



HASTINGS PRINCE EDWARD  
**Public Health**

**Hastings and Prince Edward Counties  
Radon Study  
2019 – 2020**

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## Introduction

### Background

Radon is a colourless, odourless, radioactive gas caused by the decay of naturally-occurring uranium in soil and rock.<sup>1</sup> Radon enters homes in areas exposed to soil and rock that contain uranium.<sup>1</sup> For example, radon enters a house through cracks in the basement, sump pumps and floor drains.

In the open air, radon poses limited health risks. As radon escapes from the soil, it is diluted in the open air. However, in confined spaces such as homes, radon can build up and become a health hazard.<sup>2</sup> Exposure to high levels of radon has been associated with an increased risk of lung cancer.<sup>3</sup> In Canada, radon is the second leading cause of lung cancer after tobacco smoke.<sup>1</sup> The risk of health effects from radon depends primarily on radon concentration, duration of exposure, and smoking habits or exposure to second-hand smoke.<sup>3</sup>

To protect Canadians, the radon level for indoor air is set at 200 Becquerels per cubic meter (Bq/m<sup>3</sup>) or less.<sup>1</sup> A Becquerel equals one radioactive disintegration per second. The World Health Organization radon guideline for indoor air is lower at 100 Bq/m<sup>3</sup> or less.<sup>4</sup>

Radon is found across Canada, though levels of radon vary significantly.<sup>1</sup> Areas with high radon levels mostly have large amounts of uranium in their soil and rock. Within Hastings and Prince Edward Counties (HPEC), the Bancroft area had 3 uranium mines. In a 2009-2011 study by Health Canada, 12.1% of 99 homes in HPEC sampled had radon levels of more than 200 Bq/m<sup>3</sup>.<sup>5</sup> The age or location of a house cannot predict the level of radon present.<sup>1</sup> All homes may be at-risk. Testing for radon is the only way to know the radon levels present.

Kingston, Frontenac, and Lennox & Addington (KFL&A) Public Health, situated to the east of HPEC, conducted a radon testing study in 2018-2019.<sup>6</sup> In the study, 21% of KFL&A homes tested above Health Canada's radon guideline of 200 Bq/m<sup>3</sup> and 52% of homes tested above the World Health Organization's radon guideline of 100 Bq/m<sup>3</sup>.<sup>6</sup>

The Health Canada and KFL&A Public Health studies suggest that radon is present in HPEC homes, however current radon levels within HPEC homes are not known.

### Objectives

The objectives of the study are to:

- 1) Measure radon levels of homes within HPEC.
- 2) Determine if only homes from high-risk geographic areas (e.g. Bancroft) have high radon levels.

- 3) Use the study results to better inform Hastings Prince Edward Public Health (HPEPH) stakeholders and citizens of the burden that radon exposure in the area creates.
- 4) Promote radon mitigation strategies to local municipalities, citizens and other partners.

## Methods

### Study Design

The HPEC Radon Study was a mixed-methods study. It used a combination of quantitative chemical testing for radon and a qualitative survey tool.

Residents of HPEC were invited to apply online for voluntary participation in this radon testing study through newspaper and radio ads, as well as a media release in November 2019. Only one person per household was allowed to participate in the study. To be eligible for participation, residents had to meet the following criteria:

- be 18 years of age or older;
- be able to read and follow instructions in English;
- live in the HPEC region;
- own the home they lived in most of the time;
- have a ground floor or basement in this home;
- not have tenants living in this home;
- not run a business that has customers, clients, colleagues or employees who spend 4 or more hours per day in this home (this included children in a home daycare);
- not be planning to renovate or sell this home in the next 6 months; and
- not have already tested or currently be testing this home for radon.

Upon acceptance into the study, participants provided informed consent and completed an online survey about their household to generate a customized radon risk assessment. Participants picked up their radon testing kit with instructions from HPEPH between November and December 2019. The radon testing kits used for the purposes of this study were AccuStar Alpha Track AT-100 long term radon testing kits. A portion of study participants were asked to use two testing kits for quality assurance purposes. After a minimum testing period of three months, participants returned their radon testing kits to HPEPH from February to August 2020.\* Ongoing support was provided to participants via telephone and e-mail communication throughout the study period.

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\* The onset of the COVID-19 pandemic delayed the analysis of testing kit data, however this delay did not impact the quality of the results.

Results of the radon testing kits were returned to participants 4 to 6 weeks after submission along with their customized radon risk assessment. Participants were also provided with additional resources about radon. In the event that radon levels were above the Health Canada and World Health Organization guidelines, participants further received recommendations for lowering the levels in their home.

## Data Analysis

Upon completion of the study period, the radon testing kits were sent to the AccuStar laboratory for analysis, where the average radon concentration was calculated.

Survey and laboratory data analysis were completed using protocols established by KFL&A Public Health.<sup>6</sup> Dr. Megan Carter of KFL&A Public Health completed the analysis using R programming software.

Quantitative survey data was analyzed descriptively and statistically where appropriate. Qualitative survey data was categorized into major themes and sub-themes for internal purposes and program planning at HPEPH. Quality assurance analysis was conducted using the methods outlined by Health Canada's [Guide for Radon Measurements in Residential Dwellings \(Homes\)](#).

## Results

A total of 519 homes in HPEC completed radon testing and obtained valid results from the testing kits. The majority (59.5%) of testing kits were placed in the basement of participating homes, while just over a third (38.9%) of testing kits were placed on the first floor of participating homes. The remaining testing kits (1.5%) were placed in unknown locations within participating homes.

A total of 78 homes (15.1%) had radon levels at or above the Health Canada guideline of 200 Bq/m<sup>3</sup> (Table 2) with 4 homes (0.8%) having radon levels of 600 Bq/m<sup>3</sup> or more. A total of 236 homes (45.0%) had radon levels at or above the World Health Organization guideline of 100 Bq/m<sup>3</sup> (Table 1). Radon levels in participating homes exceeded the Health Canada and World Health Organization guidelines across HPEC (Table 3).

**Table 1. Estimated prevalence of household radon levels at or above WHO guideline of 100 Bq/m<sup>3</sup>, by region**

Region	Percentage of Homes (CI*)
Belleville	40.9 (33.6 – 48.4)
Prince Edward County	41.1 (31.9 – 50.8)
Quinte West	45.3 (35.6 – 55.2)
Rural Hastings / Tyendinaga & Deseronto	56.7 (47.3 – 65.7)
<b>Total (HPEC)</b>	<b>45.5 (41.1 – 49.9)</b>

\*CI refers to a 95% confidence interval.

**Table 2. Estimated prevalence of household radon levels at or above Health Canada guideline of 200 Bq/m<sup>3</sup>, by region**

Region	Percentage of Homes (CI*)
Belleville	12.2 (7.8 – 17.8)
Prince Edward County	16.1 (9.8 – 24.2)
Quinte West	9.4 (4.6 – 16.7)
Rural Hastings / Tyendinaga & Deseronto	23.3 (16.1 – 31.9)
<b>Total (HPEC)</b>	<b>15.1 (12.1 – 18.4)</b>

\*CI refers to a 95% confidence interval.

**Table 3. Estimated prevalence of household radon levels, by region**

Region	Percentage of Homes			
	Less than 100 Bq/m <sup>3</sup>	100 to less than 200 Bq/m <sup>3</sup>	200 to less than 600 Bq/m <sup>3</sup>	600 Bq/m <sup>3</sup> or more
Belleville	59.1	28.7	12.2	0
Prince Edward County	58.9	25.0	16.1	0
Quinte West	54.7	35.8	8.5	0.9
Rural Hastings / Tyendinaga & Deseronto	43.3	33.3	20.8	2.5
<b>Total (HPEC)</b>	<b>54.5</b>	<b>30.4</b>	<b>14.3</b>	<b>0.8</b>

The regions in Tables 1-3 were established to ensure sufficient sample size to report the results with a margin of error of 10% or less. This meant that municipalities of Centre Hastings, North Hastings, Tyendinaga and Deseronto were grouped together to create the “Rural Hastings / Tyendinaga & Deseronto” region.

Based on the confidence intervals, there are no significant differences between regions in terms of the prevalence of households at or above either the World Health Organization or Health Canada guidelines.

## **Discussion and Conclusion**

This study consisted of a convenience sample and cannot accurately portray the prevalence of radon in all households within HPEC. However, it does highlight that high levels of radon exist in homes across the entire HPEC region.

The results of this study support the HPEPH commitment to increase radon awareness in the community.

HPEPH will continue to provide informational handouts to the general public, the Board of Health and local municipalities to increase awareness of the health risks associated with radon, as well as promote radon testing among homeowners. Municipalities can assist in protecting residents against radon health risks by requiring new home developers to test for radon levels, encouraging radon mitigation strategies in the construction of new homes, and subsidizing radon mitigation strategies for existing homeowners.



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