

# RADON IN ONTARIO WORKPLACES

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# Radon Survey of Workplaces in Ontario



Presented by Dr. Paul Demers and Lily Yang  
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# Land Acknowledgement

Toronto is part of the traditional territory of the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee and Wendat peoples.

# Acknowledgements

This project was funded by the Ministry of Labour, Immigration, Training and Skills Development (MLITSD).

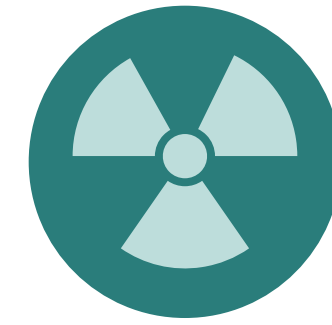
The views expressed in this presentation are the views of the Occupational Cancer Research Centre do not necessarily reflect those of the province.

# Acknowledgements

- Investigators: Paul Demers (OCRC), Laura Boksman (RSIC), Anne-Marie Nicol (SFU)
- Team members: Lily Yang, Prathna Patel, Tiffany Lieu, Carmel Hilal, Sheila Kalenge, Ela Rydz
- Study participants
- All the radon, health, and occupational health related organizations that provided their expertise and shared our study information

# What is radon?

- Radioactive gas released soil and rock
- Indoors & underground, radon can build up to dangerous levels
- Radon can enter buildings via cracks in foundation, gaps around pipes/drains, etc.



radioactive



invisible



odorless

**Thankfully, radon can be tested for, and high levels can be remediated.**

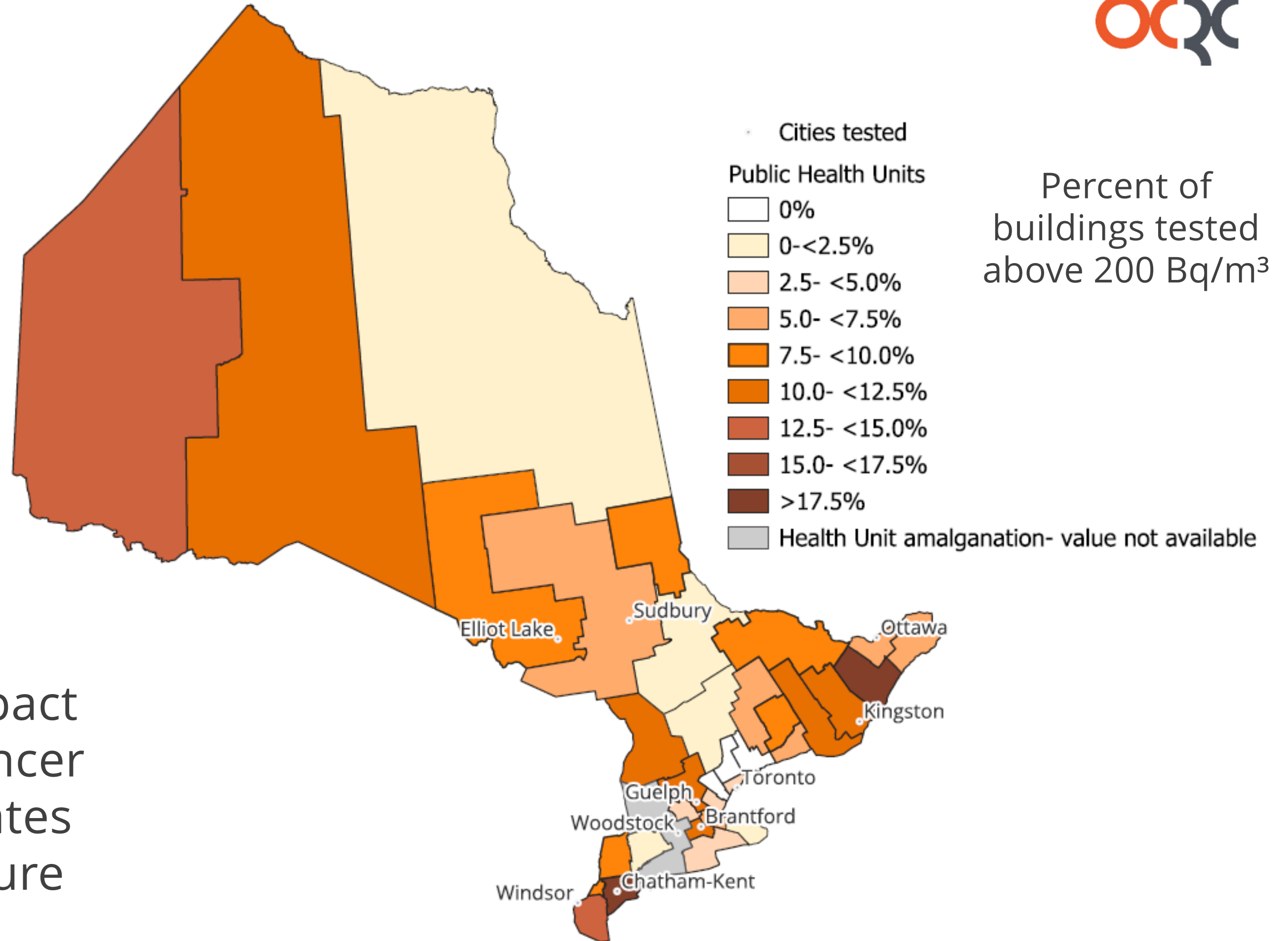


# Health Effects of Radon

- The second leading cause of lung cancer after smoking
  - 13% of Ontario lung cancer deaths (Public Health Ontario)
  - 16% of Canadian lung cancer deaths (Health Canada)
- Radon is leading cause of lung cancer in non-smokers
- Smoking amplifies the effect of radon, greatly increasing risk for smokers

# Cross-Canada Survey of Radon in Homes

Estimates of the impact of radon on lung cancer are based on estimates of residential exposure





# Radon at Work

- We first learned about the impact of radon on lung cancer from studies of uranium miners in the 1950's; we still use these studies to better understand the impact
- Outside of uranium mines, the largest workplace survey in Canada was conducted by Health Canada (2007-2019).
  - More than 21,000 federal workplaces were tested and 3.6% had concentrations above Health Canada's guideline.
- CAREX Canada estimates that 34,000 Ontarians are exposed to radon at work.

# Guidelines

- **Health Canada guideline:** 200 Bq/m<sup>3</sup>
- **World Health Organization reference level:** 100 Bq/m<sup>3</sup>

**“Reduce the radon concentration levels to below 200 Bq/m<sup>3</sup> through engineering controls where possible”**

Ministry of Labour, Immigration, Training, and Skills Development

# Objective

Measure radon levels in workplaces through Ontario


- Types of workplace: small-medium sized businesses, public buildings, and workplaces in basements

Compare radon levels between:

- High and low background radon areas
- Different cities
- Basement and non-basement levels
- Other building characteristics

# Recruitment

- 10 Ontario cities
  - Including known low and high background radon areas
- Recruited using email, phone, study partners, and in person

 **OCRC** @OCRC\_CA · Dec 12, 2022  
 Is your workplace in Sudbury? Interested in the #radon levels at your workplace? You may be eligible to participate in our study and receive free testing for radon! [bit.ly/radonstudy](http://bit.ly/radonstudy)

#Sudbury #SmallBusiness #MediumBusiness

**Now recruiting in:**

- Brantford
- Chatham-Kent
- Elliot Lake
- Guelph
- Kingston
- Ottawa
- Sudbury
- Toronto
- Windsor
- Woodstock

**Test your workplace for RADON**

**Join our study!**

Logos: OCRC, Radiation Safety Institute of Canada, SFU

ALT    2    [share icon]    [bookmark icon]    [upload icon]

**Radon in the Workplace**

**What is radon?**  
 Radon is a radioactive gas found in many buildings across Canada. It is created naturally when uranium in the ground breaks down. Radon is invisible; you can't see it, smell it or taste it.

**Which workplaces have radon?**  
 Radon levels are more likely to be elevated in poorly ventilated workspaces, especially those located underground such as basements. Radon can seep into buildings through cracks in the foundation, pipe openings, and other places where the building contacts and is open to the ground. In confined indoor spaces, radon can build up to high levels and become a health risk. The only way to know how much radon is in a workplace is to test.

**What are the health risks?**  
 Radon is the 2nd leading cause of lung cancer after smoking. An estimated 100 lung cancers diagnosed each year in Canada and 60 lung cancers in Ontario are due to exposure to radon in the workplace.

**Exposure to radon in homes contributes to an estimated 16% of all lung cancers, and 3,200 lung cancer deaths in Canada per year (and an estimated 850 lung cancer deaths in Ontario). Assessing levels of radon in the workplace is important because when individuals are exposed to radon at home AND in the workplace, they have a greater risk of lung cancer. People who are exposed and also smoke have an even higher risk.**

**The health risk from radon is long-term. The longer you are exposed to high levels of radon, the greater your risk.**

**How do I test my workplace for radon?**  
 Testing for radon is easy and inexpensive. Radon in buildings can be tested by certified radon professionals or with long-term test kits. These kits are safe and easy to use—the radon detector is set up, left for a minimum of three months, and then sent to a laboratory for analysis. To find a certified professional or test kit supplier in your area, go to: <http://www.c-nrpp.ca>.

Logos: OCRC, Occupational Cancer Research Centre, Radiation Safety Institute of Canada, SFU

For more information email [ocrc@ontariohealth.ca](mailto:ocrc@ontariohealth.ca).

## Survey of Radon in Workplaces – Study FAQ

### What is the purpose of the study?

The purpose of this survey is to better understand the levels of radon gas in small to medium sized businesses as well as in public workplaces in Ontario. Although some workplaces have been tested for radon in Ontario, they have not been sampled systematically and the results from these efforts are not publicly available. Your participation is important and will help researchers examine where levels are higher and what factors, such as building type and size, influence radon levels in the workplace. This work will also help us better understand how to target radon reduction efforts.

### Who is conducting the study?

This survey is being conducted by researchers at the Occupational Cancer Research Centre ([www.occupationalcancer.ca](http://www.occupationalcancer.ca)), University of Toronto, and Simon Fraser University, as well as staff from the Radiation Safety Institute of Canada. The University of Toronto research ethics board has approved this survey.

### What does your involvement entail?

Radon is colourless, odourless, and its prevalence varies by location, so testing is the only way to know if radon levels are higher than the guidelines. One or more monitors that measure the level of radon will be placed in your workplace in the winter months. These devices are small (dimensions: 5.1 cm tall x 7.5 cm x 7.5 cm), do not make any noise, and do not require power. The devices are safe and do not emit radiation themselves. They will be left in place for three months. We will collect information on your workplace (e.g. age and size of building, type of heating and ventilation system, building foundation type and condition, address, type of workplace, and number of employees) so that we can analyze what characteristics may influence radon levels in the workplace. After the three month time period, we will collect the device(s).

Participating workplaces should notify their Joint Health and Safety Committees or Health and Safety Representative prior to any testing. Workplaces should also notify all employees about the study to ensure the safety and security of the monitors. We encourage you to recruit a volunteer to safeguard the devices. Although it is not fragile, if the device is tampered with or moved to a different location, the integrity of the results will be compromised. Upon the completion of the study, we encourage you to share the results of the test with your employees. You may stop participating in the study at any time, for any reason, at which point we can collect the monitor. You can decide whether we use the results that are available at the time of collection, or if you would like to be excluded from the study.

### What's in it for you?

This study is an opportunity for you to contribute to scientific research in Canada and the furthering of knowledge on radon. If you participate in this study, you will receive free radon testing for your workplace, and we will analyze and interpret the results for you so that you know exactly what the numbers mean. If your workplace has elevated levels, we will share extra resources on how radon levels in buildings can be reduced.

# Radon monitor deployment

- Tested in winter months
- Two OCRC staff trained in Canadian National Radon Proficiency Program (C-NRPP) and placed monitors per Health Canada guidelines
- Min. 3-month testing period
- Monitors retrieved and mailed to lab
- Due to COVID-19 and scheduling, some deployments and retrievals done remotely

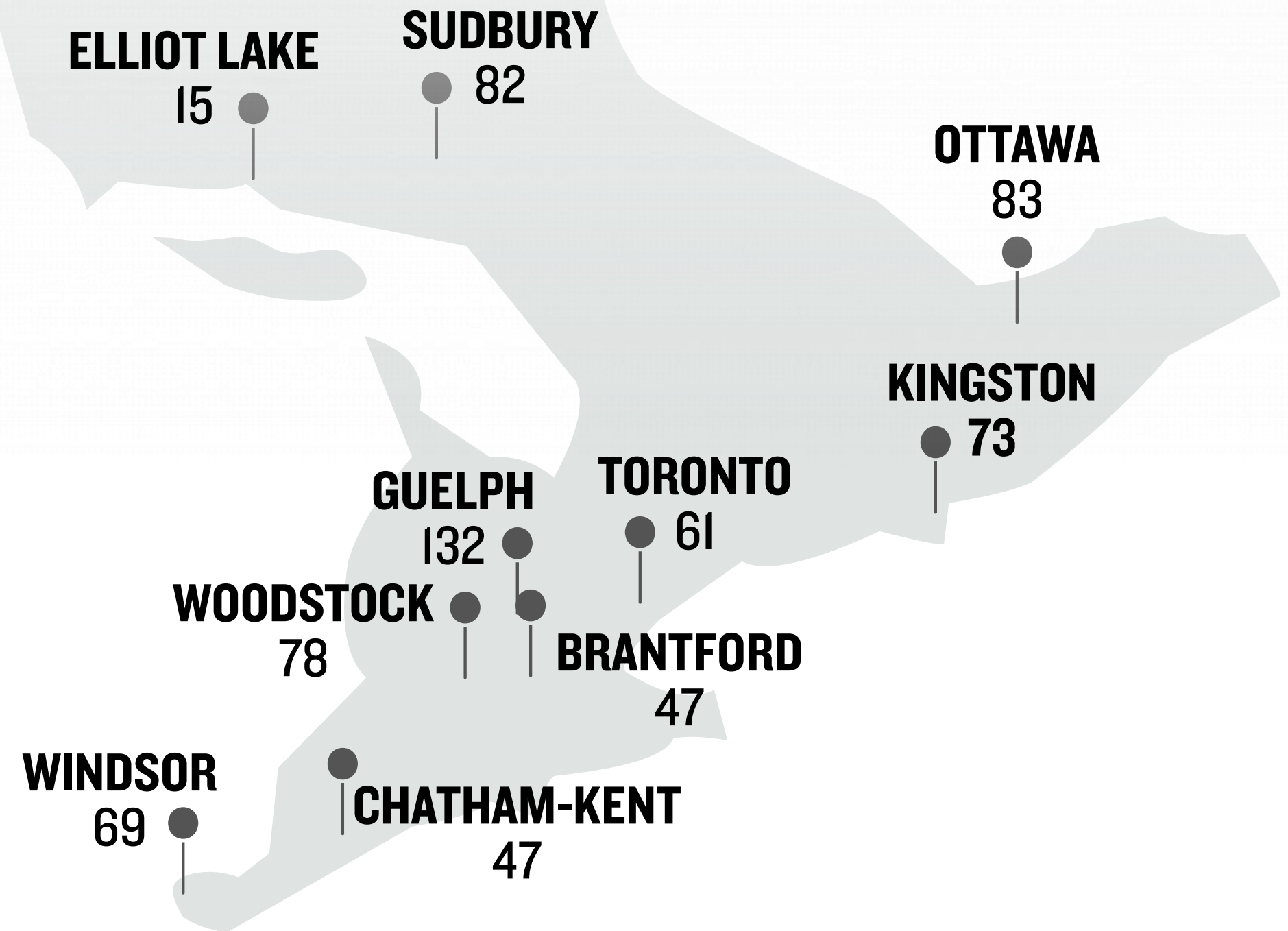


# Surveys

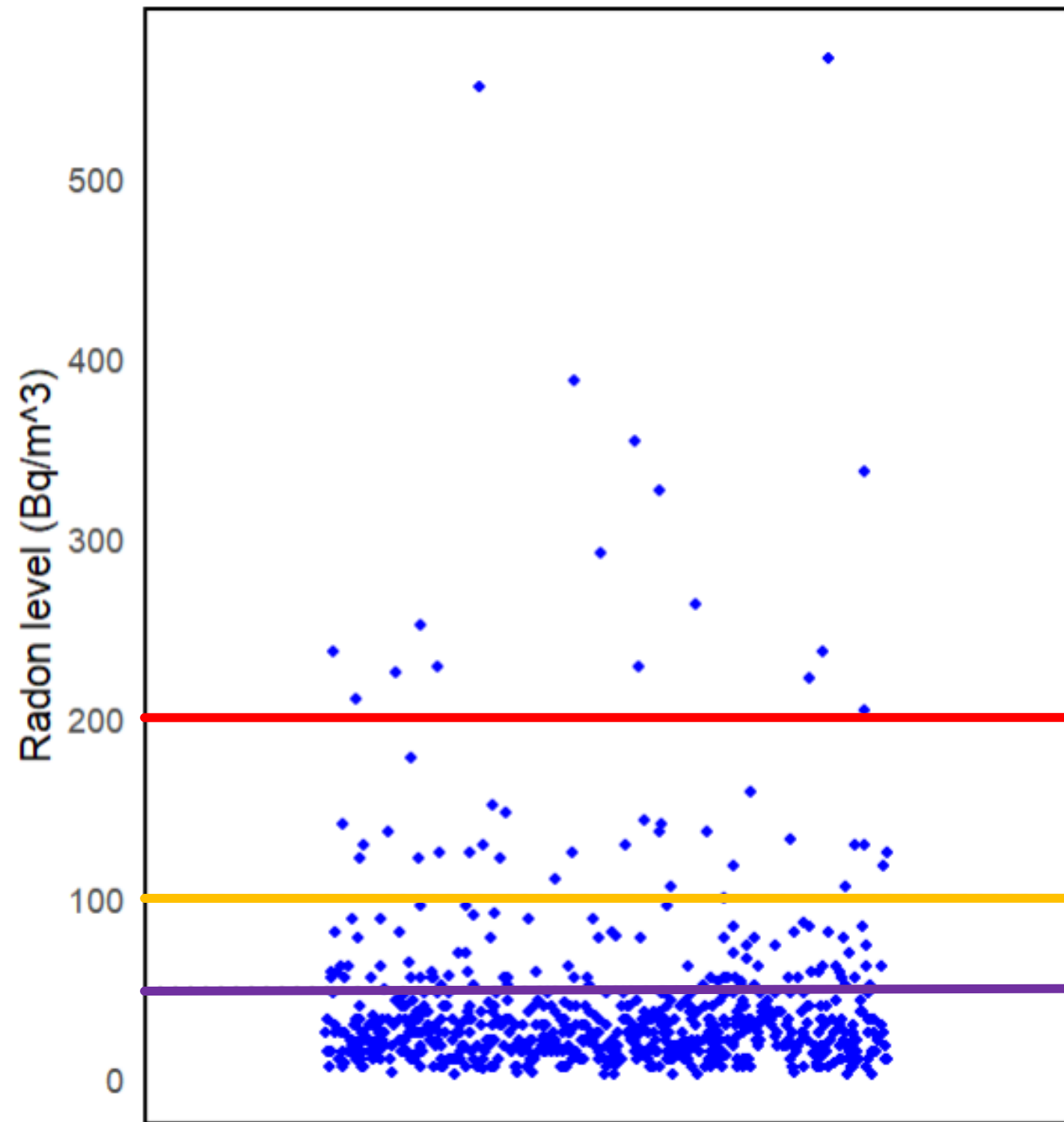
- One administered during deployment and one during retrieval
- Participating workplaces asked questions about business and building characteristics, such as:
  - How many workers are employed at the workplace?
  - Which floor(s) is your workplace located?
  - How old is the heating system?
  - What type of foundation does your building have?

# Recruited workplaces

- 453 workplaces,  
433 employers
- 687 monitors  
retrieved with valid  
results



# Results- above HC and WHO limits



- Health Canada guideline
  - WHO reference level
  - 50 Bq/m<sup>3</sup>
- 17 radon monitors above 200 Bq/m<sup>3</sup>
    - From 12 unique workplaces (2.65% of all workplaces)
  - 28 radon monitors above 100 Bq/m<sup>3</sup> and below 200 Bq/m<sup>3</sup>
    - From 22 unique workplaces (4.86% of all workplaces)



# Results: Comparison by city



City	Count	Arithmetic mean ( $\pm$ SD)*	Geometric mean ( $\pm$ GSD)*	Range*
Elliot Lake	15	79.4 ( $\pm$ 59.3)	60.2 ( $\pm$ 2.3)	11-237
Chatham	47	70.2 ( $\pm$ 88.8)	50.1 ( $\pm$ 2.0)	15-566
Windsor	69	50.4 ( $\pm$ 49.7)	36.7 ( $\pm$ 2.1)	7-237
Woodstock	78	45.6 ( $\pm$ 60.5)	32.3 ( $\pm$ 2.1)	7-388
Kingston	73	40.8 ( $\pm$ 65.0)	27.6 ( $\pm$ 2.2)	3-551
Brantford	47	38.9 ( $\pm$ 28.0)	31.6 ( $\pm$ 1.9)	7-130
Sudbury	82	37.9 ( $\pm$ 40.6)	25.9 ( $\pm$ 2.4)	3-263
Ottawa	83	36.4 ( $\pm$ 64.8)	19.5 ( $\pm$ 2.6)	4-337
Guelph	132	31.8 ( $\pm$ 27.0)	25.5 ( $\pm$ 1.0)	4-222
Toronto	61	15.3 ( $\pm$ 11.7)	12.1( $\pm$ 2.0)	3-58

\* In Bq/m<sup>3</sup>

Light red- high background areas according to Cross-Canada Survey. Green- low background areas.

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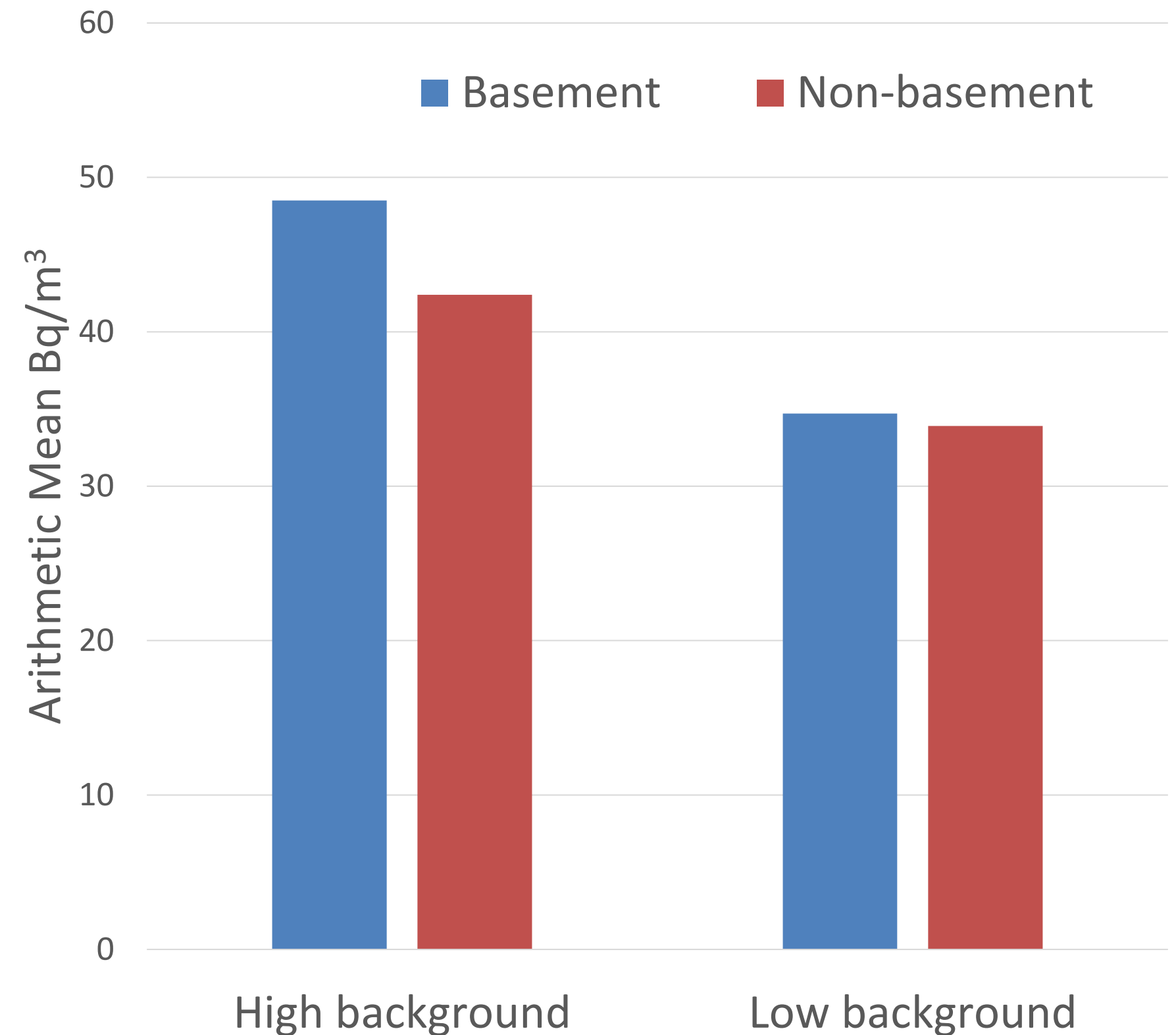
\* In Bq/m<sup>3</sup>

Light red- high background areas according to Cross-Canada Survey. Green- low background areas.

# High vs. low radon background areas



- High radon background areas > low background areas ( $p < 0.0001$ )
- Basements > non-basements in high background areas ( $p < 0.01$ )
  - No difference overall or in low background areas



# Comparison to Cross-Canada Survey



Region	Percent above 200 Bq/m <sup>3</sup>	
	OCRC study	Cross-Canada Survey of Radon Concentrations in Homes
Chatham	8.5	18.4
Elliot Lake	6.7	8.6
Ottawa	4.8	6.2
Windsor	4.4	13.8
Woodstock	2.6	11.5
Kingston	1.4	11.1
Sudbury	1.2	5.1
Guelph	0.8	10.9
Brantford	0.0	10.4
Toronto	0.0	2.7

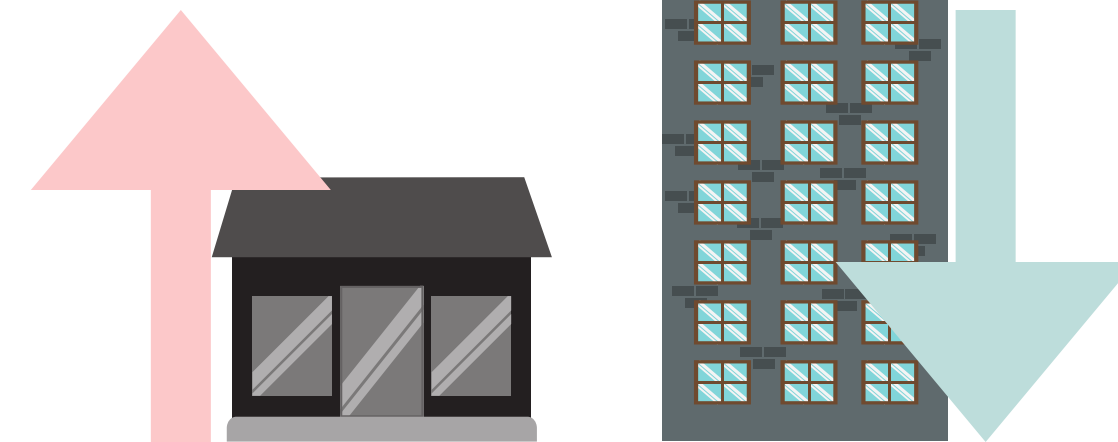
# Comparison to Cross-Canada Survey



Region	Percent between 100 and 200 Bq/m <sup>3</sup>	
	OCRC study	Cross-Canada Survey of Radon Concentrations in Homes
Elliot Lake	20.0	10.8
Windsor	7.3	30.3
Sudbury	7.3	25.8
Woodstock	5.1	22.1
Brantford	4.3	21.9
Ottawa	3.6	12.5
Guelph	2.2	14.1
Chatham	2.1	21.4
Kingston	1.4	26.3
Toronto	0.0	16.2

# Larger Workplace = Lower Radon?

- Radon in largest workplaces by square feet (along with number of employees and number of doors) were statistically lower than other workplace sizes
- Currently analyzing additional building characteristics
- Possible multivariate analysis in the future



# Individual results and impact

- All participants informed of their individual levels
- Resources and contact information given to those above 100 Bq/m<sup>3</sup> for guidance on how to reduce radon levels

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## Onaping Community Centre basement closed following radon testing

*City says it is taking the measure out of 'an abundance of caution' while remediation work is done*

Star Staff

Published Jul 22, 2023 • Last updated Jul 24, 2023 • 2 minute read

# Conclusion

- Most workplaces had low radon levels but some still tested above Health Canada and WHO guidelines
- High background radon areas > lower background areas
- In high background areas, basements > non-basements
- Smaller workplaces by sq ft > largest workplace size



# PROTECTING THE WORKPLACE FROM RADON

Exposure to radon can cause lung cancer.

All buildings are susceptible to radon.

The only way to know if radon is a problem is to test.



## What is radon?

Radon is a gas that is...



radioactive



invisible



odorless



## Why is radon a concern?

Radon is the leading cause of lung cancer for non-smokers, and exposure to radon greatly increases the risk of lung cancer for smokers.

## Where is radon found?

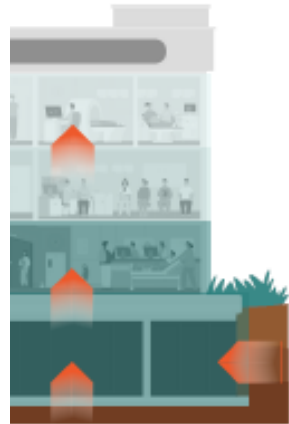
- Naturally found in rocks and soil
- Basement and ground floors are at most risk of radon gas buildup

## How to test for radon:

Health Canada recommends placing radon monitors for 90+ days.

Radon testing can be done by:

- hiring a certified radon testing professional, or
- buying a do-it-yourself radon test kit at select hardware stores.



## Reduce radon if levels test above 200 Bq/m<sup>3</sup>

The Canadian guideline for indoor radon levels is 200 Bq/m<sup>3</sup>

The OCRC tested Ontario workplaces for radon. For more information about the study and for radon reduction resources, visit our project summary page:

[VIEW PROJECT SUMMARY](#)

Additional measures workplaces can take:

- Increase air circulation (open windows, if able)
- Seal cracks in basements
- Install sump pump covers



Visit the project summary page at <https://www.occupationalcancer.ca/project/radon-in-ontario-workplaces/>. This project was funded by the Ministry of Labour, Immigration, Training and Skills Development (MLTSD). The views expressed in this publication are those of the OCRC and do not necessarily reflect those of the Province.

# RADON SURVEY OF ONTARIO WORKPLACES

## Radon is a gas that is...



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## Why is radon a concern?

Exposure to radon can cause lung cancer

## Where is radon found?

- Naturally found in rocks and soil
- Basement and ground floors are at most risk of radon gas buildup



## The OCRC Study: What are radon levels in Ontario workplaces?



### Key Insights

- Almost all cities had at least one workplace that tested above guidelines
- All buildings are susceptible to radon gas buildup
- Testing is the only way to know if radon is a problem
- Workplaces can test for radon to reduce risk



### Workplaces were tested in 10 Ontario cities



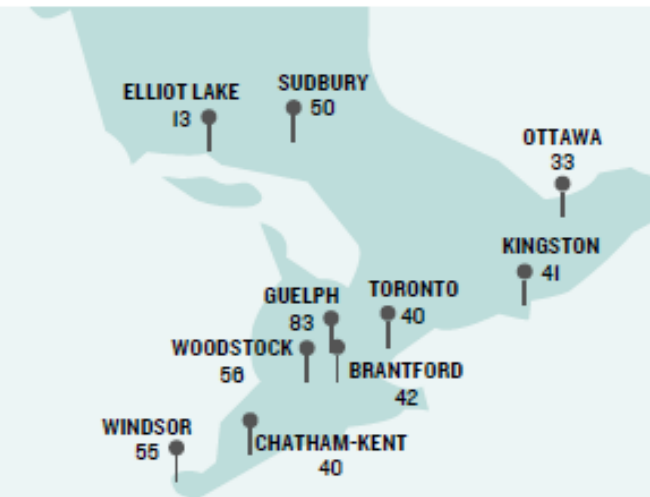
### Workplace Radon Testing

- Radon monitors were placed on ground and/or basement floors in worker-occupied rooms
- Monitors remained in place for 90+ days during winter months



### Radon was detected across Ontario workplaces

- 2.6% of workplaces tested above guidelines (200 Bq/m<sup>3</sup>)
- 7.5% of workplaces tested above World Health Organization (WHO) reference level (100 Bq/m<sup>3</sup>)



For more information on the project, visit: <https://www.occupationalcancer.ca/project/radon-in-ontario-workplaces/>. This project was funded by the Ministry of Labour, Immigration, Training and Skills Development (MLTSD). The views expressed in this publication are those of the Occupational Cancer Research Centre and do not necessarily reflect those of the Province.



# Recommendations

- Use results to educate stakeholders about workplace radon
- MLITSD and other OHS systems should encourage testing in:
  - Workplaces in high background radon regions
  - Workplaces with workers on basement/below-ground levels
  - Small workplaces