



# Radon in Canada: the challenges of putting prevention into action

Anne-Marie Nicol, PhD

The logo for Simon Fraser University (SFU) consists of the letters "SFU" in a white, bold, sans-serif font, centered within a solid red rectangular background.

SFU



National Collaborating Centre  
for Environmental Health

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Centre de collaboration nationale  
en santé environnementale

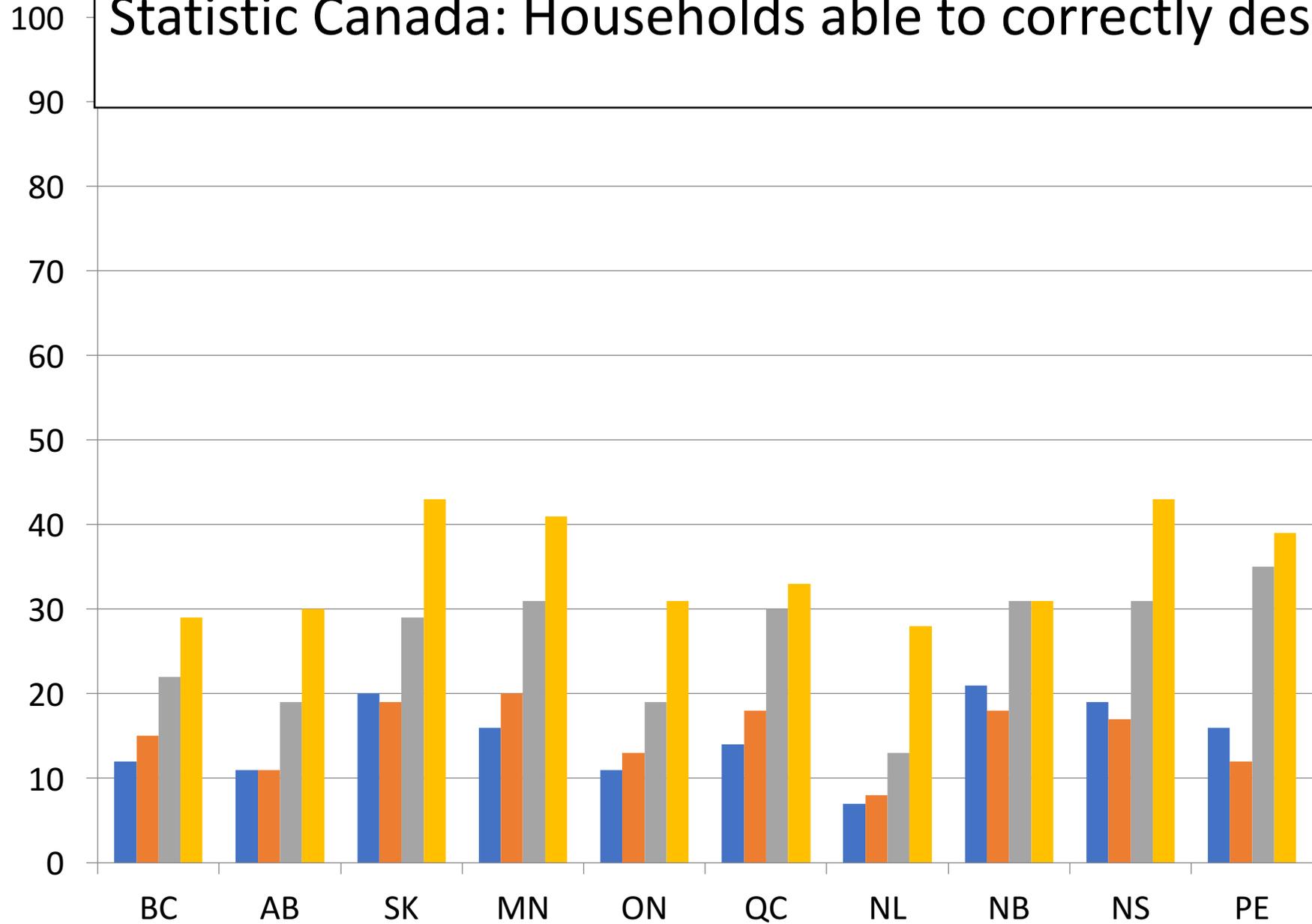
# Introduction

- Radon- radioactive soil gas -> alpha radiation
- Known Human Carcinogen (IARC 1)
- ~3,300 deaths in Canada *per year*
  - 9 deaths a day
- Presentation today
  - Current risk/policy landscape
  - Identify major gap
  - Illustrate current activity
  - Thoughts going forward



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.

# Statistic Canada: Households able to correctly describe radon gas (%)



2009  
2011  
2013  
2015

**CANSIM Table 153-0098**

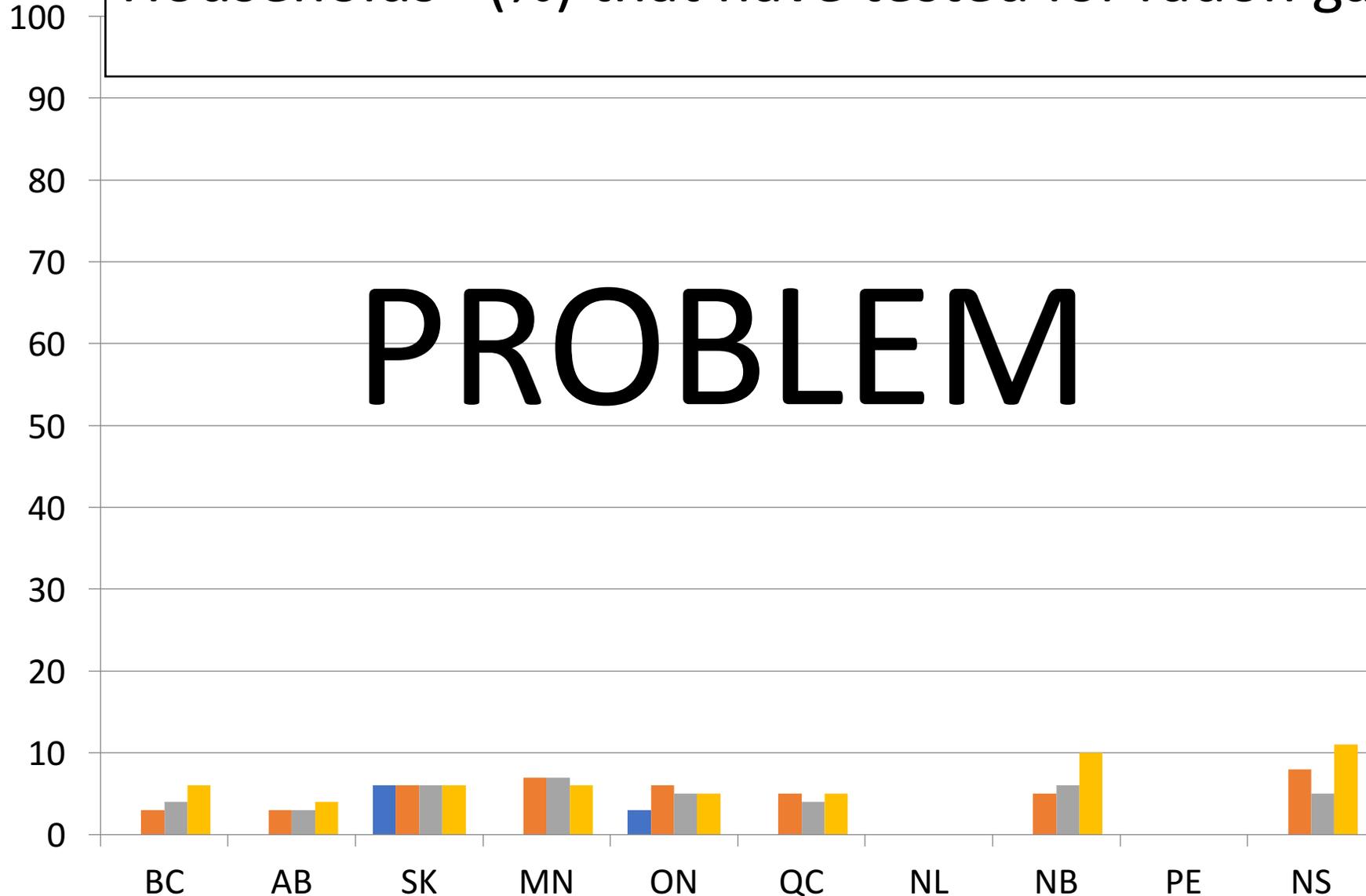
Note: survey questions changed somewhat in 2013

# Households\* (%) that have tested for radon gas<sup>†</sup>

\*As a percentage of all households that did not live in an apartment and had heard of radon

# PROBLEM

Numbers actually LESS than these percentages



2009

2011

2013

2015

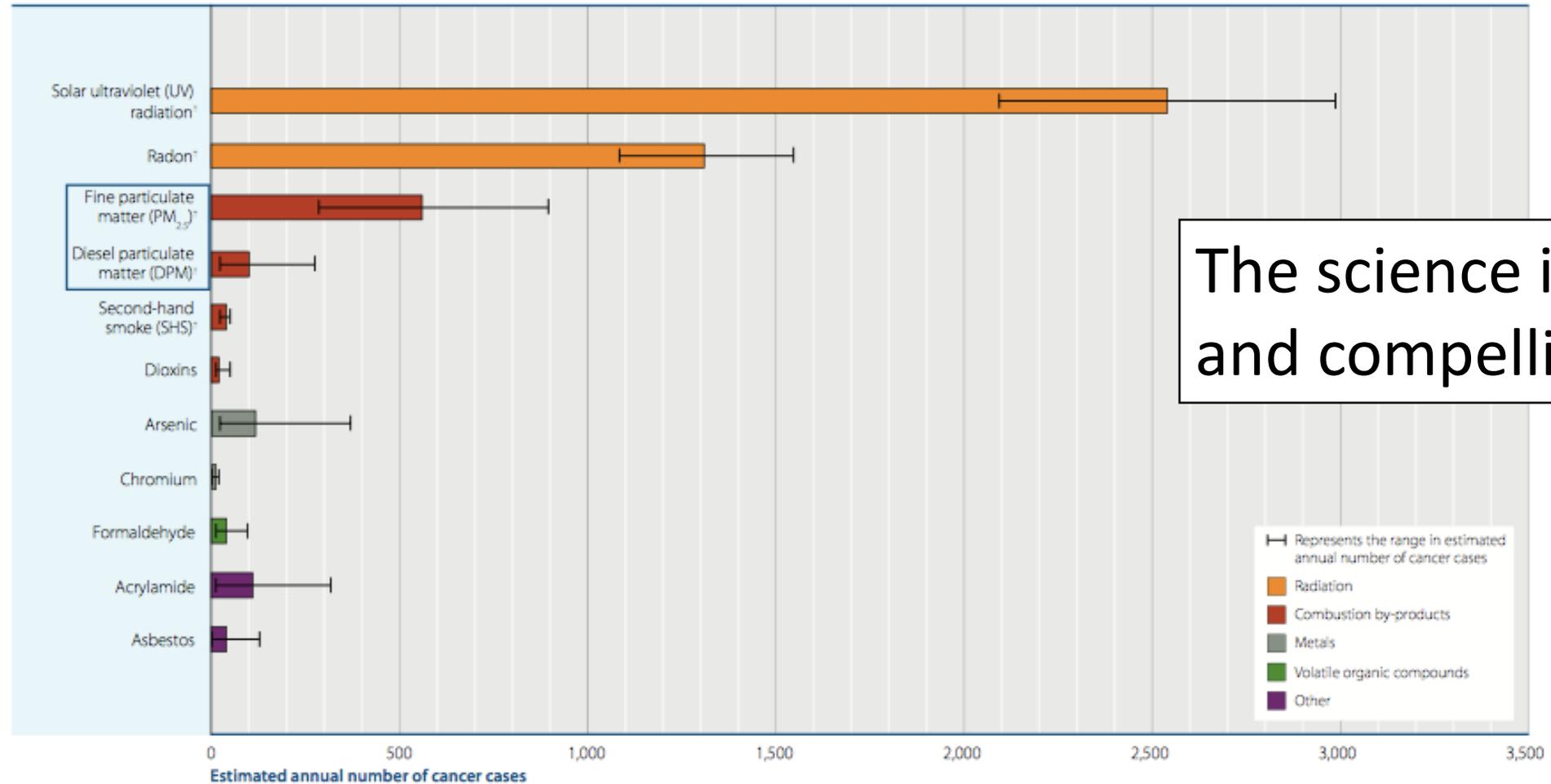
Saskatchewan data use with caution

Table 153-0098

Why so little action?

Figure 5 presents the estimated annual number of cancer cases by chemical group (radiation, combustion by-products, metals, volatile organic compounds and other). The three environmental carcinogens with the greatest estimated burden of cancer—solar UV radiation, radon and PM<sub>2.5</sub> (including diesel particulate matter)—make up over 90 per cent of all cancer cases from exposure to environmental carcinogens. Radiation is the largest contributor; followed by combustion by-products, other, metals and volatile organic compounds.

**FIGURE 5** Estimated annual number of cancer cases from exposure to environmental carcinogens\* in Ontario by chemical group



The science is clear and compelling

**NOTES:**

- \* Carcinogens with an estimated annual environmental burden of cancer greater than 10 cases.
- † Indicates a population attributable fraction model was used to estimate the annual cancer cases; otherwise a risk assessment model was used.
- Diesel particulate matter was treated as a component of fine particulate matter, so the annual cancer cases should not be summed.

Health literacy concern?  
- not because we cannot discuss numbers

# Fentanyl crisis: up to 9 drug overdose deaths in Vancouver in one night

Coroners service says as many as 13 people across B.C. died of overdoses on Thursday  
By Jason Proctor, Karin Larsen, CBC News | Posted: Dec 16, 2016 11:38 AM PT | Last Updated: Dec 16, 2016 10:38 PM PT



# Fentanyl crisis: Drug overdoses claim unprecedented 914 lives in B.C. in 2016

B.C. health minister calls on Ottawa to declare a federal public health emergency  
By Lisa Johnson, CBC News | Posted: Jan 18, 2017 11:49 AM PT | Last Updated: Jan 18, 2017 11:53 PM PT



Vancouver firefighters Jason Lynch and Jay Jakubec try to revive an addict who has already had two doses of Narcan after overdosing on fentanyl in Vancouver's downtown eastside. (CBC)

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# Dr. Oz Discusses: The #1 Cancer Risk at Home

For informational purposes only, check out a “discussion about Radon in Homes,” on the Dr. Oz show (aired February 10, 2011).

[Available on the National Center for Healthy Housing’s website.](#)

EXIT



## Living Healthy & Green

We want Americans to know that a big part of “living green” is breathing clean, healthy indoor air. One of the best ways to protect our families’ health is to get radon gas out of our homes. It is the environmentally responsible choice that can help reduce lung cancer.



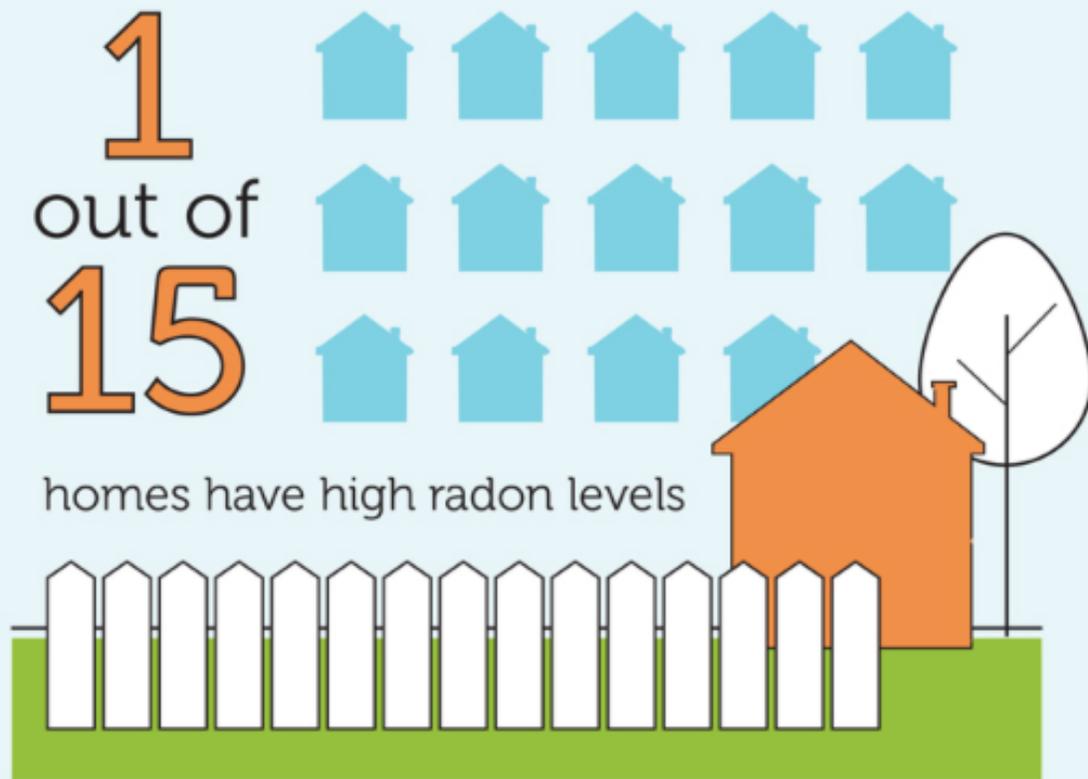
Retired NFL Player Chester Pitts tells homeowners about the dangers of radon

[View larger video](#)

Growing number of celebrities championing the cause

# Protect Your Family 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 the U.S.



Many good examples of messaging in clear language

Also more use maps and infographics



Learn more by calling the National Radon Hotline:

**1-800-SOS-RADON** (1-800-767-7236)

Source: U.S. Environmental Protection Agency



# Lung Cancer Risk

Smokers + high radon = 1 in 3



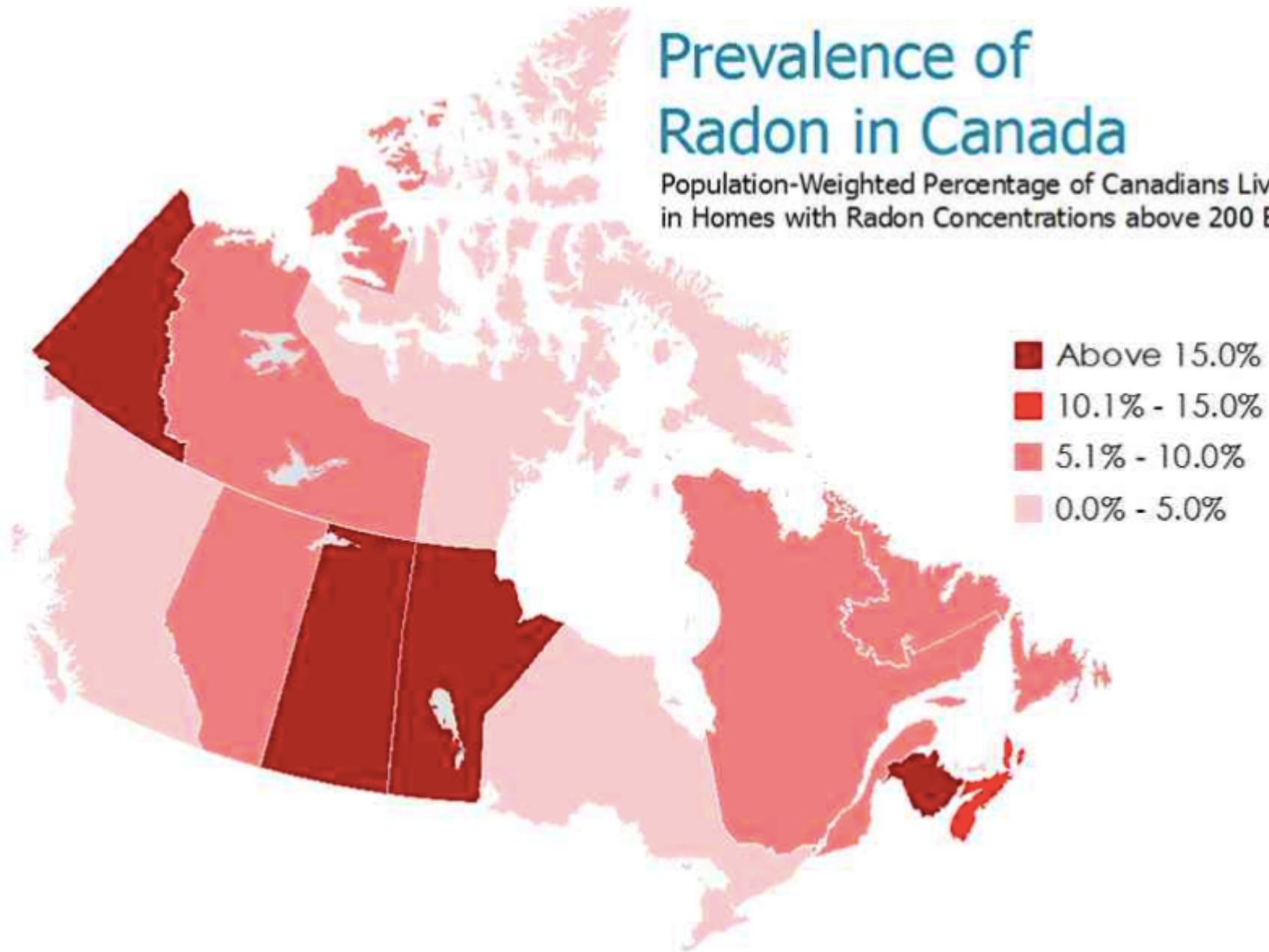
High radon only = 1 in 20



Health Canada also using visuals and infographics

# Prevalence of Radon in Canada

Population-Weighted Percentage of Canadians Living in Homes with Radon Concentrations above 200 Bq/m<sup>3</sup>



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#lungcancer

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Promoted by Rings Movie

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#نصحتك\_للبيت\_التي\_تتابع\_كوره

11.2K Tweets

#steuerdebat

14.8K Tweets

Ed Sheeran

88K Tweets

Jorge

144K Tweets

Bullrich

10.9K Tweets

Lung Association PA @AmericanLungPA · Jan 15  
3 easy steps to reduce #radon risk ! Read & RT: [tnonline.com/2017/jan/13/th...](http://tnonline.com/2017/jan/13/th...) #January #RadonActionMonth @dbrownala

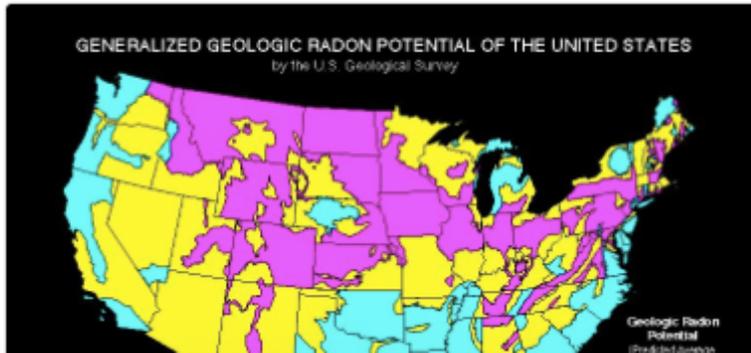
Retweets 2 Likes 1

OR Health Authority @OHAOregon · Jan 16  
#Radon is radioactive gas you can't see, smell or taste. Are you breathing #radon? Info [healthoregon.org/radon](http://healthoregon.org/radon) #Radonawareness #lungcancer



Retweets 2 Likes 1

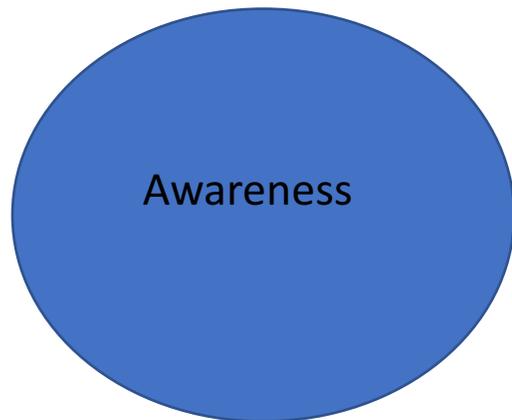
U.S. EPA - Ungagged @ungaggedEPA · 15h  
#Radon causes 21k lung cancer deaths every year. Many are preventable. See: [SoSRadon.org](http://SoSRadon.org) for a test kit.



Growing use of social media

# What more needs to be done?

- Still over half of Canadian aren't aware of radon gas
  - More awareness campaigns will continue to help...
- Awareness may need to extend from just knowing about radon to knowing what to do
- **Need clarity about testing and mitigation**



# Tackling optimistic bias?

*“[New Jersey] Respondents proved well informed, but radon levels were not highly correlated with any of the response variables. **Over optimism was more common than overreaction.**”* Weinstein et al (1989)

- **Even when they know about radon, most didn't perceive it to be a risk**
- **PROBLEM – Lack of *personalization* of risk**



Attempts to bring the risk "home"

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**Publications**

**Our Services**

**Frequently Asked Questions**

**CELA in the Courts**

**Access to Environmental Justice**

**Water Sustainability**

**Pollution and Health**

**Green Energy**

**Planning and Sustainability**

**Acting Globally**

93 Federal Ridings with more than 10% of Homes Likely to Have Above-Guideline Radon Levels

Oct 21 2016

The following 93 federal ridings are estimated to have greater than 10% of homes with above-guideline radon levels Those MPs names in bold and marked with \* are sixteen ridings estimated to have more than 20% of homes above the federal guideline.

These estimates are based upon results from Health Canada's *Cross-Canada Survey of Radon Concentrations in Homes*. This survey found approximately 7% of homes in Canada with radon levels above the federal guideline of 200 becquerels per cubic metre (Bq/m3) and some areas of Canada with higher concentrations. We have mapped these data, reported according to regional health districts, onto federal riding boundaries.

First Name	Last Name	EMAIL	Constituency	Province / Territory
Dan	Albas	<b>Dan.Albas@parl.gc.ca</b>	Central Okanagan–Similkameen–Nicola	British Columbia
William	Amos	<b>william.amos@parl.gc.ca</b>	Pontiac	Québec
<b>David</b>	<b>Anderson*</b>	<b>david.anderson@parl.gc.ca</b>	Cypress Hills–Grasslands	Saskatchewan
Mel	Arnold	<b>Mel.Arnold@parl.gc.ca</b>	North Okanagan–Shuswap	British Columbia
<b>René</b>	<b>Arseneault*</b>	<b>Rene.Arseneault@parl.gc.ca</b>	Madawaska–Restigouche	New Brunswick
Ramez	Ayoub	<b>Ramez.Ayoub@parl.gc.ca</b>	Thérèse-De Blainville	Québec
Larry	Bagnell	<b>Larry.Bagnell@parl.gc.ca</b>	Yukon	Yukon
<b>Candice</b>	<b>Bergen*</b>	<b>candice.bergen@parl.gc.ca</b>	Portage–Lisgar	Manitoba
Maxime	Bernier	<b>maxime.bernier@parl.gc.ca</b>	Beauce	Québec
Luc	Berthold	<b>Luc.Berthold@parl.gc.ca</b>	Mégantic–L'Érable	Québec
<b>James</b>	<b>Bezan*</b>	<b>james.bezan@parl.gc.ca</b>	Selkirk–Interlake–Eastman	Manitoba

**Collections**

**Green Budget Coalition**

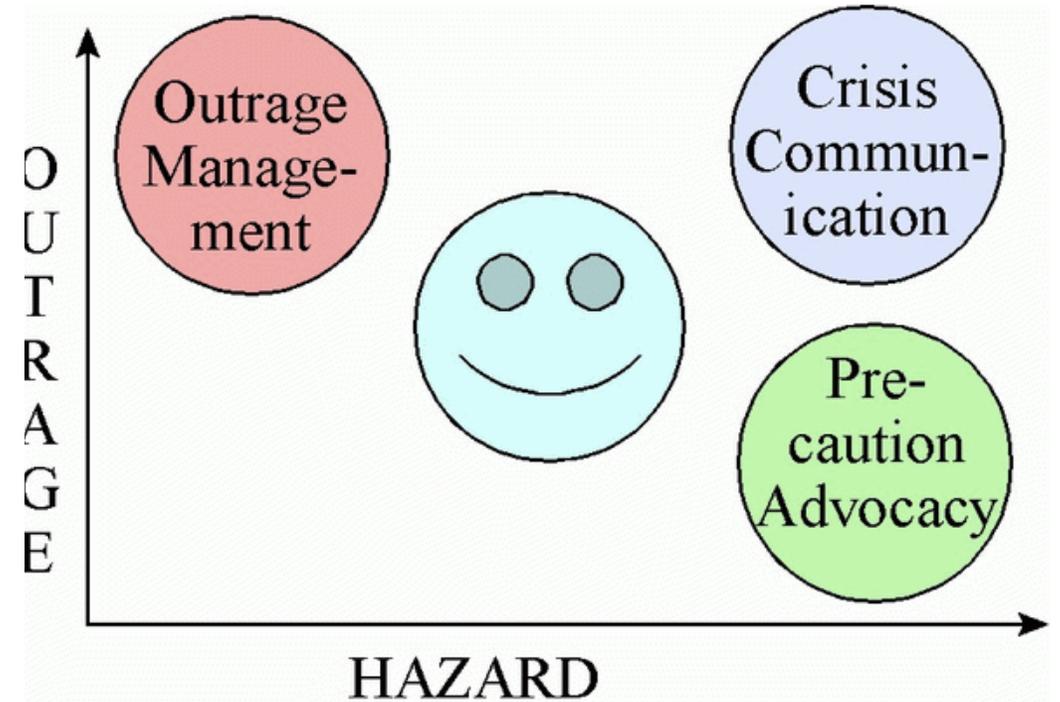
Recommendations for Greening the Federal Budget

**Radon**

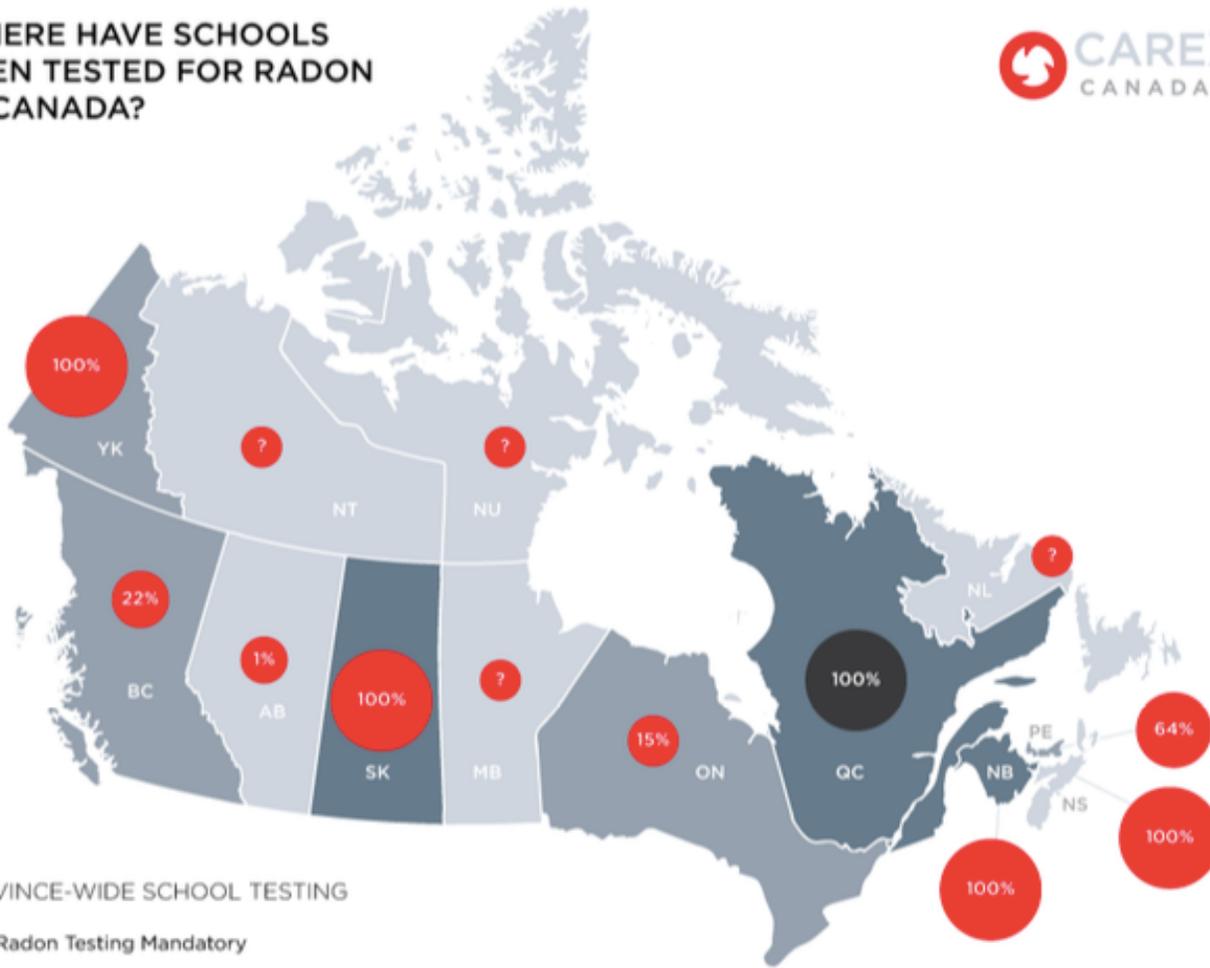
*Collection of materials related to outreach and advocacy on the leading cause of lung cancer after smoking*

# Missing psychometric parameters?

- Radon should be higher on the “outrage” factor than it is
  - Invisible
  - Involuntary
  - Dreaded disease/exposure -> cancer and radiation
- Others framing options?
  - Risks to children
  - Inequitable- basement dwellers, low income housing
  - Natural versus human oriented?



# WHERE HAVE SCHOOLS BEEN TESTED FOR RADON IN CANADA?



## PROVINCE-WIDE SCHOOL TESTING

- Radon Testing Mandatory
- Radon Testing Not Mandatory

# Radon in early life...

**CBCnews | Saskatoon**

### Little Lungs program wants to keep children away from radon gas

Lung association wants to test more than 2,000 homes in 2017

CBC News Posted: Nov 16, 2016 8:55 AM CT | Last Updated: Nov 16, 2016 8:55 AM CT

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# Radon in Schools: What Students, Parents and Teachers Need to Know



0:40 / 58:05





Publications

Presentations

Videos

Structural Profile of Public Health in Canada

Interactive Timeline - The Tobacco Story in Canada

Annotated Bibliographies

Links to Evidence

## Webinar - Public Health Ethics: A Case in Environmental Health

In this webinar, co-presented by NCCHPP and NCCEH, participants discussed the evidence and ethics of a case involving radon.  
November 2016. [Description](#). [Watch the recording](#)



**Presenters:** Michael Keeling and Olivier Bellefleur, Research Officers at the NCCHPP  
Anne-Marie Nicol, Environmental Health Scientist at the NCCEH.

The webinar, co-presented by NCCHPP and NCCEH on November 29, 2016, featured a case involving radon testing at daycares and highlighted both evidence and ethics. This webinar was developed primarily for public health inspectors, but was also intended to be of interest for a general audience.

Our goal was to present the case and a brief discussion of the evidence regarding risk, remediation and some of the issues facing inspectors, parents, building owners and managers, not to mention homeowners and the general public. Then we turned our attention to considering the ethical issues raised by the case. To do this, we presented an ethics framework in order to guide ethical deliberation in which participants were able to:

- Identify ethical values and issues that are pertinent to the case,
- Consider how some conflicts may arise between values,
- Think about how to balance those conflicts in order to decide what to do.

[Webinar - Public Health Ethics: A Case in Environmental Health](#)

54 slides

1.7 K



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New initiative to tackle equity and raise awareness

# Re-thinking naturally occurring?

- Radon researchers starting to better understand building variables

[Display Settings:](#)  Abstract

[Send to:](#)

[Sci Total Environ.](#) 1985 Oct;45:271-8.

## **Radon and radon daughter levels in energy efficient housing.**

[McGregor RG](#), [Walker WB](#), [Létourneau EG](#).

### **Abstract**

Radon and radon daughter concentrations have been measured in 33 "energy-efficient" homes in a small subdivision in Kanata, Ontario. Integrated radon measurements were determined over three month periods for a year using solid state nuclear track detectors. Radon and radon daughter grab sample determinations were made during corresponding periods and confirm the distributions of the integrated radon measurements. Annual average individual home radon concentrations show an 8 fold concentration range between homes. This variability in radon concentrations is not reflected in the range of air exchange rates for the homes. A distinct seasonal variation is noted for the median values of the radon and radon daughter concentrations and the equilibrium factor F in the dwellings.

PMID: 4081725 [PubMed - indexed for MEDLINE]

- REFRAME issue to be building-oriented
  - The housing design makes radon a risk

# Overcoming the “invisible” problem...



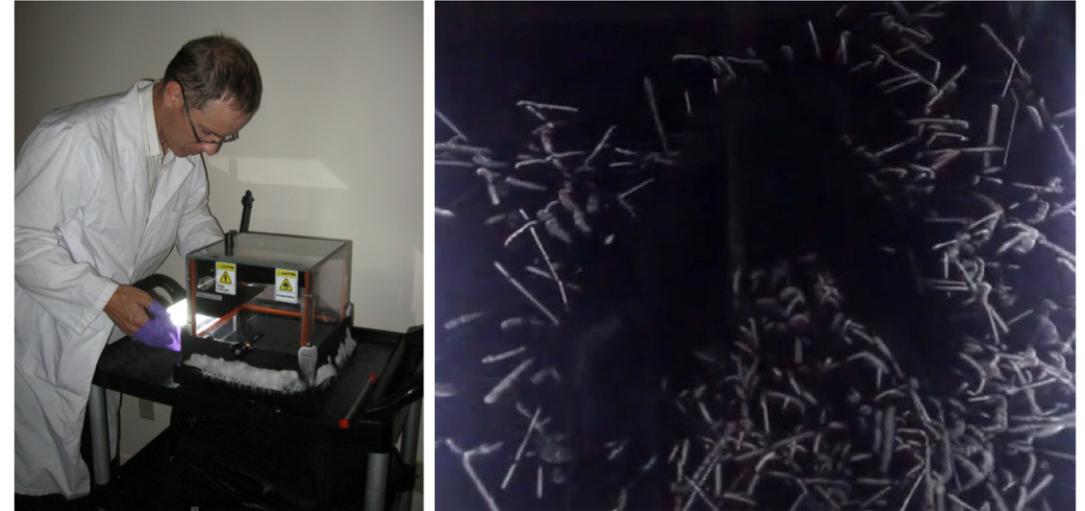
Home alarm- beeps over specified level



Home based radon monitors that show radon in real time

A radon gas detector for everyone

Quality and design are part of our Norwegian identity. Developed by our in-house CERN scientists.



Making radon visible- Cloud Chamber demonstrations by Health Canada

Please note I am not endorsing any of these products, for illustration purposes only.

## Winter best time to test for cancer-causing radon

CITIZEN STAFF / PRINCE GEORGE CITIZEN  
JANUARY 24, 2017 02:29 PM

Like    



Susanne Williamson, with her two sons, encourages all Prince George residents to test their homes for radon, the second leading cause of lung cancer. - Submitted photo

After living in the same house for 12 years in Prince George, Susanne Williamson and her family moved to a different home. First thing on her to-do list? Test for radon.

The B.C. Lung Association completed one of Canada's largest community-wide indoor radon testing campaigns in Prince George during the 2014-15 winter. Results showed one in three homes tested above the Health Canada safety guideline.

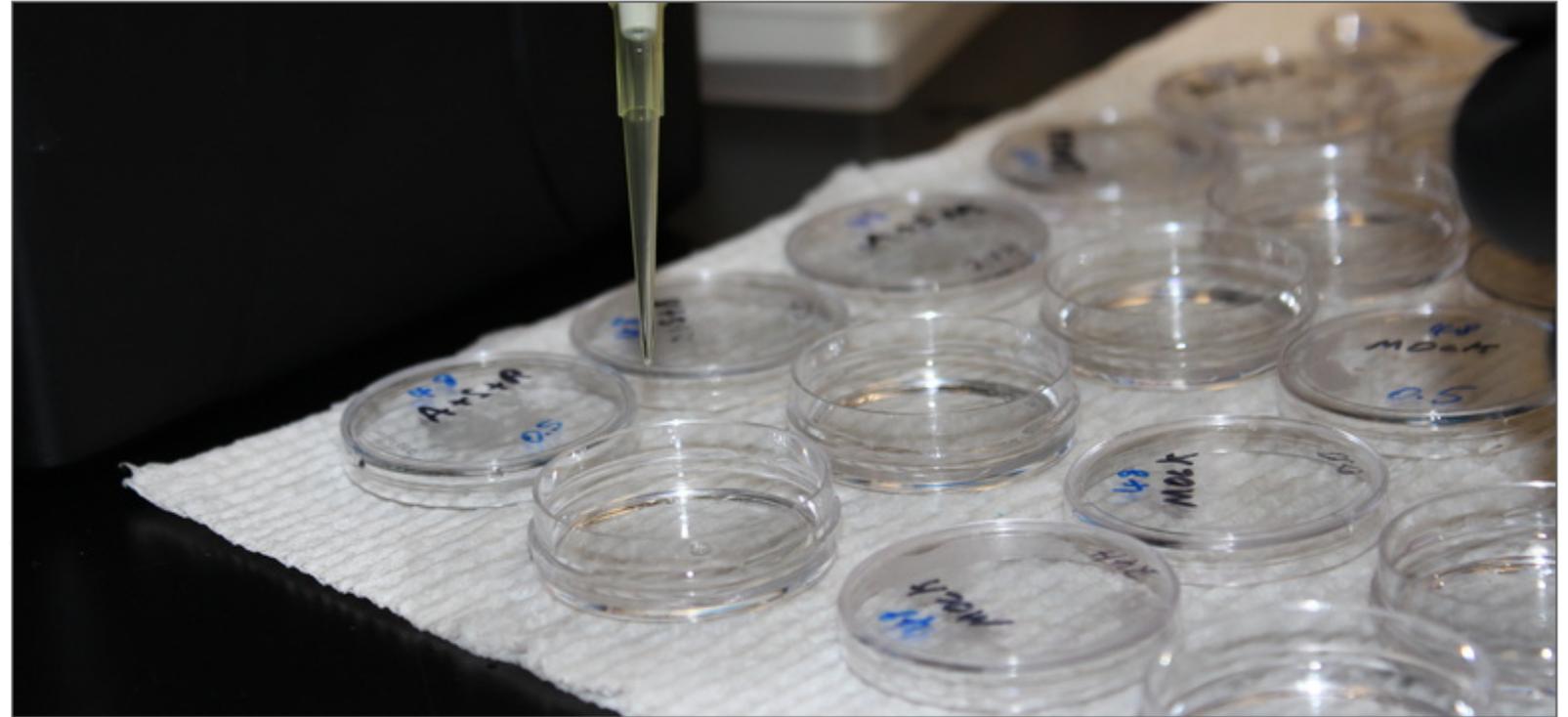
# Increasing governments involved...

- **Complex problem too large for one agency**
  - Federal government has led the radon initiative
- More provincial and municipal governments need to get involved
  - Much of the work that needs to be done on radon is at the provincial and municipal policy levels
  - Where municipalities get engaged, change happens
    - Prince George, BC
    - Outaouais, QC
    - Waterloo, ON

Naturally-occurring gas can cause lung cancer, yet few homeowners aware of the problem

January 21, 2014

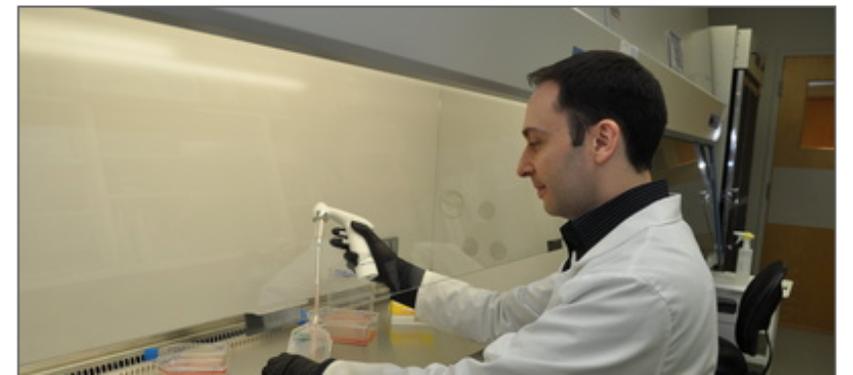
Increase  
academic and  
scientific  
community  
involvement



"Radon gas is a significant public health concern for the prairie provinces, in particular, but one which is largely invisible to the public eye," says researcher Aaron Goodarzi.

Cancer researchers and clinicians are testing their homes for radon gas this month in an effort to bring awareness to the cancer-causing radioactive gas that could be lurking in the homes of Canadians.

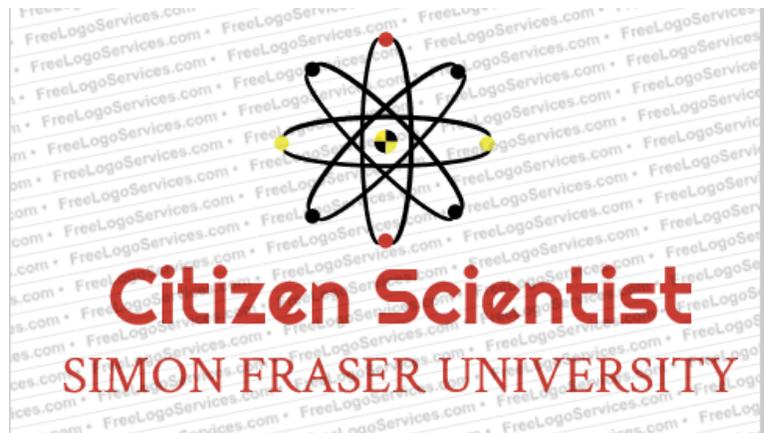
Last year, 25,528 Canadians were diagnosed with costly-to-treat and potentially fatal lung cancer. Although smoking remains the primary cause of lung cancer, between 1,000 and 4,000 new Canadian lung cancer cases each year are thought to be due to radon, which is a naturally occurring colourless and odourless radioactive gas that seeps out of the earth's crust as uranium



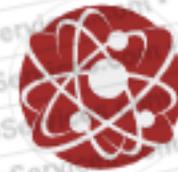


New SFU citizen science project logo contest

Citizen Scientist  
ON FRASER UNIVERSITY



Citizen Scientist  
SIMON FRASER UNIVERSITY



# Increase occupational exposure awareness



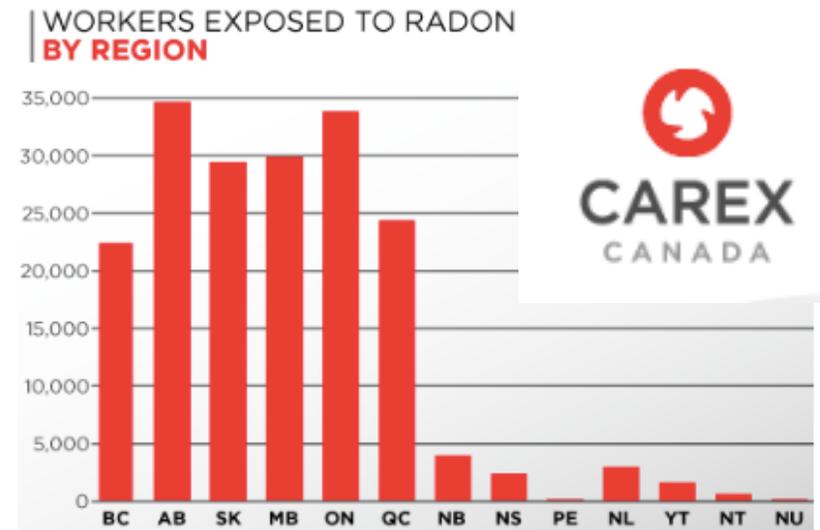
In collaboration with the Ted Rogers School of Management's Centre for Labour Management Relations at Ryerson University, and with the support of the Ontario Lung Association.

## Ontario: Building A Comprehensive Provincial Policy on Radon

**Date:**  
May 1, 2014

**Time:**  
8:00 AM to 4:00 PM

**Location:**  
Ted Rogers School of Management; 55 Dundas Street West (Suite 1-148, 7th Floor), Toronto, ON M5G 2C5



**188,000** WORKERS (EST.) **RADON EXPOSURE IN CANADA**

**FIVE LARGEST EXPOSURE GROUPS BY INDUSTRY**

**PROPORTION OF INDUSTRY EXPOSED**

Elementary & secondary schools	<b>16,000</b>	<b>&lt;5%</b>
Provincial & Territorial public administration	<b>5,900</b>	<b>&lt;5%</b>

# Need more information about the radon trajectory

- Very little qualitative research
- Most health behavior campaigns have extensive qualitative and in-depth research studying homeowner experience
  - Reactions
  - Perceptions
  - Fears
  - Barriers
- Some work done in the US but in the 1980/90s
- Look to other challenging health behavior issues
  - Stigma- AIDS
  - Asbestos in the home- strong advocacy groups/unions- human stories

# Current research: review of support for Interpreting radon test information: USA and Canada

- The U.S. Congress has set a long-term goal that indoor radon levels be no more than outdoor levels; about 0.4 pCi/L of radon is normally found in the outside air. EPA recommends fixing your home if the results of one long-term test or the average of two short-term tests show radon levels of 4 pCi/L or higher. With today's technology, radon levels in most homes can be reduced to 2 pCi/L or below. You also may want to consider fixing if the level is between 2 and 4 pCi/L.

Recommended timeframes for taking action to reduce radon levels:



200 - 600 Bq/m<sup>3</sup>  
fix your home  
within 2 years



Above 600 Bq/m<sup>3</sup>  
fix your home  
within 1 year

None of these “incentivize” fixing

# Concluding remarks

- Progress is being made in some arenas
- Serious data gaps in terms of actual prevention
  - How many of those who test high actually remediate
  - What variables lead to remediation?
  - How are we supporting people's choices to remediate?
  - Why is there little appetite for funding in this area?
- Radon testing as mandatory?
  - Even building codes real estate transactions are dependent on voluntary testing
- Tackling ALARA messaging
  - Still a long way to go

Thank-you!

Question:

What do you think is preventing  
people from testing for radon?

[anicol@sfu.ca](mailto:anicol@sfu.ca)