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Canada

GUIDE FOR RADON MEASUREMENTS IN PUBLIC BUILDINGS

Workplaces, Schools, Day Cares, Hospitals, Care Facilities, Correctional Centres

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1. Introduction

1.1 Scope and Summary

This document is intended for persons and organizations carrying out radon measurements in buildings that have a high occupancy rate and/or residency period for members of the public and are, therefore, considered "dwellings" for the purposes of radon testing [1]. Public buildings are buildings with high occupancy of long duration by the public, such as workplaces, schools, day cares, hospitals, care facilities, correctional centres, and multi-unit residential buildings such as apartments and condominiums. Given that the health risk associated with radon is based on the cumulative exposure, minimizing radon levels in schools and daycares will reduce the lifetime risk of developing lung cancer for the children occupying them. The purpose of the testing is to evaluate radon levels in order to determine the need for remedial action to protect the occupants.

Testing in buildings requires a different protocol than in homes. The purpose of this document is to provide guidance regarding types of measurement devices, device placement, measurement duration, and the interpretation of measurements in buildings.

1.2 Radon in Buildings

Radon is a radioactive gas that is formed naturally by the breakdown of uranium in soil, rock and water. It cannot be detected by the senses; i.e., you cannot see it, smell it, or taste it. However, it can be detected easily with radon measurement devices. Radon is recognized as a significant cause of lung cancer [2]. The level of risk depends on the concentration of radon and duration of exposure: at concentrations found outdoors, the health risk is negligible, but when radon enters an indoor space, such as a building, it can accumulate to higher concentrations which, in turn, pose a higher health risk.

Radon can enter any building through any opening where the building contacts the soil: cracks in foundation walls and in floor slabs, construction joints, gaps around service pipes, support posts, window wells, floor drains, sumps or cavities inside walls. The only way to know how much is inside is to test.

Because the main source of radon is the soil on which the building is standing, higher indoor radon levels are more likely to exist at the lower levels of the building. In some cases, higher radon concentrations have been found at upper levels, due to radon movement through elevator shafts or other service shafts in buildings, or due to the stack effect. Stack effect refers to the movement of air in and out of a building: warm air rises and exits through the upper parts of a building, drawing new air in through the lower parts of the building. In rare cases, radon may emanate from building materials which could also give rise to high indoor radon levels. To date, the large-scale testing of federal buildings across Canada has not shown either of these to be significant factors; therefore, radon measurement in large buildings should be done on floors in contact with the ground. Building owners or managers concerned with the potential for radon at upper levels of the building could also test upper floors. If a building is found to have high radon levels when initially tested on lower floors, then upper floors can be tested while the mitigation strategy is being developed to determine if elevated radon levels exist on those upper floors.

1.3 Radon Guideline

Although there is currently no regulation that governs an acceptable level of radon levels in Canadian homes or public buildings, Health Canada, in partnership with the provinces and territories, has determined that intervention to reduce exposure is warranted for average annual indoor concentrations that exceed 200 becquerels per cubic metre (200 Bq/m^3) [1].

The radon guideline was approved by the Federal Provincial Territorial Radiation Protection Committee in October 2006 and adopted by the Government of Canada on June 9, 2007:

> "Remedial measures should be undertaken in a dwelling whenever the average annual radon concentration exceeds 200 Bq/m^3 in the normal occupancy area.
>
> The higher the radon concentration, the sooner remedial measures should be undertaken. When remedial action is taken the radon level should be reduced to a value as low as practicable.
>
> The construction of new dwellings should employ techniques that will minimize radon entry and will facilitate post-construction radon removal, should this subsequently prove necessary."

Health Canada recommendations for remedial action:

1. **Remediate within 2 years:** Results between 200 and 600 Bq/m^3, Health Canada recommends taking steps to reduce the radon level within 2 years.
2. **Remediate within 1 year:** Results greater than 600 Bq/m^3, Health Canada recommends taking steps to reduce the level within 1 year.

While the health risk from radon exposure below the Canadian Guideline is considered reasonable, there is still an associated potential health risk which is proportional to the exposure. In addition, radon concentrations can vary year-to-year as a result of building aging, as well as season-to-season as a result of heating and cooling systems and open or closed doors or windows. As such, building owners should still consider mitigation when levels are below but approaching 200 Bq/m^3.

2. Radon Measurement Duration

2.1 Long-Term Measurements

Radon levels in a building can vary significantly over time. In fact, it is not uncommon to see radon levels change by a factor of 2 to 3 over a 1-day period and variations from season-to-season can be even larger. As a result, a long-term measurement period will give a more accurate indication of the annual average radon concentration than measurements of shorter duration. Long-term measurements are 3 to 12 months in duration. In Canada, higher radon levels are often observed during winter months when openings such as exterior windows and doors are closed.

When conducting long-term measurements, there are no requirements for the occupants to change their lifestyle once the measurement devices have been put in place. Health Canada recommends that the radon test performed in a public building be a long-term measurement, a minimum of three months and conducted during the heating season. Measurements collected during periods of warmer weather are potentially misleading due to the likelihood that windows will be open during the measurement period. In addition, some buildings use outdoor air for free cooling during spring or fall. It is best to avoid carrying out long-term measurements during free cooling periods.

2.2 Short-Term Measurements

Short-term measurements are not acceptable to determine radon concentrations for the purposes of assessing the initial need for remediation action. Since radon concentrations vary over time, it is strongly recommended that the result of any short-term measurement be confirmed with a “follow-up” long-term measurement, at the same location within the building, to inform decisions about mitigation.

A short-term test using an approved short-term device following mitigation can confirm that mitigation was successful. A long-term confirmation test should always follow during the next heating season.

3. Radon Measurement Devices

There are several radon measurement devices that may be used to test a building for radon. The detection devices listed below are currently recognized by Health Canada as acceptable for use in the measurement strategies described in this document. Health Canada recommends that Canadian National Radon Proficiency Program (C-NRPP) approved long-term radon measurement devices be used [3].

3.1 Alpha Track Detector

These detectors use a small piece of special plastic inside a container with a small defined opening. When radon enters the opening in the detector, the alpha radiation causes damage tracks on the plastic; the number of tracks is proportional to the radon concentration. At the end of the test period, the container is returned to a laboratory for reading.

Figure 1. Alpha Track Detector.

3.2 Electret Ion Chamber

This device consists of a special plastic canister (ion chamber) containing an electrostatically charged disk detector (electret). The detector is exposed to radon in the air during the measurement period. Ionization resulting from the decay of radon produces a reduction in the charge on the electret. The drop in voltage on the electret is related to the radon concentration. The detectors may be read using a special analysis device to measure the voltage or mailed to a laboratory for analysis. The detectors are sensitive to the prevailing background gamma dose rate and the results need to be corrected for this by making an onsite gamma dose rate measurement. This type of detector may be deployed for 1 to 12 months.

Figure 2. Electret Ion Chamber.

3.3 Continuous Radon Monitors (CRMs)

This detection category includes devices that record real-time continuous measurements of radon gas over a series of minutes and report the results, generally in hourly increments. Air is either pumped or diffuses into a counting chamber, typically a scintillation cell, an ionization chamber, or a solid state detector. The result using this type of detector is normally available at the completion of the test in the building without additional processing or analysis. These devices will have methods for storing, displaying, and retrieving the data logged by the device.

These devices often measure and record additional environmental parameters such as temperature, pressure, and relative humidity, and are often equipped with motion sensors which allow radon professionals to discern if they have been moved or tampered with.

4. Units of Radon Measurement

Canada, like most other countries, has adopted the International System of Units (SI Units) and thus the Canadian radon guideline is given in units of becquerels per cubic metre (Bq/m^3). In order to be able to compare a radon test result to the Canadian radon guideline, radon measurement results must be specified in units of Bq/m^3 or the appropriate conversion must be applied. (See table below).

Depending on the measurement device used to complete a test, radon gas measurement results may be in one of two units. Please see the table below for conversion calculations.

Table 1: Radon Concentration Units

Type of Device	Units Used	Conversion
Devices that measure concentrations of radon gas	becquerels per cubic metre (Bq/m^3) (Canada)	1 becquerel is equal to 1 radioactive disintegration per second
	picocuries per litre (pCi/L) (United States)	1 pCi/L is equal to 37 Bq/m^3 200 Bq/m^3 is equal to 5.4 pCi/L

5. Measurements in Public Buildings

5.1 Measurement Strategy

The primary strategy is to test occupied rooms that are in direct contact with the ground. Public buildings differ from houses in that the occupants are not usually directly involved in the measurement process.

Public buildings that have ventilation conditions during periods of high occupancy that are different from ventilation conditions during periods of low occupancy or have seasonal ventilation systems that require special consideration. For example, a school or office building may reduce the ventilation after school or office hours. Therefore, workers such as cleaning staff or building security may be exposed to higher levels of radon during this time while individuals occupying the building during school hours may be exposed to lower levels of radon. In these situations, a continuous radon monitor could be used to obtain radon measurements that better reflect radon levels, and relative/actual occupant radon exposure, in the building during these specific hours of testing. Ideally, long-term continuous monitoring (three months) would be carried out for these situations. If this is not possible, short-term continuous monitoring in combination with a long-term test (minimum 3 months) may be carried out according to the methodology provided in Annex 1 to determine the basis for mitigation. This methodology must be used with caution and should only be used if there is a significant difference between radon levels during high occupancy versus low occupancy.

Ideally, a C-NRPP Measurement Professional would be involved in the measurement strategy and implementation of radon testing.

5.2 Measurement Location in Public Buildings

The choice of the measurement device location is constrained by the need for security so that the devices are not easily disturbed or readily accessible to occupants.

As well, public buildings usually contain many rooms. A room is the space enclosed by walls that reach the ceiling. For the purposes of radon testing, a room subdivided by partitions can be treated as one room. To provide a representative radon concentration estimate for the building, measurements should be made in each occupied room in a basement or, if no basement exists, on the ground floor or the lowest floor having occupied rooms within the building. An “occupied room” is one in which an individual spends more than four hours per day. Radon measurements in the building should be made at the same time and be made in unoccupied rooms if there are plans for them to be occupied in the near future. For larger rooms, one detector should be placed for every 200 m^2 of floor space. For detailed information on where detectors should and should not be placed, refer to Annex 2.

Building owners should always consider re-testing whenever major renovations are performed that might substantially change the ventilation or airflow in the building, the interaction of the building and surrounding soils or the use of the rooms in the lowest-occupied level. If substantial changes are made, a three-month test should be performed during the first heating season after completion of the renovations. In addition, re-testing should be carried out following mitigation and every 5 years thereafter using a test of a minimum duration of 3 months during the heating season. Refer to Annex 2 for further testing guidance.

5.3 Measuring in Multi-Unit Residential Dwellings

Multi-unit dwellings can include any building used as a residence by more than one family unit and can include apartment complexes, dormitories, military residences, boarding houses, hotels, convents, monasteries, motels, and live/work units. It can also include those buildings with shared ownership or maintenance such as co-op units, townhouses, condominiums, stratas or vacation timeshare properties. To the extent practicable, these protocols should be recommended for whole building application regardless if different portions of the building are owned by different parties. When measuring radon in a specific unit within a multi-unit residential dwelling, guidance in Guide for Radon Measurements in Residential Dwellings (Homes) should be followed [4].

Conduct a measurement in each dwelling unit which is a ground-contact apartment, dwelling and other occupied units such as those used as office space. This would include a unit which has floor(s) and/or wall(s) in contact with the ground or is over crawlspaces, utility tunnels or parking garages. In addition, consideration should be made to test a sampling of dwelling units on upper floors of the building to ensure there are not any unusual airflows that may have increased radon levels. This testing should be conducted strategically, depending on the structures and possible conduits within a building.

Within each dwelling unit, test a room located in the lowest livable level that is in contact with the ground or above a crawlspace, utility tunnel or garage and is used four hours a day or more.

5.4 Quality Control

Organizations should develop their own quality control or quality assurance programs, whereby a certain percentage of samples collected or analyzed should be quality control samples.

A quality assurance program should be developed in accordance with the C-NRPP's Quality Control and Quality Assurance Manual for Radon Sampling and Analysis conducted by Radon Measurement Professionals and Laboratories [5]. Quality Control (QC) should be considered on all detectors and care should be taken to ensure an appropriate number of QC measurements are made. QC measurements generally include duplicates, blanks, and spikes.

When determining the number of detectors required to test a building, care should be taken to include an appropriate number for QC measurements.

Duplicate measurements allow the user to make an estimate of the relative precision or agreement between two measurements. Duplicate measurements should be made at the rate of 10% of the total number of measurement locations (e.g., if 10 detectors are deployed in a building, one duplicate measurement should also be made; if 20 detectors are deployed, 2 duplicate measurements should also be made, etc.).

Duplicate measurements are made by placing 2 detectors side-by-side (< 10 cm apart or 4 in). The locations selected for duplicate measurements should be distributed systematically throughout the entire population of the sampling. Large precision errors can be caused by detector manufacture, improper data transcription or handling by suppliers, laboratories or persons performing detector placement.

Duplicate measurements should be compared by calculating their relative percent difference (RPD). The RPD can be calculated by using the formula below:

$$RPD = \frac{\left|[Radon]_{Test\ 1} - [Radon]_{Test\ 2}\right|}{\left(\frac{[Radon]_{Test\ 1} + [Radon]_{Test\ 2}}{2}\right)} \times 100\%$$

where:

$[Radon]_{Test\ 1}$ is the radon concentration in Bq/m^3 for one detector, and
$[Radon]_{Test\ 2}$ is the radon concentration in Bq/m^3 for the duplicate detector.

The following chart provides guidance on allowable variances in RPD for duplicate tests.

Table 2 – Allowable variances in Relative Percent Difference

Average Test Measurement ($[Radon]_{Test\ 1} + [Radon]_{Test\ 2}$)/2	Acceptable	Warning Level	Failed QC
Average < 50 Bq/m^3	No limits	No limits	No limits
50 Bq/m^3 ≤ Average < 75 Bq/m^3	RPD < 25%	25% ≤ RPD < 50%	RPD ≥ 50%
75 Bq/m^3 ≤ Average < 150 Bq/m^3	RPD < 15%	15% ≤ RPD < 25%	RPD ≥ 25%
Average ≥ 150 Bq/m^3	RPD < 10%	10% ≤ RPD < 20%	RPD ≥ 20%

If the RPD is found to be in the warning level, an investigation should be conducted including discussions with the device manufacturer which may result in a re-test.

If the RPD is found to be a failed QC, the measurement is invalid and an investigation should be conducted including discussions with the device manufacturer. In this case, a re-test should be carried out.

As part of quality control, besides deploying duplicate detectors, consideration should also be given to incorporating an appropriate frequency of field, storage and transit blanks (generally 5%). Blanks are unopened detectors used to help evaluate any response from sources other than radon during the intended test period.

It is recommended that 3% of passive radon measurements should be spikes. Spikes are used to check the measurement accuracy of a radon measurement system. This technique involves exposing radon detectors in a radon chamber (which should be accredited) to a known radon level and analyzing the detectors as if they were routine field measurements [5]. The measured value (MV) of a spiked detector is compared to the reference value (RV) (i.e., nominal exposure value) by calculating their relative percent error (RPE). Therefore, RPE is calculated by using the formula below:

$$RPE = \frac{(MV - RV)}{(RV)} \times 100\%$$

where:

RPE is the relative percent error,
MV is the measured value of spiked detector, and
RV is the reference value.

Spikes levels should be above 150 Bq/m^3 and RPEs below 20% are acceptable.

It is also recommended that appropriate laboratory QC be conducted by the laboratory handling the detectors. Calibration of instruments should be routinely conducted as recommended by the manufacturer and, if applicable, by C-NRPP. Calibration shall be carried out by a manufacturer approved facility. Laboratories analyzing for radon may also hold other laboratory accreditations such as ISO 9001 or ISO 17025.

6. Interpretation of Results

If the long-term measurement results are below 200 Bq/m^3, further measurements are not necessary. While the health risk from radon exposure below the Canadian Guideline is considered reasonable, there is still an associated potential health risk which is proportional to the exposure. In addition, radon concentrations can vary year-to-year as a result of building aging, as well as season-to-season as a result of heating and cooling systems and open or closed doors or windows. As such, building owners should still consider mitigation when levels are below but approaching 200 Bq/m^3.

If the long-term measurement results are greater than 200 Bq/m^3, then remedial action is recommended within the timeframes identified in Table 3.

Table 3 – Timeframes to remediate

Radon Concentration	Recommended Remedial Action Time
Greater than 600 Bq/m^3	In less than 1 year
Between 200 Bq/m^3 and 600 Bq/m^3	In less than 2 years

The responsibility for remediation, and for its associated costs, rests with the owner of the building. Further information can be found in the document, Radon: Reduction Guide for Canadians [6].

References

1. Government of Canada 2007, Government of Canada Radon Guideline.
2. World Health Organization 2009, WHO Handbook on Indoor Radon.
3. Canadian National Radon Proficiency Program website, Listed Radon Measurement Devices.
4. Health Canada 2017, Guide for Radon Measurements in Residential Dwellings (Homes).
5. Canadian National Radon Proficiency Program 2018, C-NRPP Quality Control and Quality Assurance Manual for Radon Sampling and Analysis conducted by Radon Measurement Professionals and Laboratories.
6. Government of Canada 2013, Radon: Reduction Guide for Canadians.

Annex 1 – Follow-Up Measurements in Schools and HVAC Controlled Buildings to Determine the Method for Mitigation

If the long-term radon test result is above the guideline, you could follow-up with a short-term test (seven days) using a continuous radon monitor to determine the average radon concentration during hours of occupancy (for example each day from 7 AM to 9 PM, assuming that the building is unoccupied outside that range). It is important that the seven-day test does not overlap with holidays since the conditions of the building, which may affect radon levels, are not representative of radon levels during normal occupancy. Follow-up measurements should be made in the rooms where the highest concentrations are found, especially when the results exceed 200 Bq/m^3. This is done with an active C-NRPP-certified continuous radon monitor (CRM) that has the capability to integrate and record a new result at least hourly. Follow-up measurements using the CRM must be for a minimum of seven days during the heating season. The purpose of follow-up measurements are to determine if the mechanical ventilation system within the building affects the radon levels such that radon levels during occupied hours are below the guideline level. The long-term test results will be indicative of radon levels 24 hours a day. If ventilation systems are shut down when the building is not occupied, this could result in higher radon levels experienced during that time. The CRM allows one to conduct hourly measurements and to determine if radon levels vary, to more accurately estimate the radon exposure for occupants.

The average radon concentration during occupied hours can be estimated from the radon data obtained from the long-term measurement and the short-term measurement using the CRM. The data from the CRM will provide information to determine the ratio of the average radon concentration during occupied hours to the overall average radon concentration obtained over the short-term monitoring period. This gives the factor by which to multiply the long-term average radon concentration measurement result in order to estimate the long-term average radon concentration during occupied hours. The principle behind this estimate is that, if the CRM indicates that the radon level is 20% lower during occupied hours than unoccupied hours for example, one can make a correction to the long-term measurement to reflect this variation. The estimate of the long-term average radon concentration during occupied hours is given by:

$$[\,RADON\,]_{ELTARCDOH} = [\,RADON\,]_{LTARC} \times \left(\frac{[\,RADON\,]_{STARCDOH}}{[\,RADON\,]_{STARC}} \right)$$

where:

ELTARCDOH = estimated long-term average radon concentration during occupied hours;
LTARC = long-term average radon concentration;
STARCDOH = short-term average radon concentration during occupied hours; and
STARC = short-term average radon concentration.

If the long-term average radon concentration during occupied hours is above 200 Bq/m^3, remedial action is recommended.

An example illustrating the use of the above formula follows:

Assume the original long-term radon test result for a room in a particular school was 275 Bq/m^3. The room was then tested again using a CRM for a seven-day period. The following information was extracted from the CRM data:

Average [Radon] during the entire 7-day period = 288 Bq/m^3
Average [Radon] during occupied hours (7 AM to 9 PM) over the 7 day period = 176 Bq/m^3
The result for the estimated long-term average radon concentration during occupied hours would then be:
$\textbf{[RADON]}_{\textbf{ELTARCDOH}}$ = 275 Bq/m^3 x (176 Bq/m^3 / 288 Bq/m^3) = 168 Bq/m^3

This is the value on which the decision to mitigate should be based. In the above example, the room in question has a long-term radon concentration during school hours of 168 Bq/m^3. Since this value is below the radon guideline value, the room would not need to be mitigated. This example assumes that the ventilation system is operating in the same way during the full year whenever the school is occupied. As is always the case, if there are modifications done to the building, or changes made in how the ventilation system operates, the building should be re-tested. If substantial changes are made, a three-month test should be performed during the first heating season after completion of the renovations.

IMPORTANT NOTE

It is important to stress the approximate nature of this estimate. For example, if the long-term test is conducted during the heating season and followed-up with the CRM measurement a few months after, the variation measured during occupied hours vs. unoccupied hours by the CRM is not necessarily representative of the variation observed during the heating season. Therefore, if one wants to rigorously estimate this correction factor, a seven-day CRM test should be conducted at the same time and with the same ventilation conditions as the long-term test during the heating season.

This method to estimate long-term average radon concentration during occupied hours should not be used if there is not a significant difference between radon levels during occupied hours and unoccupied hours. Also, if the CRM test indicates radon levels above the guideline during occupied and unoccupied hours, the estimate formula proposed above should not be used even if the calculated estimate for long-term average radon concentration during occupied hours is below the guideline.

The estimate formula is only one extra tool to help building managers make decisions. In any case of doubt, decisions should be made based on the long-term measurement(s).

When levels are near 200 Bq/m^3, mitigation should be strongly considered since radon concentrations can vary year-to-year and season-to-season.

Annex 2 – Recommended Procedure for Testing Radon in Public Buildings

Initial Radon Testing

Where to Test

Rooms to be tested are defined as an area with walls from floor to ceiling (or false ceiling). In the case of multiple cubicles within a room, the individual cubicles will not be treated as separate rooms but rather the whole collection of cubicles will be considered as one room.

- Radon detectors should be deployed for at least three months during the heating season.
- The size of the room determines the number of detectors required (exclusive of any blanks and duplicates required for quality control testing):
  - One detector should be deployed in rooms smaller than 200 m^2 (2153 ft^2).
  - One detector should be deployed for every 200 m^2 (2153 ft^2) in rooms larger than 200 m^2 (2153 ft^2).
- The detector should be placed:
  - where it will not be moved during the measurement period;
  - in the typical breathing zone;
  - 0.5 to 2 m (1.5 to 6.5 ft) from the floor;
  - at least 0.5 m (1.5 ft) from the ceiling;
  - a minimum of 30 cm (1 ft) from an exterior wall; and
  - away from objects with a suggested minimum of 10 cm (4 in) to allow normal airflow around the detector (with the exception of the surface the device is placed on or mounted to). This may be accomplished by suspending the detector from the ceiling.
- Radon testing only needs to be done in rooms occupied by an individual for more than four hours per day.
- Test all rooms with floors or walls that are in direct contact with the ground or a crawl space. If there are no occupied rooms on the level(s) in direct contact with the ground or crawl space, test all occupied rooms on the first occupied level until the entire building footprint is tested. In case building owners are concerned with the potential of radon at upper levels, the highest occupied floor could also be tested.

Examples of appropriate places to place a detector include but are not limited to a shelf, top of a filing cabinet, suspended from the ceiling, mounted on an interior wall, etc.

Where NOT to Test

Do not test in:

- bathrooms, kitchens and storage areas;
- indoor parking level(s) within a building; or
- on or near electrically powered appliances or equipment such as computers, television sets, stereos or speakers as some measurement devices may be affected.

Avoid placing detectors:

- in air currents caused by heating, ventilating and air conditioning, doors, fans and windows; and
- in areas near heat, such as over radiators, fireplaces or in direct sunlight.

Examples of rooms and locations that are appropriate for radon testing are illustrated in Figure 3 and Figure 4.

Figure 3. Potential radon testing locations in an office environment. Locations that may be appropriate (⚠) should be assessed to ensure that detectors will not be disturbed if they are placed in these locations.

Figure 4. Potential testing locations in an office. Locations that are ***appropriate*** (✓) for radon testing and locations that are ***not appropriate*** (✗) for radon testing are indicated.

Floors to Test

Rooms with floors or walls that are in direct contact with the ground or a crawl space will be tested based on the following frequency criteria:

- Test all occupied rooms.
- If none of these floors have occupied rooms, test all occupied rooms on the first occupied floor level above.

If there is concern about the potential radon levels at upper floors, optional testing could be carried out in every third occupied room on the highest occupied floor. See Figure 5 for radon measurement locations for various multi-storey building scenarios.

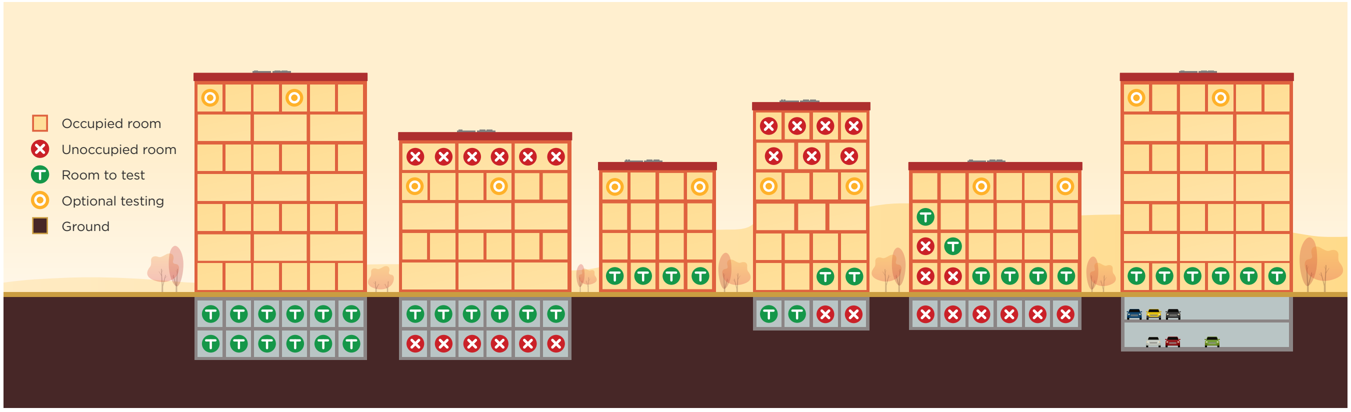

Figure 5. Recommended radon measurement locations in multi-storey buildings.

Post-Mitigation Testing

Re-testing Original Locations

Short-term testing should be completed a minimum of 24 hours after completion of mitigation activities to ensure radon levels have been reduced below 200 Bq/m^3. Should testing indicate radon levels are still elevated, mitigation efforts should be continued until acceptable results have been achieved. Testing should be conducted in the same locations that were originally tested.

Long-term testing should be completed during the next heating season (fall/winter) after the mitigation is complete. Testing should be conducted in the same locations that were originally tested. Re-testing should be done every five years to confirm radon levels remain low.