Radiation Safety Institute of Canada
Institut de radioprotection du Canada

Lunch, Learn, & Dance
Wellness Webinars

April 22, 2021

Radon

Followed by Araguacu Latin Dance Company

Good Science in Plain Language®

Radiation Safety Institute of Canada
Institut de radioprotection du Canada

Webinar Functionality

- Audio and video
  - Will be from the presenters only
  - Use computer or telephone (call in)
  - Computer seems to give the best sound quality
- Use the “Chat” feature to enter comments
- Use the “Questions” feature to ask questions
- Posted on webinar page
  - Video, Q&A answers, copy of the slides
- Follow up email will be sent
  - Topics covered, time of attendance
- It may be possible to change your Zoom view if the controls are hiding the closed captioning.

Overview

- What is radon?
- Where is it found?
- How does radon get into homes?
- What are the health risks?
- How do I measure for it?
- Radon guidelines
- What to do for elevated levels?
- Where to get more information?

What is Radon?

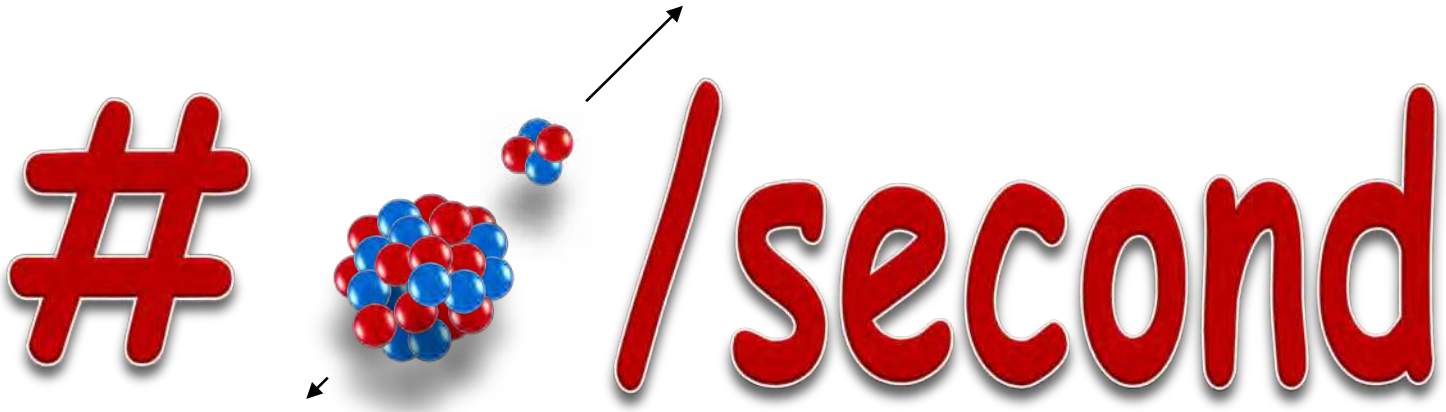
- Radioactive noble gas
- Colourless, odourless, no taste/smell
- Formed naturally
  - breakdown of uranium
- Properties include:
  - Water soluble
  - More dense than air
  - Can accumulate in enclosed spaces

Where is Radon Found?

- Radon is found all over the world
- Canada
  - all provinces and territories
- It is a gas
  - Forms in rocks and soil
  - Moves through cracks/spaces
  - Enters the air/dissolves in water

Activity

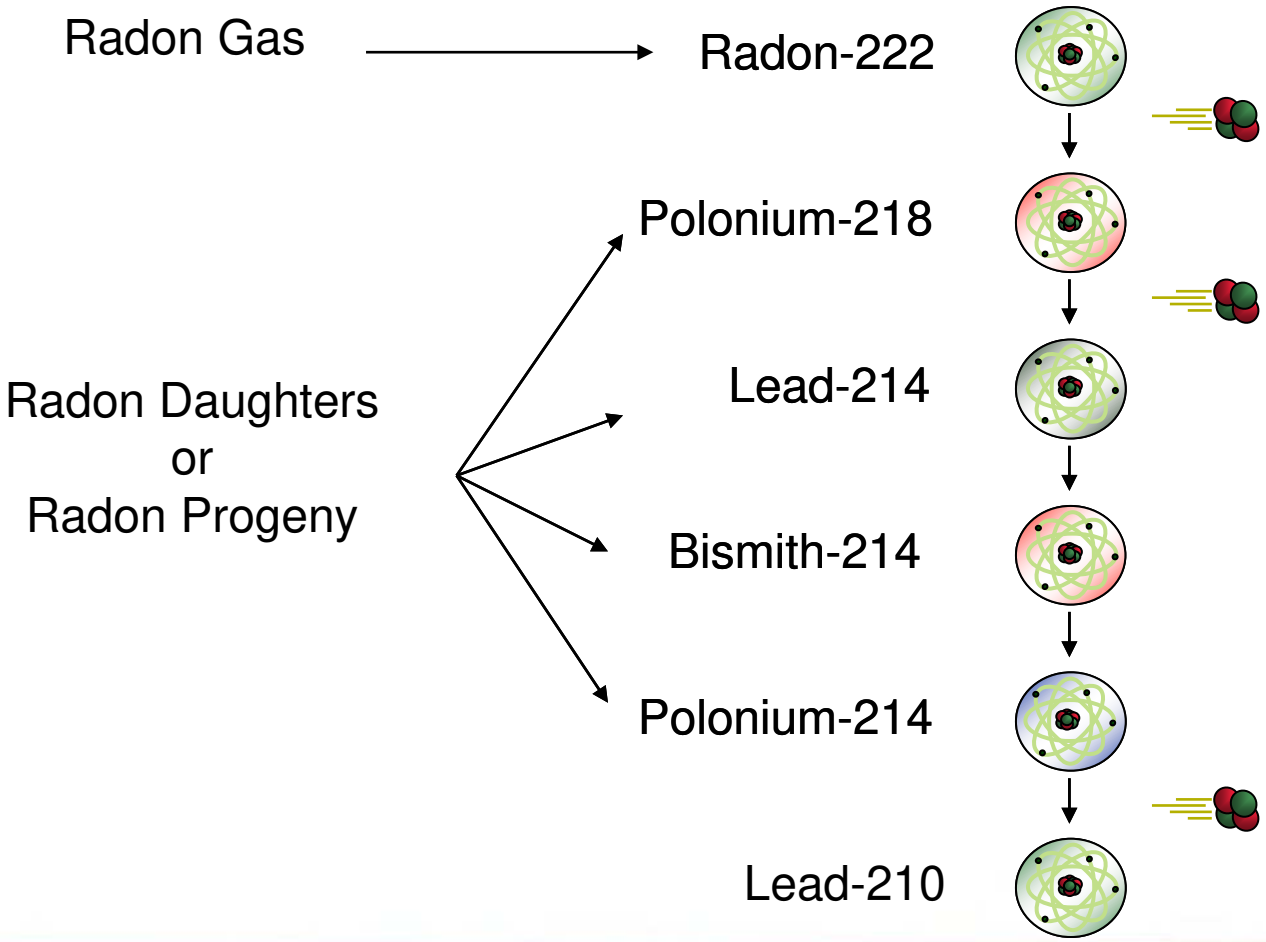
- ***Activity***: The rate of radioactive decay.
  - The number of radionuclide decays per unit of time.



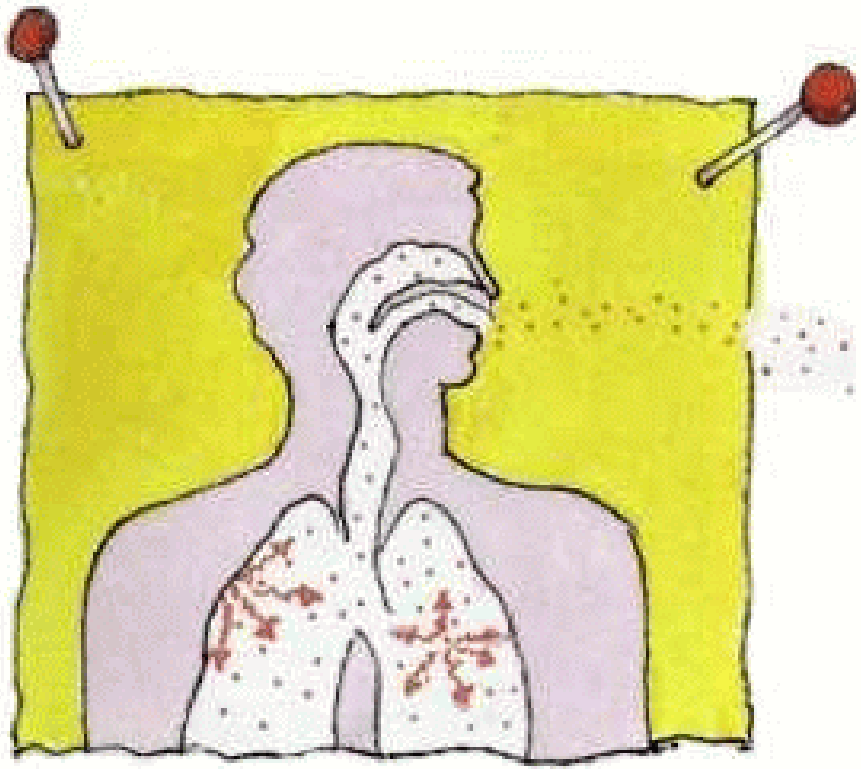
Half-Life

- ***Half-life***: The time required for a radioactive sample to lose 50% of its activity by radioactive decay.
- Each radioactive atom has its own unique half-life, regardless of the quantity or form.
  - Element or compound
  - Solid, liquid, gas

Radon-222 and Short-Lived Progeny



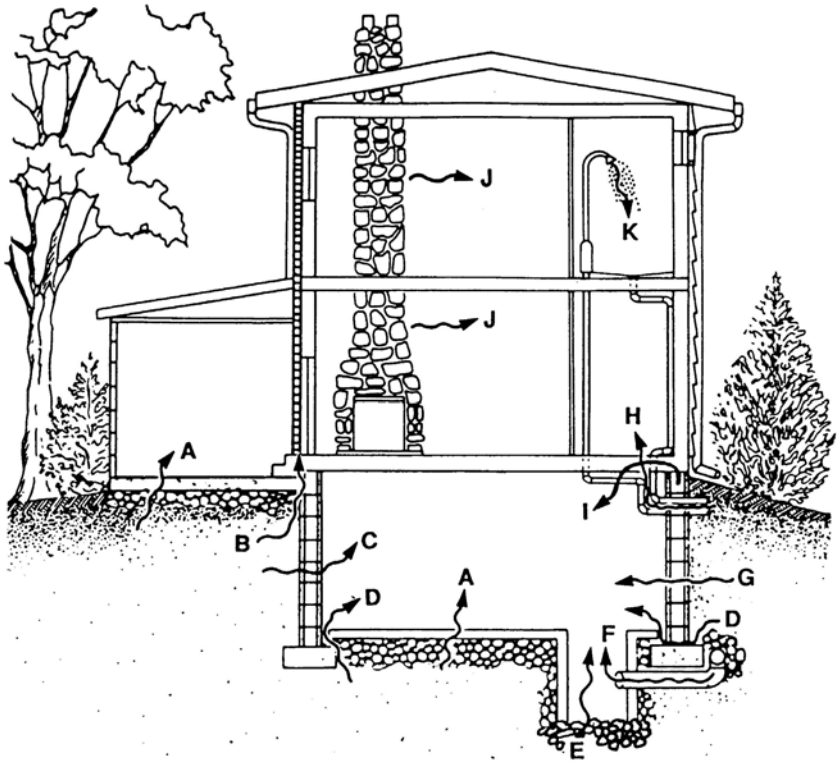
Radon & Progeny Inhalation



- Radon progeny
  - Settle on dust
  - Inhaled and stay in lungs
  - Po-218, Po-214
  - Increase possibility of mutation
  - Increase risk of lung cancer

Radiation Safety Institute of Canada
Institut de radioprotection du Canada

Radon Sources – Building Entry

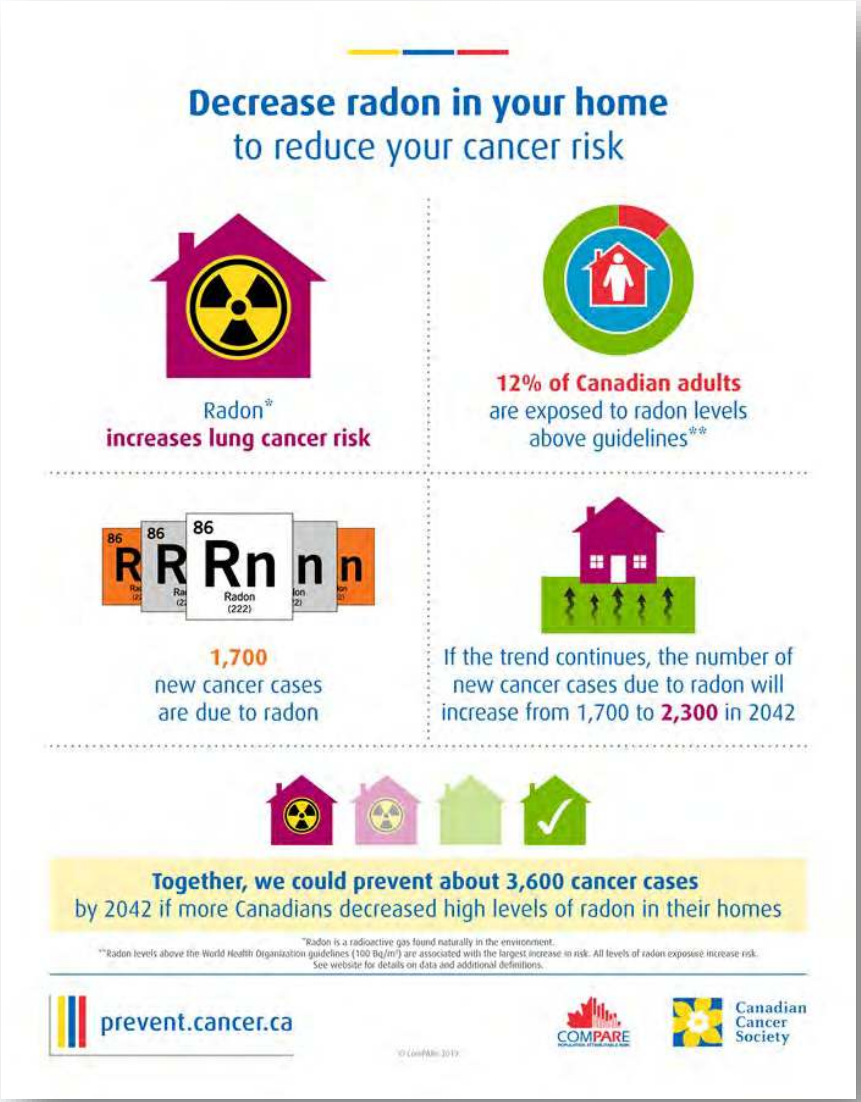


- Cracks in foundations
- Gaps at floor-wall joings
- Concrete block walls
- Open sumps and floor drains
- Around utility entry
- Natural gas
- Water emission

Radon Sources – Water Emission

- Dissolves in water
- Escapes into air
  - Slowly in still water
  - More quickly when agitated
  - Depends on temperature and agitation level
  - Some will remain dissolved
  - 100 Bq/l results in 10 Bq/m^3

Health Effects



From the Canadian Cancer Society

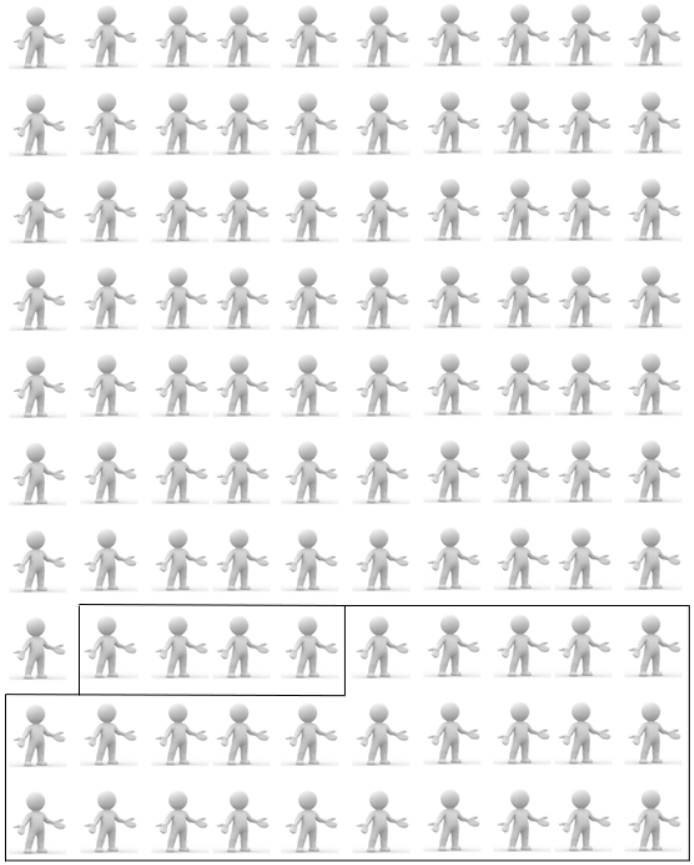
Health Effects

- Stochastic/probabilistic
- Not everyone exposed will get lung cancer
- Increased risk
- Depends on
  - Amount of radon exposure
  - Time duration of radon exposure
  - Age
  - Smoking status

The Risk - Some Numbers

- The risk of developing a fatal cancer as a result of exposure to radiation is approximately 4% per 1000 mSv.

The Risk - Some Numbers



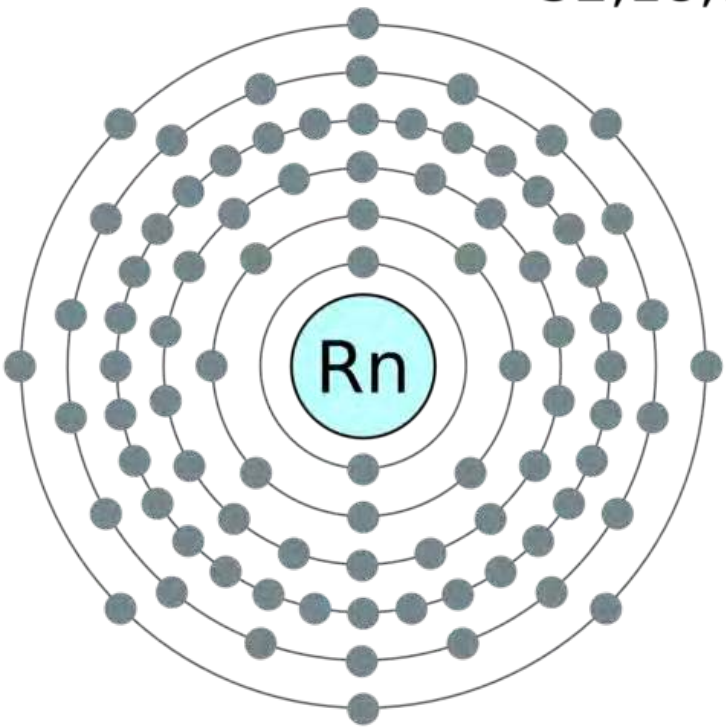
- Approximately 25% of people develop a fatal cancer in their life.
- So, this person's risk of developing a fatal cancer becomes 29% instead of 25%.

Radiation Detection

- No senses to detect
- Must rely on instruments

Radiation Detection

86: Radon 2,8,18, 32,18,8



- Radon progeny give the most dose
  - Difficult to measure
- Radon gas concentration measured
- Converted to dose using equilibrium factor

Radiation Detection – Radon

- Short-term
  - Grab sample
  - Charcoal canister
- Long-term
  - Electret monitor (E-PERM)
  - Alpha track monitor
- Continuous electronic

Radiation Detection – Radon Short-term

- Sample in a moment of time
- May or may not require power
- Sent away for analysis
  - Radon decays during transit
- Inexpensive
- Inaccurate
- Not recommended by Health Canada

Radiation Safety Institute of Canada
Institut de radioprotection du Canada

Indoor Radon Concentration

- Affected by
  - Uranium concentration
  - Soil characteristics
  - Water concentration and usage
  - HVAC system
  - Outdoor and indoor environment
  - Occupancy factors

Radiation Safety Institute of Canada
Institut de radioprotection du Canada

Radiation Detection – Radon Long-term

- Gather data for 3 to 12 months
- Generally do not require power
- Sent away for analysis
- Much better measure of average concentration
- Relatively inexpensive
- Health Canada recommended
  - Heating season
  - Lowest occupied level

Radiation Detection – Radon Alpha Track

Example alpha track damage viewed under a microscope.

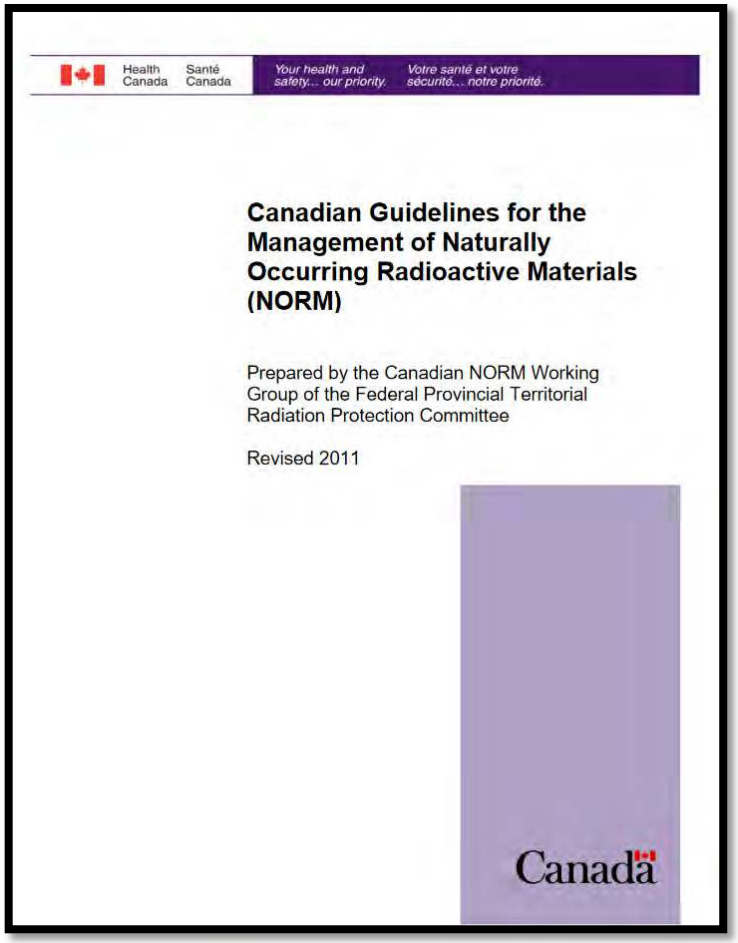
Radiation Detection – Radon Electret

Radiation Detection – Radon Continuous

- Ion chamber
- Real-time readout
- Require power supply
- Need to collect data over a long period
- Good to observe fluctuations
- Expensive
- Require annual calibration

Canadian NORM Guidelines

- Published by Health Canada
- Prepared by the FPTRPC NORM working group
- Provides dose conversion factors
  - Based on measured radon or radon progeny concentration
- Provides classifications based on radon concentration
  - Indicates actions to be taken to protect the workers



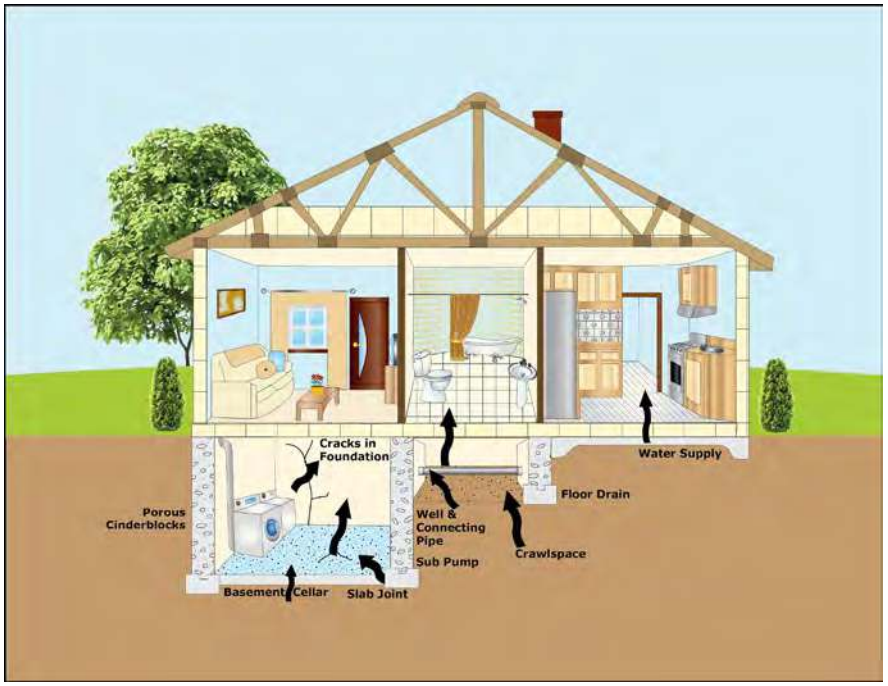
Radon Measurement Units

- Radon gas
  - activity concentration (Bq/m^3).
  - 200 Bq/m^3). For 2000 hrs ~ 1.4 mSv
- Radon progeny
  - Working Levels (WL)
  - 1 WL for 170 hrs ~ 5 mSv

Radon in Water Guidelines

- Health risk from ingesting water negligible
- Significantly increases airborne radon
- No guidelines in Canada for radon concentrations in drinking water

Radon in Homes



United States Environmental Protection Agency | US EPA, Public domain

- No Canadian regulation
  - Some provincial/territorial building codes
- Health Canada
  - Remediation within 1 year if over 600 Bq/m^3
  - Remediation within 2 years if over 200 Bq/m^3
  - New home construction
    - Minimize radon entry
    - Facilitate remediation

Regulation of Radon in Workplaces

- Federal
  - Federally regulated workplaces
  - Workplaces regulated under the Nuclear Safety and Control Act
    - Uranium mines, nuclear power, radiation sources, etc.
    - Radiation protection regulations require dose from radon to be monitored and reported
- Provincial/Territorial
  - Workplaces under provincial/territorial regulation
  - Occupational Health and Safety Regulations
  - Mine Safety Regulations

Canadian NORM Guidelines

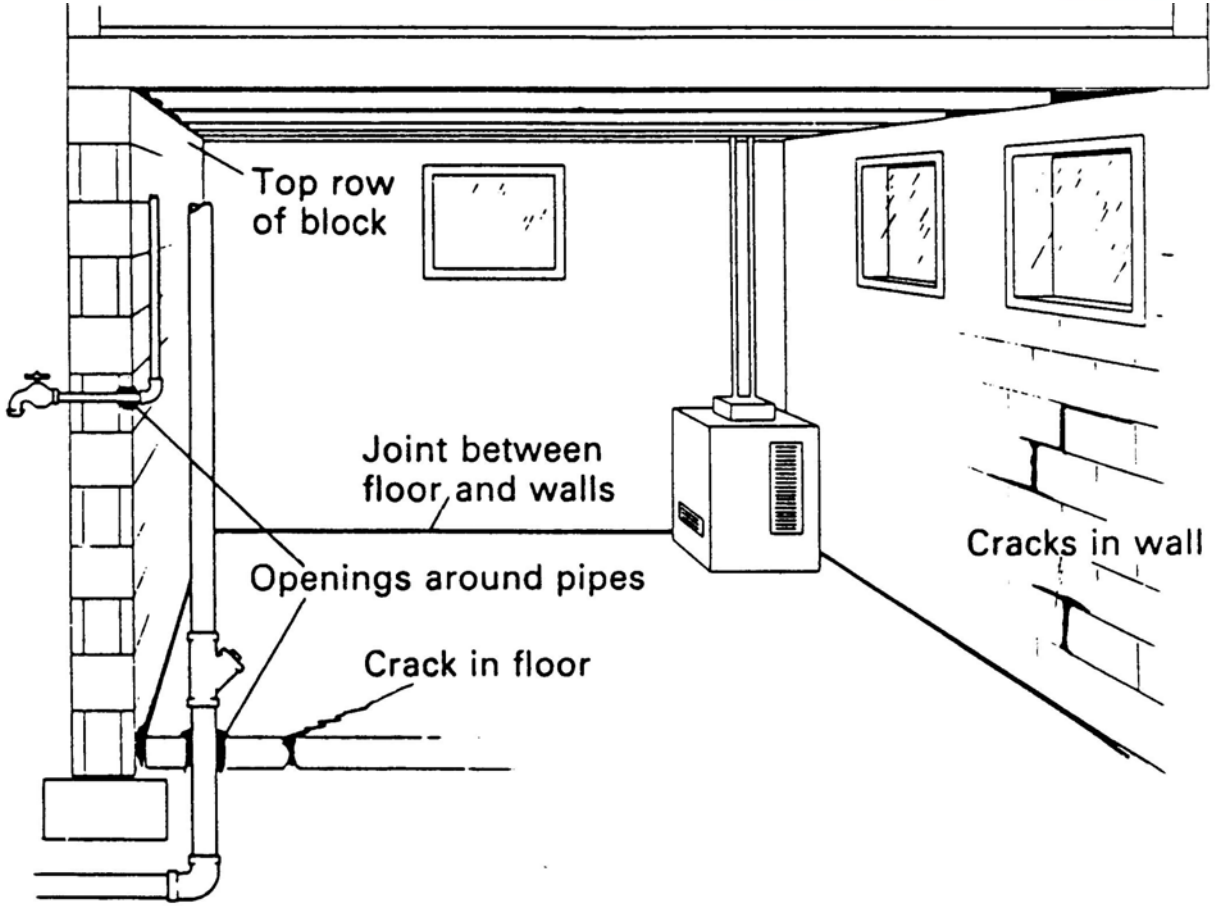
Exposure Bq/m³ (WLM)	Annual Dose mSv	NORM Classification
< 200 (0.25)	1.3	Unrestricted
200 – 800 (0.25–1)	1.3 – 5	Norm Management -Application of an ALARA program which may include changes in work practices, changes to work procedures, and introduction of access controls for members of the public and incidentally exposed workers -Should reduce radon levels to below 200 Bq/m³.
> 800 (1)	> 5	Radiation Protection Management -A Radiation Protection Management should be implemented (radiation protection program, dosimetry for workers, provide protective equipment). The program should include steps to reduce the radon levels to below 200 Bq/m³.

Radon Progeny Dosimeters

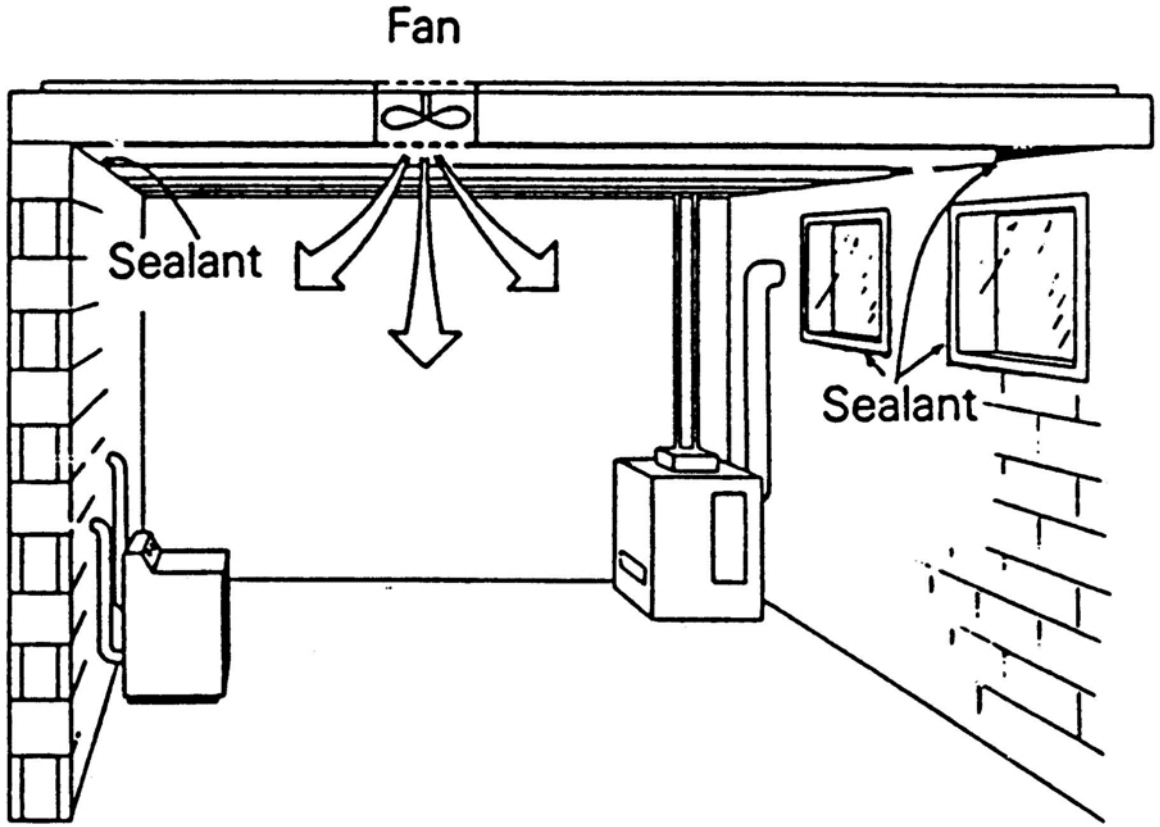
- Mandated for use in Uranium mines
- Alpha track
- Measures the total exposure to radon progeny over time
- Dose calculated from the exposure
- Doses above a certain require licensed dosimetry service provider

Personal Alpha Dosimeter

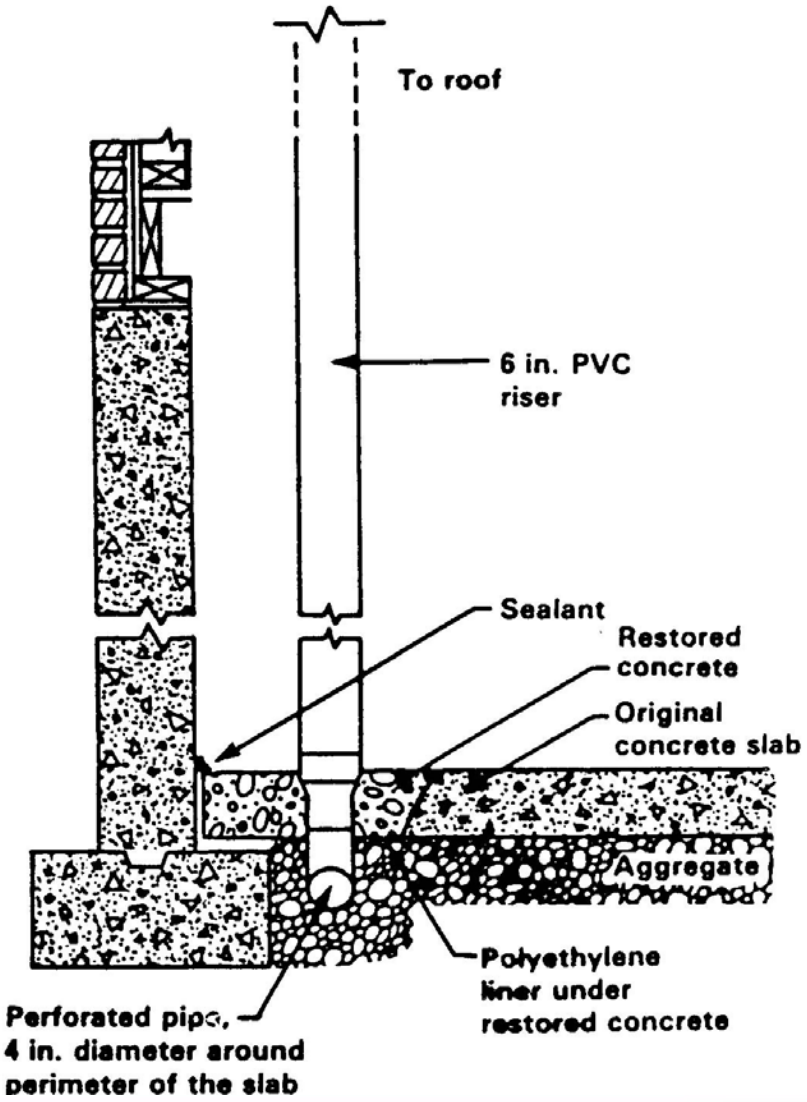
Control of Radon Hazards



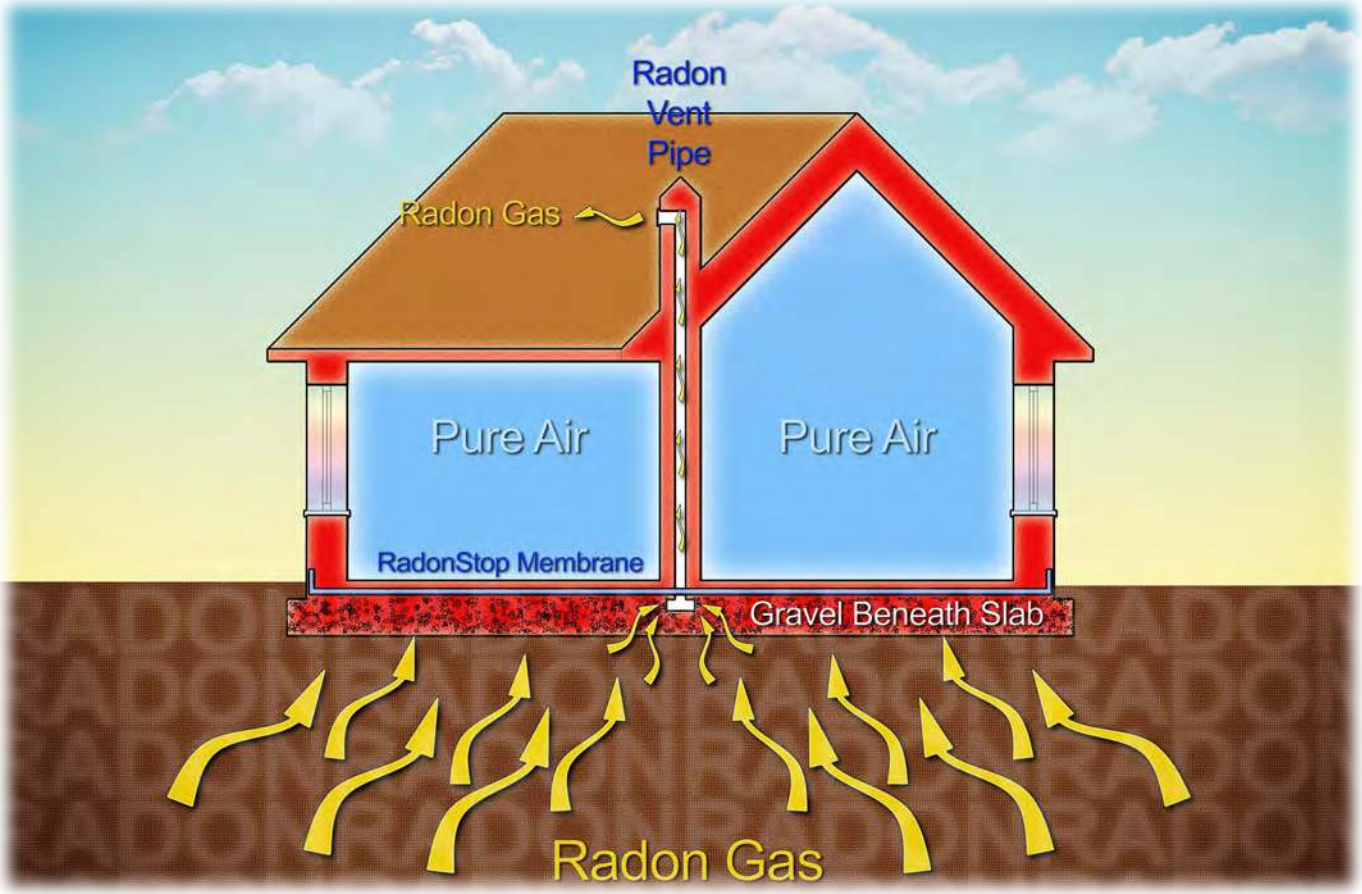
Control of Radon Hazards



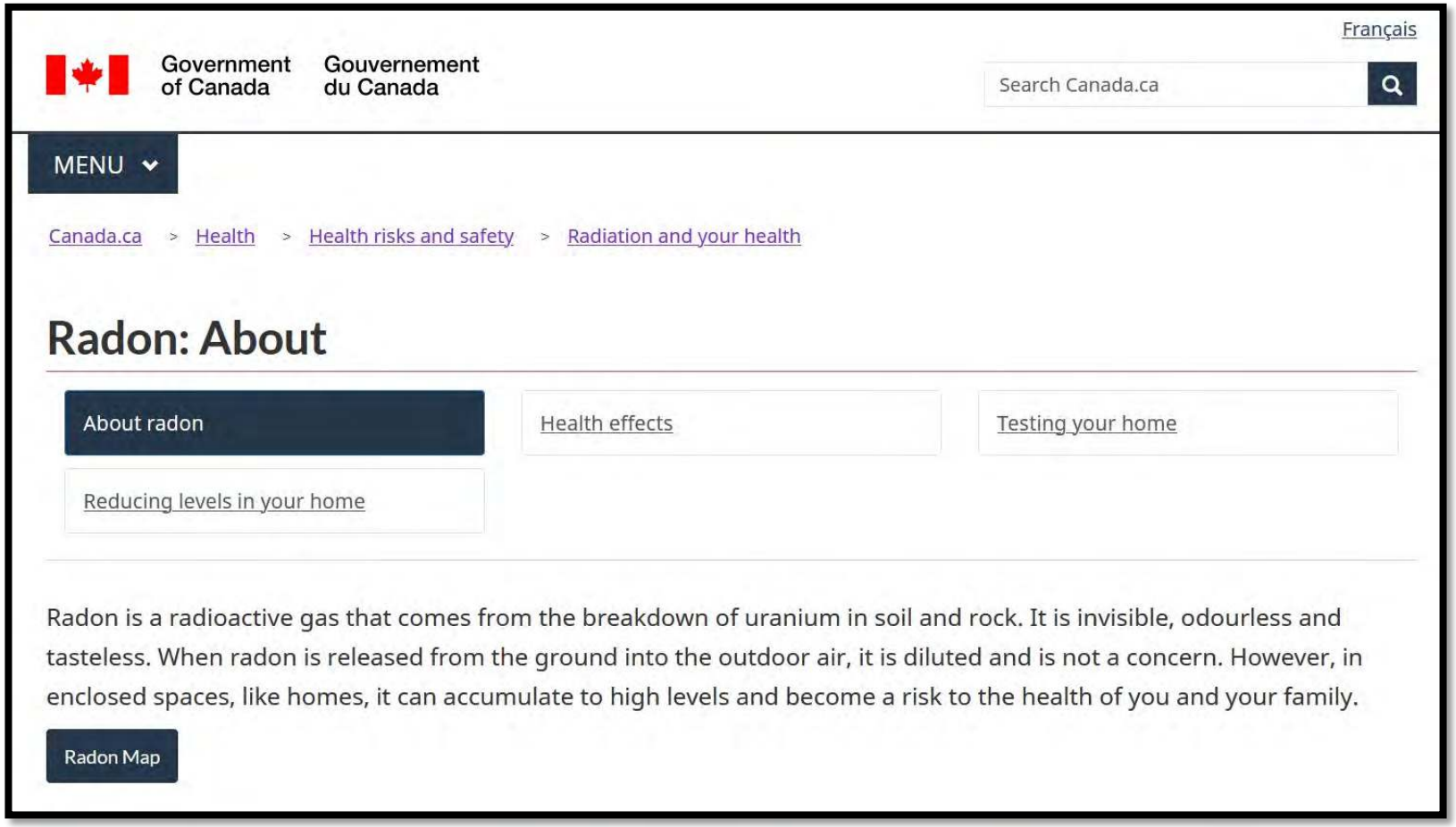
Control of Radon Hazards



Summary of Radon Hazards and Control



Health Canada



Cross-Canada Survey of Radon Concentrations in Homes

Radiation Safety Institute of Canada

Good Science in Plain Language®

	"Raw" Percentage of Homes with Radon Concentrations:			
Province/Territory	% Below 200 Bq/m^3	% 200 to 600 Bq/m^3	% Above 600 Bq/m^3	% Above 200 Bq/m^3
Alberta (AB)	93.4	6.0	0.6	6.6
British Columbia (BC)	92.1	6.7	1.2	7.9
Manitoba (MB)	76.3	21.1	2.6	23.7
New Brunswick (NB)	75.2	18.7	6.1	24.8
Newfoundland and Labrador (NL)	94.1	4.6	1.3	5.9
Nova Scotia (NS)	91.2	6.3	2.5	8.8
Northwest Territories (NT)	94.6	4.9	0.5	5.4
Nunavut (NU)	100.0	0.0	0.0	0.0
Ontario (ON)	91.8	7.3	0.9	8.2
Prince Edward Island (PE)	96.5	3.5	0.0	3.5
Quebec (QC)	89.9	9.0	1.1	10.1
Saskatchewan (SK)	83.7	15.3	1.0	16.3
Yukon (YT)	80.4	13.8	5.8	19.6

Government of Canada | Gouvernement du Canada

Search NRC.Canada.ca | Search

MENU

Canada.ca > National Research Council Canada > Certifications, evaluations and standards > Codes Canada > Construction Innovation

Radon control in Canadian homes

From: National Research Council Canada

March 25, 2019 - Ottawa, Ontario

Since 2011, the National Research Council of Canada (NRC) and Health Canada's National Radon Program have been working on a multi-year study to develop safe and cost-effective solutions to minimize the health risks from radon gas exposure in Canadian homes and to provide guidance for radon prevention and mitigation.

Radon Diffusion Test Chamber and a test sample

The intent is to:

- support the National Building Code's (NBC) standing committee to address proposed changes to the NBC,
- provide input for updating guidance documents to be adopted as standards, such as the Canadian General Standards Boards National Standards for

Related links

- Codes Canada
- Subscribe to Construction Innovation

Contact us

Christopher Pezoulas, Business Advisor
Telephone: 613-993-9502
Email: Christopher.Pezoulas@nrc-cnrc.gc.ca

Canadian Centre for Housing Technology

Government of Canada | Gouvernement du Canada

Search NRC.Canada.ca | Search

MENU

Canada.ca > National Research Council Canada > Research and development > NRC facilities

Canadian Centre for Housing Technology research facility

From: National Research Council Canada

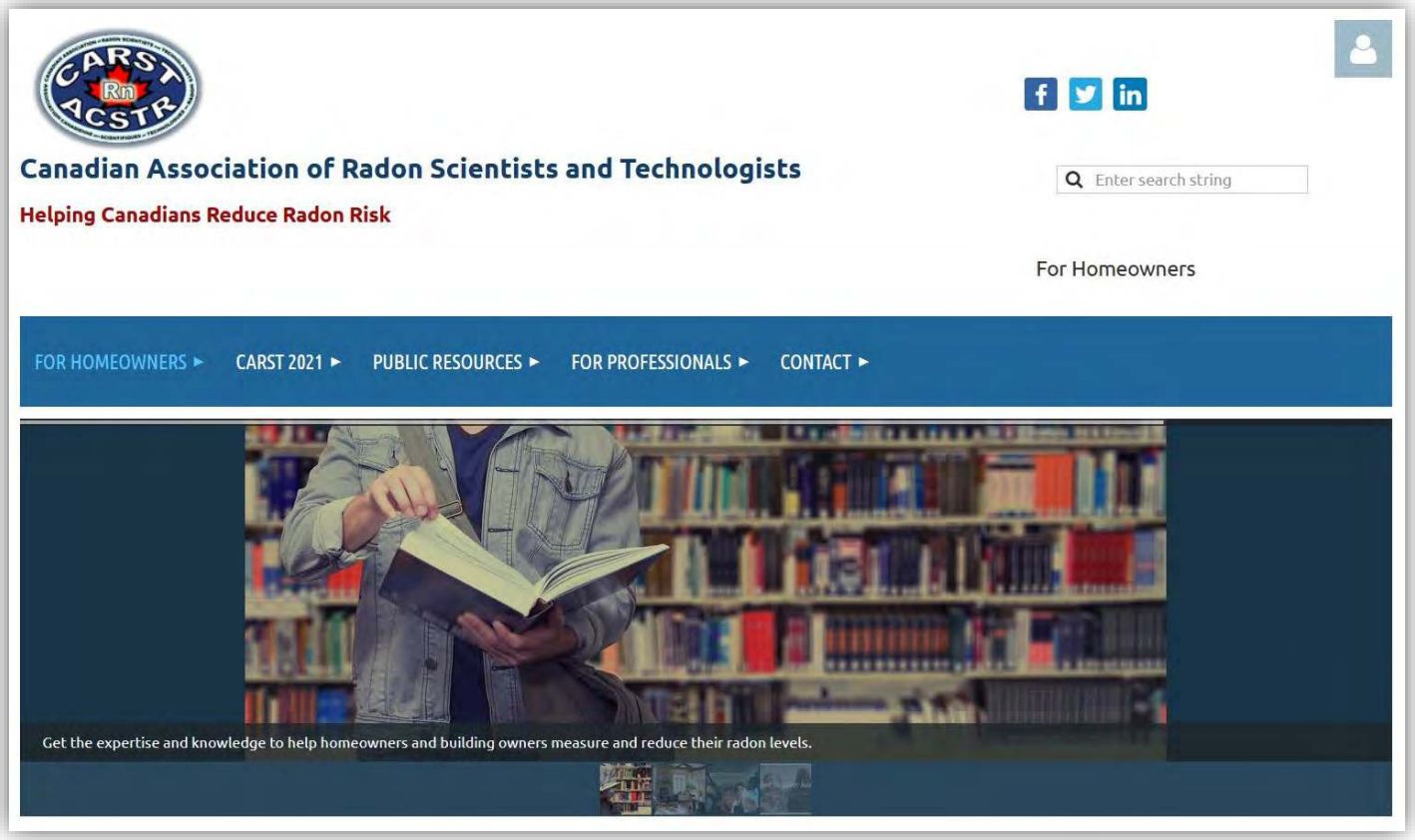
The Canadian Centre for Housing Technology (CCHT) offers manufacturers, public utilities and housing technology companies unique, real-life, whole-house performance and fully monitored testing environments. Located in Ottawa, Ontario, the CCHT provides the means to develop and validate innovative residential products prior to full field trials in occupied houses to accelerate their acceptance in the marketplace.

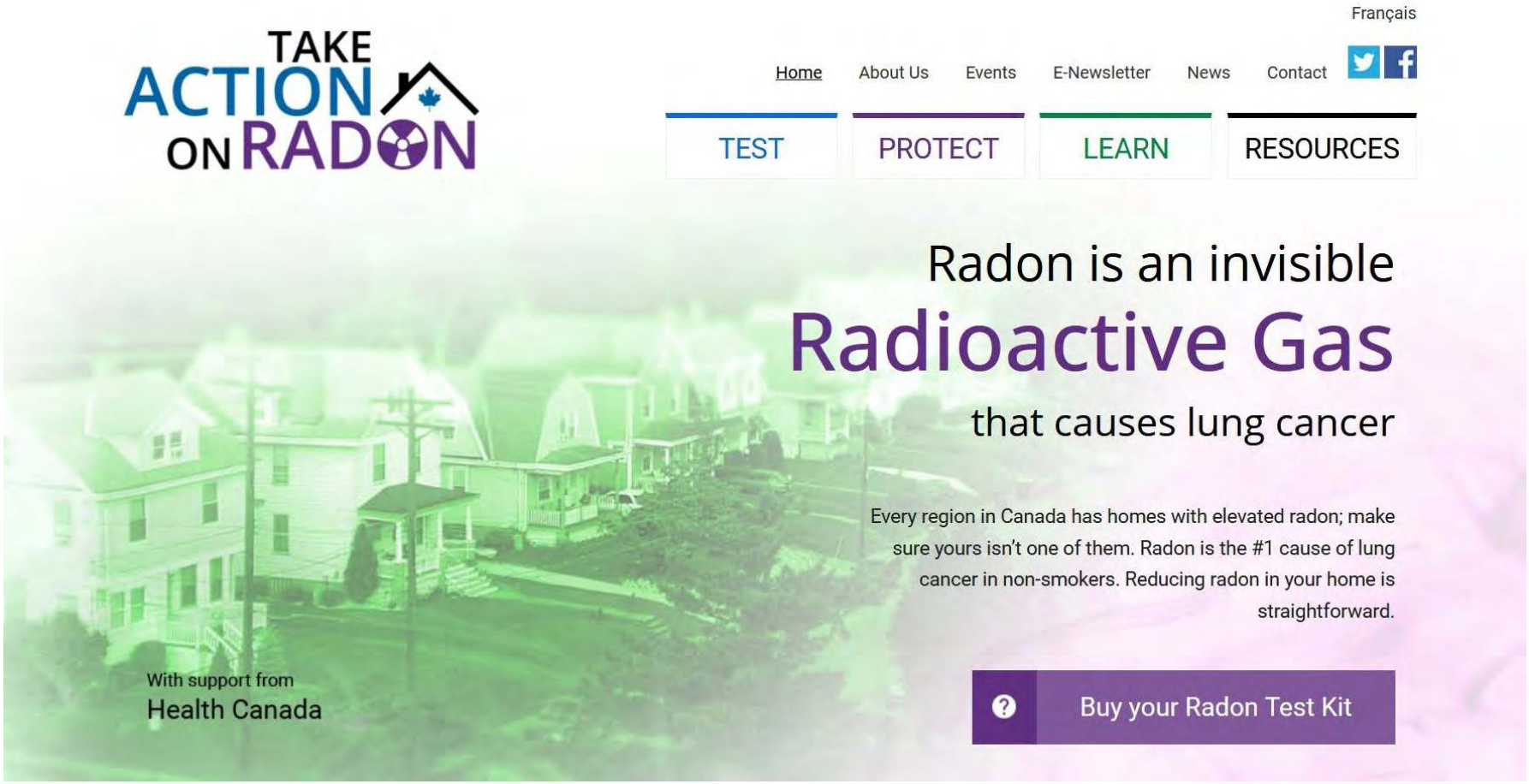
Image gallery

Our capabilities

The CCHT team will work with you to design the research and development or measurement and verification project most suited to meet your company's goals, needs and budget. Our team will help you develop and validate innovative housing products and systems that keep pace with market needs.

CARST


Canadian Association of Radon Scientists and Technologists
Helping Canadians Reduce Radon Risk
Enter search string
For Homeowners
FOR HOMEOWNERS ►
CARST 2021 ►
PUBLIC RESOURCES ►
FOR PROFESSIONALS ►
CONTACT ►
Get the expertise and knowledge to help homeowners and building owners measure and reduce their radon levels.


TAKE ACTION ON RADON
Français
Home
About Us
Events
E-Newsletter
News
Contact
TEST
PROTECT
LEARN
RESOURCES
Radon is an invisible
Radioactive Gas
that causes lung cancer
Every region in Canada has homes with elevated radon; make sure yours isn't one of them. Radon is the #1 cause of lung cancer in non-smokers. Reducing radon in your home is straightforward.
With support from
Health Canada
Buy your Radon Test Kit

Global Information

Radiation Safety Institute of Canada

Factsheets

The scientists at the Radiation Safety Institute of Canada closely monitor global developments in radiation safety to ensure that all of our products and services are up-to-date with the latest research.

We periodically release summaries of this research in the form of helpful and informative factsheets to assist communities and organizations.

We encourage you to read and share the latest Radiation Safety Institute of Canada publications:

- **Fukushima Effects on Canadians**
- **What Is Radiation?**
- **Naturally Occurring Radiation Materials**
- **Radiation Doses and Relative Risks**
- **Patient Radiation Exposure in Nuclear Medicine Imaging**
- **Radiation and Airport Security**
- **Radiation Use in Correctional and Other Facility Security**
- **Staff Radiation Protection in Fluoroscopy**
- **Cell Phones and Radiation**
- **Wi-Fi in Schools**
- **Cosmetic Lasers**
- **Baked Not Beautiful Tans Are Not Healthy**
- **Radiation Related Regulations in Canada**
- **Radon Gas**
- **Radon in the Home**
- **Information on EMF**

Radiation Safety Institute of Canada

- The Radiation Safety Institute of Canada is an independent, not-for-profit organization specializing in radiation safety.

- For further information on all types of radiation contact us at:

1-800-263-5803

info@radiationsafety.ca

www.radiationsafety.ca