



RADON AWARE CASE STUDY #1  
IN A SERIES OF REPORTS ON RADON IN BC HOMES

# A MODEL FOR RADON TESTING AND MITIGATION IN AFFORDABLE HOUSING

PUBLISHED BY

THE  LUNG ASSOCIATION™  
British Columbia

AS PART OF ITS

RADON **AWARE**  
THE  LUNG ASSOCIATION™

PROGRAM

## **THE BC LUNG ASSOCIATION**

The British Columbia Lung Association is one of the province's oldest not-for-profit health advocacy and service organizations. BC Lung Association 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 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 the BC Lung Association in 2012. The program is focused on providing research, information, testing resources, education and public advocacy on issues related to reducing the lung cancer risk of radon exposure. For more information, please visit [www.radonaware.ca](http://www.radonaware.ca)

## **ACKNOWLEDGEMENTS**

The BC Lung Association would like to express its gratitude to the Board, management, staff and residents of the Aboriginal Housing Society of Prince George for their participation in the Prince George Radon Testing Study. We would also like to thank the BC Ministry of Health for their generous funding support, the Fraser Basin Council for their project coordination and outreach, and Hardy Nickel of Central Interior Radon Testing for his technical services.

Prepared for the BC Lung Association and Aboriginal Housing Society of Prince George by Britt Swoveland, Manager, RadonAware Program & Partnerships

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# FOREWORD FROM SCOTT MCDONALD & LEO HEBERT

## The Importance of Healthy Housing for all Indigenous People



### Scott McDonald, President and CEO, BC Lung Association

The BC Lung Association's on-going partnerships are critical to increasing awareness of radon and its serious health risk. Health Canada estimates that as many as 3,200 men and women die every year in Canada from radon induced lung cancer. Partnering with the Aboriginal Housing Society of Prince George allowed us to better understand how to develop and implement a radon testing project in affordable housing, and more importantly, how to build a connection to Aboriginal Housing in order to create a community-wide radon testing program that was inclusive of all people and housing situations.

The BC Lung Association has a long term goal to continue to collaborate with various organizations to support our vision of a British Columbia where no one is diagnosed with radon induced lung cancer. We are grateful for the opportunity to work alongside the Aboriginal Housing Society of Prince George and commend them on their leadership. From their efforts British Columbia now has a successful model of radon testing and mitigation for affordable housing. We hope this case study will be used as a reference point to support additional project work to create safe and healthy housing for all Indigenous People and anyone living in affordable housing.



### Leo Hebert, Executive Director, Aboriginal Housing Society of Prince George

Healthy housing is a key determinant of health. A house encompasses not just a physical structure, but the social and natural environment in which it is situated. The physical condition of a home includes: the state of repair; plumbing; electricity; safe drinking water; insulation; fire prevention; heating; flooring; furnishings; and, exposure to physical, biological or chemical contaminants such as pests, allergens, mold and radon (Krieger and Higgins, pp. 758-760).

Over the years, new housing technology has been introduced to our people and their homes. This has brought with it positive outcomes as well as challenges. For example, during renovations our homes have become increasingly 'airtight' to reduce energy and increase comfort, but without considering proper ventilation to ensure a high level of indoor air quality.

We are thankful for the continued opportunity to work with the BC Lung Association and others to learn about the health risks of radon, and to take proactive steps to address the radon issue within our homes to better protect the health and safety of our tenants, who are important members of our community. It is and has always been our culture and traditions to ensure we protect the health and safety of our Elders, children, women, and men. Testing our homes for radon, and providing mitigation measures where needed, allowed us to uphold these important values and beliefs.

# BACKGROUND

## Community-wide Radon Testing Study

In January 2014, the BC Lung Association (BCLA) launched Canada's largest single community radon testing study in Prince George (PG), British Columbia (BC). The study offered long-term test kits at no cost to 2,008 PG homeowners and renters to test indoor radon levels. A total of 1,436 test kits, or 71.5 per cent of test kits distributed, were returned from across PG.

## Aboriginal Housing Society of Prince George

The Aboriginal Housing Society of Prince George (AHSPG), formerly the Prince George Metis Housing Society, is a not-for-profit housing provider with a goal to provide safe, healthy, and affordable housing for Aboriginal people of all incomes, ages, and capabilities. As part of the larger Prince George community radon testing study, the AHSPG volunteered to test 136 of their individual housing units for radon. Testing took place for 3 months over the winter of 2013/2014, beginning in mid-December.

The core purpose of the BCLA working with the AHSPG was to determine the main challenges and successes when conducting a radon testing project in an affordable housing arrangement. The AHSPG is committed to providing safe and healthy housing; as such, the Executive Director and the Board determined testing for radon was an important public health initiative and a priority. This case study is intended to provide an overview of the entire radon testing process, how mitigation work was completed, project costs, and recommendations. Organizations responsible for affordable housing may find the information provided in this case study valuable in planning for their own radon testing and mitigation project.

## Radon and Health

Radon gas is a serious public health risk and the leading cause of lung cancer in Canada after smoking. Health Canada estimates that as many as 16 per cent of total lung cancer cases each year in Canada can be attributed to indoor radon exposure. In fact, radon accounts for an average of 55 per cent of a person's lifetime exposure to radiation – a risk factor that is not well known or understood by the general public. The longer a person is exposed to radon, and the higher the radon level, the greater the risk of that person developing lung cancer in their lifetime.

## Radon and Homes

Radon is an indirect decay product of uranium found in rock, soil, and water. Most people are exposed to the risk of radon in their homes, schools and workplaces. The challenge with radon is that you can't see it, smell it, or taste it. Radon gas can infiltrate into a building at any point where the foundation comes into direct contact with the soil. It is when radon decays and particles get 'trapped' in a home and are unable to ventilate to the outdoors, that building occupants are deemed at-risk for developing lung cancer. Through initial conversations with the BCLA, the AHSPG determined that all of its 136 houses needed to be tested for radon.

# Radon Testing

A home's radon level, and the amount of time a person is exposed, are equally weighted in the equation of factors that increase a person's risk of developing lung cancer. The first step to reducing a person's risk of exposure to radon is to perform a simple and low cost indoor air test. An indoor air radon test is typically accomplished by deploying a device known as an alpha-track detector. All the radon tests used in the AHSPG radon testing project were alpha-tracks. The radon detectors remained in the lowest lived-in level of each of the 136 houses for at least 91 days – the minimum period recommended by Health Canada for determining if mitigation is required. At the end of the testing period, detectors were packaged and shipped to a certified lab for analysis. Once the lab analysis was complete, a radon level was provided to the AHSPG that was either above or below the Health Canada guideline of 200 Becquerels per cubic metre (Bq/m<sup>3</sup>). A Becquerel is a standard unit for measuring radon levels.

## AHSPG Houses

All of the 136 AHSPG houses in the study are located within the City of PG. Most of the houses are single family detached dwellings with full basements as shown in Figures 1, 2, 3 and 4. The average age of house in the study was 49 years, with most houses constructed in the 1970s. Most of the people and families living in the houses are considered long-term tenants. In other words, these houses are truly 'home' to many people.



Figure 1. AHSPG House with Basement





Figure 2. AHSPG House with Basement



Figure 3. AHSPG House with Basement



Figure 4. AHSPG House with Basement

## GETTING STARTED

There were three main steps leading up to the launch of the AHSPG radon testing project:

1. The first step was to present a plan to the AHSPG Board for their consideration and approval (Appendix 1). This plan included information on the health risks of radon, the scope of the project (number of houses to be tested), and the overall testing process.
2. The second step was to develop a document to provide to each of the tenants informing them of the planned work, when testing would occur, how long testing would take, and the testing process (Appendix 2).
3. The final step was to develop the actual testing process (Table 1.), schedule deployment dates, and train Outreach Assistants to work with the AHSPG housing manager to deploy the tests and collect building data for each of the houses.

## RADON TESTING PROCESS

Table 1. AHSPG Radon Testing Process

1.	Outreach Team	Worked on the ground alongside the AHSPG maintenance person and property manager to deploy radon detectors.
2.	BCLA	Supplied radon detectors for each of the houses.
3.	Outreach Team	Estimated 7-10 days to deploy the radon detectors in all of the houses.
4.	Outreach Team	Deployed the detectors in December 2013 and continued into January 2014.
5.	AHSPG	One week before deployment of the detectors tenants were provided with an information pamphlet about radon and the study.
6.	AHSPG	2 days notice was provided to all tenants before entry into the house.
7.	AHSPG	The property manager assisted in scheduling access to each of the houses and was present during detector deployment.
8.	Outreach Team	Provided a verbal explanation to each tenant of the radon testing process while the detector was being deployed in the house.
9.	Tenant	Detectors remained in the house undisturbed for a minimum of 91 days.
10.	Outreach Team	Worked with housing staff to collect building data for each of the houses.
11.	Outreach Team	Worked with the AHSPG property manager to collect the radon detectors at the end of the 91-day testing period.
12.	Outreach Team, BCLA and AHSPG	After the test results were collected tenants were provided with information about their home's radon level and what the results indicated.



## COLLECTION OF DATA

The minimum amount of time required for all radon tests to be deployed was 91 days. When the 91-day period ended, Outreach Assistants coordinated with the AHSPG staff and tenants to collect the radon detectors. The detectors were then shipped in bulk to a lab for analysis. The Outreach Assistants also worked with the AHSPG building manager to gather building information on each of the 136 units. This information was used to fill out the Building Survey (Appendix 5), to later be paired with each unit's test result. The BCLA and the AHSPG received copies of the test results.

## RESULTS

Lab analysis concluded the following results for all units tested (Table 2.):

- Of 136 units, 36 (26 per cent) tested above the Health Canada guideline of 200 Bq/m<sup>3</sup>.
- Of 136 units, 100 (74 per cent) tested below the Health Canada guideline of 200 Bq/m<sup>3</sup>.
- Of 136 units 23 (17 per cent) tested between 200 and 300 Bq/m<sup>3</sup>.
- Of 136 units, 6 (5 per cent) tested between 301 and 400 Bq/m<sup>3</sup>.
- Of 136 units, 6 (4 per cent) tested between 401 and 1000 Bq/m<sup>3</sup>.
- Of 136 units, 1 (1 per cent) tested above 1000 Bq/m<sup>3</sup>.

**Table 2.** Radon Levels in AHSPG Houses

UNITS TESTED	RADON LEVEL Bq/m <sup>3</sup>	PER CENT OF PORTFOLIO	UNIT SPLIT
7	401 – 1036	26 per cent	36 Units above 200 Bq/m <sup>3</sup>
6	301 – 400		
23	201 – 300		
30	101 – 200	74 per cent	100 Units below 200 Bq/m <sup>3</sup>
70	0 – 100		
136 total			

## NEXT STEPS

Health Canada recommends action be taken to reduce a person's radon exposure if a home's long-term test result indicates levels above 200 Bq/m<sup>3</sup>. The results of the AHSPG radon testing study indicated a total of 36 units where radon levels met or exceeded the Health Canada safety guideline. The next step for the AHSPG was to develop a plan that included a prioritized method to mitigate each of the 36 units, along with a projected budget for costs and a strategy to inform tenants of the results (See Appendix 3 and 4). The AHSPG consulted with a local Certified Radon Mitigation Professional to provide an estimate of project costs for mitigation work for all 36 houses<sup>1</sup>.

## PROJECT COSTS

Each of the 36 houses with radon levels that met or exceeded the Health Canada guideline were scheduled for mitigation, and provided with a cost estimate to be fitted with an Active Sub-slab Depressurization System (ASDS). The AHSPG provided funds to cover the costs of mitigation measures for 20 houses. The Aboriginal Housing and Management Association (AHMA) provided funds to cover the costs of mitigation measures for 16 houses. Total estimated project costs for mitigation measures for all houses needing mitigation was \$65,660 as outlined in Table 3. The average cost of each ASDS installed was ~\$1,850. It should be noted that all testing was provided to AHSPG free of cost by the BCLA<sup>2</sup>.

**Table 3.** AHSPG Mitigation Budget

UNITS	# of UNITS FUNDED BY AHSPG	# of UNITS FUNDED BY AHMA	COSTS TO AHSPG	COSTS TO AHMA	TOTAL MITIGATION COSTS
36	20	16	\$37,520	\$28,140	\$65,660

1. Please note: Mitigation costs may vary depending on a variety of factors. The BCLA recommends meeting with a minimum of 3 contractors before making a decision.

2. Long-term radon test kits for testing radon in air typically range in cost from \$30 - \$50. Most test kits include lab analysis fees, but do not include shipping. For more information on test kits visit [www.radonaware.ca](http://www.radonaware.ca)

## MITIGATION

All 36 houses that tested at or above the Health Canada guideline of 200 Bq/m<sup>3</sup> received an ASDS.

An ASDS reduces the amount of radon entering a home by enabling its evacuation from below the sub-slab via a pipe. This pipe typically extends from the sub-slab (Figure 5), and out the roof, or via a side-wall as shown in Figure 6. Attached to the pipe is an electrically powered fan (as seen in Figure 6) that helps to increase the draw of soil gases from below the foundation and out the pipe.

An ASDS is the most common radon reduction method used by Certified Radon Mitigation Professionals to reduce indoor radon levels. The average reduction achieved by an ASDS can be as high as 90 per cent, and in some cases, to near undetectable levels. A decision was made by the AHSPG to prioritize mitigation whereby the homes with the highest levels of radon received mitigation measures first.



**Figure 5.** Radon Vent Pipe through Sub-slab



**Figure 6.** Radon Pipe Venting through Side Wall

## POST MITIGATION

Upon completion of each ASDS installation, the site was cleaned of construction debris and the tenant was provided with information on how the system works. In addition, each home was left with a Pro-Series 3 Continual Radon Monitor to measure the levels of radon post-mitigation and to ensure radon levels remain below the Health Canada safety guideline. The Pro-Series 3 Continual Radon Monitor provides digital readings for indoor radon exposure levels. This approach to monitoring radon levels can put tenants' minds to ease knowing that their radon system is working. If radon levels go above the Health Canada guideline the tenant can let the building manager know, and a check of the system scheduled.

All AHSPG houses that received an ASDS reported post-mitigation indoor radon levels well below the Health Canada guideline of 200 Bq/m<sup>3</sup>. An estimated 85 – 90 per cent of houses reported levels below 100 Bq/m<sup>3</sup>, with the highest post-mitigation level reported to be 129 Bq/m<sup>3</sup>.

# RECOMMENDATIONS

1. Budgeting for potential mitigation work is an important part of any radon testing project. When testing homes for radon in a known high radon risk region, the BCLA recommends estimating that between 20 and 30 per cent of homes may test above the Health Canada guideline of 200 Bq/m<sup>3</sup>. The actual per cent of homes that test above the guideline could be higher or lower, but the suggested range provides a safe estimation to ensure an adequate budget to mitigate homes with elevated radon levels.
2. Meet with a Certified Radon Mitigation Professional early to determine what mitigation might cost based on 20 to 30 per cent of homes testing above the Health Canada guideline.
3. When meeting with a Certified Radon Mitigation Professional, determine the time that will be required to complete mitigation and the estimated number of visits needed per home.
4. Make sure tenants are provided with adequate notice to enter, understand the intent of the project (to determine radon levels), and are provided with clear instructions to leave test kits undisturbed for the entire testing period.
5. Provide radon test results to tenants as soon as they are known.
6. Inform tenants that all homes that test above the Health Canada guideline will be mitigated and the radon level reduced.
7. Discuss with a Certified Radon Mitigation Professional the best strategy for ensuring radon levels in remediated homes remain below the Health Canada guideline.
8. Think about a long-term plan for re-testing each of the homes and what the budget for testing will be. The BCLA recommends homes in high radon risk regions be tested with a long term test (91 days) every 2 years.
9. Document the radon testing and mitigation process by filing all test results, and keeping images of completed mitigation work. This can serve as part of your housing portfolio and asset management plan. In addition, this documentation can serve as a record of radon testing completed for when new tenants move in.
10. Let people know your organization has completed radon testing. Place information on your website about radon, what it is, and that your organization has tested its homes and has a plan for managing radon.

# APPENDICES

## APPENDIX 1.

### Project Introduction Letter to Board

*The following document was provided to the AHSPG in December of 2013 and can be used as a guide for other Societies looking to undertake a radon testing project.*

#### What is Radon?

Radon is a radioactive gas that occurs naturally when uranium in soil and rock breaks down. Radon is an invisible, odourless, and tasteless gas. In enclosed spaces such as a home, it can accumulate to high levels and is a major health risk.

#### Radon Health Effects

Radon exposure is the second leading cause of lung cancer after smoking, and is linked to as many as 16 per cent of lung cancer deaths in Canada. Smokers who are also exposed to radon have a 1 in 3 risk of developing lung cancer in their lifetime.

#### What is the Indoor Radon Study?

The BC Lung Association (BCLA) in partnership with the Fraser Basin Council (FBC) is currently conducting an Indoor Radon Study in Prince George. Participants have the opportunity to test their home for radon and complete a survey about the building characteristics. Participants will receive a free radon test kit and a copy of the radon test result.

#### Why is this Study Being Conducted?

Preliminary radon testing over the last several years indicates that over 20 per cent of homes that have been tested in Prince George have radon levels that are higher than the Canadian action level of 200 Bq/m<sup>3</sup>. Participation in the Study will help the BCLA learn more about the types of homes that have radon, the best ways to reduce the radon levels, and help inform provincial health policies and construction standards.

#### Who Can Participate in the Study?

- Homeowners in Prince George.
- Homeowners in Prince George that have installed radon mitigation measures.
- Tenants of rental homes in Prince George.



## Proposed Testing Program with the AHSPG

1. The FBC Outreach Team proposes to work with the AHSPG maintenance person and property manager to test indoor radon levels.
2. FBC will supply, free of cost, radon detectors for each of the AHSPG urban homes.
3. FBC estimates 7-10 days to deploy the radon detectors in each of the homes.
4. FBC would like to begin deployment December 2013 and continue into January 2014.
5. At least 1 week before deployment of the detectors begins, all tenants will be provided with an information pamphlet about radon and the Study being conducted.
6. At least 2 days' notice will be provided to all tenants before entry into the home.
7. FBC recommends that the AHSPG property manager assist in scheduling access to each of the homes and that this person be present during detector deployment.
8. FBC Outreach Assistants will provide verbal explanation to each tenant of the radon testing process while they are deploying the detector in the home.
9. Detectors must remain in-place and undisturbed for at least 3 months.
10. The FBC Study Coordinator will work with AHSPG staff to collect building data for each unit.
11. FBC will work with the AHSPG property manager to collect the radon detectors at the end of the 3 month testing period.
12. After the test results are collected, FBC and PGMHS will work together to review the results and provide information to tenants about their home radon levels and how to interpret them.

## Documenting the Process

The BCLA would like to propose documenting the engagement, testing, and training/education process with the AHSPG through the creation of a short video. This would be an opportunity to showcase the AHSPG as a model for other housing providers on how to engage with tenants on public health issues, accurately test for radon, and work with local community organizations to access important resources in order to provide safe, healthy and affordable housing.

# FURTHER INFORMATION ABOUT RADON

## Radon Entry into the Home

Radon is present in the soil and can enter anywhere a house comes in contact with the soil. This may include, but is not limited to,

- Construction joints
- Gaps around service pipes
- Window casements
- Floor drains
- Sumps or cavities inside walls
- Cracks in foundation walls and in floor slabs

## How can radon levels in a home be reduced?

For homes that have radon levels above the Canadian guideline of 200 Bq/m<sup>3</sup>, one or more of the following measures may be needed:

- Sealing cracks in the foundation and opening around pipes and drains.
- Increasing mechanical ventilation.
- Installing a pipe that draws air from beneath your basement floor to outside the house using a small pump (Active Sub-slab Depressurization).
- Note: It is highly recommended that you consult a C-NRPP certified radon professional to assess your home and determine the best method to reduce radon.

## How much will it cost to reduce radon levels?

The cost of radon reduction will typically range from \$1,500 to \$3,000, depending on the size and design of a house and the amount of work required.

For more information on the Study, please contact:

### **Tiffany Bonnett**

Indoor Radon Study Coordinator  
Fraser Basin Council  
T: 250-961-4524  
E: PGRadonStudy@bc.lung.ca

### **Britt Swoveland**

Radonaware Project Coordinator  
C: 250-686-1597  
E: swoveland@bc.lung.ca  
W: radonaware.ca

## APPENDIX 2.

# Project Introduction Letter to Tenants

*The following document was provided to the AHSPG tenants in December of 2013 and can be used as a guide for other Societies looking to undertake a radon testing project.*

Dear Tenant,

The Fraser Basin Council and BC Lung Association are pleased to let you know that we are partnering with the Aboriginal Housing Society of Prince George (AHSPG) to provide free indoor radon testing for all of the Society's housing units located in Prince George. You can read more about radon gas and how it can affect your health in the information below, and you can contact us anytime at the contact information below for more information.

Starting in December and January, we will be contacting you to arrange for a short visit to your home so we can place a small radon detector in the house. The detector is smaller than a hockey puck, and simply measures the average radon in the home over a period of 3 months. These detectors must remain in place and undisturbed for the 3 months. After the test is completed, we will return to collect the detector and send it away for analysis. We will contact you again to let you know what your radon test results mean.

This testing program will help the AHSPG further its mission for providing safe, healthy, and affordable housing. We hope that you will take this opportunity to learn more about radon in the home, and contact us with any questions you may have.

**Tiffany Bonnett**

Indoor Radon Study Coordinator  
Fraser Basin Council

**Leo Hebert**

Executive Director  
Prince George Metis Housing Society

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## What is Radon?

Radon is a radioactive gas that occurs naturally when Uranium in soil and rock breaks down. Radon is an invisible, odourless, and tasteless gas. In enclosed spaces such as a home, it can accumulate to high levels and is a major health risk.

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## What is the Indoor Radon Study?

The BC Lung Association (BCLA) in partnership with the Fraser Basin Council (FBC) is currently conducting an Indoor Radon Study in Prince George. Participants have the opportunity to test their home for radon and complete a survey about the building characteristics. Participants will receive a free radon test kit and a copy of the radon test result. This is a voluntary research program.

## Why is this Study Being Conducted?

Preliminary radon testing over the last several years indicates that over 20 per cent of homes that have been tested in Prince George have radon levels that are higher than the Canadian action level of 200 Bq/m<sup>3</sup>. Participation in the Study will help the BCLA learn more about the types of homes that have radon, the best ways to reduce the radon levels, and help inform provincial health policies and construction standards.

## Who Can Participate in the Study?

- Homeowners in Prince George.
- Homeowners in Prince George that have installed radon mitigation measures.
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# FURTHER INFORMATION ABOUT RADON

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- Construction joints
- Gaps around service pipes
- Window casements
- Floor drains
- Sumps or cavities inside walls
- Cracks in foundation walls and in floor slabs

Testing is simple and cost-effective. The only way to know if a home has radon is to test.

## How can radon levels in a home be reduced?

For homes that have radon levels above the Canadian guideline of 200 Bq/m<sup>3</sup>, one or more of the following measures may be needed:

- Sealing cracks in the foundation and opening around pipes and drains.
- Increasing mechanical ventilation.
- Installing a pipe that draws air from beneath your basement floor to outside the house using a small pump (Active Sub-slab Depressurization).
- Note: It is highly recommended that you consult a C-NRPP certified radon professional to assess your home and determine the best method to reduce radon.

## How much will it cost to reduce radon levels?

The cost of radon reduction will typically range from \$1,500 to \$3,000, depending on the size and design of a house and the amount of work required.

For more information on the Study, please contact:

**Tiffany Bonnett**

Indoor Radon Study Coordinator  
Fraser Basin Council  
T: 250-961-4524  
E: PGRadonStudy@bc.lung.ca

**PGMHS Office**

T: 250-564-9794  
E: pgmhs@pgmhs.com  
W: www.pgmhs.com

## APPENDIX 3.

# Letter to Tenants: Above Health Canada guideline

*The following document was provided to the AHSPG tenants in May of 2014 and can be used as a guide for other Societies looking to undertake a radon testing project.*

## Attention: Home occupant

### Re: RADON test results

We participated in a community wide radon awareness and testing program coordinated by the Fraser Basin Council in partnership with the BC Lung Association, Canadian Cancer Society, Ministry of Health, Home Builders Association, and Central Interior Radon Testing and Mitigation.

Each home was tested to determine the level of radon, and develop a strategy depending upon the results. The results of the test for your home is: \_\_\_\_\_ which is above the Health Canada action level of 200 Bq/m<sup>3</sup>. This means action is required to reduce the level of radon in the home. We have a certified contractor in place who will be in contact with you to arrange a time to come into your home and to speak to you about reducing your radon level and installing an approved radon mitigation system. If you have any questions about this process, please contact our office.

If you have any questions about radon in general and want to learn more about the results of the test, please refer to the attached Q & A or contact the BC Lung Association's RadonAware Provincial Coordinator by email at [radonaware@bc.lung.ca](mailto:radonaware@bc.lung.ca) or by calling toll free 1-800-665-5864 and asking for Britt Swoveland.

We are committed to providing safe, healthy, and affordable housing for all of our tenants and home occupants. Thank you for your patience, understanding, and cooperation as we continue to make improvements. If you have any other concerns about your health and safety, please contact our office us as soon as possible.

Sincerely,

Leo Hebert, Executive Director

cc: unit maintenance file



## APPENDIX 4.

# Letter to Tenants: Below Health Canada guideline

The following document was provided to the AHSPG tenants in May of 2014 and can be used as a guide for other Societies looking to undertake a radon testing project.

### Attention: Home occupant

#### Re: RADON test results

We participated in a community wide radon awareness and testing program coordinated by the Fraser Basin Council in partnership with the BC Lung Association, Canadian Cancer Society, Ministry of Health, Home Builders Association, and Central Interior Radon Testing and Mitigation.

We had each home tested to determine the level of radon, and develop a strategy depending upon the results. The results of the test for your home is: \_\_\_\_\_ which is below the Health Canada action level of 200 Bq/m<sup>3</sup>. This means no action is required. If you have any questions about radon and want to learn more about the results of the test, please refer to the attached Q & A or contact the BC Lung Association's RadonAware Provincial Coordinator at radonaware@bc.lung.ca or by calling toll free 1-800-665-5864 and asking for Britt Swoveland.

We are committed to providing safe, healthy, and affordable housing for all of our tenants and home occupants. Thank you for your patience, understanding, and cooperation as we continue to make improvements. If you have any other concerns about your health and safety, please contact our office as soon as possible.

Sincerely,

Leo Hebert, Executive Director

cc: unit maintenance file

# APPENDIX 5. Building Survey



## 1. DETECTOR ID AND EXPOSURE PERIOD

Detector ID Number	Date Detector Placed (e.g. Dec / 15 / 2013)	Date Detector Removed (e.g. Mar / 15 / 2014)
<p><b>If this is your only detector, please skip to Section 2 and continue with the survey.</b></p> <p><b>If you have received two radon detectors:</b></p> <p style="text-align: right;">Second (other) Detector ID Number</p> <p>• Write the other detector ID number here (<b>IMPORTANT</b>): <input style="width: 150px; height: 20px;" type="text"/></p> <ul style="list-style-type: none"> <li>• You must place BOTH on the same day in the same location (4 inches / 10 cm apart).</li> <li>• Complete Section 1 of both surveys. Please only complete Sections 2 - 8 on <b>one</b> survey.</li> <li>• After testing, return each survey with its own detector in separate zip lock bags.</li> </ul>		

## 2. CONTACT AND BUILDING FOR DETECTOR PLACEMENT

Contact First Name	Contact Last Name	Email	Phone
For the Building, do you (check all that apply):			Would you like to be contacted regarding radon related outreach or assistance programs? <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Own <input type="checkbox"/> Rent <input type="checkbox"/> Work <input type="checkbox"/> Live <input type="checkbox"/> Rent to Tenants <input type="checkbox"/> Other (specify)			
Building Address		City	Postal Code
Mailing Address of Contact (if different from Building Address)		City	Postal Code

## 3. DETECTOR PLACEMENT DETAILS

How many feet above the floor was it placed?	Who placed the detector?
	<input type="checkbox"/> Owner <input type="checkbox"/> C-NRPP Certified Measurement Professional <input type="checkbox"/> Other (specify): <input type="checkbox"/> Program Volunteer <input type="checkbox"/> Maintenance Professional
Able to place as per instructions?	If No, specify:
<input type="checkbox"/> Yes <input type="checkbox"/> No	
What floor?	
<input type="checkbox"/> Basement <input type="checkbox"/> Main <input type="checkbox"/> Second <input type="checkbox"/> Third <input type="checkbox"/> Other (specify):	
What room?	
<input type="checkbox"/> Rec Room <input type="checkbox"/> Living Room <input type="checkbox"/> Den/Study <input type="checkbox"/> Basement <input type="checkbox"/> Gym <input type="checkbox"/> Other (specify): <input type="checkbox"/> Storage Room <input type="checkbox"/> Bedroom <input type="checkbox"/> Office <input type="checkbox"/> Dining Room <input type="checkbox"/> Attic	
Type of space?	
<input type="checkbox"/> Closed <input type="checkbox"/> Open Concept <input type="checkbox"/> Other (specify):	

## 4. BUILDING

Type of Home			
Single Detached	Semi-detached	Other	
<input type="checkbox"/> Bungalow <input type="checkbox"/> 2-Story	<input type="checkbox"/> Side by Side <input type="checkbox"/> Duplex	<input type="checkbox"/> Trailer/Mobile Home	
<input type="checkbox"/> Split-Level <input type="checkbox"/> 3-Story	<input type="checkbox"/> Row House <input type="checkbox"/> Townhouse	<input type="checkbox"/> Other (specify):	
Year Constructed	Building Footprint Area (sqft)	Number of Storeys (incl. basement)	Heating Fuel Type (check all that apply)
			<input type="checkbox"/> Natural Gas <input type="checkbox"/> Propane <input type="checkbox"/> Oil <input type="checkbox"/> Wood <input type="checkbox"/> Electric
Heat Delivery System (check all that apply)			
<input type="checkbox"/> Furnace <input type="checkbox"/> Stove <input type="checkbox"/> Hydronic/Radiant Water <input type="checkbox"/> Heat Pump <input type="checkbox"/> Baseboard <input type="checkbox"/> Fireplace <input type="checkbox"/> Heat Recovery Ventilator			

## 5. GROUND FLOOR CHARACTERISTICS

Basement or lowest ground level type (check all that apply)				
<input type="checkbox"/> Finished	<input type="checkbox"/> Partially Finished	<input type="checkbox"/> Concrete	<input type="checkbox"/> Open Ground	<input type="checkbox"/> Unknown
<input type="checkbox"/> Unfinished	<input type="checkbox"/> Crawl Space	<input type="checkbox"/> Indoor Parking	<input type="checkbox"/> No Basement	<input type="checkbox"/> Other (specify):

### 5. GROUND FLOOR CHARACTERISTICS continued

What types of openings are in the basement? (check all that apply)	
<input type="checkbox"/> Sump <input type="checkbox"/> Cracks around foundation walls <input type="checkbox"/> Gap in foundation <input type="checkbox"/> Bath/Kitchen Fan <input type="checkbox"/> Dryer <input type="checkbox"/> Stairs <input type="checkbox"/> Drain <input type="checkbox"/> Humidify/air condition drain <input type="checkbox"/> Various Cracks <input type="checkbox"/> Water Supply <input type="checkbox"/> Furnace <input type="checkbox"/> Other (specify):	
Is there plumbing in the basement/crawlspace?	Type of slab on grade floor of basement/crawlspace?
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Poured Concrete <input type="checkbox"/> Earth/dirt <input type="checkbox"/> Rock <input type="checkbox"/> Other (specify):
Type of foundation walls?	
<input type="checkbox"/> Poured Concrete <input type="checkbox"/> Cinder Block <input type="checkbox"/> Brick <input type="checkbox"/> Stone <input type="checkbox"/> Wood <input type="checkbox"/> Other (specify):	
Sub-slab building composition (check all that apply)	
<input type="checkbox"/> Fine <input type="checkbox"/> Wet <input type="checkbox"/> Gravel <input type="checkbox"/> Sand <input type="checkbox"/> Clay <input type="checkbox"/> Other (specify): <input type="checkbox"/> Coarse <input type="checkbox"/> Dry <input type="checkbox"/> Dirt <input type="checkbox"/> Rock <input type="checkbox"/> Don't Know	
Poly or other membrane under slab?	
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partial <input type="checkbox"/> Don't Know <input type="checkbox"/> Other (specify):	

### 6. MOTIVATION AND INTENTION

If the detector shows a high radon level in your home, do you intend to reduce that level? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Maybe If no or maybe, why not? Specify:	Reasons that caused you to test your building or want to test initially (check all that apply) <table border="0"> <tr> <td><input type="checkbox"/> Friend's suggestion</td> <td><input type="checkbox"/> Concern for children</td> </tr> <tr> <td><input type="checkbox"/> Doctor's suggestion</td> <td><input type="checkbox"/> Renovating anyway</td> </tr> <tr> <td><input type="checkbox"/> Buying the building</td> <td><input type="checkbox"/> BC Lung Radon Study</td> </tr> <tr> <td><input type="checkbox"/> Selling the building, thought it was a good idea</td> <td><input type="checkbox"/> Other Radon Program</td> </tr> <tr> <td><input type="checkbox"/> Selling the building, buyer asked for it to be done</td> <td><input type="checkbox"/> Other (specify):</td> </tr> <tr> <td><input type="checkbox"/> Read an article about radon</td> <td></td> </tr> <tr> <td><input type="checkbox"/> Attended a public information session</td> <td></td> </tr> </table>	<input type="checkbox"/> Friend's suggestion	<input type="checkbox"/> Concern for children	<input type="checkbox"/> Doctor's suggestion	<input type="checkbox"/> Renovating anyway	<input type="checkbox"/> Buying the building	<input type="checkbox"/> BC Lung Radon Study	<input type="checkbox"/> Selling the building, thought it was a good idea	<input type="checkbox"/> Other Radon Program	<input type="checkbox"/> Selling the building, buyer asked for it to be done	<input type="checkbox"/> Other (specify):	<input type="checkbox"/> Read an article about radon		<input type="checkbox"/> Attended a public information session	
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<input type="checkbox"/> Read an article about radon															
<input type="checkbox"/> Attended a public information session															

### 7. OCCUPANT INFORMATION

Does anyone regularly sleep in basement?	How many hours per day is anyone in basement?	How often are windows open (days/year) in basement?

### 8. PAST BUILDING CHANGES (complete only if you are aware of renovations or upgrades which have been done to the building)

Date of Last Work (e.g. Nov / 27 / 2013)	Cost of Work	What was the radon concentration prior to work done? <input type="checkbox"/> Didn't Test
		_____ Bq/m <sup>3</sup> OR _____ pCi/l OR <input type="checkbox"/> Tested but Unsure
Who performed the work? (check one only)		Was a permit issued for this work?
<input type="checkbox"/> Homeowner <input type="checkbox"/> Local Handyman <input type="checkbox"/> Friend / Relative <input type="checkbox"/> C-NRPP Certified Mitigator <input type="checkbox"/> Builder During Construction <input type="checkbox"/> Other Professional		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unsure
Type of Building Change (check all that apply)		
<input type="checkbox"/> Radon mitigation <input type="checkbox"/> Made addition to building <input type="checkbox"/> Insulation <input type="checkbox"/> Finished or converted basement <input type="checkbox"/> Changed or upgraded main ventilation or heating system <input type="checkbox"/> Windows <input type="checkbox"/> Other (specify):		
If you checked Radon Mitigation above, was an indicator installed that would advise you of how well the system is working?		If yes, was it an audible alarm?
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
If you checked Radon Mitigation above, type of radon mitigation (check all that apply)		If system is now active SSD, where is the fan?
<input type="checkbox"/> Fill some foundation cracks/holes <input type="checkbox"/> Active SSD <input type="checkbox"/> Fan added to passive SSD <input type="checkbox"/> Fill all foundation cracks/holes <input type="checkbox"/> Passive SSD <input type="checkbox"/> Ventilation <input type="checkbox"/> Seal sump/drain/membrane(s) <input type="checkbox"/> Roof discharge <input type="checkbox"/> Installed during construction <input type="checkbox"/> Crawlspace/membrane depressurization <input type="checkbox"/> Sidewall discharge <input type="checkbox"/> Capped pipe		<input type="checkbox"/> Fan in basement <input type="checkbox"/> Fan in attic <input type="checkbox"/> Fan in garage <input type="checkbox"/> Fan outdoors
If you checked any Sub Slab Depressurization (SSD) above, ways the system is connected to below the slab (check all that apply)		
<input type="checkbox"/> Core through slab with _____ penetrations <input type="checkbox"/> Connected to sump <input type="checkbox"/> Other (specify): <input type="checkbox"/> Under membrane in crawlspace (was membrane sealed to walls and at seams? <input type="checkbox"/> Yes <input type="checkbox"/> No)		
If you checked Ventilation above, what type (check all that apply)		
<input type="checkbox"/> Heat recovery ventilator connected to furnace <input type="checkbox"/> Air cleaner connected to furnace <input type="checkbox"/> Fresh air brought in <input type="checkbox"/> Heat recovery ventilator not connected to furnace <input type="checkbox"/> Air cleaner not connected to furnace <input type="checkbox"/> Other (specify):		
Contractor Name (if a Contractor was used)	Contractor Email	Contractor Phone