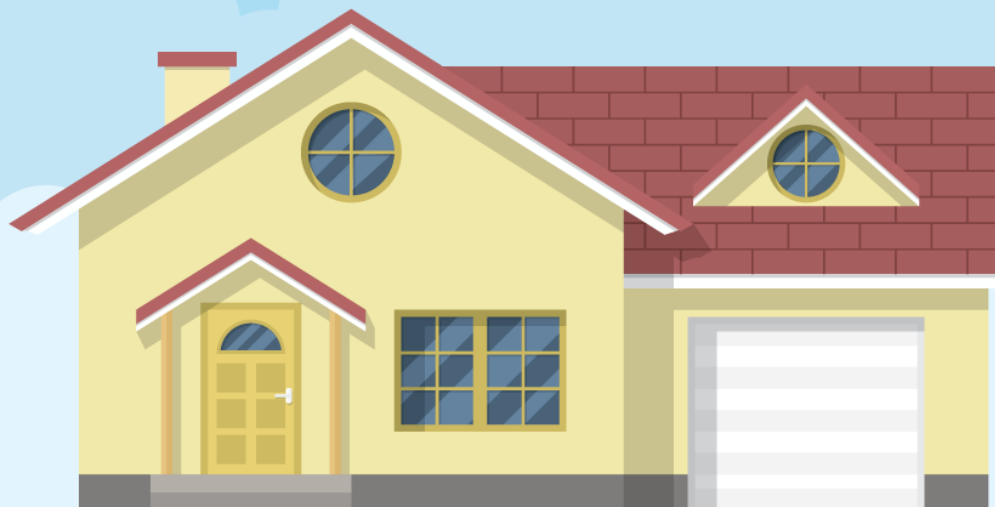




# CARST Guideline for Conducting a Radon Screening Assessment as Part of a Real Estate Transaction of a Residential Dwelling in Canada

April 2020



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## 1 Introduction

Reducing radiation exposure from radon in the home should be a priority for all Canadians in order to protect themselves from radon-induced lung cancer. In order to do this, all homes must be tested for radon, and then mitigated if radon levels are elevated.

Radon testing during the heating season (October through April) over several months (91 days and longer) is recommended by Health Canada for all houses across Canada. Ideally, a home listed for sale would already have been tested for radon and mitigated as required. Radon measurement reports should be provided as part of the seller's declaration/disclosure statements and should indicate that a long-term radon measurement of at least 3 months' duration was performed. Any home with a radon concentration above Health Canada's Action Level of 200 Bq/m<sup>3</sup> should be mitigated. In many cases, however, a home that is listed for sale has not previously been tested for radon. This document provides guidance on how these homes may be screened for radon during a real estate transaction.

Due to the time constraints frequently experienced during a real estate transaction, long-term radon measurements are often not practical during the time a house is for sale. If a long-term radon measurement has not been conducted prior to a real estate transaction, a radon screening assessment can provide important information on whether funds may be required to cover the installation of a radon mitigation system. While a radon screening assessment can be a good indicator of the radon level during the screening period, it may not provide an accurate prediction of the average annual radon concentration. In an effort to protect public health, this document uses the conservative indicator levels of 75 Bq/m<sup>3</sup> (during the winter or heating season) or 50 Bq/m<sup>3</sup> (during the summer or outside the heating season) to alert home sellers to the possibility that a mitigation system may be required. Also in the interest of public health, this document includes recommendations as to the specific measurement devices to be used, the use of a C-NRPP professional, and the conditions under which the tests should be conducted.

The minimum duration of a radon screening assessment is 4 days. Research shows that the longer the testing period, the better its comparison to an annual average level in a building <sup>(22, 23, 26, 29, 30)</sup>. The user should be advised to test for the longest available period with a properly approved device.

### 1.1 Scope

This guideline is intended for use by C-NRPP Radon Measurement Professionals. This guideline includes procedures, minimum requirements and general guidance for performing radon screening assessments in residential dwellings as part of, or in preparation for a real estate transaction. The guidance contained within is based on the recommendations of Health Canada for radon measurements in residential dwellings <sup>(1)</sup>. The purpose of this guideline is to help produce reliable and repeatable radon screening

assessments to assess the likelihood that the annual average radon concentration in a dwelling may be above 200 Bq/m<sup>3</sup>.

## 1.2 Applicability

This document is not intended to replace Health Canada's Guide for Radon Measurement in Residential Dwellings (Homes)<sup>(1)</sup>, as decisions concerning radon mitigation should be based on long-term radon measurements rather than on radon screening assessments. Instead, this guideline provides a consistent method for determining the potential that a radon mitigation system may need to be installed in a dwelling, based on a radon screening assessment during a real estate transaction.

## 1.3 Conventions

**“shall”, “will” and “must”**: Are terms that stipulate that a prescribed action is considered mandatory.

**“should”, “may” and “recommended”**: Indicate provisions considered helpful or good practice, but that are not considered mandatory.

**“shall not”, and “must not”**: Indicate the action is prohibited.

**“test”**: Within the scope of this document, this means the act of sampling and measuring the levels of radon concentration to perform either a radon assessment or radon measurement.

## 1.4 Definitions

**CRT**: C-NRPP Radon Measurement Professional

**CRMT**: C-NRPP Radon Mitigation Professional

**CAL**: C-NRPP Certified Radon Analytical Laboratory

**C-NRPP Approved Measurement Devices**: Only C-NRPP listed Short-Term Radon Measurement devices shall be used to perform radon measurements. No substitutions may be made. Listed devices may be found on the C-NRPP website. <http://c-nrpp.ca/approved-radon-measurement-devices>

**Continuous Radon Monitors**: Radon measurement devices that can provide radon measurements in increments of one hour or shorter. If a device is not capable of logging and producing a report of the data, it will be considered as a passive device under this guideline.

**True Passive Integrating measurement devices**: Radon measurement devices which are true passive time or dose integrating devices which **do not** require power to conduct measurements. These include alpha track detectors and electret ion chambers.

**Post Mitigation Radon Assessment**: A radon test with a duration of at least 48 hours, conducted after radon mitigation measures have been completed.

**Radon Screening Assessment**: A radon test with a duration of at least 4 days but less than 7 days, generally conducted during a real-estate transaction to assess the likelihood of elevated radon levels in a dwelling.

**Short-Term Radon Measurement:** A radon test with a duration of at least 7 days but less than 91 days.

**Long-Term Radon Measurement:** A radon test with a duration of 91 days or longer.

**Residential Dwelling/ Home:** A dwelling of 4 units or less.

**Responsible Person:** An individual responsible for the dwelling to ensure all requirements of the radon test are followed.

## 2 LEGAL DISCLAIMER

**Disclaimer:** This guideline is a resource; it is not legal advice. It is not intended to replace any regulations in force at any specific moment in time. The radon reference and action levels from the various jurisdictions are subject to change with or without notice. It is the responsibility of the radon professional to ascertain the current reference level for the jurisdiction of the property being tested and check with C-NRPP to establish any deviation from the information within this document which is based upon the Health Canada Radon Action Level (RAL) of 200 Bq/m<sup>3</sup>.

This document will be reviewed periodically and may be updated as required.

## 3 Guideline for Radon Screening Assessments

### 3.1 Testing Recommendations

Radon levels in a dwelling cannot be reliably predicted or determined by any means other than through a radon assessment or measurement. A radon screening assessment should be conducted prior to any real-estate transaction unless a long-term radon test has been conducted by a C-NRPP professional in the dwelling during the heating season in the last 2 years. Re-testing should be conducted in the basement in cases where only the main floor of a dwelling was previously occupied, but where the basement could potentially be converted into living space.

A C-NRPP Measurement Professional who is not otherwise involved in the real-estate transaction should be consulted for the radon screening assessment to ensure that an unbiased third party oversees the process and to ensure it is conducted according to a consistent, pre-established method.

Regardless of the result of the radon screening assessment (whether it tested green, yellow, or red), a long-term test shall be conducted by the responsible person during the first heating season following the real-estate transaction. Follow-up tests should be conducted every 2 years and upon the completion of any major renovations.

### 3.2 Radon Measurement Process and Interpretation of Results

A Radon Screening Assessment shall be conducted for a minimum of 4 days using a C-NRPP Listed Short-Term Radon Measurement Device, following “C-NRPP Protocol for Conducting Short-Term Radon

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Measurements in Air". The results will be presented in a Radon Screening Report with an indicator of either "green", "yellow" or "red". The average of the co-located devices shall be used for the interpretation of the results.

### **3.2.1 Green Test Result**

A Green Test Result indicates a radon screening assessment of 75 Bq/m<sup>3</sup> or less during the heating season and 50 Bq/m<sup>3</sup> or less outside the heating season. If a Green Test Result is achieved, then the Radon Screening Report shall be defined as "Green", and no further action with regard to radon testing is recommended or warranted prior to purchase. It is important to note that a "Green" test does not guarantee that the annual average radon concentration in the dwelling is below 200 Bq/m<sup>3</sup>. A follow-up long-term radon measurement conducted during the next heating season must still be carried out.

### **3.2.2 Yellow Test Result**

A Yellow Test Result indicates a radon screening assessment of greater than 75 Bq/m<sup>3</sup> during the heating season or 50 Bq/m<sup>3</sup> outside the heating season, up to and including 400 Bq/m<sup>3</sup>. This result indicates that there is a higher likelihood that the annual average radon concentration is above 200 Bq/m<sup>3</sup>. The Radon Screening Report shall be defined as "Yellow" and shall initiate action as specified in Section 3.4.

### **3.2.3 Red Test Result**

A Red Test Result indicates a radon screening assessment of greater than 400 Bq/m<sup>3</sup>. This result indicates a strong likelihood that the annual average radon concentration is above 200 Bq/m<sup>3</sup>. The Radon Screening Report shall be defined as "Red" and shall initiate the action as specified in Section 3.4.

## **3.3 Radon Screening Assessment Procedures**

### **3.3.1 Placement Instructions**

The radon device shall be placed in accordance with the placement instructions detailed in Health Canada's "Guide for Radon Measurements in Residential Dwellings (Homes)" (Appendix B) with the location chosen in the basement in cases where the basement could potentially be converted into living space and with the following additional considerations.

### **3.3.2 Additional Considerations & Closed-House Conditions**

Additional considerations and closed-house conditions shall be met by following C-NRPP/CARST's "Guideline for Conducting Radon Assessments and Short-Term Radon Measurements".

### **3.3.3 Closed-house Conditions**

Closed-house conditions will be met by following C-NRPP/CARST's "Guideline for Conducting Radon Assessments and Short-Term Radon Measurements".

### **3.3.4 Anti-Interference Measures**

The C-NRPP Measurement Professional shall use anti-interference techniques and provide home occupants with proper information to ensure the radon screening assessment is conducted in accordance with this guideline since the device will be unattended for the duration of the assessment period. Anti-interference techniques shall be employed and noted on the final report. Some suggestions are included in Appendix F.

### **3.3.5 Non-Interference Agreement**

A non-interference agreement that clearly states that violation of the test requirements voids the validity of the assessment shall be signed by a responsible person having care, custody and control over the home/dwelling. A sample is found in Appendix D.

### **3.3.6 Preliminary Inspection & Signage**

A visual inspection of the dwelling shall be conducted and signage shall be installed as per C-NRPP/CARST's "Guideline for Conducting Radon Assessments and Short-Term Radon Measurements".

### **3.3.7 Post-Test Inspection & Retesting**

A visual inspection of the dwelling and any required retesting shall be conducted as per C-NRPP/CARST's "Guideline for Conducting Radon Assessments and Short-Term Radon Measurements".

## **3.4 Actionable Test Results**

A test reported as "Yellow" (greater than 75 Bq/m<sup>3</sup> during the heating season or 50 Bq/m<sup>3</sup> outside the heating season and up to and including 400 Bq/m<sup>3</sup>) indicates that a radon remediation may be warranted and consideration should be made for a long-term follow-up test and installation of a radon mitigation system. Purchase negotiations should take the potential cost of a mitigation system into account (for example; setting funds in escrow).

A test reported as "Red" (greater than 400 Bq/m<sup>3</sup>) indicates a strong possibility that a radon remediation may be warranted, and consideration should be made for a long-term follow-up test and installation of a radon mitigation system. Purchase negotiations should take the potential cost of a mitigation system into account (for example; setting funds in escrow).

### **3.4.1 Long-Term Radon Measurement**

When the new home purchaser has taken possession of the dwelling, a long-term radon measurement of 91 days or longer shall be conducted by a C-NRPP certified measurement professional, in accordance with Health Canada's "Guide for Radon Measurements in Residential Dwellings (Homes)".

### **3.5 Radon Screening Assessment Report**

The Radon Screening Assessment Report shall be prepared in accordance with “C-NRPP Protocol for Conducting Short-Term Radon Measurements in Air” with additional information as described below. The assessment results shall be reported as detailed in section 3.5.2. See Appendix G for an example.

#### **3.5.1 Information sources**

References or links to Health-Canada’s “Radon Reduction Guide for Canadians” shall be included in the report.

#### **3.5.2 Assessment Results**

The radon assessment result for each location shall be reported as “Green”, “Yellow”, or “Red” as defined in Section 3.2, along with the actual numeric levels. The colour should be recorded with words, as well as colours.

#### **3.5.3 Interference**

Any condition that indicates a violation of the radon assessment requirements (intentional or not), or that may indicate non-compliance with closed-house conditions or anti-interference conditions shall result in the radon assessment being reported as invalid. A follow-up assessment shall be conducted.

#### **3.5.4 Anti-interference Methods Used**

A description of all methods used for anti-interference and the status of a signed non-interference agreement shall be reported.

#### **3.5.5 Radon Mitigation System Status**

The presence and status of any known radon mitigation systems installed in the dwelling shall be reported.

#### **3.5.6 Recommended Actions**

Recommended actions as a result of the Radon Screening Assessment shall be reported.

#### **3.5.7 Statement of Screening Assessment Limitations**

A statement should be included on the report which specifies limitations of the radon screening assessment. This can include but is not limited to; “This radon screening assessment report provides an indication of whether indoor radon levels are likely to exceed 200 Bq/m<sup>3</sup>. This is not a radon measurement result; a long-term radon measurement should be conducted once the new owner occupies the house. This radon screening assessment was conducted in the liveable space (per section 3.3.1) of the main dwelling and does not provide an indication of radon levels of other attached or detached buildings on the property.”

Any other reasonable limitations pertaining to the assessment and site conditions should be reported.

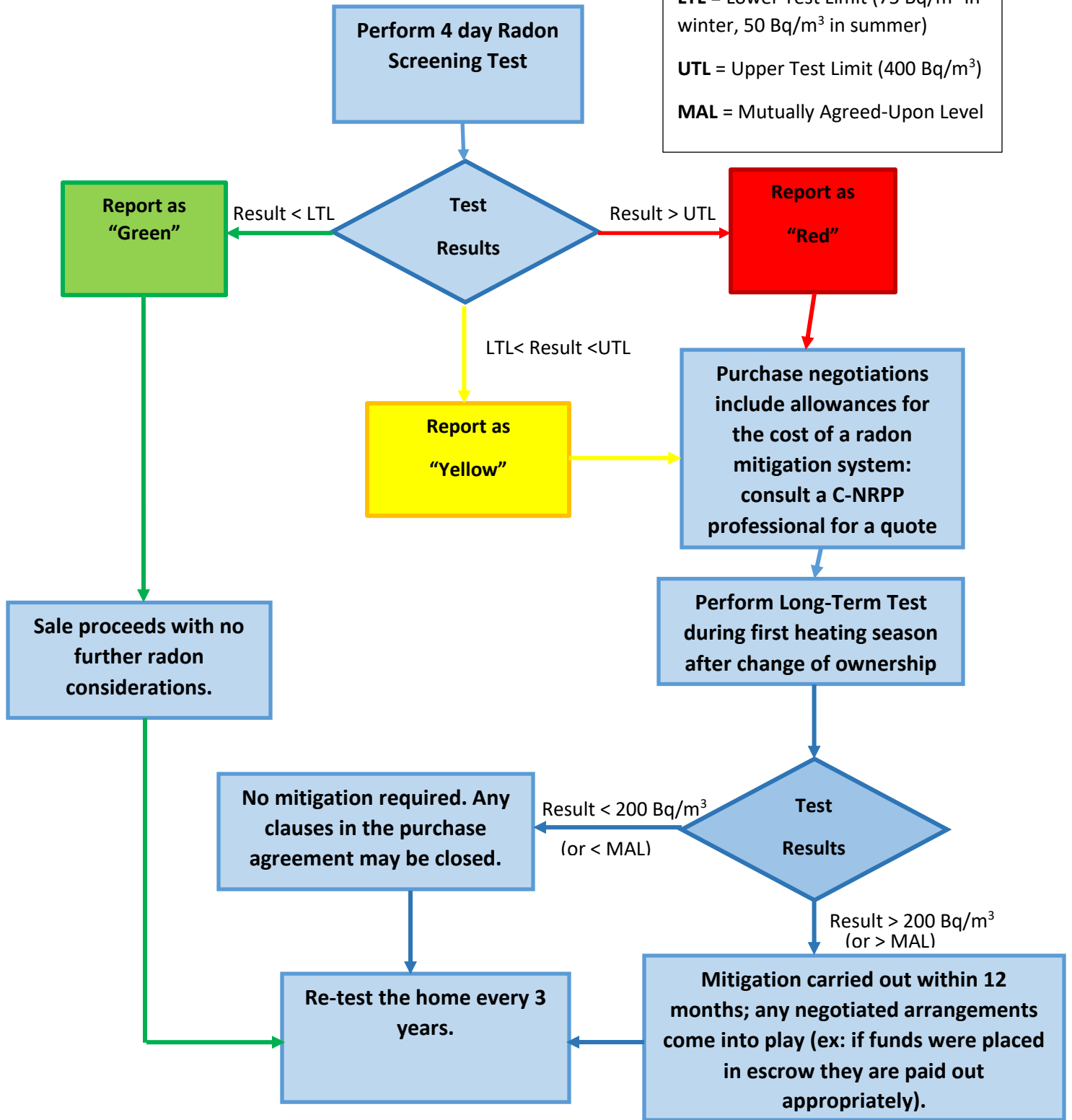
## **4 Maintaining Records**

Radon Screening Assessment reports shall be maintained as per “C-NRPP Protocol for Conducting Short-Term Radon Measurements in Air”.



## Appendix A: Real Estate Radon Measurement Process Chart

**LTL** = Lower Test Limit (75 Bq/m<sup>3</sup> in winter, 50 Bq/m<sup>3</sup> in summer)  
**UTL** = Upper Test Limit (400 Bq/m<sup>3</sup>)  
**MAL** = Mutually Agreed-Upon Level



## Appendix B: Placement Guidance

From Health Canada's Guide for Radon Measurements in Residential Dwellings (Homes)

### Where to Test

Place the radon device in the normal occupiable area of the lowest lived-in level of the home.

**IF** the basement has finished rooms such as bedroom, playrooms, family room,

**THEN** place the device in the basement area occupied for more than 4 hours each day.

**IF** the basement does **not have** any areas where people work, play or sleep for more than 4 hours each day,

**THEN** test on the main level.

### Where to Locate the Detector

The preferred device location is by an interior wall at a height of 0.8 m to 2 m (3 to 6.5 feet) from the floor in the typical breathing zone, however, at least 50 cm (20 inches) from the ceiling and 20 cm (8 inches) from other objects so as to allow normal airflow around the detector. The device should be placed approximately 40 cm (16 inches) from an interior wall or approximately 50 cm (20 inches) from an exterior wall.

Do **not** place the device in kitchens, laundry rooms, bathrooms, closets, cupboards, sumps, crawl spaces or nooks within the foundation.

Do **not** place the device by heating, ventilating and air conditioning vents, doors, fans, windows, fireplaces, electrically powered equipment, on television sets, stereos or speakers, or in direct sunlight.

## Appendix C: Occupant Information

This is a radon measurement device. It must stay in place where located for the full duration of the test.

Please, DO NOT MOVE the radon measurement device or devices.

If you have any questions, please contact:

\_\_\_\_\_  
Name of C-NRPP Professional

\_\_\_\_\_  
Phone Number

### The following conditions must be maintained in order to achieve a valid test:

1. All exterior windows must be kept closed. Exterior doors must be kept closed except for **momentary** entry and exit.
2. The radon measurement device or devices cannot be moved, covered, or tampered with in any way.
3. High volume whole-house and window fans shall be turned off during the testing period.
4. Fireplaces or wood stoves shall not be operated unless they are a primary heat source.
5. Heat-Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) shall be left to operate (or not operate) as found. For example, if an HRV is plugged in and working it should be left working, if unplugged, should be left unplugged.
6. Heating and air conditioning (including permanently-installed heat recovery ventilators) should operate normally. Window-unit air conditioners shall operate only in the re-circulation mode.
7. Devices that are labeled as radon mitigation devices shall be in normal operation.
8. The “closed-house conditions” described in points 1 through 7 must be maintained for the duration of the radon screening assessment.

Date: \_\_\_\_\_

Monitor #: \_\_\_\_\_

Test #: \_\_\_\_\_

## Appendix D: Non-Interference Agreement

# Authorization Agreement

The radon device installed in the dwelling referenced below has been approved by the Canadian National Radon Proficiency Program (C-NRPP) for conducting radon assessments. The C-NRPP Measurement Professional will conduct a radon screening assessment for a **minimum** of 4 days according to protocols designed for use in residences, as described in the CARST document, "CARST Guideline for Conducting a Radon Screening Assessment as Part of a Real Estate Transaction of a Residential Dwellings in Canada". These guidelines were developed specifically to deal with the time-sensitive nature of real-estate transactions.

**The following conditions must be maintained in order to achieve a valid test:**

1. All exterior windows must be kept closed. Exterior doors must be kept closed except for **normal** entry and exit.
2. The radon measurement device or devices cannot be moved, covered, or tampered with in any way.
3. High volume whole-house and window fans shall be turned off during the testing period.
4. Fireplaces or wood stoves shall not be operated unless they are a primary heat source.
5. Heat-Recovery Ventilator (HRV) and/or Energy Recovery Ventilator (ERV) shall be left to operate (or not operate) as found. For example, if an HRV is plugged in and working it should be left working, if unplugged, should be left unplugged.
6. Heating and air conditioning (including permanently-installed heat recovery ventilators) should operate normally. Window-unit air conditioners shall operate only in the re-circulation mode.
7. Devices that are labeled as radon mitigation devices shall be in normal operation.
8. The "closed-house conditions" described above must be maintained for the entire duration of the screening/testing period. It is further recommended they be maintained for the 12 hours prior to the beginning of this period, if possible.

C-NRPP recommends that radon screening assessments conducted for real estate transactions be performed using tamper-detection techniques. Methods to identify interference with this radon assessment have been employed. The C-NRPP professional may nullify the assessment result if there are any signs of test interference. **In that event, the seller may incur the cost of a re-assessment.** Further, any individual who falsifies or assists in falsifying information related to a real-estate transaction **may be subject to legal action.**

### Authorization Signatures

I, as the undersigned responsible individual having care, custody and control of the premises, understand all the above conditions and restrictions, and agree to inform all the occupants of this dwelling of the conditions above, and agree to maintain these conditions during the radon test period.

\_\_\_\_\_  
*Responsible Individual Signature*

\_\_\_\_\_  
*Title (owner, real estate agent, other)*

\_\_\_\_\_  
*Date*

\_\_\_\_\_  
*Address of Property being assessed under this Authorization Agreement*

\_\_\_\_\_  
*Radon Measurement Professional Signature*

\_\_\_\_\_  
*(Witness)*

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## Appendix E: Radon Measurement in Progress Signage

### **RADON MEASUREMENT IN PROGRESS**

#### **PLEASE, DO NOT MOVE DEVICE.**

If you have any questions, please contact:

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Name of C-NRPP Professional

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Phone number:

**The following conditions must be maintained in order to achieve a valid test:**

1. All exterior windows must be kept closed. Exterior doors must be kept closed except for **normal** entry and exit.
2. The radon measurement device or devices cannot be moved, covered, or tampered with in any way.
3. High volume whole-house and window fans shall be turned off during the testing period.
4. Fireplaces or wood stoves shall not be operated unless they are a primary heat source.
5. Heat-Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) shall be left to operate (or not operate) as found. For example, if an HRV is plugged in and working it should be left working, if unplugged, should be left unplugged.
6. Heating and air conditioning (including permanently-installed heat recovery ventilators) should operate normally. Window-unit air conditioners shall operate only in the re-circulation mode.
7. Devices that are labeled as radon mitigation devices shall be in normal operation.
8. The “closed-house conditions” described in points 1 through 7 must be maintained for the duration of the radon screening assessment.

## **Appendix F: Anti-Interference Suggestions**

### **Preventing or Detecting Test Interference**

There is a potential for interference during radon screening assessments. As a deterrent to tampering, have the responsible person sign a non-interference agreement. There are several ways to prevent or detect test interference.

For example:

- Use a test device that frequently records radon or decay product levels to detect unusual changes in conditions.
- Employ a motion detector to determine whether the test device has been moved or if testing conditions have changed.
- Record barometric pressure to identify environmental conditions which may have affected the test.
- Record the temperature to help assess whether doors and windows have been opened.
- Apply tamper-resistant seals or tape to windows to ensure closed-house conditions.

# Appendix G: Sample Radon Assessment Report

## Radon Assessment Report

Report Date: August 6, 2018

**Customer Contact Information:**

First Name

Mailing Address

Phone

Email

**Test Site:**

11 Canoe Street

Prairie Town, SK S0V 2K4

**Device Location:**

Basement Bedroom

**Radon Assessment Result:**

**Yellow**

*See below for explanation and recommendations.*

*Test Device Used: Detector type (S/N of Voltage Meter if applicable)*

*C-NRPP Listed*

*Quality Assurance Plan in place.*

Detector S/N	Detector Type	Analyzed By: or Calibration Expiry Date	Test Start Date	Test End Date	Test Duration	Test Result (Bq/m <sup>3</sup> )
123456	Continuous Radon Monitor	February 6, 2019	3:05pm July 30, 2018	3:30pm August 4, 2018	5 Days	90

**Recommendations:** A test reported as “Yellow” (greater than 75 Bq/m<sup>3</sup> during the heating season or 50 Bq/m<sup>3</sup> outside the heating season and up to and including 400 Bq/m<sup>3</sup>) indicates that a radon remediation may be warranted and consideration should be made for a long-term follow-up test and installation of a radon mitigation system. Purchase negotiations should take the potential cost of a mitigation system into account (for example; setting funds in escrow).

*See following pages for additional information.*

A **Green Test Result** indicates a radon screening assessment of 75 Bq/m<sup>3</sup> or less during the heating season and 50 Bq/m<sup>3</sup> or less outside the heating season. It is important to note that a “Green” test does not guarantee that the annual average radon concentration in the dwelling is below 200 Bq/m<sup>3</sup>.

A **Yellow Test Result** indicates a radon screening assessment of greater than 75 Bq/m<sup>3</sup> during the heating season or 50 Bq/m<sup>3</sup> outside the heating season, up to and including 400 Bq/m<sup>3</sup>.

A **Red Test Result** indicates a radon screening assessment of greater than 400 Bq/m<sup>3</sup>.

This radon screening assessment report provides an indication of whether indoor radon levels are likely to exceed 200 Bq/m<sup>3</sup>. This is not a radon measurement result; a long-term radon measurement should be conducted once the new owner occupies the house. This radon screening assessment was conducted in the liveable space of the main dwelling, and does not provide an indication of radon levels of other attached or detached buildings on the property.

**Information sources:**

Radon - Is it in Your Home?, [http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_brochure/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_brochure/index-eng.php)

Radon - What you need to know, <http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/radon/index-eng.php>

Radon Reduction Guide for Canadians, [http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_canadians-canadiens/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_canadians-canadiens/index-eng.php)

**Temporary Conditions:** *Dwelling conditions or other factors which may affect the measurement results shall be reported. These may include, but are not limited to conditions such as vacancy or renovation of the dwelling. Note the presence of an HRV or ERV in the dwelling and note any unusual circumstances regarding the HRV or ERV.*

**Deviations:** *Any deviation from the prescribed guidance deemed necessary to complete the test should be reported and explained.*

**Radon Mitigation System Status:** *The presence and status of any known radon mitigation systems installed in the dwelling shall be reported.*

**Interference**

*Any condition that indicates a violation of the radon assessment requirements (intentional or not), or that may indicate non-compliance with closed-house conditions or anti-interference conditions shall result in the radon assessment being reported as invalid. A follow-up assessment shall be conducted.*

**Anti-interference Methods Used**

*A description of all methods used for anti-interference and the status of a signed non-interference agreement shall be reported.*

Any other reasonable limitations pertaining to the assessment and site conditions should be reported.



## Appendix H: Reference Documents

### Health Canada Publications for Professionals:

1. Radon Measurements in Residential Dwellings (Homes),  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_homes-maisons/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_homes-maisons/index-eng.php)
2. Radon Measurements in Public Buildings  
(Workplaces, Schools, Day Cares, Hospitals, Care Facilities, Correctional Centres),  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_building-edifices/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_building-edifices/index-eng.php)
3. Radon - What you need to know,  
<http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/radon/index-eng.php>
4. Radon Reduction Guide for Canadians,  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_canadians-canadiens/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_canadians-canadiens/index-eng.php)

### Health Canada Publications for Consumers:

5. Cross Canada Survey of Radon Concentrations in Homes, <http://www.hc-sc.gc.ca/ewh-semt/radiation/radon/survey-sondage-eng.php>
6. Radon - Another Reason to Quit, [http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_smokers-fumeurs/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_smokers-fumeurs/index-eng.php)
7. Radon - Is it in Your Home?, [http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_brochure/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_brochure/index-eng.php)
8. Radon - What you need to know, <http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/radon/index-eng.php>
9. Radon Reduction Guide for Canadians, [http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_canadians-canadiens/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_canadians-canadiens/index-eng.php)

### C-NRPP Documents

10. C-NRPP Quality Control and Quality Assurance Manual for Radon Sampling and Analysis conducted by Radon Measurement Professionals and Laboratories, October 2018
11. C-NRPP Listed Radon Measurement Devices, <https://c-nrpp.ca/approved-radon-measurement-devices/>
12. C-NRPP Protocol for Conducting Short-Term Radon Measurements in Air, October 2018

### Other Canadian Publications

13. 2006 Report of the Radon Working Group in Canada,  
<http://carst.ca/Resources/Documents/2006%20Report%20of%20the%20Radon%20Working%20Group%20in%20Canada.pdf>
14. Canada Living with Radiation, Atomic Energy Control Board, 1995,  
[http://publications.gc.ca/collections/collection\\_2014/eacl-aecl/CC172-7-1995-eng.pdf](http://publications.gc.ca/collections/collection_2014/eacl-aecl/CC172-7-1995-eng.pdf)

15. Exposure Sources for Collective Effective Dose, 2006

<http://www.diagnosticimaging.com/articles/ionizing-radiation-exposure-skyrockets-1980s-0>

**EPA Documents**

16. Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family from Radon

[https://www.epa.gov/sites/production/files/2016-02/documents/2012\\_a\\_citizens\\_guide\\_to\\_radon.pdf](https://www.epa.gov/sites/production/files/2016-02/documents/2012_a_citizens_guide_to_radon.pdf)

17. Technical Support Document for the 1992 Citizen's Guide to Radon, Radon Division, Office of Radiation Program, US Environmental Protection Agency, May 20, 1991 EPA 400-R-92-011 Section 1.3.3

<https://nepis.epa.gov/Exe/ZyNET.exe/000001L3.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000002%5C00001L3.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL>

**Other Documents**

18. WHO Reference: WHO Handbook on Indoor Radon,

[http://apps.who.int/iris/bitstream/10665/44149/1/9789241547673\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/44149/1/9789241547673_eng.pdf)

19. Guidelines for the Retention of Laboratory Records & Materials, June 2006

<http://oaml.com/wp-content/uploads/2016/05/Guideline-for-the-Retention-of-Records-Materials-June-06.pdf>

**Research Documents:**

20. Comparative Analysis of Radon Measurements of Various Durations in Dwelling, Presentation

[http://www.npl.co.uk/upload/pdf/20051008\\_armug\\_gillmore\\_1.pdf](http://www.npl.co.uk/upload/pdf/20051008_armug_gillmore_1.pdf)

21. An Evaluation of the Screening Measurement as an Indicator of Average Annual Indoor Radon Exposure, LaFontaine, M 1996

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23. Radon exposure is rising steadily within the modern North American residential environment and is increasingly uniform across seasons, Stanley, F; Irvine, J; Jacques, W; Salgia, S; Innes, D; Winquist, B; Torr, D Brenner, D; Goodarzi, A, December 2019

24. Reliability of Inexpensive Charcoal and Alpha-Track Radon Monitors, Mose, D; Mushrush, G; and Chrosniak, C, 3 November 1989

25. Reliability of Integrating Radon Gas Measurements in the Domestic Environment – An InterComparison between One-Week, One-Month and Three-Month Sampling, Denman, A. R. , Crockett, R.G.M, Groves-Kirkby, C.J., Phillips, P.S., Woolridge, A,

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26. Residential Radon Risk Assessment: How Well is it Working in a High Radon Region?, Steck, D
27. Review of domestic and international methods of measuring radon in residential buildings, Lee, D., Lee, C 23 February 2016, <https://aoemj.biomedcentral.com/articles/10.1186/s40557-016-0097-0>
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29. Winnipeg radon testing: comparison of test durations, effects of house characteristics, and efficacy of floor-drain seals, Warkentin, P. E., Johnson H. M., <https://www.ncbi.nlm.nih.gov/pubmed/25706136>

**Additional useful links:**

Tarion, Ontario New Home Warranty Program Radon Information:

<https://www.tarion.com/homeowners/your-warranty-coverage/radon-and-your-warranty>

## **Appendix I: Estimated Radon Mitigation System Pricing Tables**

Unique features of the house should be identified and may increase the costs of a mitigation system.

It is strongly recommended that a written estimate from a professional mitigation contractor who has visited the site be obtained, as costs can vary widely due to many factors not easily determined by a non-professional.

The cost of radon mitigation varies depending on the type of house construction, the type of mitigation system required, the location of the home, and market trends. It is difficult for a non-professional to assess the various factors that will determine how difficult it is to mitigate a given home. It is therefore important to obtain a quote from a C-NRPP mitigation professional when budgeting for the cost of mitigation. While the majority of mitigations across Canada range in price from \$2 000 to \$4 000, the cost may occasionally be as high as \$10 000.

Recent data from our 2017 Radon Reduction Sweepstakes showed that out of the 166 entries received from Canadian mitigation systems installed between 2013 to 2018, the average cost of a radon mitigation system was \$2,900.