



STUDY #2 IN A SERIES OF REPORTS ON RADON IN BC HOMES

Prince George: COMMUNITY-WIDE RADON TESTING RESULTS

THE  LUNG ASSOCIATION™
British Columbia

AS PART OF ITS

RADON AWARE
PROGRAM

THE  LUNG ASSOCIATION™

BC Lung Association

The British Columbia Lung Association (BCLA) is one of the province's oldest not-for-profit health advocacy and service organizations. BCLA began operations in 1904, first focusing its efforts to eradicate the spread of tuberculosis. Over the last hundred years BCLA has widened its efforts to address many other lung related diseases such as asthma, Chronic Obstructive Pulmonary Disease, flu, and lung cancer. Although a significant funder of medical research, BCLA works primarily in the public health area of prevention and control.

RadonAware

RadonAware is a branded public education and advocacy program established by BCLA. The program is focused on providing research, information, education and public advocacy on issues related to reducing the public health risk from radon. For more information see www.radonaware.ca

Acknowledgements

BCLA is grateful to all the partner agencies that supported the Prince George Radon Testing Project with their time and expertise. A project Collaborative Committee was established to share information and resources related to the Project, which meant everything from raising awareness, finding homeowner and contractor participants, distributing radon test kits or facilitating home appointments, educating homeowners on radon testing techniques and providing organization support.

A special note of appreciation goes to committee members from the Fraser Basin Council, the Canadian Cancer Society, Northern Health Authority, the Prince George Metis Housing Society, Canadian Home Builders' Association of Northern BC and Central Interior Radon Testing.

Most importantly, BCLA would like to thank and acknowledge the participation of the more than 2,000 residents of Prince George and area in this community research project.

Prepared by the BC Lung Association's RadonAware Team

Dennis Rogoza, Project Lead, RadonAware

Hugh Roberts, Project Specialist, RadonAware

Britt Swoveland, Provincial Coordinator, RadonAware

OCTOBER 2014

A NOTE ON PRIVACY

Participants in this research project participated on a voluntary basis. Each participant received radon test results for their own residence, and these results were shared with BCLA on a confidential basis. The overall information collected has been used by BCLA to analyze and report out radon test results at a community wide level.

SUMMARY

Radon is a colourless, odourless gas that is found in soil, rocks and water. Radon has been identified as the second leading cause of lung cancer in Canada. Health Canada estimates as many as 16 percent of lung cancer deaths can be attributed to radon exposure. Most of the lung cancer risk posed by radon happens in homes.

Many homeowners want to know what the radon level is in their home. In January 2014, the BC Lung Association launched Canada's largest single community radon testing project in Prince George, BC. This project serves to answer the radon level question for homeowners and tenants, and provide average radon level results for all testing tracked by Postal Code Area (PCA).

The Project offered free radon test kits to 2,000 Prince George homeowners and tenants to test indoor radon levels in their homes. A total of 1,436 test kits, or 71.5 percent of test kits distributed, were returned from across the City. Each participant in the Project has received the radon test results for their home.

This report provides the radon test results for the community as a whole and by PCA.

The test results show that 29 percent of Prince George homes have radon levels above the Health Canada action level of 200 Bq/m³. Above this level Health Canada recommends that residents take action to reduce the radon levels in their home.

The test results also show that there are variable radon levels across Prince George based on the test results over the four PCAs. One PCA reports that 56 percent of homes in that area had radon levels above 200 Bq/m³.

It must be noted that PCAs have been used to track the number of tests completed by geographic location within Prince George and should not be viewed as an indicator of whether or not any home may have radon levels above or below 200 Bq/m³. The only way to know if your home has elevated levels of radon is to test.

SECTION 1 - Overview

Background

Radon is a colourless, odourless gas that is found in soil, rocks and water. It is a product of the decay of uranium and is found throughout the earth's crust. As a gas, radon moves freely through the soil and when radon reaches the atmosphere it is diluted to low levels and does not pose a significant health risk. However, when radon is trapped within a building and can't escape it can be a very serious health risk to occupants. Radon has been identified as the second leading cause of lung cancer in Canada. Health Canada estimates as many as 16 percent of lung cancer deaths can be attributed to radon exposure.

Most of the lung cancer risk posed by radon happens where people spend much of their time – in their homes. A high concentration of radon in a home and exposure over many years increases the health risk from radon. Smoking also increases the health risk of radon. Individuals that smoke (or have smoked) and are exposed to high levels of radon have an increased risk of developing lung cancer.

RadonAware

BCLA has been a long-time advocate for stronger action to address the public health risk from radon. With funding from the BC Ministry of Health, BCLA launched an array of new initiatives to support its radon-related efforts in the summer of 2013. BCLA created a central radon information hub, www.radonaware.ca, which offers information and educational materials including videos and a do-it-yourself instructional manual on how to mitigate high radon levels in housing. Copies of this manual have been placed in libraries across the province. Residents can also purchase easy to use home radon test kits from the website.

With respect to radon initiatives related to housing, in September 2014, BCLA completed a detailed study on radon mitigation measures and the BC Building Code. The Association wanted to ensure that new housing has the proper measures installed to offer a low radon risk to occupants. This study, *A Comparison of Three Radon Systems in British Columbia Homes: Conclusions and Recommendations for the British Columbia Building Code*, was an important factor in the BC Government implementing recent changes to the Building Code to reduce the health risks of radon in new housing. This study is now available on the RadonAware web site.

A question many homeowners ask is: "What is the radon level in my home?" There is only one way to answer this question: The home should be tested. BCLA works diligently to help homeowners and tenants answer this question, but also believes it is important to determine how large a health risk radon can be at a larger, community wide level.

In January 2014, the BCLA launched Canada's largest single community radon testing project in Prince George, BC. This project serves to answer the radon level question for homeowners and tenants.

SECTION 2 - Radon Health Guidelines vs. Test Results

Radon Measurement

Radon is measured in becquerels/cubic metre (Bq/m³). A becquerel measures the amount of radioactivity decay in radon gas. Health agencies have set out guidelines on the Bq/m³ exposure levels that are deemed to present a public health risk.

Health Guidelines

Health Canada's radon exposure guideline is 200 Bq/m³. The US Environmental Protection Agency's guideline is 148 Bq/m³. The World Health Organization set its guideline for action at 100 Bq/m³. This suggests strong international scientific consensus within a narrow guideline range that action should be taken to reduce radon levels to below this range.

Radon Test Results vs. the Guidelines

It is important to note that the BCLA is of the view that these are guidelines only and that homeowners should apply the precautionary principle and make every effort to reduce radon levels in their homes to the lowest level possible.

Reducing radon levels is especially important in situations where an individual smokes and lives in a home with high levels of radon exposure. Smoking and radon appear to have negative synergistic health effects. Health Canada estimates the risk of developing lung cancer is significantly higher if a person is exposed to unsafe levels of radon and also smokes. A person has a 1 in 20 lifetime chance of developing lung cancer if they are exposed to high levels of radon. A person has a 1 in 3 lifetime chance of developing lung cancer if they are exposed to high levels of radon and they smoke.

SECTION 3 – The Prince George Radon Testing Project

Radon Test Kits

The project offered free radon test kits to Prince George homeowners and tenants to test indoor radon levels in their homes. The radon testing technology selected by the BCLA for use in the Project was the AT-100 Long Term Alpha Track detector provided by AccuStar Labs. AccuStar is a long time supplier of radon test kits to the BCLA and worked closely with the Prince George Radon Project team to facilitate all the logistics in dealing with several thousand test kits. AccuStar products and labs are certified by the Canadian National Radon Proficiency Program (C-NRPP) and National Radon Safety Board, which are recognized by Health Canada.

Included in each test kit was one AT-100 Long Term Alpha Track detector and a survey form.

| PROJECT TIMELINE | |
|---|---|
| January 2014 – February 28 th 2014 | Distribution of test kits |
| April 2014 – July 15 th 2014 | Collection of test kits and submission to lab |
| May 2014 – September 2014 | Test results distributed to participants |

Homeowner Participation

The BLCA used a variety of methods to bring awareness of the Project to the community and invite homeowners to participate. These included TV news media, advertising, door to door visits, booths at public events and public locations, social media, and direct mail. Any participant who owned or rented a home in Prince George was invited to participate. The Fraser Basin Council and the Canadian Cancer Society were the two agencies responsible for test kit distribution and assisting participants with filling out the registration form. The Northern Health Authority distributed 150 test kits at a local secondary school.

Deploying the Detectors

Participants were instructed to deploy the radon detector in the lowest lived-in level of the home. If the dwelling had more than one floor level, only the lowest lived-in level was tested. However, if the lowest floor level was a basement with a high occupancy (at least 4 hours per day), the participant was encouraged to place the detector in the basement. Participants received one test kit per home. A second test kit was provided as a quality assurance measure at a rate of 10 percent of total test kits distributed.

Additional Data

As part of the deployment of radon test kits, each participant was asked to complete a survey regarding their home. The purpose of collecting this information was to allow for a detailed analysis by the BCLA of housing characteristics versus radon test results. This detailed analysis will assess any correlation in radon test results and specific features of a home such as, size of home, one versus two stories, basement versus no basement, year of construction, heating systems, etc. This survey building data will be analysed by the BCLA in 2015.

Number of Homes Tested

The total number of homes successfully tested in Prince George was 1,436, although over 2,000 homeowners received a test kit. This resulted in a 71.5 percent radon test completion rate.

| | |
|---|--------------|
| Total number of homes that received radon test kits in Prince George | 2008 |
| Total number of homes that returned radon test kits in Prince George | 1436 |
| Return rate of test kits in Prince George | 71.5% |

Of those, 369 participants were randomly selected for home visits. The purpose of this initiative was to enable comparison of the radon test return rates between having an outreach assistant deliver and deploy a test kit (and fill out the survey) versus a resident picking up a test kit and deploying the detector themselves. This personal interaction was clearly more effective as the return rate was 89 percent compared to 68 percent without a home visit.

Quality Assurance – Confirming the Accuracy of the Radon Test Data

The Project applied a number of Quality Assurance Measures to confirm the accuracy and precision of the radon test devices and resulting data. The methods used are described below:

| Type of Quality Assurance Test | % of Total Radon Test Devices | Quality Assurance Procedure | Purpose |
|--------------------------------|-------------------------------|---|--|
| Duplicate Test Devices | 10% | A second radon detector was placed 4" from the primary detector in the same location of the home for the same exposure period. | To confirm the results of the primary detector applied in the same home. |
| Blanks | 5% | Detectors were left in original sealed packages for the entire testing period. The package was opened, immediately re-sealed to simulate an actual home test, and shipped to AccuStar Labs for analysis with a batch of field-deployed detectors. | To assess whether detectors that had not been exposed to any radon had any amounts of exposure due to shipping and/or storage processes. |
| Spikes | 3% | Radon detectors were exposed to an exact amount of radon at a special lab in the US. The spiked detectors were then sent 'blind' to AccuStar's lab for analysis. | To test the accuracy of the detector in measuring a known level of radon. |

The results of these measures allow the BCLA to confirm the accuracy and precision of the Prince George radon test results.

SECTION 4 – Radon Test Results for Prince George

Radon test results for Prince George were assessed and organized using the four Postal Code Areas for Prince George as shown in the map below: V2K, V2L, V2M, and V2N.

Map of Postal Code Areas in City of Prince George

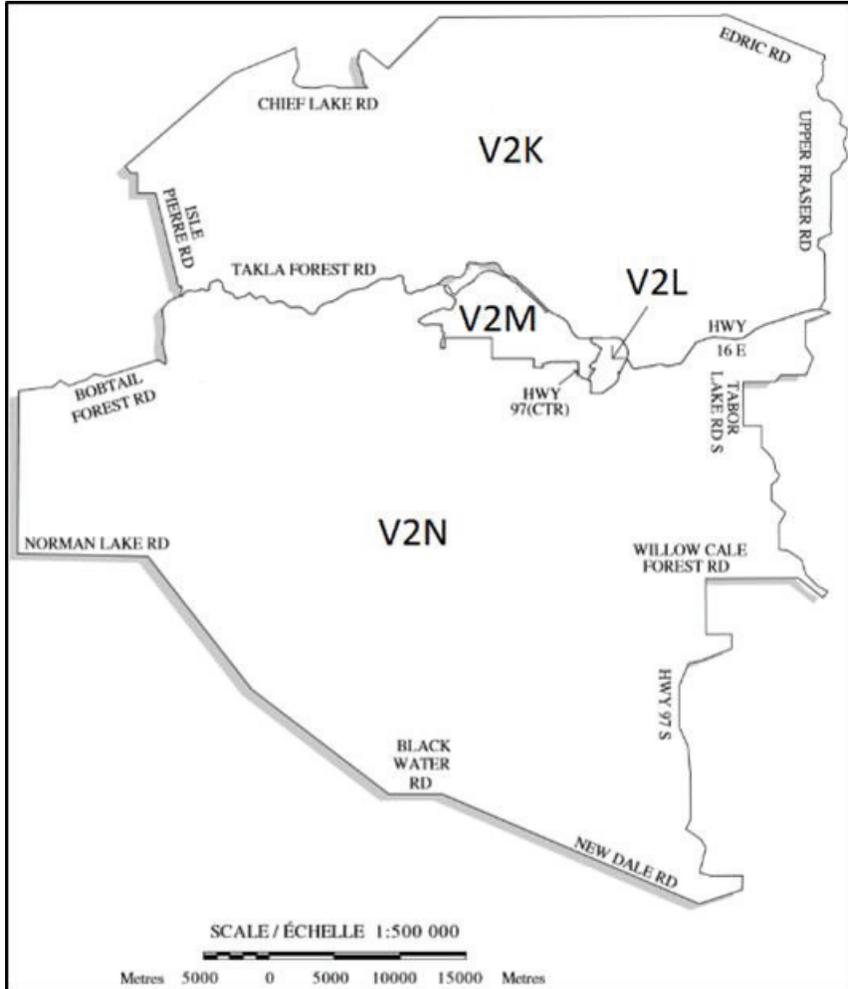


Chart 1 – Radon Test Results for All Homes Tested In Prince George

Charts 1 through 5 show the percent of radon test results above 100 Bq/m³ and 200 Bq/m³.

In Chart 1, the radon test results for 1,436 homes shows that the average level for all Prince George homes is 185 Bq/m³. This number is quite high and is between the very high average test results in one Postal Code Area (V2M) and lower results in the other areas.

Chart 1 also shows that:

- 29 percent of Prince George homes have radon levels above 200 Bq/m³.
- 53 percent of Prince George homes have radon levels above 100 Bq/m³.

Chart 1 - Radon Test Results: All Homes in Prince George

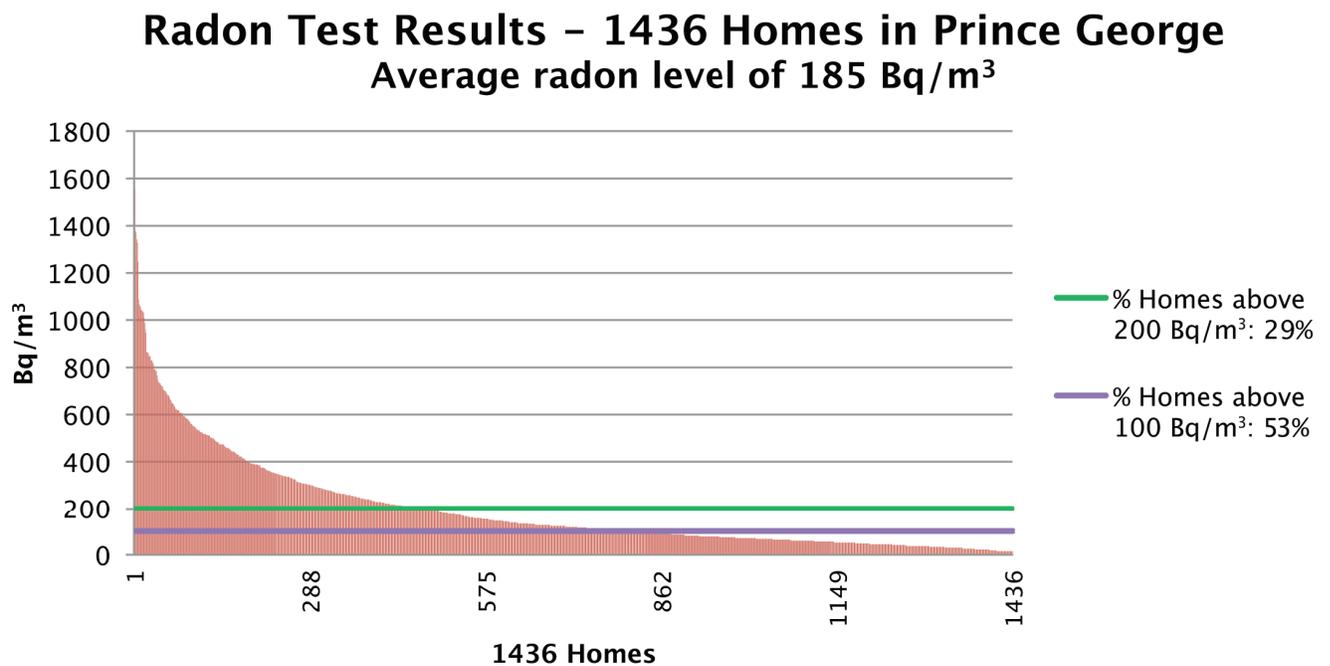


Chart 2 – Radon Test Results for Homes Tested In V2K Postal Code Area (PCA)

In Chart 2, the radon test results for 312 homes tested in the V2K PCA shows that the average radon level is 156 Bq/m³. While this average is lower than the average for all test results, it is still quite high. It is noteworthy that many homes have very high radon levels in the V2K area; some thirteen times higher than 100 Bq/m³. People living in these homes should mitigate these levels to reduce their health risk.

Chart 2 also shows that:

- 18 percent of Prince George homes tested in the V2K PCA have radon levels above 200 Bq/m³.
- 36 percent of Prince George homes tested in the V2K PCA have radon levels above 100 Bq/m³.

Chart 2 - Prince George Radon Results in V2K Postal Code Area

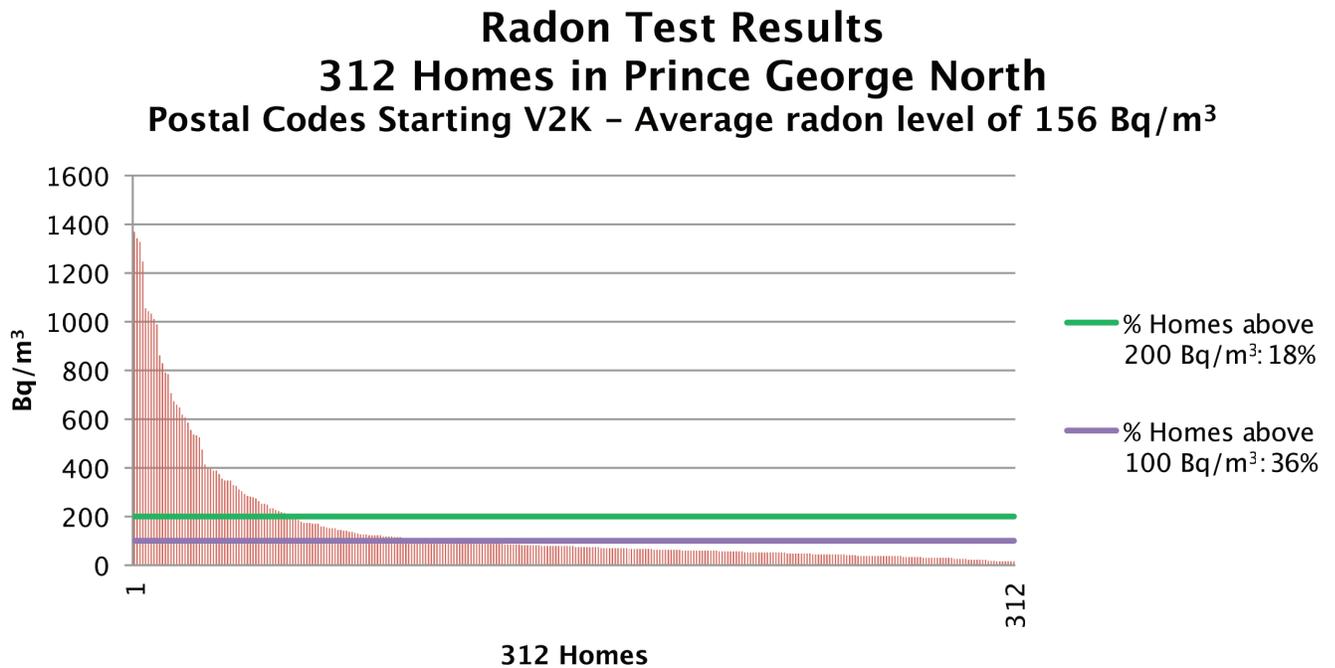


Chart 3 – Radon Test Results for Homes Tested In V2L Postal Code Area (PCA)

In Chart 3, the radon test results for 154 homes tested in the V2L PCA show that the average radon level is 126 Bq/m³ – the lowest average level for all four PCAs. This average is lower than the total homes tested average.

Chart 3 also shows that:

- 14 percent of Prince George homes tested in the V2L PCA have radon levels above 200 Bq/m³.
- 47 percent of Prince George homes tested in the V2L PCA have radon levels above 100 Bq/m³.

Chart 3 - Prince George Radon Results in V2L Postal Code Area

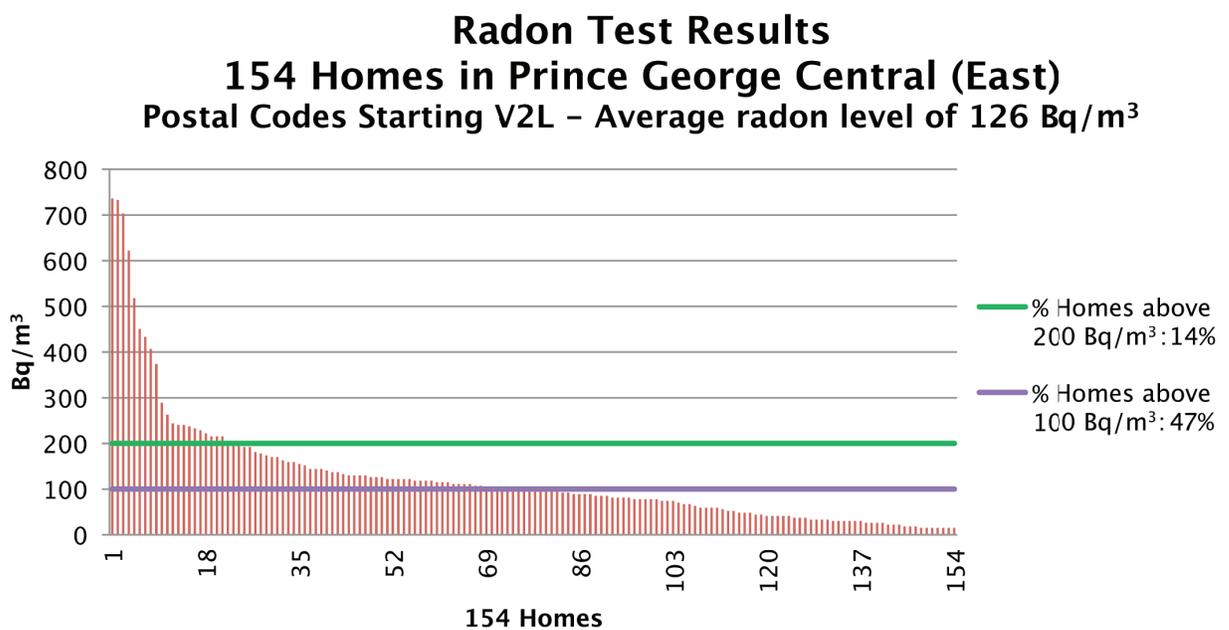


Chart 4 – Radon Test Results for Homes Tested In V2M Postal Code Area (PCA)

In Chart 4, the radon test results for 502 homes tested in the V2M PCA show that the average radon level is 291 Bq/m³. This is a very high radon exposure level and affected homeowners in this area are advised to make radon measurement or mitigation in their home a priority. The very high average number suggests there may be some type of geological conditions that result in high radon levels in this area.

Chart 4 also shows that:

- 56 percent of Prince George homes tested in the V2M PCA have radon levels above 200 Bq/m³.
- 79 percent of Prince George homes tested in the V2M PCA have radon levels above 100 Bq/m³.
-

Chart 4 - Prince George Radon Results in V2M Postal Code Area

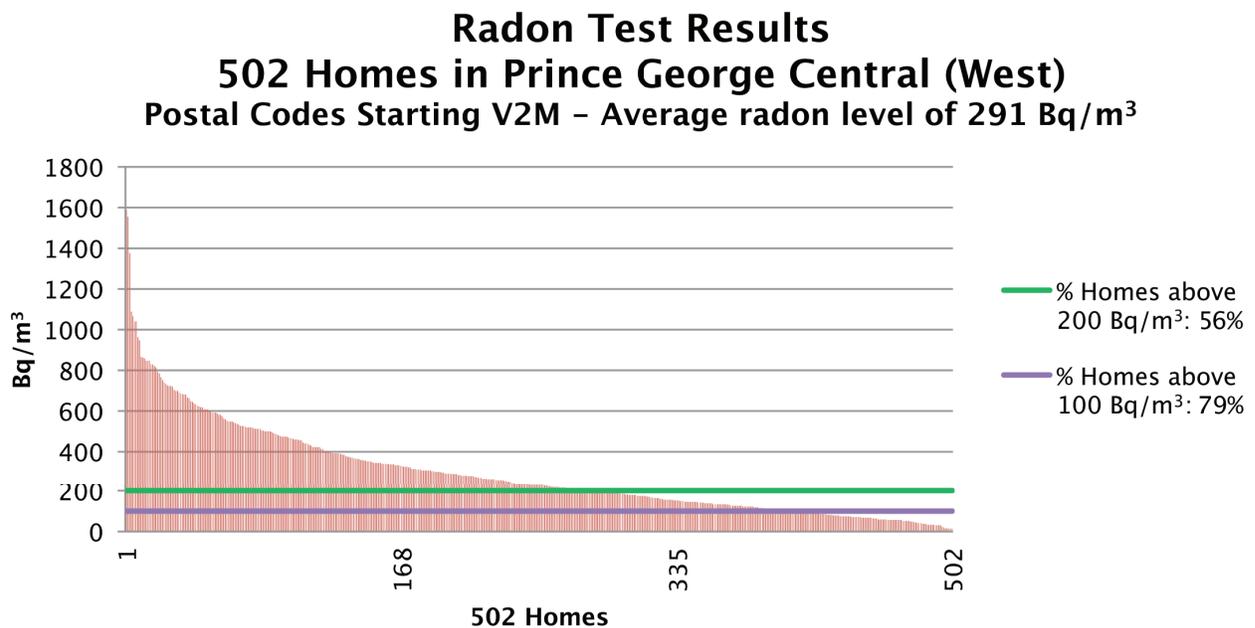


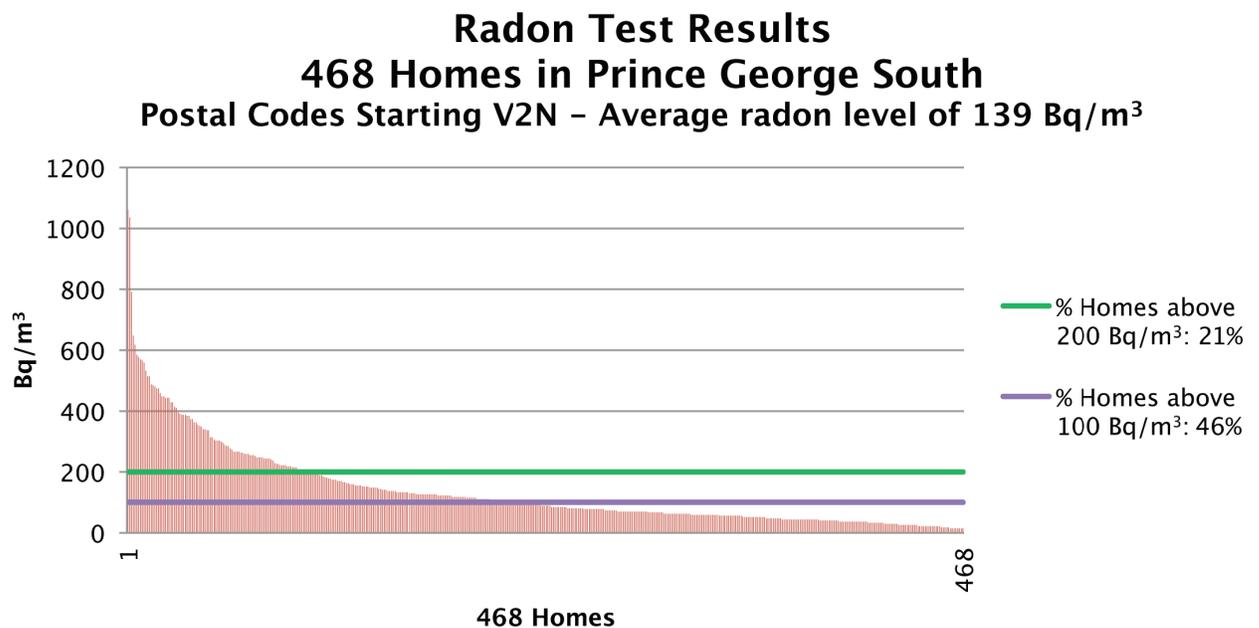
Chart 5 – Radon Test Results for Homes Tested In V2N Postal Code Area (PCA)

In Chart 5, the radon test results for 468 homes in the V2N PCA show that the average radon level is 139 Bq/m³. In the V2N area radon levels are generally lower across the 468 homes tested versus the other three PCAs. At the same time, 46 percent of homes are experiencing test levels above the WHO guideline for mitigation (100 Bq/m³).

Chart 5 also shows that:

- 21 percent of Prince George homes tested in the V2N PCA have radon levels above 200 Bq/m³.
- 46 percent of Prince George homes tested in the V2N PCA have radon levels above 100 Bq/m³.

Chart 5 - Prince George Radon Results in V2N Postal Code Area



SECTION 5 – Study Conclusions

Based on the results and analysis of indoor radon testing performed on 1,436 homes in the four Prince George PCAs (V2K, V2L, V2M, and V2N) the BC Lung Association concludes that:

1. Prince George residents are concerned about radon and the associated health risk as evidenced by over 2,000 homeowners who requested test kits for their homes and the 1,436 homes that were tested. This suggests a wide community interest in the radon issue.
2. All PCAs in Prince George (V2K, V2L, V2M, and V2N) contain a significant percentage of tested homes that show radon concentrations above the guidelines for mitigation published by Health Canada (200 Bq/m³), the US EPA (148 Bq/m³) and the WHO (100 Bq/m³).
3. 56 percent of the 502 homes tested in the V2M PCA have radon levels above the Health Canada guideline for mitigation (200 Bq/m³). This high percentage of homes suggests an underlying geological condition that results in higher radon levels in this part of Prince George.
4. Homeowners in Prince George who participated in the project and have radon levels in their homes above the Health Canada 200 Bq/m³ action level should take action within one year to reduce the radon levels and re-test the home's radon level upon completion of any remediation.