REPORT #4 IN A SERIES OF REPORTS ON RADON IN BC HOMES

Future Proofing: Protecting Consumers from Radon in New Homes

A COLLABORATIVE APPROACH TO ACHIEVING CANADA'S MOST PROTECTIVE RADON BUILDING CODE MEASURES

PUBLISHED BY

THE LUNG ASSOCIATION™ British Columbia

AS PART OF ITS

RADON AWARE THE LUNG ASSOCIATION™ PROGRAM

RADONAWARE

RadonAware is a branded public education and advocacy program established by the BC Lung Association. The program is focused on providing research, information, education and public advocacy on issues related to reducing the lung cancer risk caused by radon. For more information see www.radonaware.ca

ACKNOWLEDGEMENTS

The BC Lung Association would like to express its gratitude to those homeowners who participated in this study and the assistance provided by the BC Ministry of Health and the BC Office of Housing and Construction Standards, Building and Safety Standards Branch. We would also like to extend our appreciation to the City of Castlegar, Interior Radiation Protection Services, Central Interior Radon Testing and Mitigation Services, the Fraser Basin Council, and all the industry stakeholders that provided their expertise and knowledge to the 2012 BC Building Code radon review.

PREPARED BY THE BC LUNG ASSOCIATION'S RADONAWARE TEAM

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OCTOBER 2015

LIST OF APPENDICES

Future Proofing: Protecting Consumers from Radon in New Homes

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% of total lung cancer deaths each year in Canada can be attributed to indoor radon gas exposure. In fact, radon gas accounts for an average of 55% of a person's lifetime exposure to radiation. The only known risk factor associated with radon exposure is lung cancer.

Radon and Homes

Most people are exposed to the risk of radon in their homes, schools and workplaces. 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 at risk.

Reducing the Risk

A key aspect of protecting occupants from radon gas is to ensure that new homes are built to reduce this risk for all future residents over the building lifetime. In effect, "future proofing" new homes from radon exposure is an important public health objective fully supported by the BC Lung Association (BCLA). Since 2013 the BCLA's RadonAware Program has focused considerable efforts to identify options and recommendations on how future proofing new homes can be achieved across British Columbia.

Radon Exposure Guidelines

It is important to note that exposure guidelines exist to guide both personal and regulatory decision making on which combination of building techniques, materials and technologies can best achieve the goal of minimizing radon exposure versus the guideline. In Canada, Health Canada published a radon exposure guideline of 200 Bq/m^3, (a technical measure of radon concentration levels) above which action should be taken to reduce radon levels. In the United States the guideline is 148 Bq/m^3 and the World Health Organization sets its guideline for action at 100 Bq/m^3. This suggests strong international scientific consensus within a narrow guideline range that action should be taken to reduce radon levels below this range.

What Is the National Building Code of Canada?

The National Building Code of Canada (NBC) is the model building code for Canada. The NBC provides a solid foundation for the consistent construction of all types of buildings in Canada. As a model building code the NBC has no actual legal effect until adopted by a jurisdiction responsible for regulating construction. A province may adopt the NBC in its entirety, or modify the building code or introduce other changes that reflect local practices or materials. Provincial authority to modify or strengthen recommendations in the NBC is important from a public health perspective.

The National Building Code of Canada and Radon

Minimum requirements for soil gas mitigation, including radon, have been included in Canada's NBC since 1995. A substantial change to radon exposure policy came in 2007 when Health Canada adjusted the radon guideline level for action in buildings from 800 Bq/m^3 to 200 Bq/m^3. The 2010 NBC included changes meant to increase protection against radon entry into a house such as the requirement for the air barrier system to be continuous under the home's foundation slab, and a prescriptive rough-in requirement that could support a future radon mitigation system such as a Passive Radon Reduction System or Active Radon Reduction System.

The BC Building Code

The BC Office of Housing and Construction Standards is the authority that manages the BC Building Code (BCBC), and is responsible for developing regulations that protect new homeowners from soil gases, such as radon. The BCBC uses the model NBC with some variations that reflect the needs of the province. The BCBC applies throughout British Columbia, with the exception of some federally owned lands and the City of Vancouver.

The 2012 BCBC included changes (adopted from the NBC) that required all new homes built in specific communities in British Columbia (referred to in the BCBC Appendices as Area 1) include prescriptive rough-in measures with the following:

- Layer (100mm) of sub-slab granular material (10%/4mm sieve rule),
- 4" pipe into each contiguous sub-slab area,
- Pipe to be located through the sub-slab near centre of the floor, and
- Pipe capped and properly labelled.

The prescriptive radon rough-in measures included in the 2012 BCBC were meant to accommodate the later addition of a full radon vent pipe, known as a Passive Radon Reduction System, should the homeowner determine that radon levels exceeded the 200 Bq/m^3 guideline.

Creating Change through Collaboration

In the spring of 2013 the Ministry of Health (MoH)and the BCLA began meeting with various building industry stakeholders, local government building departments, and the BC Office of Housing and Construction Standards, Building and Safety Standards Branch (BSSB) to inform the technical issues and concerns surrounding effective radon mitigation in new residential construction. This report provides the background information to better understand how the MoH, the BSSB, and the BCLA worked together with the outcome being the new 2014 radon measures in the BCBC.

The BC Ministry of Health, BC Building and Safety Standards Branch, and the BC Lung Association Working Together

The BCLA and the MoH determined "future proofing" newly constructed homes from radon was a critical step to reducing the lung cancer risk posed by indoor radon exposure for all future occupants. With support from the MoH, the BCLA began a dialogue with senior staff at the BSSB that focused on the health risks posed by radon, the 2012 BCBC radon protection measures, and how BCLA could facilitate dialogue between BSSB staff and industry stakeholders. Early communication with the BSSB indicated the need to gather information on how the 2012 BCBC radon protection measures were being implemented in new construction, and if these measures required by the 2012 BCBC were effective at protecting building occupants from levels of radon above the 200 Bq/m^3 guideline.

BC Lung Association Radon Technical Workshop

A milestone event that facilitated significant understanding of the 2012 BCBC radon measures, and their effectiveness, occurred in Victoria, BC in October of 2013. The BCLA hosted a Radon Technical Workshop funded by the MoH and invited industry stakeholders and experts to share their experiences with the 2012 BCBC radon protection measures. Comments and feedback from home inspectors, construction trades workers, industry experts, and community advocates to the BSSB highlighted the need for further research to determine the actual efficacy of the 2012 BCBC radon protection measures. These early discussions between building authorities and industry were critical in determining the best course of action against radon in new residential construction in British Columbia.

Closing the Data Gap

Emerging from the October, 2013 Radon Technical Workshop, the BCLA and the MoH acted quickly to develop a research project. The primary purpose was to investigate the 2012 BCBC radon measures, their effectiveness in protecting occupants from radon, and what other construction measures might offer solutions to reducing indoor radon levels and "future proofing" new construction (and building occupants) from a lung cancer risk.

A Comparison of Radon Systems in British Columbia Homes

Limited data existed in British Columbia to inform the effectiveness of radon protection measures installed under the 2012 BCBC versus more complete Passive Radon Reduction Systems or Active Radon Reduction Systems. Given the important need to ensure that new homes are future proofed to reduce the public health risk of radon, with funding from the MoH the BCLA commissioned a detailed in-the-field study of three variants of a typical radon reduction system, namely:

1. Rough-in Capped System
2. Passive Radon Reduction System
3. Active Radon Reduction System

Study Approach

Two Canadian-National Radon Proficiency Program (C-NRPP) Certified Mitigation Providers were contracted to inspect, test and mitigate 16 homes for each of the measures which had been built under 2012 BCBC. Of the 16 homes, 8 were located in Northern BC (Prince George), and 8 were located in the Southern Interior of British Columbia (Castlegar and Nelson). The project was carried out between January and June 2014.

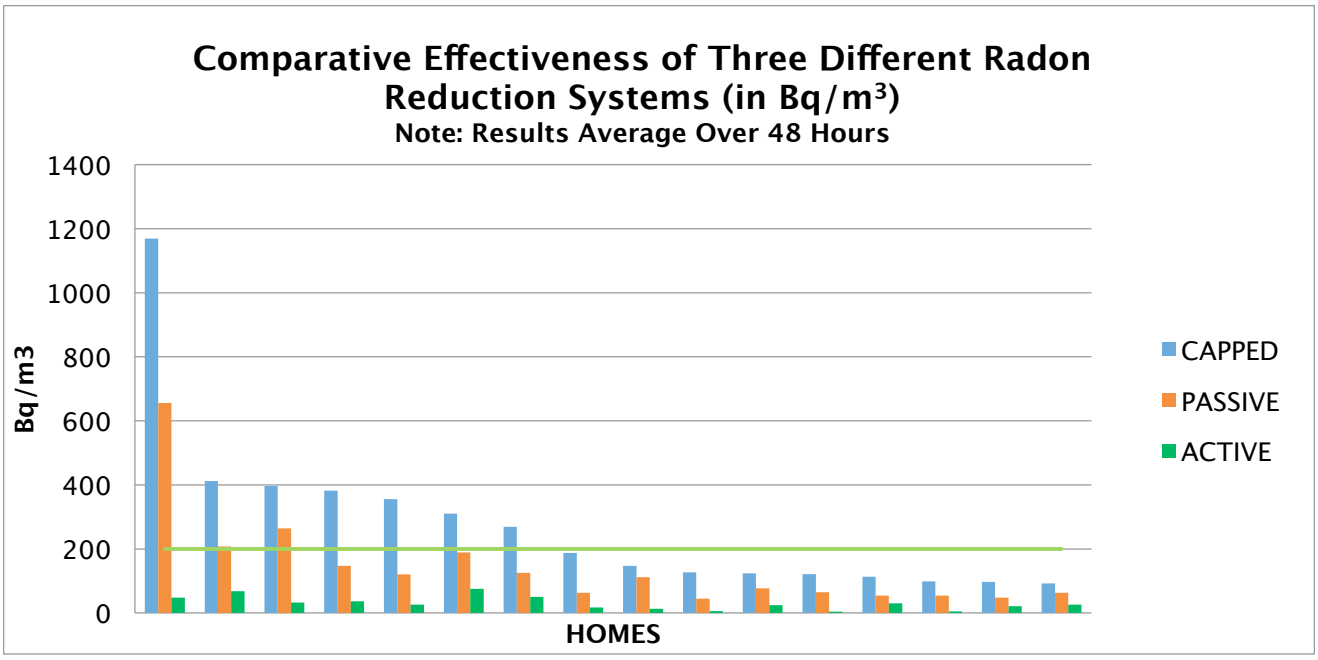
The research methodology provided a unique opportunity to test each of the 16 homes with the 3 different radon reduction systems. All of the homes selected already had a fully installed Passive Radon Reduction System. This enabled the Certified Radon Mitigators to cap the Passive System to emulate the 2012 BCBC rough-in measure, and add a fan to achieve an Active Radon Reduction System. As part of the field study the researchers also noted the degree to which home builders had fully satisfied the requirements of the BCBC with regard to aspects that are radon related. Upon completion of the study all 16 homes were provided with an Active Radon Reduction System at no cost to the homeowner.

Comparative Effectiveness of Different Radon Reduction Systems

The test results showed that (see Chart 1):

- The Rough-in Capped Systems did not reduce radon levels in homes below the Heath Canada guideline of 200 Bq/m^3 in just over half of the homes tested.
- Passive Radon Reduction Systems were consistently more effective in all cases in reducing radon levels versus the Rough-in Capped Systems.
- Active Radon Reduction Systems were significantly the most effective in all cases at reducing levels below the maximum exposure radon guidelines from Health Canada (200 Bq/m^3), the US Environmental Protection Agency (150 Bq/m^3) and the World Health Organization (100 Bq/m^3).

Chart 1: Comparative Effectiveness of Three Different Radon Reduction Systems (in Bq/m³)



Results of Technical Study

The test results lead the BC Lung Association to conclude that:

- The Rough-in Capped System required in the 2012 BCBC (for Area 1 communities referenced in the 2012 BCBC) provides limited protection from the cancer health risk posed by radon.
- The addition of a Passive Radon Reduction System consistently reduced radon levels but in 5 of 16 cases the
- reduction levels were close to or above the Health Canada guideline of 200 Bq/m³.
- Active Radon Reduction Systems reduced indoor radon levels to the most health protective level possible. In one case, radon levels were undetectable with the Active Radon Reduction System.
- In some cases home builders have not followed the requirements of the radon related requirements in the BCBC; these deficiencies have not been identified or enforced by local BCBC compliance authorities.

In summary, the results of the technical study helped to close the data gap to understand the effectiveness of the 2012 BCBC radon protection measures, and supported subsequent changes for radon protection measures in the BCBC. Changes to the 2012 BCBC for radon protection measures became effective December 19th, 2014. The most significant BCBC change included the addition of a full radon vent pipe (attached to the rough-in) exhausting to the outdoors. The BCBC changes to radon protection measures did not include the addition of a radon fan.

Key Observations

In addition to the changes to the 2012 BCBC radon protection measures for new residential construction, the lessons learned and key observations made in the areas of communication, collaboration and partnerships, were invaluable. The BCLA wishes to share these final points to encourage other organizations and authorities to work in partnership to reduce the serious health risk posed by radon, and ultimately, to decrease the number of lung cancer cases, and deaths, in Canada.

#1: Radon is a multi-stakeholder issue. In order to create meaningful solutions, there must be dialogue between building code authorities and individuals working directly in the industry. Health researchers and health agencies can raise awareness of radon health risks, but building industry stakeholders and building code authorities are the solution providers and implementers.

#2: Proactive leadership to encourage discussions between industry stakeholders and building code authorities is vital to achieving an outcome. Changes to building codes are regulatory in nature, methodical and can be process intensive. Patient leadership and an open dialogue through this sometimes slow process is essential.

#3: The National Building Code is a model ONLY and therefore the opportunity and legal authority exists for every jurisdiction to introduce radon protection measures beyond the National Building Code.

#4: Building code regulators, when considering changes to buildings codes, take account of many different factors and often these factors must be balanced between costs and benefits. At the same time, the maintenance of public health and safety of buildings is a central tenet of building codes. While radon is a relatively new issue for building code authorities, there has been a very positive understanding between the core public health tenet of the building code, and that measures to minimize cancer risks from radon exposure are required.

#5: In order for radon protection measures to be effective they must be enforced by building compliance authorities that understand the public health relationship between exposure to indoor radon and the measures included in the building code that are meant to protect building occupants. To ensure that radon measures in a building code are effective these measures must be implemented on a wide scale. Building inspection departments, home inspectors, builders and trades, realtors, and home warranty organizations all need to be part of the radon dialogue.

APPENDICES

APPENDIX 1:

List of Events Leading to Changes in the 2012 BCBC Radon Measures

The following table provides a time chronological list of key activities leading up to the BCBC changes to the 2012 BCBC radon protection measures. The table of activities is meant to guide and support provincial organizations should they decide to work towards stronger building code radon protection measures.

Table 1: Events Leading to Changes in 2012 Code Radon Measures

1	**FEBRUARY 2013**	BCLA 10th Annual Air Quality & Health Workshop
2	**JULY/AUGUST 2013**	The BCLA begins initial discussions with various industry stakeholders.
3	**JULY 2013**	Letter from the City of Castlegar to the Honourable Minister Rich Coleman, Minister Responsible for Housing, requesting an amendment to the City's Building Bylaw #950.
4	**OCTOBER 2013**	The BCLA Radon Technical Workshop in Victoria, BC.
5	**NOVEMBER 2013**	Honourable Minister Rich Coleman, Minister Responsible for Housing, sends a response letter to the City of Castlegar re: request for amendments to the City's Building Bylaw #950.
6	**DECEMBER 2013**	Castlegar's Director of Development Services, brings forward a proposal to Mayor and Council to partner with the BCLA to test various home mitigation systems in Castlegar.
7	**DECEMBER 2013**	The BCLA partners with the City of Castlegar to test the effectiveness of 2012 BCBC radon measures (capped pipe rough-in versus passive and active systems).
8	**JANUARY 2014**	The BCLA launches its 16 Home Radon Mitigation Study and implements a specific testing protocol.
9	**APRIL 2014**	The BCLA completes its 16 Home Radon Mitigation Study.
10	**MAY 2014**	The Building and Safety Standards Branch invites participation in a public review of 2012 Code radon measures.
11	**JULY 2014**	The BCLA gives a presentation to the MoH and Building and Safety Standards Branch on the results of the 16 Home Radon Mitigation Study.
12	**SEPTEMBER 2014**	The BCLA completes the 16 Home Radon Mitigation Study report.

APPENDIX 2

Proposal to Mayor and Council, City of Castlegar to Partner with the BC Lung Association

CASTLEGAR

REPORT TO COUNCIL

DATE:	December 11, 2013	**REPORT NO.:** 13-224
SUBMITTED BY:	Director of Development Services	**FILE NO.**:4900-40
SUBJECT:	**Radon Gas Research Project**	

RECOMMENDATION:

That the update report on the Radon Research Project be received for information.

PURPOSE:

To bring Council up to date on the status of the BC Lung Association and City of Castlegar's – Radon Research Project.

SUMMARY/BACKGROUND:

Castlegar City Council, at the Regular Council Meeting of December 2, 2013 passed the following resolution:

> ***"that a letter be forwarded to the Honourable Rich Coleman, Minister Responsible for Housing and Deputy Premier, thanking him for the information provided to the City regarding the radon testing and mitigation pilot project that is currently being planned by the BC Lung Association, and further,***
>
> ***that Minister Coleman be advised that the City will contact the BC Lung Association and request that the City of Castlegar be included in the pilot project and that the City looks forward to future changes to the BC Building Code which the City believes will result from this pilot project.***

UPDATE:

Staff has held a number of discussions with the B.C. Lung Association regarding the key organizational and action steps needed in order to be in the field in January 2014.

1. Organization

(a) A working group would be established to oversee the project.

(i) Membership will be the City of Castlegar, B.C. Lung Association, Codes Office (Building Standards Branch) and C-NRPP certified radon testers/mitigators. (Others may be added as needed.)

(ii) Dennis Rogoza, Radon Project Lead for the B.C. Lung Association will chair the working group.

(iii) The overall Project Coordinator will be Britt Swoveland, the B.C. Lung Association's full time Radon Coordinator for the province. (Britt Swoveland is also the Project Coordinator for B.C. Lung's large research project now underway in Prince George.)

(b) Communication

(i) The Working Group will hold bi-weekly calls to ensure a coordinated common action.

(ii) A common email distribution list will be established and information shared with those on the list as the project advances.

(iii) To ensure consistent communication with the media (as may be required) Britt Swoveland will be designated the media contact person for the B.C. Lung Association and Phil Markin for the City of Castlegar.

(c) Decision Making

(i) This will be a collaborative project using consensus decision making in the context of using rigorous research protocols to ensure quality study results are achieved.

(d) Data and Reporting

(i) The B.C. Lung Association would be responsible for collecting, organizing, evaluating and drawing conclusions from the research data and will share this information with other members of the working group.

(ii) Detailed level data would be shared with members of the working group (subject to the Provincial Privacy Laws).

(iii) The B.C. Lung Association would author the final study on behalf of, and subject to the approval of both the Lung Association and the City of Castlegar.

2. Project Purpose

(a) The initiative is a research project whose purpose is to:

(i) obtain detailed radon test data in early 2014 on homes built in the City of Castlegar (and surrounding area) under the 2006 or 2012 B.C. Building Code using the best available technology and test protocols.

(ii) conduct *in the field* research on different methods used to reduce radon in homes built under the two codes and to assess the need for the application of added measures under the 2012 Code to reduce the public health risk of radon.

(b) Three test groups will be established for the project.

3. Project Scope

(a) Test Group A

(i) This group would involve a minimum of 10 - 20 houses (30 would be ideal), built under the 2006 and 2012 code. These houses would be actively tested for radon levels using different test conditions and methodologies.

(ii) Each of these homes would be tested as to whether they have no radon rough in, rough in, passive radon systems installed, and then active sub-slab depressurization systems installed where appropriate. They would be tested again – both with the fan off as a passive system, and with the fan active.

(iii) C-NRPP (Canadian National Radon Proficiency Program) certified radon testers/mitigators would be contracted to do *in the field* work using agreed to research protocols under the guidance of a member of the B.C. Lung Radon Project, Hugh Roberts. (The exact research protocols will be established between Mr. Roberts and the certified mitigators once there is available detailed information on the characteristics of the homes in this test group.)

(iv) This testing would occur in the January to April 2014 period.

(b) Test Group B

(i) This group will consist of those homeowners who volunteer to participate in the project but whose homes are not part of Test group A.

(ii) This group will be offered radon detectors for free by B.C. Lung so that baseline radon levels in the homes built after 2006 can be collected. This group could be as large as 100 homeowners and the larger the group the better.

(iii) The logistical details for this group will be developed by B.C. Lung with the City prior to January.

(c) Test Group C

(i) All interested participants of homes constructed prior to 2006 will be offered free tests.

4. Specific Actions

(a) The City will identify all homes built under both the 2006 and 2012 Building Code and establish a data base of homeowners that will be contacted for the project.

(b) B.C. Lung Association will draft three documents for review and use for the project. (These will be co-branded with both the City's and B.C. Lung Association logos.)

(i) Document 1 – This will be a general description of the project that will be sent to all homeowners who are interested in the project.

(ii) Document 2 – This will be a consent form that a homeowner will need to return to the City which confirms their participation in the project.

(iii) Document 3 – This will be a special consent form for those homeowners in which physical changes would be made (if required) to their home which B.C. Lung Association would pay for (example is the installation of a retro fitted passive/active radon system).

(c) Research Protocol

(i) B.C. Lung will work with the mitigators to confirm a detailed *in the field* research program for the Group A homes.

(ii) B.C. Lung will collaborate with the City on developing and implementing the program for the Group B and C homes.

(iii) They will also ensure there are an adequate number of 90 day radon detectors ready for distribution to Castlegar homeowners in early January 2014 and establish a collection protocol in the spring.

IMPLICATIONS:

(1) Social/Environmental	Public education on radon gas mitigation measures will promote the well being of the community.
(2) Personnel	No issue
(3) Financial	The B.C. Lung Association would pay for direct research costs including radon test kits and testing, installation of any added mitigation systems project analysis and reporting and the cost of the certified radon mitigators.

The City would offer in-kind support and be the local support point for the project and provide liason with homeowners and others as needed.

POLICY IMPLICATIONS:

The B.C. Lung Association is in the process of developing a consistent survey form.

One of the goals of the research project is to identify the radon levels in a number of homes built in the Castlegar and surrounding area.

Another important question is to determine what is driving the radon level difference between one home and others constructed under the same building code criteria.

Respectfully submitted,

Phil Markin
Director of Development Services

Approved by:

John Malcolm
Chief Administrative Officer

APPENDIX 3

Radon Testing Protocol in 16 Homes

The study used a standardized testing methodology and sequence for each of the 16 homes in the study. The information provided below lists the various steps in the testing process undertaken by the Certified Radon Professionals.

Testing Procedures:

STEP 1	• Visit home to prep for test and ensure "closed house conditions". • Determine electrical requirements for the fan and schedule electrician if required. • Wait 48hrs.
STEP 2	• Take baseline 48hr test as Passive. • Install cap. • Wait 48hrs.
STEP 3	• Take 48hr test as Capped. • Install certified fan, remove cap, and energize. • Wait 48hrs.
STEP 4	• Take 48hr test as Active. • Leave long term test kit and instructions with owner.

APPENDIX 4

Building and Safety Standards Branch Invitation to Review Changes to the BC Building Code

Tue 2014-05-06 4:05 PM

Hello,

By way of this email, you are invited to participate in a public review of draft changes to the BC Building Code.

As a result of consultation with a number of stakeholders, the Building and Safety Standards Branch is proposing a number of changes to the BC Building Code requirements related to radon.

A draft proposal has been prepared that is intended to address key concerns with the existing requirement for a capped rough-in, by introducing a new requirement for a completed pipe

that terminates outside the building. This change is meant to better achieve the existing

intent of this section of the Code, which is to remove barriers for the future installation of a depressurization system.

This draft proposal does not make any changes to the way radon zones are determined in British Columbia, and does not require testing or the installation of an active depressurization system.

Please review the attached draft proposal and submit comments by replying to this email by Tuesday, May 13, 2014.

Best,

Zachary D. May

SENIOR CODES ADMINISTRATOR | BUILDING & SAFETY STANDARDS BRANCH |
MINISTRY OF NATURAL GAS DEVELOPMENT AND HOUSING

APPENDIX 5

The BC Lung Association Submission to Building and Safety Standards Branch Invitation to Review Changes to the BC Building Code

THE LUNG ASSOCIATION™ British Columbia

RADONAWARE THE LUNG ASSOCIATION™

Zachary May
Senior Codes Administrator
Building & Safety Standards Branch
Ministry of Natural Gas Development and Housing

May 13, 2014

Dear Zachary May,

Thank you for providing the BC Lung Association [BCLA] with an opportunity to respond to the proposed language changes to the BC Building Code requirements related to radon. We are very pleased to support the proposed changes to the Code. These changes are the most advanced of any in Canada and reflect the concern by your Branch, the BC Government and the BC Lung Association that further action is needed to reduce the public health risk associated with radon in buildings. Our Association is also pleased to have played an important role in fostering this proposed radon solution for new housing.

The scale of the radon public health risk in BC is still not clearly known, and has uncertainties. As radon has been identified as the *leading* cause of lung cancer for people who do not smoke, the BCLA follows the Health Canada precautionary principle that measures should be implemented where possible that minimize the lung cancer risk in both new and existing housing.

Over the past year the BCLA has partnered with the public, private and non-profit sector to assess the effectiveness of current Code radon measures in new BC Housing. In this regard our research programs have tried to identify issues in the field so that we could ensure the application of the most cost-effective solutions to "future proof" new buildings from the serious public health risk of radon. The proposed changes to the Code are, in our view, very cost effective. The incremental costs of installing a full radon pipe at time of new home construction is dramatically lower than the costs of retrofitting this solution when homeowners determine their home has a radon risk. These small incremental costs are not comparable to the high personal and public health costs associated with lung cancer.

The suggestions and comments in the attached document reflect the precautionary public health viewpoint and are based on the findings from the Radonaware research project in the winter of 2014.

Yours sincerely,

Scott McDonald
CEO

CC. Arlene Paton, Assistant Deputy Minister, BC Ministry of Health
Tim Lambert, Executive Director, Health Protection Branch, BC Ministry of Health
Neil Moody, CEO, Canadian Home Builders Association, BC
Wendy Acheson, Vice-President and Registrar, Homeowner Protection Office

THE LUNG ASSOCIATION™ British Columbia

RADON AWARE THE LUNG ASSOCIATION™

COMMENTS: Proposed Changes to the BC Building Code – May 13, 2014

1. **Radon Labeling -** Data collected by BCLA from field research performed in Castlegar and area indicates that homes with "passive" type radon mitigation systems can still have elevated radon levels [above 200 Bq/m^3]. Passive systems also do not function well with side venting.
    a. For this reason we are pleased the proposed changes to the Code avoid using the term passive system.
    b. We also note that an important companion aspect of the proposed changes is the need for radon testing in homes to ensure that even with a passive system there may be a need to install a radon fan to reduce radon levels to below the Health Canada guideline.
    c. Given the practical limitations of Code being used to ensure that radon testing occurs, the **BCLA recommends that the radon labeling requirement in the Code should specify that language must be placed on the label that recommends the homeowner should test their home for radon.** This type of language has been incorporated on the voluntary label that has been developed by BC Lung and CHBA and is now being widely distributed to builders.
    d. This concept reflects the view of the Code that homeowners should test their home and if the radon levels are high then install a fan to their radon pipe. The label will be the only visible reminder of this homeowner communication and therefore is important.

2. **Communities** - The proposed Code changes set the use of radon measures as a default, and then provide an exemption list for Area 2 communities which are at a low radon risk.
    a. BCLA endorses this approach with the Code Area 2 list (as is) as it ensures at risk community coverage except in areas where the radon risk is proven to be low.
    b. The inclusion of an Area 1 list in the Code is confusing to the end user, and the concern is that if they see their community is not on either list, they will assume the Code does not apply to them.
    c. **We propose that the Area 1 list reference be removed entirely, and a new term called a "Community Exemption List" be used in place of "Area 2".**
    d. This approach will serve to substantially improve the coverage of the Code, add clarity, and ensure that at risk communities apply the proposed requirements.

3. **Rough-in for a Subfloor Depressurization System -** BCLA is pleased that the proposed Code language change reflects a possible need to install more than one inlet.
    a. BCLA recommends the following amendment to section 9.13.4.3 to ensure that users don't assume that an inlet or inlets which allow for depressurization of only part of the gas permeable layer meets the requirement.
    b. The rough-in referred to in Clause (1) (a) shall include:
        i. a radon vent pipe that has an inlet or inlets that allow for the effective depressurization of the entire gas permeable layer,

4. **Clearance for Radon Fan –** BCLA recommends that the Code include language that ensures if testing confirms high levels of radon and a radon fan is required to be attached to the radon vent pipe that there is adequate clearance between the egress point of the home and adjacent areas inside the home that will allow for a radon fan to be installed.

5. **Section 9.16.2.1. Requires Installation of a Gas Permeable Layer -** The Code states that:
    a. 2) The gas permeable layer required in Sentence (1) need not be installed below:
    c) *buildings* constructed in areas where it can be demonstrated that soil gas does not constitute a hazard.
    b. BC Lung recommends the removal of this sub-clause.
    c. The issue is how can it be demonstrated that soil gas does not pose a hazard? Research has indicated that low levels of radon found in soil do not correlate into low levels of indoor air radon. Low levels of radon in soil, once accumulated and trapped inside a building over time, can become high levels and a health risk.
    d. There is also no definition of the term "hazard" in the Code. According to health scientists any level of radon poses a hazard but the actual health effects are correlated to exposure levels and time. The only way to determine the level of health risk is to use the reference action radon standard of 200 Bq/m^3 and test **indoor** air against this standard.

6. **Radon Pipe Placement** - BCLA is pleased to note the removal of language from the Code that the suction point and radon vent pipe must be located in a central location of the slab floor.
    a. Doug Kladder's Manual, *Protecting Your Home from Radon in Canada*, clearly points out the benefits of locating the suction point near an exterior wall where a stronger vacuum effect may be created. According to Kladder, other benefits to locating the suction point near an exterior wall include:-
        i. The soil is looser under this portion of the slab.
        ii. The vacuum is applied to the floor wall joint which is a large radon entry point.
        iii. The adjacent wall provides a convenient support surface for piping attachment.

APPENDIX 6

Building and Safety Standards Branch Information Bulletin on Changes to 2012 BC Building Code Radon Measures

Information Bulletin
Building and Safety Standards Branch
PO Box 9844 Stn Prov Govt
Victoria BC V8W 9T2
Email: building.safety@gov.bc.ca
Website: www.housing.gov.bc.ca/building

No. B14-07
September 19, 2014

New Radon Rough-in Requirements

On December 19, 2014, new requirements for protection from soil gases become effective. BC Building Code provisions for the rough-in for a subfloor depressurization system now require installation of a radon vent pipe which extends through, and terminates outside, the building.

The new requirements provide a more adaptable substructure for future radon mitigation and require the designer to account for routing of the radon vent pipe during the design stage. This change applies to Part 9 dwelling units and buildings containing residential occupancies where floor assemblies separate conditioned space from the ground. There are no changes to building exemptions based on location and building occupancy.[1]

The potential for high levels of radon infiltration can be challenging to evaluate prior to construction and a radon problem may only become apparent once the building is completed and occupied. Radon mitigation systems are proven to reduce the likelihood of adverse health effects from radon, such as lung cancer. There are links provided in Appendix A of the BC Building Code for information on testing for radon in your home and guidelines for when mitigation is recommended. Those links, as well as sources for more information on radon, are included in the Appendix to this bulletin. It is the owner's responsibility to test their home, and it is recommended that the home be tested again after installation of a radon mitigation system.

The most common and efficient radon mitigation method is soil depressurization. A soil depressurization system requires:

a. space for the movement of soil gases between the ground and the air barrier system (see the gas permeable layer in Figure 1) into which a radon vent pipe is inserted;
b. the radon vent pipe then extends to the exterior of the building and terminates in a safe location (as shown in Figure 1); and
c. the radon vent pipe to be mechanically assisted, typically by means of a fan installed along the pipe, to create a negative pressure in the space between the air barrier system and the ground and exhaust soil gases outside the building.

The BC Building Code does not require installation of a fan during initial construction, although designers should consider the future installation of a fan (which will require access and electrical supply) somewhere along the radon vent pipe.

The BC Building Code refers to material that creates the space allowing the movement of soil gases between the air barrier system and the ground as a gas permeable layer[2] (see Figure 1). The gas permeable layer allows for effective depressurization of that space, and functions as the drainage layer required in Article 9.16.2.1. A typical solution is to install coarse clean granular material below the floor on the ground. This allows compliance with 9.16.2.1.(1)

[1] Exceptions are listed in Article 9.13.4.2. and Table C-3 in Appendix C of the BC Building Code.
[2] The gas permeable layer described in Clause 9.13.4.3.(3)(a) consists of not less than 100 mm of clean granular material containing not more than 10 % of material that will pass a 4 mm sieve.

through either the performance language in 9.13.4.3.(2) or the prescriptive language in 9.13.4.3.(3).

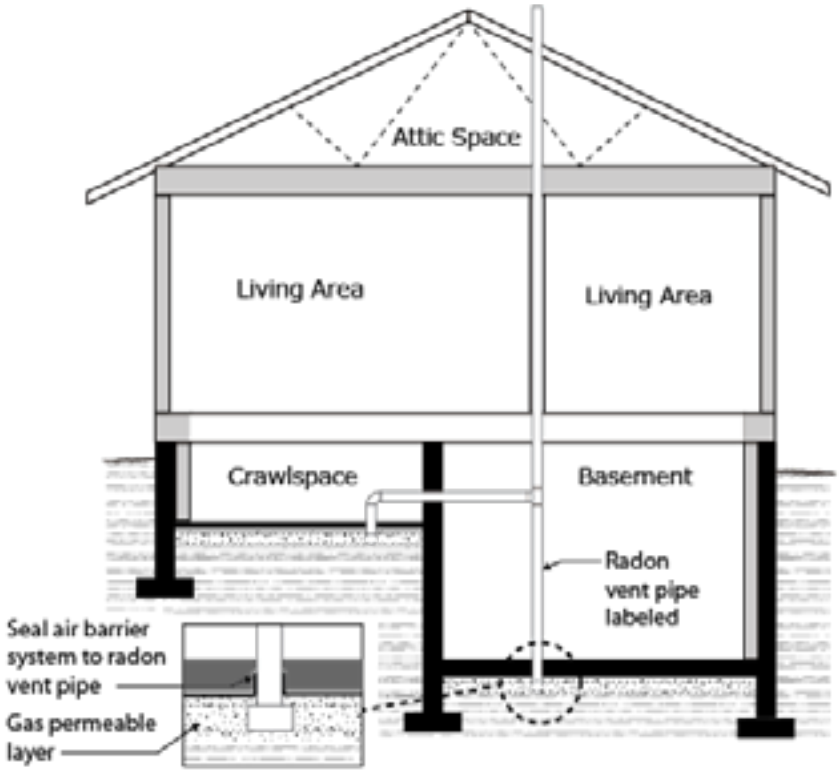


Figure 1

The designer has the performance option in 9.13.4.3.(2) to terminate the radon vent pipe outside the building in a manner that does not constitute a hazard, or use the prescriptive option in 9.13.4.3.(3) and follow the requirements for the location of the termination. The prescriptive termination requirements are similar to the requirements for the termination of plumbing vents[3] and will be familiar to designers and builders.

Installing a gas permeable layer and radon vent pipe after initial construction can be costly and invasive. Extending a pipe through the building to the exterior after initial construction can be problematic if the building design did not account for radon mitigation. The provisions for a radon rough-in during initial construction require a small cost and effort at the time of construction to reduce the much larger cost of retrofitting a radon mitigation system after construction. The requirements provide added benefits of improved sub-slab drainage and integrity of the air barrier system.

[3] The termination of plumbing vents is described in Article 2.5.6.5. and illustrated in Appendix note A-2.5.6.5.(4) of the BC Plumbing Code.

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Frequently Asked Questions

Question 1: What was wrong with the old provisions?

Answer: The old provisions required the pipe to be capped in the interior of the building. The capped pipe did not permit soil gases to leave the building and stakeholders expressed concerns that the location and condition of the rough-in were not always suitable for future connection of a radon mitigation system. The Building and Safety Standards Branch consulted with the Canadian Codes Center, the Ministry of Health, BC Lung Association, as well as industry advocates for radon mitigation to inform improvements to the existing code requirements.

Question 2: Is every home at risk of radon infiltration?

Answer: Radon gas, a result of the decay of uranium, is found in varying degrees as a component of soil gas in all regions of Canada. Health Canada guidelines recommend mitigation when exposure levels exceed 200 becquerels per cubic meter. Table C-3, "Locations in British Columbia Requiring Radon Rough-Ins," in the BC Building Code classifies locations demonstrated to have an elevated risk of the presence of indoor radon levels which exceed 200 Bq/m³ as Radon Area 1. Radon rough-ins are required in Radon Area 1 locations. The remaining locations listed in Table C-3 are simply not known to have an elevated risk, and are classified as Radon Area 2. The geographical separation of Radon Areas 1 and 2 generally follows the Coast Mountains as shown in Figure 2.

Figure 2

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Question 3: Can I use perforated pipe below the air barrier system?

Answer: Yes, you may have multiple inlets on the same radon vent pipe and the perforations act as inlets. The material that serves as the gas permeable layer should project beyond the perforations to facilitate effective depressurization. The pipe must be sealed where it penetrates the air barrier system to maintain its integrity and must be air tight from that joint until termination.

Question 4: If I install a fan during initial construction, what are the code requirements for that fan?

Answer: Because the BC Building Code does not require a fan, there are no requirements specific to radon mitigation that the fan must comply with other than to be air tight. A fan installed along the radon vent pipe must maintain the air-tightness of the radon vent pipe and maintain the integrity of the air barrier system in order to limit leakage from the radon vent pipe into the building.

Question 5: How are buildings other than dwelling units protected against radon?

Answer: Buildings that do not conform to the provisions discussed in this bulletin must conform to environmental separation and ventilation requirements which are found in Parts 5 and 6 of the BC Building Code.

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Appendix

The following sources can provide more information on radon in homes:

British Columbia Ministry of Health (health.gov.bc.ca)

RadonAware, British Columbia Lung Association (radonaware.ca)

The Canadian Cancer Society (cancer.ca)

Canadian Mortgage and Housing Corporation and Health Canada publication

- **Radon: A Guide for Canadian Homeowners 2007** (publications.gc.ca)

Health Canada publication

- **Guide for Radon Measurements in Residential Dwellings (Homes) 2008** (publications.gc.ca)
- **Radon – Reduction Guide for Canadians** (hc-sc.gc.ca)