

Radon Measurement and Mitigation in Schools

Key messages

- Radon is a colorless, odorless, and tasteless gas that accumulates in indoor spaces. Over time, breathing radon gas can increase your likelihood of developing lung cancer.
- Lung cancer caused by radon is preventable. Reducing radon concentrations in an indoor space is called mitigation.
- Because of the amount of time that children spend at school, schools should be tested for radon and mitigated where needed.
- Consult a C-NRPP certified measurement or mitigation professional.
- Schools can be a community leader in raising radon awareness and promoting action.
- Contact your local health authority and BCCDC Environmental Health Services to share radon measurement data in support of research and health protection work.

Introduction

Radon is a colorless, odorless, and tasteless radioactive gas produced by the breakdown of uranium found naturally in rock and soil. Through permeable features within buildings, radon can accumulate within confined indoor spaces, where increased concentration and time exposed leads to greater risk of lung cancer. Radon is the second leading cause of lung cancer in Canada behind tobacco smoking, and it is estimated that 16% of Canadian lung cancer deaths are radon-induced. There is also a synergistic effect between tobacco smoking and radon exposure, such that smokers have a higher risk of radon-induced lung cancer than non-smokers.

As geologic features vary across the province, some areas, such as the provincial Interior, have higher radon potential than others. Detailed information about the geographic variation of radon in British Columbia can be found in this interactive map: <https://bccdc.shinyapps.io/bcradonmap/>.

However, the risk of radon exposure is also highly dependent on building-specific factors, so radon concentrations can vary widely from building to building, even in the same neighborhood. The only way to know the radon concentration in a given space is to test for it.

Schools are a potential source of radon exposure for staff and students. School districts have a legal responsibility to ensure the health and safety of all occupants. Therefore, schools and school districts should include radon in their routine indoor air quality maintenance programs.

The purpose of this document is to provide an overview for community members and public health/education professionals on how to test for and reduce radon exposure in schools.

The recommendations presented here are consistent with Health Canada's 2022 *Guide for Radon Measurements in Public Buildings*, which can be consulted for more detailed information¹.

Radon Mitigation

There are many ways to reduce radon exposure inside a building. This is commonly referred to as radon abatement, remediation, or mitigation. Typically, mitigation involves installing a system to capture radon from underneath the building and vent it outside where it will dilute quickly to negligible levels. These can be supported by less resource intensive measures such as adjusting heating, ventilation, and air conditioning system (HVAC) settings or sealing basement floor openings (e.g., sumps, cracks, dry floor drains).

Effective mitigation and their costs vary widely depending on factors such as structural layout and the HVAC system. Consulting a Canadian National Radon Proficiency Program (C-NRPP) certified professional can help develop a plan and estimate costs. A list of such professionals can be found here: <https://c-nrpp.ca/find-a-professional/>.

Radon Measurement

Becquerels per cubic metre (Bq/m³) is a common unit of measurement for indoor radon concentration. Health Canada recommends mitigating a building within one year if concentrations are above 600 Bq/m³ and within two years if concentrations are between 200 and 600 Bq/m³, with the goal of reaching the lowest reasonably achievable level below 200 Bq/m³ as soon as possible.

A list of devices can be found here: <https://c-nrpp.ca/approved-radon-measurement-devices/>.

Measurement Locations

Rooms on the lowest floor or any that are in direct contact with earth, including skirted portables, are at the greatest risk of radon exposure. Rooms at risk of radon exposure that are occupied for more than 4 hours a day should be tested.

In larger schools, a sensible representative sample of rooms (e.g., testing in different buildings in a multi-building school) can be taken as an initial screening measure, with the eventual goal of testing all occupied rooms at risk of radon exposure.

The measurement device should be placed near breathing height of most occupants, away from electronic devices and sources of heating, ventilation, or air currents, and in a space where it is unlikely to be disturbed. For optimal quality control, duplicate and blank tests should also be placed.

¹ https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/radiation/radon_building-edifices/27-20-2740-radon-guidance-hc-en.pdf

Long-Term Measurement

Conduct a long-term test for at least 91 days during the winter season. Measurement over 91 days helps account for natural variation over time.

Use an alpha track detector for long-term measurements. These single-use devices cost roughly \$30 to \$60 per unit and require analysis at a laboratory (cost inclusive). The entire process of measurement, analysis, and shipping can take several months. The measurement result is an average concentration over the tested period.

Short-Term Measurement

Conduct a short-term measurement for mitigation-related spot checks, determination of higher priority rooms for long-term testing, examining systematic time-based impacts to measurement results such as HVAC scheduling², or any other reason where it is unreasonable to conduct a long-term test.

Use a continuous radon monitor for short-term measurements. These reusable instruments cost roughly \$750 to \$1,500 per unit and can provide near real-time results, typically in hourly increments and in digital form. Ability to share between schools, potential lower cost per use, and near real-time digital results make continuous monitors an excellent tool for schools' routine indoor air quality maintenance programs.

Future Measurements

A full re-test should be done every five years or whenever major renovations are completed that would potentially impact radon exposure, such as structural changes to the lowest occupied levels or major HVAC system changes.

Community Leadership

Schools can be a community leader in raising radon awareness and promoting action. Testing in schools can be an opportunity to engage staff, students and parents, and introduce them to the health risks of radon, how to test for it, and mitigate harms in their homes and other buildings. We encourage directing individuals to the BC Centre for Disease Control (BCCDC) radon webpage for more information:

<http://www.bccdc.ca/health-info/prevention-public-health/radon>.

² Consult Health Canada's 2016 *Guide for Radon Measurements in Public Buildings* for a detailed protocol on this. <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/guide-radon-measurements-public-buildings-schools-hospitals-care-facilities-detention-centres.html>

Data Sharing

The BCCDC is compiling indoor radon measurement data from various sources into the BC Radon Data Repository (BCRDR)³. Anonymized summary-level data from the BCRDR is shared in BCCDC's interactive radon map⁴ and supports internal and approved external health protection and research work.

Please contact your local health authority and BCCDC Environmental Health Services at the contact info in this document header for how to contribute your school testing data to the BCRDR.

Further Information

More information about radon mitigation can be found in Health Canada's 2013 *Radon Reduction Guide for Canadian*⁵.

More information about legal rights and duties surrounding radon in British Columbia schools can be found in BC Lung Foundations' 2022 *Radon in BC: Legal Duties and Responsibilities*⁶.

This three minute video from the National Collaborating Centre for Environmental Health is an excellent introduction to radon to share with others: <https://www.youtube.com/watch?v=HryzrFjU4fQ>

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Notes: Referenced links may be broken as websites update over time. Please notify BCCDC Environmental Health Services at the contact info in the document header as necessary.

³ http://www.bccdc.ca/Health-Info-Site/Documents/BCRDR_HC_report.pdf

⁴ <https://bccdc.shinyapps.io/bcradonmap/>

⁵ <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/radon-reduction-guide-canadians-health-canada-2013.html>

⁶ <https://bclung.ca/radon-rights-and-duties-in-schools>