products - Chemical hazard

What to do: Immediately stop using the recalled radon monitoring device.



For recalled products see: <https://recalls-rappels.canada.ca/en>



What if your level is above the Guideline level?

- **Clear and effective intervention**
- **A radon mitigation system is the most effective way to reduce radon**
- **Simple to maintain**
- **Also called “Sub Slab Depressurization”**

ALL HOMES CAN BE FIXED.

Current building codes not require full systems-

How to increase awareness and testing?

Federal government

- Postcards
- Radon Action Guides
- Radon Action Month (Nov)

Provincial government

- Public Health testing initiatives
- Awareness programs
- Contests
- School and childcare testing
- Workplace testing – Ontario Lung

Municipal

- Options for building officials

RADON GAS
CAUSES LUNG CANCER

Lung cancer is the **most common cancer** in Canada and has a low survival rate. Long-term exposure to radon is the **#1 cause of lung cancer** for non-smokers.

Too many non-smokers do not think they are at risk of developing lung cancer.

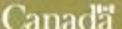
3,000+ CANADIANS a year die from radon-induced lung cancer.	30% OF CASES are non-smokers.	19% PROBABILITY of surviving lung cancer (5 years).
--------------------------------------------------------------------------------	-----------------------------------------------	---------------------------------------------------------------------

All homes have radon gas, the question is – how much?

 You can reduce your risk of radon-induced lung cancer. **The first step is to test your home.**
www.takeactiononradon.ca

Find out more:
www.canada.ca/radon



 Health Canada Santé Canada 

Examples of community testing in Ontario

Previous community-based testing has been done in:

- Cambridge- tested public buildings
- Kingston, Frontenac and Lennox & Addington area.:
 - Study of 1,047 homes
- Thunder Bay/District Health Unit
- Windsor-Essex Public Health
- Oliver-Paipoonge Municipality
- Ottawa- Capital Regional District
- Southwestern Public Health – Woodstock and St. Thomas
- North Kawartha
- Augusta
- Leeds and 1000 Islands
- Chatham- Kent Public Health
- Workplace testing- Ontario Lung Association

Testing in 2024/25 in *currently* being done in:

- Kenora
- Haldimand-Norfolk Health and Social Services
- Township of Ashfield-Colborne-Wawanosh
- Algoma/Elliot Lake (starting Jan 2025)

Take Action on Radon community reports



NORTH KAWARTHA, ON

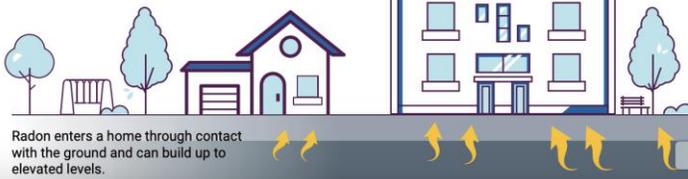
100 Radon Test Kit Challenge

51 HOMES participated by testing for radon gas during the winter of 2023 using 91 day alpha track detectors. This represents approximately 4% of the community dwellings.

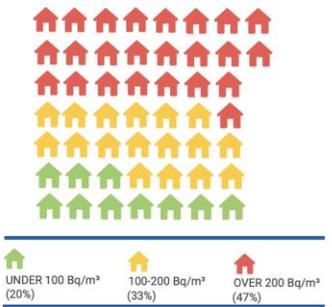
47% of homes tested above Health Canada's guideline of 200 Bq/m³

 Radon is a naturally occurring radioactive gas that comes from the ground.

 Exposure to elevated levels of radon is linked to increased chances of developing lung cancer.



Radon enters a home through contact with the ground and can build up to elevated levels.

Levels can vary between neighbouring houses. The only way to know your radon level is to test.



ST. THOMAS and WOODSTOCK, ON

100 Radon Test Kit Challenge

115 HOMES participated by testing for radon gas during the winter of 2023 using 91 day alpha track detectors. This represents less than 1% of the community dwellings.

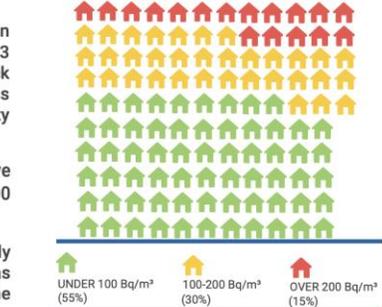
15% of homes tested above Health Canada's guideline of 200 Bq/m³

 Radon is a naturally occurring radioactive gas that comes from the ground.

 Exposure to elevated levels of radon is linked to increased chances of developing lung cancer.



Radon enters a home through contact with the ground and can build up to elevated levels.

Levels can vary between neighbouring houses. The only way to know your radon level is to test.



OTTAWA, ON

100 Radon Test Kit Challenge

335 HOMES participated by testing for radon gas during the winter of 2021. This represents approximately 0.1% of the community dwellings.

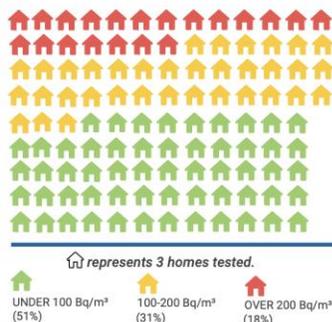
1 in 5 homes tested above Health Canada's guideline of 200 Bq/m³

 Radon is a naturally occurring radioactive gas that comes from the ground.

 Exposure to elevated levels of radon is linked to increased chances of developing lung cancer.

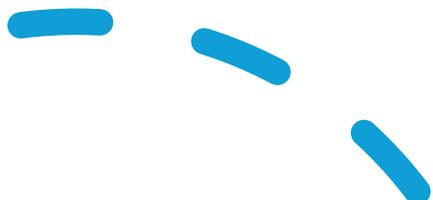


Radon enters a home through contact with the ground and can build up to elevated levels.

Levels can vary between neighbouring houses. The only way to know your radon level is to test.

In summary



Radon is a known human lung carcinogen

- May cause other health effects
- Awareness and testing rates still fairly low

Indoor levels appear to be **increasing** in Canada

- Building changes
- Energy efficiency...

Public health can get involved

- Support community testing
- Promote radon action month
- Test public buildings
- Collate and share data



Thanks for listening!

Questions?

anne-marie.nicol@bccdc.ca

jeffrey.trieu@bccdc.ca

david.mcvea@bccdc.ca



Cats like radon testing because they breathe indoor air too!

Occupational cohorts- other health effects??

Pooled Uranium Miner cohort studies have seen increased rates of **lung diseases** outside cancer

- Richardson, D. B., et al. "Mortality among uranium miners in North America and Europe: the pooled uranium miners analysis (PUMA)." *International journal of epidemiology* 50.2 (2021): 633-643

Non statistical associations for **cerebrovascular diseases**

- Lu, Liping, et al. "Radon exposure and risk of cerebrovascular disease: a systematic review and meta-analysis in occupational and general population studies." *Environmental Science and Pollution Research* 29.30 (2022): 45031-45043.

Reddy A, et al. Residential radon exposure and cancer. Oncology reviews. 2022 Feb 2;16(1).

More research is needed to evaluate the association between residential radon and non-lung cancers, particularly with regard to skin cancer, central nervous system (CNS) cancer, renal, and stomach cancer, in which existing literature suggests potential associations with residential radon may exist.

However, the literature largely demonstrates that lung cancer is the primary concern associated with residential radon exposure; the lack of association with nonlung cancers could reflect the lack of studies which have an adequate sample size, establish accurate levels of radon exposure, and control for confounders.

Radon exposure during **pregnancy**

- Papatheodorou, Stefania, et al. "Residential radon exposure and **hypertensive disorders of pregnancy** in Massachusetts, USA: A cohort study." *Environment International* 146 (2021): 106285.
- Heo, Seulkee, et al. "Associations between gestational residential radon exposure and **term low birthweight** in Connecticut, USA." *Epidemiology* 35.6 (2024): 834-843.
- Angley, Meghan, et al. "Exposure to Radon and Ambient Particle Radioactivity During Pregnancy and Adverse Maternal, Fetal and Perinatal Outcomes: The Current Literature and Potential Mechanisms." *Environmental Research* (2024): 120272.

Radon is soluble in **blood** and **moves to different organs and tissues**

- Harley NH, Leslie LA. Radon-222 and leukemia. *Health Physics*. 2023 Jun 1;124(6):475-7.
- Hinrichs, Annika, et al. "Radon solubility in different tissues after short term exposure." *International Journal of Environmental Research and Public Health* 20.3 (2023): 1773

Randomly sampled radon measurements in BCRDR higher than non-randomly sampled measurements

May be due to:

- More energy efficient homes over time
- Testing more likely in at-risk areas
- ‘Neighbor effect’

