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# RADON

## ACTION GUIDE

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FOR MUNICIPALITIES

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# Summary



Radon is a naturally occurring radioactive gas that emanates from the ground and can enter and accumulate in buildings. Radon gas is found in every building in Canada at some level. Radon exposure is the leading cause of lung cancer after smoking, and accounts for an estimated 16 percent of lung cancer deaths in Canada. Radon risk reduction is easy to address through testing and mitigation. Simple tests involve placing a long-term radon detector in the lowest lived-in level of a building for three months during the fall-winter months. Health Canada estimates that ~7% of homes will have a high radon level; this percentage varies significantly across Canada, as indicated by [Health Canada's radon map](#). There are relatively inexpensive and very effective ways to reduce radon exposure in homes and buildings with high radon levels, i.e., over the Canadian Radon Guideline of 200 Bq/m<sup>3</sup>.

Municipalities can become leaders in advancing radon action through education and awareness, supporting community testing, creating databases and maps, enforcing radon provisions in building codes, policy development, and other actions. **This Radon Action Guide for Municipalities describes why municipalities should take action, how to create radon action strategies, and important steps that can be taken to reduce radon-induced lung cancer in communities.**

# Table of Contents



Summary .....	i
1. What is Radon and Why is it a Problem? .....	1
2. Why Municipalities Should Take Action on Radon .....	4
3. Planning for Radon .....	6
4. Education and Awareness .....	7
5. Testing, Mapping and Databases .....	8
6. Government Operations and Social Housing .....	10
7. Building Codes .....	11
8. Standards of Maintenance/Housing Standards .....	13
9. Radon Requirements in Public Spaces .....	14
10. Subsidies and Incentives for Testing and Mitigation .....	15
11. Energy Efficiency Retrofits .....	16
12. New Development Areas .....	17
13. Conclusion .....	18



# Appendix

<b>1. Education and Awareness</b> .....	<b>19</b>
1.1 Web Pages.....	19
1.2 Local Government Resolutions on Radon.....	20
1.3 Canadian Guidance and Protocols on Testing and Mitigation .....	20
1.4 Guides for the General Public on Radon Testing and Mitigation.....	20
1.5 Technical Guidance and Studies on Testing and Mitigation .....	20
<b>2. Testing, Databases, and Mapping</b> .....	<b>21</b>
2.1 Testing and Awareness .....	21
2.2 Community Testing Initiatives .....	21
2.3 Citizen Science Projects .....	21
2.4 Database and Mapping Initiatives.....	21
2.5 Library Lending Programs .....	22
<b>3. Government Operations and Social Housing</b> .....	<b>23</b>
3.1 Testing of Government Occupied Buildings .....	23
3.2 Testing and Mitigation in Social Housing .....	23
<b>4. Building Codes</b> .....	<b>24</b>
4.1 Varying Building Code Provisions across Canada .....	24
4.2 Radon in Municipal Building Codes .....	26
4.3 Building Code Enforcement .....	27
<b>5. Standards of Maintenance Bylaws</b> .....	<b>28</b>
5.1 Housing and Maintenance Standards.....	28
5.2 Enforcement of Bylaws .....	29
<b>6. Radon Requirements in Public Spaces</b> .....	<b>30</b>
6.1 Radon Provisions for Clean Air and Health Bylaws.....	30
<b>7. Subsidies and Incentives for Radon Testing and Mitigation</b> .....	<b>31</b>
<b>8. Energy Efficiency</b> .....	<b>32</b>
8.1 Energy Efficiency Guides .....	32
8.2 Home Renovation Subsidies and Incentives .....	32
8.3 Financing for Energy Efficiency and Home Repairs .....	32
8.4 Green Certification Standards.....	32





# 1. What is Radon and Why is it a Problem?

Radon is a naturally occurring radioactive gas found in every building in Canada. Radon gas comes from the breakdown of uranium in the ground. Long-term exposure to high radon levels is the leading cause of lung cancer after smoking, and accounts for more than 3,000 lung cancer deaths in Canada.<sup>1</sup> The [Government of Canada Radon Guideline](#) is set at 200 Bq/m<sup>3</sup>. Remedial measures should be undertaken whenever the average annual radon concentration exceeds the Canadian Guideline in normally occupied areas of buildings.<sup>2</sup> Across Canada an average of 7% of homes have radon concentrations that exceed the Guideline. Radon levels in buildings vary significantly by geography and building characteristics. Surveys have found that in parts of New Brunswick and Manitoba over 40% of homes tested were above the Canadian Guideline<sup>3</sup> and some cities, such as Castlegar, British Columbia and Regina, Saskatchewan, show over half of homes above the Guideline.<sup>4</sup> Public awareness remains low and a vast majority of Canadian homeowners (>90%) have never tested for radon.<sup>5</sup>

Health Canada has developed guidance on radon testing in homes: Testing ideally involves placing a small detector in the lowest regularly occupied level of the home (basement or main floor) for at least 3 months during the heating season.<sup>6</sup> These do-it-yourself (DIY) long-term test kits are available, typically costing 30 to 60 dollars, from a variety of online suppliers and hardware stores. “Real time” digital monitors are also available and can give a short snapshot of radon levels, but should be supplemented with 3-month tests. Radon measurement services from professionals certified by the [Canadian National Radon Proficiency Program \(C-NRPP\)](#) are also available. If test results are high (above 200 Bq/m<sup>3</sup>), a radon mitigation professional certified by the C-NRPP can determine and implement the most appropriate method to reduce the radon level. Techniques to lower radon levels are effective and can save lives. A radon mitigation system, which can be installed in less than a day, will reduce the radon level by more than 80% in most homes. The cost is about the same as other common home repairs, such as replacing the furnace or air conditioner.<sup>7</sup> While waiting for mitigation, people can also temporarily open windows on the lowest level of the home or run a well-maintained mechanical ventilation system to dilute with fresh air.<sup>8</sup>

- 1 Chen, J., Moir, D. and Whyte, J., 2012. “Canadian population risk of radon induced lung cancer: a re-assessment based on the recent cross-Canada radon survey,” *Radiation Protection Dosimetry* 152(1-3), pp. 9-13. For a recent review of the lung cancer risks of radon see United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), 2019. Sources, Effects and Risks of Ionizing Radiation, Annex B: Lung cancer from exposure to radon. Available at <https://www.unece.org/unscear/en/publications/2019.html> accessed August 20, 2021.
- 2 Health Canada, 2009. Government of Canada Radon Guideline. Available at <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/radon/government-canada-radon-guideline.html> (accessed August 20, 2021).
- 3 Health Canada, 2012. Cross Canada Survey of Radon Concentrations in Homes, Final Report. Available at <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/cross-canada-survey-radon-concentrations-homes-final-report-health-canada-2012.html> (accessed August 20, 2021).
- 4 Rogoza, D., Roberts, H. and Swoveland, B. 2014. Castlegar: Community Wide Radon Testing Results. British Columbia Lung Association. Available at <https://www.nature.com/articles/s41598-019-54891-8> accessed August 20, 2021. Stanley, F.K., Irvine, J. L., Jacques, W.R., Salgia, S.R., Innes, D.G., Winquist, B.D., Torr, D., Brenner, D.R. and Goodarzi, A.A., 2019. “Radon exposure is rising steadily within the modern North American residential environment, and is increasingly uniform across seasons,” *Scientific Reports* 9(1), pp. 1-17.
- 5 See Statistics Canada, 2017. Knowledge of radon and testing. Table: 38-10-0086-01.
- 6 See Health Canada, 2017. Guide for Radon Measurements in Residential Dwellings (Homes). Available at <https://www.canada.ca/en/health-canada/services/publications/health-risks-safety/guide-radon-measurements-residential-dwellings.html> (accessed August 20, 2021); Take Action on Radon, 2021. Testing for Radon. Available at <https://takeactiononradon.ca/test/> accessed August 20, 2021.
- 7 Health Canada, 2018. Residential Radon Mitigation Actions Follow-Up Study: Public Summary. Available at <https://www.canada.ca/en/health-canada/services/publications/health-risks-safety/residential-radon-mitigation-actions-follow-up-study.html> (accessed October 20, 2020).
- 8 Take Action on Radon, 2021. Protect Yourself from Radon. Available at <https://takeactiononradon.ca/protect/>. Accessed August 20, 2021.



Over the last decade, some radon awareness, action and policy progress have been achieved in Canada.

Health Canada's National Radon Program (NRP) has taken a number of steps to ensure radon is taken seriously in Canada. It reduced the Canadian Radon Guideline from 800 to 200 Bq/m<sup>3</sup> in 2007, leads an extensive public education program, and has conducted surveys<sup>9</sup> and health research.<sup>10</sup> The NRP has developed and validated technical guidance to ensure clear standards for how radon is measured and mitigated.<sup>11</sup> The NRP works with the Canadian National Radon Proficiency Program (C-NRPP) to ensure Canadians have access to accredited radon services and resources to help test and reduce indoor radon exposure.

Across Canada, some actions taken by governments and other institutions include:

- Radon reduction requirements in building codes,
- Promoting radon awareness and testing on websites,
- Testing of public buildings: government offices, schools, daycares, and social housing,
- Inclusion of radon in real estate Property Disclosure Statements and guidance on professional obligations for real estate agents to treat radon as a latent defect,
- Coverage for elevated radon in New Home Warranty claims,
- Requirement of radon mitigation in rental properties by some tribunals for landlord-tenant disputes; and,
- Clarifying guidelines for radon in the workplace.

Despite this progress there still remain many regulatory gaps in Canada, with many people living and working in high radon environments without knowing it.

While public awareness has increased, there is much work still to be done. A vast majority of Canadian households (<90%) have never tested for radon.<sup>12</sup> Local, community-based implementation is needed to ensure progress in reducing radon exposure.

**This guide will help municipal governments develop programs and policies to address radon.** It considers individual interventions across the built environment such as: Public education programs; community testing; radon risk maps; testing and mitigation in schools, daycares and public buildings;

9 Health Canada, 2012. Cross Canada Survey of Radon Concentrations in Homes, Final Report. Available at <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/cross-canada-survey-radon-concentrations-homes-final-report-health-canada-2012.html>.

10 Chen, J., Moir, D. and Whyte, J., 2012. "Canadian population risk of radon induced lung cancer: a re-assessment based on the recent cross-Canada radon survey," Radiation Protection Dosimetry 152(1-3), pp.-13. Chen, J., 2013. "Canadian lung cancer relative risk from radon exposure for short periods in childhood compared to a lifetime," International Journal of Environmental Research and Public Health 10(5), pp. 1916-1926. Chen, J., Bergman, L., Falcomer, R. and Whyte, J., 2015. "Results of simultaneous radon and thoron measurements in 33 metropolitan areas of Canada," Radiation Protection Dosimetry 163(2), pp. 210-216. Chen, J., 2019. "Risk Assessment for Radon Exposure in Various Indoor Environments," Radiation Protection Dosimetry 185 (2), pp. 143-150.

11 Health Canada, 2008. Guide for Radon Measurements in Residential Dwellings (Homes). Available at <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/guide-radon-measurements-residential-dwellings-homes.html> (accessed August 20, 2021). Health Canada, 2014. Radon—reduction guide for Canadians. Available at <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/radon-reduction-guide-canadians-health-canada-2013.html> (accessed August 20, 2021). Health Canada, 2014. Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors. Health Canada, 2016. Guide for Radon Measurements in Public Buildings Workplaces, Schools, Day Cares, Hospitals, Care Facilities, Correctional Centres. Available online at <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> (accessed August 20, 2021).

12 See Statistics Canada, 2019. Knowledge of radon and testing. Table: 38-10-0086-01. Available at <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810008601> (accessed August 20, 2021).



and including radon in standards of maintenance and business bylaws. It draws on existing experience of radon action from across Canada, the United States, and Europe.<sup>13</sup>

Companion documents to this one should be reviewed, including the following:

**Justifications and Policy Rationales for Radon Action:** Provides detail on why governments should take action, discussing societal values around public health, saving lives, and environmental concern. It also discusses initiatives already in place for which radon action is a natural extension, from Disease Prevention Strategies to Healthy Community Planning.

**Radon Action Guide for Provinces and Territories:** Provides a series of steps that provinces can take to establish a Radon Action Plan. It also discusses in detail the division of powers in Canada, why provincial action is required, and draws from international experience.

**Radon Action in Municipal Law: Understanding the Legal Powers of Cities and Towns in Canada:** Provides a review of the powers that municipalities have to address radon, recognizing that municipalities are “creatures of the provinces” and constrained by enabling law.

<sup>13</sup> Quastel, N., Siersbaek, M., Cooper, K. and Nicol A-M. 2018. Environmental Scan of Radon Law and Policy: Best Practices in Canada and the European Union. Toronto and Burnaby: Canadian Environmental Law Association and CAREX Canada. Available at [https://cela.ca/wp-content/uploads/2019/07/Radon-Policy-Scan-Full-Report-with-Appendices\\_0.pdf](https://cela.ca/wp-content/uploads/2019/07/Radon-Policy-Scan-Full-Report-with-Appendices_0.pdf) (accessed August 20, 2021). For US laws, see Environmental Law Institute, 2019. Database of State Indoor Air Quality Laws. Database Excerpt: Radon Laws. Available at [https://www.eli.org/sites/default/files/docs/2019\\_radon\\_with\\_cover\\_boldded.pdf](https://www.eli.org/sites/default/files/docs/2019_radon_with_cover_boldded.pdf) (accessed August 20, 2021).





## 2. Why Municipalities Should Take Action on Radon

Governments play a role in helping individuals avoid risks. Health Canada research estimates that with lifetime exposure at 800 Bq/m<sup>3</sup>, the lifetime lung cancer risk would be 5% (1 in 20) for non-smokers, significantly higher than the baseline lung cancer rate of 1% (1 in 100).<sup>14</sup> People who smoke and also live in high radon environments can have a 1 in 3 chance of contracting lung cancer.<sup>15</sup> Canadians expect health and safety standards for their homes, workplaces, and recreational spaces. Radon is one of a number of emergent indoor air quality concerns which lead to a focus on indoor environmental health. Radon is thus included in [Health Canada's Residential Indoor Air Quality Guidelines](#). **Radon action is a proven and cost-effective way to save lives and is a natural extension of existing policy and planning frameworks that support action on health and environment.** In the companion document, **Justifications and Policy Rationales for Radon Action**, a variety of reasons why governments should take action on radon are outlined in more detail.

This guide details many action items that municipalities and local government can take, independently or in concert with higher levels of government. Radon fits within a variety of policy platforms municipalities already use, such as sustainability planning, housing policies, healthy built environments, standards of maintenance, and clean air bylaws.

**Municipalities have legal powers to act on radon.** Most provinces' municipal legislation mentions protecting health and safety as part of the general purposes of a municipality or allows for bylaws concerning health.<sup>16</sup> Many provinces also provide that municipalities have the purpose of fostering environmental well-being or can make bylaws to protect the environment.<sup>17</sup> Radon can fit into these powers, and the document **Radon Action in Municipal Law** sets out specific actions on radon that municipal law frameworks support.

**Municipalities can take a leadership role and show that bold action on radon is possible.** As the level of government often closest to people, and the one with which they identify, municipalities will often be trusted to respond to citizens' concerns. Even when provinces engage in comprehensive radon planning there will be important roles for municipalities. Municipalities enforce areas which make up core components of radon policy, including but not limited to building codes, construction permits, air quality in indoor public spaces (as is currently done for smoking), and standards of maintenance for rental accommodation.

14 Chen, J., 2017. "Lifetime lung cancer risks associated with indoor radon exposure based on various radon risk models for Canadian population," *Radiation Protection Dosimetry* 173(1-3), pp. 252-258.

15 US EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003). Available at <https://www.epa.gov/sites/production/files/2015-05/documents/402-r-03-003.pdf> (accessed August 20, 2021).

16 Community Charter, SBC 2003, c 26, s. 8(3)(i); Municipal Government Act, RSA 2000, c M-26, s. 3(c) and 7(a); Municipalities Act, SS 2005, c M-36.1, 4(2), and s. 8(1)(b); The Cities Act, SS 2002, c C-11.1, 4(2) and 8(1)(b); The Northern Municipalities Act, 2010, SS 2010, c N-5.2 The Northern Municipalities Act, 2010, SS 2010, c N-5.2 s. 4(2) and 8(1)(b); Municipal Act, CCSM c M225 232(1) (a); Municipal Act, 2001, SO 2001, c 25, (s. 10 (1), s. 10 (2)(6), s. 11(1) and 11(2)(6)); Municipal Powers Act, CQLR c C-47.1, s. 4 (5), s. 4(7), s. 55; Local Governance Act, SNB 2017, c 18, s. 10 (1)(a); Municipal Government Act, RSPEI 1988, c M-12.1, s. 180, Municipal Government Act, SNS 1998, c 18 s. 172 (1)(a).

17 Community Charter, SBC 2003, c 26, s. 7(d); Municipal Government Act, RSA 2000, c M-26, s. 3(a.1); Municipalities Act, SS 2005, c M-36.1, 4(2)(d); The Cities Act, SS 2002, c C-11.1, 4(2)(d); The Northern Municipalities Act, 2010, SS 2010, c N-5.2 s. 4(2) (d) and 8(1)(b); Municipal Act, 2001, SO 2001, c 25, (s. 10 (2)(5), s. 10 (2)(6), s. 11(2)(5); Municipal Powers Act, CQLR c C-47.1, s. 4 (4), s. 19 Local Governance Act, SNB 2017, c 18, s.5 (d); Municipal Government Act, RSPEI 1988, c M-12.1, s. 180 m), Municipal Government Act, SNS 1998, c 18 s. 172 (1)(a).



**Risk management.** Municipalities are employers, building owners and operators and at times landlords. As such they are subject to many laws that impose general duties to ensure spaces are safe—and increasingly these laws are recognized as including protection from elevated radon. Municipalities are also subject to a duty of care when inspecting buildings. As building codes are updated to include radon-resistant construction techniques, this creates new responsibilities for municipal building inspectors. Becoming aware of radon and taking steps to address it can be a good way to avoid exposure to litigation.

**Radon action can increase the value of the building stock.** Certified mitigators can reduce radon levels to safe levels, which can become a selling feature—not only ensuring users/owners that radon has been dealt with, but also increasing the value of the home or business.



### 3. Planning for Radon

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Municipal governments regularly engage in long-term proactive planning, as found in long-term land use plans, sustainability plans, healthy community strategies or housing initiatives. Not only do municipalities have the power to include radon in these plans, but doing so follows from existing municipal roles of planning for housing and healthy built environments. More detail on the way radon can be included in established municipal planning frameworks is outlined in **Radon Action in Municipal Law**.

Radon planning is well established in many countries. Municipalities can begin to put in place many of the core features of a Radon Action Plan, including:

- Delivering annual public education and awareness campaigns during November, Radon Action Month in Canada.
- Conducting community testing to gain better understanding of local radon levels.
- Adopting goals of reducing indoor radon exposure in the community.
- Establishing specific bylaws and operating policies covering building code enforcement, rental accommodation, municipal owned buildings, and publicly accessible places.

In later sections, this guide describes in more detail specific actions municipalities can take, either as part of a comprehensive plan or individually.

Developing radon plans should include collaboration, consultation, and partnerships. Municipalities should particularly reach out to independent organizations that have a strong presence at the local level and can play an important role concerning radon. Health authorities are likely to have significant knowledge about radon and be prepared to engage in education campaigns and site investigations. School boards can ensure testing and mitigation in educational spaces. Local libraries can lend out radon detection devices (akin to book loans). Non-profit health associations may also have special insight into the problem and lend grassroots support. One possible approach here is to form a Radon Working Group—a multi-stakeholder task force that brings together radon stakeholders including staff from cities, health authorities, non-governmental organizations and other stakeholder organizations.<sup>18</sup>

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<sup>18</sup> As reported to authors as current practice by the Province of Nova Scotia by John Drage, Senior Geologist/Hydrogeologist, Geoscience & Mines Branch, Department of Lands and Forestry, Nova Scotia.



## 4. Education and Awareness

Developing a radon outreach program is a good first step for governments to take, because awareness is a precondition for action. Websites, pamphlets, ad campaigns, and public presentations can be good ways to start building momentum. Ideally, materials will guide the general public through the science and health risk of radon, show how to test and mitigate, explain relevant legal requirements (such as in the building code), and provide links and resources for people to learn more and take action. Health Canada has developed many radon outreach materials that can be used and adapted as required. Many local governments have put up radon websites.

[Section 1 of the Appendix](#) provides a list of Health Canada’s resources, messaging and outreach materials that municipalities can use and examples of radon websites for Canadian towns and cities.

An effective way to draw attention to radon is through civic declarations. For instance, many provinces have taken the lead from Health Canada and the Canadian Lung Association and declared November “Radon Action Month.” This aligns with the start of winter as the ideal time to begin long-term radon testing. This type of awareness campaign has been used by some provinces and municipalities ([Appendix, Section 1](#)).

Ideally, educational campaigns are combined with other initiatives to maximize reach, impact and ensure knowledge is translated into action. Some successful Canadian campaigns have included well-known players from the Canadian Football League<sup>19</sup> and home improvement personalities with their own television shows.<sup>20</sup> Rather than simply giving people knowledge, some programs provide ways for the public to gain hands-on experience, such as through sample community testing initiatives and “citizen science” engagement programs.<sup>21</sup> (See this Guide, [section 5](#), and Appendix, [section 2](#)). Other initiatives discussed in this Guide will also have a strong educational component and subsidies (see this Guide, [section 10](#), and Appendix, [section 7](#)), and new bylaws (see this Guide, [section 8](#) and [9](#) and Appendix, [section 5](#) and [6](#)).

19 Giesbrecht, L. 2019. “CFL players tackling radon with new awareness campaign,” Regina Leader-Post, August 31, 2019. Available at <https://leaderpost.com/news/local-news/cfl-players-tackling-radon-with-new-awareness-campaign> (accessed August 20, 2021).

20 Holmes, M. 2018. What is Radon? Mike’s Advice / Home Safety & Maintenance. Available at <https://makeitright.ca/holmes-advice/home-safety-maintenance/what-is-radon/> (accessed August 20, 2021).

21 McKinley, Duncan C., et al. 2017. “Citizen science can improve conservation science, natural resource management, and environmental protection,” *Biological Conservation* 208: pp. 15-28. Examples of citizen science programs include Simon Fraser University and Dr. Anne-Marie Nicols’ projects in Metro Vancouver, and the University of Calgary and Dr. Aaron Goodarzi’s Evict Radon program. See Simon Fraser University, 2018. SFU researcher urges North Shore citizens to test for cancer-causing radon gas. Available at <https://www.sfu.ca/fhs/news-events/news/2018/health-sciences-researcher-urges-locals-to-test-for-cancer-causing-radon-gas.html> (accessed August 20, 2021). Evict Radon, 2020, available at [Evictradon.org](http://Evictradon.org) (accessed August 20, 2021).



## 5. Testing, Mapping and Databases

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An important step in radon action is testing for radon concentrations in residences, businesses, and other indoor public spaces. For individual residents, businesses, and occupiers of buildings, this indicates whether mitigation is needed.

**Local governments can consider selling test kits as a way to increase testing and collect radon data in their communities.** Promoting radon testing and making it available through municipal channels validates and adds credibility to this important issue, resulting in increased action by community members. A further advantage of this approach is that the agency selling the test kit can ask buyers to agree up front for test data to be shared with the municipality. Municipalities may also be able to find ways to reduce the price relative to commercial vendors, such as through buying in bulk, not charging markup, having city staff sell from their desks, working with existing lung associations and charitable societies, or through a direct subsidy (see the Appendix, [Section 2](#)).

At a municipal scale it is important to know radon prevalence, because in some regions much greater percentages of buildings have a high radon problem compared to other regions. Individuals will respond better to health prevention messaging if they can translate the risks into their own personal experience, such as by knowing if radon is very common where they live. **Community testing can help municipalities characterize local radon prevalence, and for relatively high radon areas, send a strong signal of the need to take action.** This can help professionals such as realtors, building inspectors, and employers be alert to local radon risks. Community testing provides data that can support important policy and regulatory change, such as public health standards, school and daycare testing requirements, occupational health and safety and tenancy considerations. In some provinces, such as Ontario, the building code requires radon mitigation systems “where methane or radon gases are known to be a problem.”<sup>22</sup> Community testing becomes a way to establish whether radon levels are higher, and the community can then take steps to enforce radon requirements.<sup>23</sup> In British Columbia, the building code provides that municipalities can take additional steps to be added to the list of places where radon levels are higher and mitigation is needed.<sup>24</sup> For further resources on community testing, see [Section 2](#) of the Appendix.

**Radon testing also contributes to improving databases and risk mapping, which helps research on radon and provides easy visual cues that radon is an issue.** Find a list of existing Canadian and international radon database and mapping initiatives in [Section 2](#) of the Appendix.

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<sup>22</sup> Ontario Building Code Section 9.13.4.2. and Supplementary Standard SB-9.

<sup>23</sup> Guelph, 2020. Radon Gas Mitigation Program. Available at <https://guelph.ca/city-hall/building-permits-inspections/residential-building-permits/radon/> (accessed August 20, 2021). Kingston Soil Gas Mitigation Strategy. Available at <https://www.cityofkingston.ca/resident/building-renovating/radon-gas-mitigation> (accessed August 20, 2021).

<sup>24</sup> BC Building Code, 2018 Division B, sec. 1.1.3.3 (2).



**There are a variety of programs to stock digital radon monitors in public libraries, which allows participants to check them out (akin to book loans) and conduct a radon test at home.** Currently there are radon library lending programs in Nova Scotia, Prince Edward Island, British Columbia, Alberta, and Ontario (see [Appendix 2](#) for more detail). These programs can help people with limited funds, or who want an initial introduction to radon. These programs should be considered a screening test only with a primary goal of raising awareness about radon. Health Canada recommends a long-term test of at least three months during the heating season. This is not always possible with the library lending programs, but these programs can help people understand radon and can motivate them to conduct long-term tests. Municipalities can work with libraries, supporting lending programs or the distribution of long-term test kits to patrons/community members. Health Canada, in collaboration with provincial lung associations and radon experts, has developed a [Radon Library Lending Program Guide](#) to provide libraries across the country with support, education, and useful resources to run an effective and successful radon monitor lending program.



## 6. Government Operations and Social Housing

Governments have broad duties to ensure spaces they control are safe. When acting as employers they are bound by “general duty clauses” that require attention to hazards.<sup>25</sup> They are also open to compensation claims if workers contract lung cancer from radon.<sup>26</sup> Many municipalities control social housing—as landlords they have a duty to address radon to ensure the spaces they rent are in good repair.<sup>27</sup> Social housing providers may be open to litigation under occupiers’ liability law if their spaces lead tenants to develop lung cancer.<sup>28</sup> Addressing radon in social housing is an ethical and socially responsible action for municipalities to take. In some cases, municipalities may also control schools, daycares, and other facilities for which radon action is also important.

A government could choose to test and mitigate its existing buildings and improve standards in new buildings as a way of acting ethically, or to help support local environmental industries. Testing of government buildings and social housing demonstrates leadership by example. [Section 3](#) of the Appendix summarizes initiatives in Canada for testing of government-occupied buildings, and summarizes federal, provincial, and municipal social housing testing initiatives.

An important principle in government testing and mitigation is to use certified radon professionals. **Health Canada recognizes professionals certified under the [Canadian National Radon Proficiency Program \(C-NRPP\)](#).** In the absence of clear rules from the provinces on who should perform radon services, local governments should consider setting policies limiting any contracts for radon work to C-NRPP certified professionals. This not only ensures high standards but helps build an important industry.

- 25 British Columbia, Occupational Health and Safety Regulation, BC Reg 296/97, Part 4 - General Conditions - 296/97 at s. 4.1; Alberta, Occupational Health and Safety Act, RSA 2000, c O-2 at s. 2(1); The Saskatchewan Employment Act, SS 2013, c S-15.1, at s. 3-8; Occupational Health and Safety Regulation, 1996 O-1.1. at section 12; Manitoba, Workplace Health and Safety Act, s. 4(1) C.C.S.M. c. W210; Ontario, Occupational Health and Safety Act, RSO 1990, c O.1 s. 25(2)(h); Quebec, Act respecting the occupational health and safety, CQLR c S-2.1 at s. 51 Nova Scotia, Occupational Health and Safety Act, SNS 1996, c 7 at s. 13 (1); New Brunswick, Occupational Health and Safety Act, SNB 1983, c O-0.2 at s.9; Prince Edward Island, Occupational Health and Safety Act, RSPEI 1988, c O-1.01 s. 12; Newfoundland, Occupational Health and Safety Regulations, 2012 under the Occupational Health and Safety Act(O.C. 2012- 005) at s. 42, Yukon, Occupational Health and Safety Act, RSY 2002, c 159 at s. 3(1); Northwest Territories, Safety Act, RSNWT 1988, c S-1 at s. 4. (1); Nunavut, Safety Act, RSNWT (Nu) 1988, c S-1 at s. 4(1).
- 26 All provinces and territories have workers compensation legislation with broad provisions for injury on the job. Many specifically list ionizing radiation or radon leading to lung cancer as an occupational disease, see Nova Scotia, The Workers’ Compensation Act, SNS 1994-95, c 10 s. 15(1); Quebec, The Workers’ Compensation Act, CQLR c A-3, s. 111(8) and Schedule D (8); Alberta, Workers’ Compensation Act, RSA 2000, c W-15 s. 24(6); Workers’ Compensation Regulation, Alta Reg 325/2002 s. 20(1), Schedule B; British Columbia, The Workers Compensation Act RSBC 1996, c 492 s. 5 (1), s. 6(11), Schedule B.
- 27 All provinces and territories have landlord-tenant law that includes broad language about fitness of habitation or good state of repair. On how this applies to radon see Ontario, CET-67599-17 (Re) 2017 CanLII 60362 (ON LTB) Quebec– Vanderwerf v. Dolan, 2019 QCRDL 37417.
- 28 Quastel, N. 2021. Radon and Renters: Current BC Law and Potential for Reform. Healthy Indoor Environments Legal Brief No. 5. British Columbia Lung Association. Available at <https://bclung.ca/programs-initiatives/healthy-indoor-environments-program/current-projects/radon-and-renters>, accessed August 20, 2021.



## 7. Building Codes

New construction is an excellent place to implement radon provisions. Building codes are often updated, and this is an area where health and safety standards are widely accepted. Targeting new construction is particularly cost-effective. There are radon provisions in the (model) National Building Code (with the radon provisions last updated in 2010), and many provinces have incorporated some radon provisions in their Code. The National Radon Program continues to work with Codes Canada and the National Research Council to encourage improvements in the radon provisions in the National Building Code. As well, some municipalities may be in a position to add radon provisions to building codes.

Whether a municipality can impose stricter building code requirements depends on the provincial and municipal law system. Where possible, municipalities should consider requiring full radon reduction systems in new homes and low-rise residential buildings. **The most recent statement on best practices is now the Canadian General Standard Board’s 2019 “Radon control options for new construction in low-rise residential buildings.”**<sup>29</sup> [Section 4](#) of the Appendix describes varying standards for radon in new construction across Canada and best practices.

In some provinces, municipalities have some control over whether radon provisions apply in their area. For instance, the Ontario Building Code has a section on “Soil Gas Control” which imposes requirements “where methane or radon gases are known to be a problem.”<sup>30</sup> As a result, a number of municipalities and local health units have completed community testing to determine if radon is a problem and if so, they are then enforcing the radon building code provisions. Beyond enforcing or improving building codes, there is scope for municipalities to communicate and conduct education about radon with builders and homeowners as part of the permitting and enforcement processes. Some cities, such as the Ontario municipalities of Guelph and Kingston, now deny occupancy permits to new construction that does not meet the Code requirements on radon.<sup>31</sup>

In provinces with uniform building codes, local governments can also consider negotiating voluntary compliance with builders as a way of reaching higher standards, such as full passive sub-slab depressurization systems rather than “rough-in stubs.” This would be especially appropriate in areas where elevated radon is known to be prevalent. Generally, requirements for uniformity concerning building codes attach to mandatory requirements and “enactments” in bylaws. There is thus still the option of tying compliance to other benefits a city might provide. For instance, a municipality might be able to use density bonus bylaws or land covenants to impose higher standards, or offer subsidies and incentives.<sup>32</sup>

29 Canadian General Standards Board CAN/CGSB-149.11-2019. Available at <https://publications.gc.ca/site/eng/9.882605/publication.html> (accessed August 20, 2021) section 6, page 10.

30 Ontario Building Code Section 9.13.4.1. and Supplementary Standard SB-9.

31 City of Guelph, Radon Gas Mitigation Program. Available at <https://guelph.ca/city-hall/building-permits-inspections/residential-building-permits/radon/> (accessed August 20, 2021). City of Kingston. Radon Gas Mitigation. Available at <https://www.cityofkingston.ca/resident/building-renovating/radon-gas-mitigation> (accessed August 20, 2021).

32 Bullhozer, B. 2017. The Building Act: What You Need to Know. Young Anderson Seminar Paper. Available at [https://www.younganderson.ca/assets/seminar\\_papers/2017/The-Building-Act-What-You-Need-to-Know.pdf](https://www.younganderson.ca/assets/seminar_papers/2017/The-Building-Act-What-You-Need-to-Know.pdf) (accessed August 20, 2021) p. 6.





Building code enforcement is a key focus of municipal governments. Most provinces now have some form of radon protection in place for new construction but rely on municipalities for enforcement. This is an important role, and municipalities need to ensure inspectors understand radon and radon mitigation systems. Ensuring building inspectors receive training on radon, including C-NRPP mitigation credentials, can be a good way to ensure radon is not overlooked. This can ensure inspectors meet the required standard of care, and can help protect municipalities from the risk of liability.<sup>33</sup> [Section 4](#) of the Appendix provides more detail on steps municipalities can take to enforce radon provisions, such as outlining the inspection process and ensuring building inspectors have relevant C-NRPP training.

<sup>33</sup> Rothfield v. Manolakos [1989] 2 S.C.R. 1259; Just v. British Columbia, 1989 CanLII 16 (SCC), [1989] 2 SCR 1228; Ingles v. Tutkaluk Construction Ltd., 2000 SCC 12 (CanLII), [2000] 1 S.C.R. 298.



## 8. Standards of Maintenance/Housing Standards

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Many Canadian municipalities have standards of maintenance bylaws that cover the conditions of property. In practice, these often focus on “community standards” that aim to create calm, ordered, and quiet outdoor environments through attention to issues such as graffiti, garbage, or noise.<sup>34</sup> However, some municipalities include details on indoor environments in these bylaws, and so supplement provincial residential tenancies protections.<sup>35</sup> In some cases, such as British Columbia, the provincial government provides explicit guidance to municipalities that include indoor conditions, such as having plumbing in good working order.<sup>36</sup> Municipalities should consider updating these standards to explicitly require radon testing and mitigation to ensure Canadian Radon Guidelines are met.

Municipalities can also take steps to ensure enforcement of maintenance standards. In Waterloo, Ontario, the city uses the business license process to enforce standards of maintenance, denying permits to landlords who do not maintain rental properties in good condition, and allowing enforcement by medical officers of health, as well as building inspectors, enforcement officers, and police officers.<sup>37</sup> Municipalities can add protection from high radon to such bylaws, creating a powerful tool for protecting renters. [Section 5](#) of the Appendix provides examples of model language to help draft such bylaws and ensure their enforcement.

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34 c.f. Regina Community Standards Bylaw No: 2016-2.

35 c.f. Winnipeg Neighbourhood Liveability By-law 1/2008, at Part 2; Montreal By-law concerning the sanitation, maintenance and safety of dwelling units (03-096).

36 See BC Government, 2020. Standards of Maintenance Bylaw. Available at <https://www2.gov.bc.ca/gov/content/housing-tenancy/local-governments-and-housing/housing-resources/housing-guides> (accessed August 20, 2021). BC Government, 2020. Standards of Maintenance Bylaw: Sample Bylaw. Available at <https://www2.gov.bc.ca/gov/content/housing-tenancy/local-governments-and-housing/housing-resources/housing-guides> (accessed August 20, 2021).

37 City of Waterloo Rental Licensing Bylaw 2011-047.



## 9. Radon Requirements in Public Spaces

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Through the 1990s and 2000s many municipalities and other local governments in Canada came to adopt bylaws prohibiting smoking in public spaces such as restaurants, shopping malls, workplaces, or parks. In some cases, these were described as “Clean Air Bylaws”.<sup>38</sup> In other cases they were part of a more omnibus “Health Bylaw” that covered areas such as bans on pesticides, spitting in public, or boats discharging sewage.<sup>39</sup> “Clean Air” or “Health” bylaws could be expanded to include rules requiring testing and necessary mitigation of radon in public indoor spaces. Cities generally can also use business permitting powers to enforce health bylaws.

Typically, anti-smoking bylaws drew on explicit wording in provincial legislation allowing municipalities to pass smoking regulations. However, municipalities could expand clean air/health bylaws or create new radon bylaws on the basis of the very general powers to pass health-related regulations (or, in some cases, general environmental powers).

Municipalities generally cannot prohibit normal business activity or trade, or, in most provinces (outside of Quebec, Newfoundland, and Prince Edward Island) impose more stringent building codes. **It is important to emphasize that requirements to ensure low radon levels will not be unduly costly and so will not severely impact businesses.** As well, regulating the health impacts of air can be differentiated from imposing structural requirements. While building codes can provide detailed prescriptions for how buildings should be built, which can have the result of lowering radon levels or making it easier to do so, this is different from a requirement concerning the quality of indoor air. There will not be conflict between complying with a low radon requirement and complying with the building code (indeed, they will likely work together).

[Appendix 6](#) suggests content for radon bylaws for public spaces.

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<sup>38</sup> Capital Regional District, Bylaw No. 3962, Capital Regional District Clean Air Bylaw No 1, 2014; Kelowna Bylaw #: 5980-86; Clean Indoor Air and Smoking Regulation Bylaw; City of Revelstoke Clean Air Bylaw NO. 2186; Brantford Smoking-Clean Air Bylaw, Chapter 570.

<sup>39</sup> City of Vancouver, Health By-Law No. 9535; Leduc Bylaw No. 581-2004, Health Bylaw.



## 10. Subsidies and Incentives for Testing and Mitigation

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Subsidies and incentives are an important component of radon action. Many people do not know about radon and need forms of encouragement. Poorer households might need financial help, and so subsidies represent a way of ensuring equity of access. Landlords may only be responsive to fiscal incentives. Local governments may pursue subsidies and incentives as a way to achieve broader goals of reducing elevated radon in their towns and cities. Earlier in this guide we mentioned municipalities could sell or offer price subsidies on test kits as a way of spreading awareness and developing databases and maps. However, it is also important that mitigation costs not become a barrier, and disincentivize people from even taking steps to test.

There are many ways in which subsidies can be offered. Municipalities can include a subsidy system for radon in their municipal budgets and adjust tax rates accordingly. Subsidies can take the form of low- and no-interest loans, direct payments, or reduction of other taxes or fees. Subsidies for mitigation should only be made available where mitigation is performed by C-NRPP certified radon professionals. [Section 7](#) of the Appendix covers examples of radon incentives as part of broader sustainable building programs pioneered by municipalities such as Victoriaville, Quebec.



## 11. Energy Efficiency Retrofits

Green building programs are a core part of urban sustainability initiatives.<sup>40</sup> It is common for municipalities to have green building programs covering city-owned property,<sup>41</sup> or to have policies that catalyze low or zero emissions in new developments.<sup>42</sup> As well, many municipalities own electricity and other utilities, which commonly include efficiency programs.<sup>43</sup> Many building codes across Canada will over time adopt stricter energy efficiency standards. Attention to radon and other indoor air quality concerns should be an important part of energy efficiency programs. [Section 8](#) of the Appendix provides examples of energy efficiency guides and programs that include recommendations for radon.

Energy efficiency often relies on controlling indoor air flow, but since the 1980s building scientists have been aware that “tight” buildings can prevent radon from escaping into the outdoors.<sup>44</sup> There is evidence that in some cases increasing airtightness can elevate mean radon concentrations by over 50%.<sup>45</sup> In newer homes there may be applicable radon standards in building codes, but in retrofits the Code may not be engaged. The result can be that radon issues are ignored and made worse.<sup>46</sup> Alternatively, some energy efficiency initiatives, including third-party certification standards, do include radon mitigation (Appendix, [Section 8](#)).

Energy efficiency programs should be coupled with attention to ventilation rates as well as testing and mitigating for radon.<sup>47</sup> At minimum, home occupants should be advised to test for radon after any energy retrofits. Radon policy should include measures to engage with energy retrofits as a way to reduce lung cancer rates and save lives and to eliminate unnecessary conflicts between reducing carbon emissions and human well-being.

Municipalities can ensure that where they promote energy efficiency, they also draw attention to radon and other indoor air quality issues, explaining the possibility of unwanted effects of a tight home. Incentive and financing programs for efficiency and other green building improvements should include covering the costs of radon testing and mitigation. There are possibilities to help link energy retrofit and radon mitigation financing—for instance, with low-interest loans which are paid back on monthly utility bills (sometimes called “on-bill financing”). [Appendix 8](#) covers financing models.

40 See for example 2020 Declaration for Resilience in Canadian Cities. Available at <https://www.2020declaration.ca> (accessed January 9, 2021). Principle 19.

41 See for example City of Ottawa, 2020. Green Building. Available at <https://ottawa.ca/en/living-ottawa/environment-conservation-and-climate/climate-change-and-energy/green-buildings> (accessed August 20, 2021).

42 City of Vancouver, 2020. Zero Emission Buildings. <https://vancouver.ca/green-vancouver/zero-emissions-buildings.aspx#zero-emissions-building-plan> (accessed August 20, 2021).

43 See for example Kingston Ontario’s Utilities Kingston’s conservation programs. Available at <https://utilitieskingston.com/Electricity/Conservation/Overview> (accessed August 20, 2021).

44 United States General Accounting Office, 1986. Indoor Radon Air Pollution. GAO/BCED-S6-170. Available at <https://www.gao.gov/assets/150/144501.pdf> (accessed August 20, 2021, at page 12). More recently see Shrubsole, C., Macmillan, A., Davies, M. and May, N., 2014. 100. “Unintended consequences of policies to improve the energy efficiency of the UK housing stock,” *Indoor and Built Environment* 23(3), pp. 340-352.

45 Stanley, F.K., Zarezadeh, S., Dumais, C.D., Dumais, K., MacQueen, R., Clement, F. and Goodarzi, A.A., 2017. “Comprehensive survey of household radon gas levels and risk factors in southern Alberta,” *CMAJ Open*, 5(1), pp. E255-E264.

46 Colligan, B., Le Ponner, E. and Mandin, C., 2016. “Relationships between indoor radon concentrations, thermal retrofit and dwelling characteristics,” *Journal of Environmental Radioactivity* 165, pp. 124-130.

47 Arvela, H., Holmgren, O., Reisbacka, H. and Vinha, J., 2013. “Review of low-energy construction, air tightness, ventilation strategies and indoor radon: results from Finnish houses and apartments,” *Radiation Protection Dosimetry* 162(3), pp. 351-363.



## 12. New Development Areas

Local governments might consider radon in soil when siting, zoning, and permitting new housing.<sup>48</sup> Municipal legislation generally does allow for specific site planning, and specific restrictions due to hazards or health and safety concerns.<sup>49</sup> This enables the council of the municipality to ensure the quality of site planning and architectural integration. In some cases, such as in British Columbia's *Local Government Act*, municipalities are given powers to impose special standards asking developers to provide special reports, timing and process of construction, or added safety features as a condition to obtaining permits.

Municipalities may have information indicating particularly high radon in some areas, and as a result give special attention to any new developments. Radon mitigation using sub-slab depressurization is almost always sufficient to ensure indoor radon levels are below the Government of Canada Guideline, even where radon levels are very high pre-mitigation.<sup>50</sup> It is thus unlikely that municipalities would need to prohibit housing due to high background radon levels. However, new developments in locations known to have a high prevalence of elevated radon in buildings could be subject to specific standards or negotiated agreements, such as for radon testing prior to occupancy.

48 See BC Centre for Disease Control. 2018. Healthy built environment linkages toolkit: Making the links between design, planning and health, Version 2.0. Vancouver, BC: BC Provincial Health Services Authority. Available at <http://www.bccdc.ca/health-professionals/professional-resources/healthy-built-environment-linkages-toolkit> (accessed August 20, 2021 at p. 52 and p. 71).

49 British Columbia, *Local Government Act* s. 488 to 491; Alberta, *Municipal Government Act*, RSA 2000, c M-26, s. 640 (2)(c)(iv), s. 641; Saskatchewan, *Municipal Government Act*, RSA 2000, c M-26 s. 32(2)(d); Manitoba, *Provincial Planning Regulation*, Man Reg 81/2011, S, 2, Part 3, 1.1.1, Part 4; Ontario *Planning Act*, RSO 1990, c P.13, 34(1)(3 and 3.1; Quebec *Act respecting land use planning and development*, CQLR c A-19.1 s, 145.15 to 145.20).

50 Health Canada, 2018. Residential Radon Mitigation Actions Follow-Up Study. Available at <https://www.canada.ca/content/dam/hc-sc/documents/services/publications/health-risks-safety/residential-radon-mitigation-actions-follow-up-study/27-1968-Public-Summary-Radon-EN2.pdf> (accessed August 20, 2021).



## 13. Conclusion

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Municipal governments have many reasons to take action on radon, stemming from concern with health and safety. Municipalities have broad powers to act in municipal law and can take a leadership role acting in concert with, or ahead of provinces. Municipalities have the power to take concrete steps that will not only help prevent lung cancer and save lives but help get the ball rolling on broader provincial and territorial action. Municipalities can spread awareness, subsidize test kits and mitigation, conduct community testing, enforce building codes, permit construction, regulate indoor spaces (as they currently do for smoking), and uphold standards of maintenance for rental accommodation. Radon action fits into broader municipal planning and is a natural addendum to sustainability plans and healthy community strategies. Addressing radon is also a way to manage legal risks that municipalities may face when inspecting new construction, or as landlords, employers, owners and managers of buildings. The time for action on radon has arrived in Canada. Municipalities can collaborate with provincial governments, local health authorities, school boards, libraries and lung health and cancer organizations to take radon action and reduce the incidence of radon induced lung cancer.

# Appendix



## 1. Education and Awareness

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A key component of addressing radon is ensuring that people know that it is a health risk and have the tools to act to remedy it. Many government agencies in Canada and around the world have radon education programs, information portals and outreach resources, including municipalities.

### 1.1 Web Pages

#### Canada (Federal)

- [Take Action on Radon Resources for Stakeholders](#)
- [Health Canada Materials to Share or Print](#)

#### Canada (Provincial and Territorial)

- [Public Health Ontario](#)
- [Cancer Care Ontario, Risk of Residential Radon Varies Geographically](#)
- [Health Link BC](#)
- [Manitoba Health](#)
- [Nova Scotia Environmental Health](#)

#### Canada (Municipal and Regional)

- [Algoma Public Health](#)
- [Chelsea, Quebec](#)
- [Edmonton, Alberta](#)
- [Grey Bruce Public Health](#)
- [Guelph, Ontario](#)
- [Hamilton Public Health](#)
- [Peterborough Public Health](#)
- [Regina, Saskatchewan](#)
- [Toronto, Ontario](#)

#### International

- [European Radon Association](#)
- [Ireland Environmental Protection Agency](#)
- [US Environmental Protection Agency](#)
- [Public Health England](#)





## 1.2 Local Government Resolutions on Radon

Educational programs can be strengthened by broad resolutions, such as legislation and declarations recognizing November as Radon Action Month in Canada.

- [Health Canada Radon Action Month and Lung Cancer Awareness Month](#)
- [Legislative Gazette Part I, November 1, 2019, No. 44, 2577-2624](#) (Saskatchewan)
- [Edmonton, AB](#)
- [Chelsea, QC](#)

## 1.3 Canadian Guidance and Protocols on Testing and Mitigation

- [Government of Canada Radon Guideline](#)

## 1.4 Guides for the General Public on Radon Testing and Mitigation

- [Radon - Reduction Guide for Canadians](#) (Health Canada)
- [Testing for Radon](#) (Take Action on Radon)
- [Testing for Radon](#) (C-NRPP)
- [Reducing Radon](#) (Take Action on Radon)
- [Steps to Reduce Radon](#) (C-NRPP)

## 1.5 Technical Guidance and Studies on Testing and Mitigation

- [Guide for Radon Measurements in Residential Dwellings \(Homes\)](#) (Health Canada)
- [Guide for Radon Measurements in Public Buildings \(Workplaces, Schools, Day Cares, Hospitals, Care Facilities, Correctional Centres\)](#) (Health Canada)
- [Cross-Canada Survey of Radon Concentrations in Homes - Final Report](#) (Health Canada)
- [Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors](#) (Health Canada)
- [Summary Report on Active Soil Depressurization \(ASD\) Field Study](#) (Health Canada)
- [Residential Radon Mitigation Actions Follow-Up Study: Public Summary](#) (Health Canada)
- [Radon mitigation options for existing low-rise residential buildings](#). CAN/CGSB-149.12-2017 (Canadian General Standards Board)(for purchase)
- [Radon control options for new construction in low-rise residential buildings](#). CAN/CGSB-149.11-2019 (Canadian General Standards Board)



## 2. Testing, Databases and Mapping

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### 2.1 Testing and Awareness

- [Take Action on Radon 100 Test Kit Challenge](#). This Health Canada supported campaign distributes 100 test kits to approximately 20 communities per year.
- [Yukon Radon Awareness Campaign](#). The Yukon Housing Corporation, in partnership with Yukon Lung Association, Health Canada, and Yukon Health and Social Services delivered a radon awareness campaign that included free radon kits and testing in remote communities.
- [Donna Schmidt Lung Cancer Prevention Society](#). In British Columbia, this non-profit, volunteer driven society provides radon test kits through the library offices of the Regional District of Central Kootenay in Creston, Nakusp, and Nelson.

### 2.2 Community Testing Initiatives

These initiatives aim to assess radon prevalence in a community through sample testing of homes and other buildings (ranging from approximately 400 to 1100 tests depending on community characteristics). They also improve awareness.

- Ontario Health Units, in support of policy changes related to building codes. Examples include:
  - [Kingston, Frontenac and Lennox & Addington Public Health](#)
  - [Hamilton Public Health](#)
  - [Thunder Bay District Health Unit](#)
  - [Windsor-Essex Health Unit](#)
  - [York Region Public Health](#)
- [BC Lung Association, Radon Community Testing: BC Municipalities and Regional Districts](#)

### 2.3 Citizen Science Projects

- [Evict Radon](#). This includes significant public education and outreach materials.
- [Simon Fraser University Citizen Science Project for Radon Gas](#)

### 2.4 Database and Mapping Initiatives

#### Public maps in Canada

- [Health Canada Radon Map](#)
- [Nova Scotia Radon Map](#)
- [C-NRPP Radon Database and Map](#)



## International Examples

- [EPA Map of Radon Zones](#)
- [United Kingdom Maps of Radon](#)
- [Connaître le potentiel radon de sa commune](#) (République Française. Institut de radioprotection et de sûreté nucléaire)
- [Radon in the soil and air in Germany](#) (German Federal Office for Radiation Protection)
- [WHO Existence of National Radon Map](#)

## Other Maps, Data Sets and Working Groups

- [Radon and Thoron Data from Canadian Homes](#)
- [British Columbia Centre for Disease Control BC Radon Data Repository](#)
- [Canadian Radon Mapping Working Group](#)
- [Radon Environmental: Mapping Radon Risk](#) (for purchase)
- [United Kingdom Radon Data: Radon Potential Dataset](#)

## 2.5 Library Lending Programs

### Ontario

- [Thunder Bay Public Library](#)
- [Saul Ste. Marie Public Library](#)
- [Essex County Public Library](#)
- [Hamilton Public Library](#)

### Alberta

- [Edmonton Public Library](#)
- [Red Deer Public Library](#)
- [Parkland Regional Public Library](#)
- [Marigold Library System](#)
- [Strathmore Municipal Library](#)

### Nova Scotia

- [Nova Scotia Library Service](#)

### Prince Edward Island

- [PEI Library Service](#)

### British Columbia

- [North Shore and Sunshine Coast Libraries](#)
- [Kootenay's Library Federation](#)
- [Okanagan Region Libraries](#)
- [Thompson-Nicola Region Libraries](#)

Health Canada has a Radon Library Lending Program Guide. Available on request, send email to [radon@hc-sc.gc.ca](mailto:radon@hc-sc.gc.ca)



## 3. Government Operations and Social Housing

### 3.1 Testing of Government Occupied Buildings

The federal government has completed a report on [Radon Testing in Federal Buildings](#).

Examples of radon testing of government buildings at the provincial level:

- [Environment and Labour Annual Accountability Report for the Fiscal Year 2007-2008](#) p. 12 (Nova Scotia)
- [Prince Edward Island](#)
- [Alberta](#)
- [British Columbia](#)

CARcinogen EXposure (CAREX) Canada's, 2017 [Radon in schools: A summary of testing efforts across Canada](#) documents radon testing across Canada. All public schools have been tested in Nova Scotia, Prince Edward Island, New Brunswick, Saskatchewan, Quebec, and the [Yukon](#). Some schools have been tested in British Columbia, Alberta, Ontario, and Northwest Territories.

### 3.2 Testing and Mitigation in Social Housing

- Quebec Housing Corporation (SQH) initiated [a pilot project in Gaspésie in 2014](#), with a [follow up on all social housing being tested and mitigated](#).
- The Aboriginal Housing Society of Prince George participated in a [radon testing program in 2014](#). Of 137 social housing units tested, 36 were above the guideline and then mitigated.
- In 2015 [Manitoba Housing and Renewal Corporation committed](#) to testing and mitigation.
- Manitoba Housing's [Design Guidelines for Multi-Unit Affordable and Social Housing](#) (November, 2017) include provisions for radon control.
- In 2019 Yukon Housing Corporation [reported all units being tested for radon](#) and mitigation to be completed by 2020.
- In Kingston, Ontario, the local health authority (KFL&A Public Health), as part of broader radon testing initiatives, approached the City of Kingston and housing providers concerning testing social housing units. KFL&A Public Health organized the testing of the units (hired term staff to place and pick up the detectors) and the City offered to pay the cost of radon mitigation. KFL&A staff used a sampling strategy, focusing on ground floor and basement units. They sampled 1135 units leading to 923 detectors being analyzed (212 detectors were lost to follow-up). Of the 923 detectors analyzed, 27 were above Health Canada's limit of 200 Bq/m<sup>3</sup>. Currently, 18 of 27 have been mitigated (author's correspondence with Sarah Ryding, Environmental Health Team Manager, KFL&A Public Health, also see [Radon Testing Initiative in Kingston Social Housing](#)).



## 4. Building Codes

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### 4.1 Varying Building Code Provisions across Canada

There are radon provisions in the (model) National Building Code (with the radon provisions last updated in 2010), and many provinces have incorporated some radon provisions in their Code.

To unpack the variety of codes in Canada it may be useful to analyze different radon reduction strategies, ranging from the most rudimentary to the most effective.

- **Soil gas barriers:** This involves placing a membrane between the slab and the ground below. **Soil gas barriers are not considered an effective stand-alone radon reduction strategy.**
- **Radon rough-in with stub:** This involves the sealing of radon (and other soil gas) entry points, granular material below the slab, and a radon rough-in ‘stub’- a short vent pipe which rises from the floor and is capped. This was added to Canada’s National Building Code in 2010 and has been adopted into several provincial and territorial building codes. There is a significant risk that high radon environments remain untested and unmitigated. Current best practices require more complete systems.
- **Passive sub-slab depressurization:** This involves a pipe installed through the foundation that runs upwards through the inside of the building and vents to the outside at the roofline. British Columbia’s Building Code started with the rough-in stub (following the National Building Code). A study found the radon rough-in stub was generally insufficient ([A Comparison of Three Radon Systems in British Columbia Homes: Conclusions and Recommendations for the British Columbia Building Code](#)). This led to [changes to the BC Code to require an outside venting pipe](#). While often effective at reducing radon, these systems cannot be relied on to reduce high radon concentrations to below the guideline level. Homes with these systems should still have the radon level tested.
- **Active sub-slab depressurization:** This involves adding a fan to passive sub-slab depressurization systems to further increase the reduction of radon. Québec’s [Construction Code](#) now requires the radon rough in with stub, with the additional need for radon test results to be submitted to the authority having jurisdiction (generally municipal building officials) and the addition of sub-slab depressurization sufficient to reduce levels to within Health Canada’s Guidelines.<sup>1</sup>

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<sup>1</sup> chapter B-1.1, r. 2, Construction Code, s. 9.13.4.6. Available at <https://www.quebec.ca/en/homes-and-housing/healthy-living-environment/residential-radon> March 4, 2021.



<b>Table 1: Building codes in Canada and Radon System Requirements</b>				
<b>Building Code</b>	<b>If Limited Area of Application</b>	<b>Soil Gas Barrier</b>	<b>Radon Rough-In With Stub</b>	<b>Passive Sub-Slab Depressurization</b>
National Building Code of Canada, 2015			Explained <a href="#">here</a>	
<a href="#">Provinces and territories that follow the National Building Code:</a> Saskatchewan, Manitoba, New Brunswick, Nova Scotia, Newfoundland and Labrador, Northwest Territories, Yukon, Nunavut. PEI in major municipalities.			Explained <a href="#">here</a>	
British Columbia Building Code, 2018	Select municipalities predominantly East of Coast Mountains, see <a href="#">Table C-4</a> <a href="#">Locations in British Columbia Requiring Radon Rough-Ins</a>			<a href="#">s. 9.13.4</a>
<a href="#">National Building Code – 2019 Alberta Edition</a>			Explained <a href="#">here</a> , to be augmented with testing and other design as per 6.2.1.1 and <a href="#">‘good engineering practice’</a>	
Ontario Building Code, 2017 in Conjunction with Supplementary Standard SB-9, providing three options	Areas of Ontario with known radon problem	<a href="#">s.9.13.4.2.4(a)</a> and Supplementary Standard SB-9, explained <a href="#">here</a> (with Voluntary radon gas testing)	Supplementary Standard SB-9, explained <a href="#">here</a>	<a href="#">9.13.4.2. 4(b)</a> and Supplementary Standard SB-9, explained <a href="#">here</a>
Quebec Construction Code		<a href="#">Quebec Construction Code A-9.13.2.1.(3)</a> (prior to Sept 2020)	<a href="#">Quebec Construction Code, 9.13.4.6.</a> (as of September 2020),	<a href="#">Quebec Construction Code, 9.13.4.6.</a> (as of September 2020), if test results show need



Current best practices in mitigation are outlined in the [Canadian General Standard Board's 2019 "Radon control options for new construction in low-rise residential buildings"](#) and should be referenced in building codes. The standard provides detailed technical prescriptions for radon mitigation strategies.

There are significant benefits to targeting radon prone areas and requiring new homes to have operational systems (i.e., at least a passive sub-slab system), ensuring that homes are built with less radon in them and reducing the incidence of radon-induced lung cancer in higher risk regions.

If building codes continue to require forms of 'rough-ins' that are incomplete, provinces and territories should consider requiring clear labelling on these systems stating that they are incomplete, and that further radon testing is required by homeowners once they occupy the home. Provinces and territories can consider requiring builders to leave radon test kits and informational guides with new homeowners and requiring occupants of new homes to test for radon.

## 4.2 Radon in Municipal Building Codes

In some provinces (Quebec, Newfoundland and Prince Edward Island), there are possibilities for municipalities to put more stringent requirements in place that go beyond provincial building code requirements.

- [Municipalities Act, 1999, SNL 1999, c M-24 s.414\(1\)\(d\), and s. 414\(3\);](#)
- [Building Codes Act, RSPEI 1988, c B-5.1 s. 16\(5\); s. 26;](#)
- [Act respecting land use planning and development, RSQ, c. A-19.1, s. 118](#)

Some municipalities independently enact codes that meet the National Building Code (including for radon).

- [City of St. Johns, Building By-Law, By-Law No. 1438](#), s. 46

Municipalities that have implemented their own radon standards include:

- Municipalité de L' Ascension, [Règlement numéro 2000-350 relatif à la construction s. 2.17.2](#) (French only) (This calls for a rough-in stub similar to the National Building Code requirements).
- Municipalité de Chelsea, [Règlement de construction numéro 638-05 s. 9.5](#) (These provide technical specifications for a 'rough in stub ' similar to the National Building Code provisions, plus requirements for testing and if over Canada's Radon Guideline, the connecting of a sub-slab depressurization system).

In Ontario, the radon provisions only apply in "known radon areas". The following municipalities have taken steps to implement the building code provisions and provide explicit direction to builders:

- [Radon Gas Mitigation Program](#) (Guelph, ON)
- [Soil Gas Mitigation Strategy](#) (Kingston, ON)
- [Soil Gas Mitigation Program](#) (Central Elgin, ON)
- [Residential Construction Requirements for Radon Gas Mitigation](#) (Hamilton, ON)



In British Columbia, the [BC Building Code, 2018](#) lists specific municipalities where radon mitigation systems are needed (at [Division B Appendix C Table C-4. Locations in British Columbia Requiring Radon Rough-Ins](#)). Municipal governments can take steps to be added to this list if they have evidence of elevated radon in their area.

### 4.3 Building Code Enforcement

Municipal building inspectors are encouraged to make use of Canadian National Radon Proficiency Program (C-NRPP) Training for Building Professionals: [Controlling Radon in New Canadian Homes \(CRNCH\): CNRPP-EL-9](#)

Hamilton, Ontario's [radon inspection process](#) can serve as an important example. The web page clearly indicates builders' and owners' responsibilities. For new construction and/or additions, the property owner or builder is required to arrange for inspections relating to:

- Installation of the rough-in soil gas pipe and granular material prior to pouring the basement slab.
- Installation of soil gas barrier on foundation wall and under floor slab.
- Sealing of the perimeter of the slab.
- Pipe cap and labelling and inline fan (where required) prior to occupancy.

As well, depending on the radon gas mitigation option chosen by the builder, it is the property owner's responsibility to conduct radon gas testing (following specified procedures) and submit the results to the City. Where mandatory radon gas testing results come back above 200 Bq/m<sup>3</sup> (becquerels per cubic metre), the property owner is to install an active subsoil depressurization system and ensure any resultant decrease in soil temperature will not adversely affect the foundation using documentation provided by a qualified person.





## 5. Standards of Maintenance Bylaws

### 5.1 Housing and Maintenance Standards

Many provinces have specific wording in municipal law allowing local governments to make standards of maintenance bylaws. For examples see:

- [Local Government Act, RSBC 2015, c 1 s. 298\(1\)\(n\)](#) (British Columbia)
- [Municipal Act, CCSM c M225 s. 232\(1\)\(c\) and 233\(a\)](#) (Manitoba)
- [Building Code Act, S.O. 1992, c.23, s. 15.1](#) (Ontario)
- [Act respecting land use planning and development](#), CQLR c A-19.1 [s. 145.41](#) (Quebec)
- [Local Government Act, SNB 2017, c. 18 s. 10\(1\)\(e\)](#) (New Brunswick)
- [Municipal Government Act, RSPEI 1988, c M-12.1 s. 180\(i\)](#) (Prince Edward Island)

In some cases, there is a process for approval of standards of maintenance bylaws:

- [Local Governance Act, SNB 2017, c 18 s. 17\(b\)](#) (New Brunswick)

Provinces also at times provide specific language directing municipalities to receive complaints, make investigations and issue orders against landlords.

- [Residential Tenancies Act, 2006, SO 2006, c. 17 s. 224 to 225](#) (Ontario)
- [Act respecting land use planning and development](#), CQLR c A-19.1 [s. 145.41](#) (Quebec)
- [Residential Properties Maintenance and Occupancy Code Approval Regulation, NB Reg 84-86, s. 3](#) (New Brunswick)
- [Occupancy and Maintenance Regulations, CNLR 1021/96, s. 41](#) (Newfoundland and Labrador)

Municipalities are encouraged to have standard of maintenance bylaws that protect renters indoor air quality, including from radon. Radon specific provisions can specify that:

- Canada's Radon Guideline applies to rental accommodation in the municipality.
- Landlords are required to test for radon following Health Canada approved procedures.
- Tenants and prospective tenants must be notified by right of test results.
- Tenants have the right to conduct their own tests and a procedure established in case of disagreement.
- For average long-term results over Canada's Radon Guideline mitigation must be performed by a C-NRPP certified radon professional to as low as reasonably achievable.
- For average long-term results over 600 Bq/m<sup>3</sup> mitigation must be completed within one year.
- That testing be repeated every five years.



## 5.2 Enforcement of Bylaws

Municipalities should take steps to enforce standards of maintenance bylaws.

An example of an enforcement bylaw is the City of Waterloo's [Rental Licensing Bylaw 2011-047](#). This has a number of provisions that could be used to enforce standards of maintenance.

- Requires landlords to have a license to conduct a Residential Rental Business.
- Allows the Director of Municipal Enforcement Services for the City (or his/her staff or designates) to require information and documentation as part of issuing or renewing a license, including that the landlord have a property maintenance plan to ensure compliance with the City's Property Standards bylaw.
- Allows city officials to enter on land to carry out inspections.
- Provides for the city to make orders to ensure compliance with the bylaw.
- If a landlord does not comply with an order, the city can make a order work and charge the landlord.
- Allows for a license to not be renewed in cases of non-compliance with the law, or where there are outstanding orders pursuant to the City's Property Standards By-Law, to comply with the building code, or by the Medical Officer of Health.

Iowa City, Iowa has instituted [Radon Testing Requirements](#) for rental properties. This plans for a two-year inspection cycle whereby all single family detached and duplex units that become rentals will need to be tested and come into compliance with the regulation.





## 6. Radon Requirements in Public Spaces

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### 6.1 Radon Provisions for Clean Air and Health Bylaws

Municipalities can regulate radon in indoor spaces, including for businesses, recreation centres and other areas accessible to the general public. Similar to smoking regulations, these can be made a part of general health or clean air bylaws. Details can include:

- Indoor spaces open to the public should have radon levels below Canada's Radon Guideline of 200 Bq/m<sup>3</sup>.
- Business owners, governments and other occupiers of buildings are required to test for radon following Health Canada approved procedures.
- Test results should be clearly identifiable, posted, and visible to the public.
- For average long-term results over Canada's Radon Guideline mitigation must be performed by a C-NRPP certified radon professional to as low as reasonably achievable.
- For average long-term results over 600 Bq/m<sup>3</sup> mitigation be completed within one year.
- Testing be repeated every five years.
- The municipal government creates an inspection process to verify testing and mitigation has occurred.
- Enforcement through business licensing and permitting.



## 7. Subsidies and Incentives for Radon Testing and Mitigation

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### Prizes

- [Radon Reduction Sweepstakes](#) – Take Action on Radon and the Canadian Association of Radon Scientists and Technologists offered a \$1,000 prize (in 10 regions) towards the cost of mitigation.

### Distribution of Free or Subsidized Test Kits

- Take Action on Radon's [100 Test Kit Challenge](#) distributes 100 free test kits to 10 or more Canadian municipalities a year.
- [The Donna Schmidt Lung Cancer Prevention Society](#) (charity in the Kootenays Region of British Columbia) has an ongoing test kit distribution program.
- [Ontario health boards](#) have distributed free test kits as part of community testing.
- [State of Pennsylvania and the American Lung Association](#) – targeted free distribution for high-risk zones.
- The [Wyoming Department of Health](#) offers free home radon test kits.
- The Canadian municipalities of [Chelsea, QC](#) and [Saint Joseph du Lac, QC](#) (French only) sell subsidized test kits.

### Free Air Quality Inspections

- The City of Fort Collins, Colorado has a [Healthy Homes](#) program, which offers free indoor air quality testing in resident homes, including for radon, as well as self-assessment tools.

### Tax Credits for Mitigation

- [Saskatchewan's renovation tax credit now includes radon mitigation.](#)

### Loan Programs

- [Manitoba Hydro's Energy Finance Plan](#) provides an on-bill financing loan for upgrades to gas and electrical systems and includes radon mitigation. Municipalities can consider on-bill financing options for property taxes and utility bills.

### Direct Subsidies

- The [Habitation Durable](#) program in Quebec offers financial subsidies to home renovations, including radon, and applies in Dixville, Piessisville, Ham-Sud, Dixville, [Petite-Rivière-St-François](#), [St-Valérien](#), [Varennnes](#) and Victoriaville.
- After participating in Take Action on Radon's 100 Test Kit Challenge, the [City of Vaudreuil-Dorion](#) began selling radon detectors for just \$5, including analysis and shipping. It will reimburse 50 per cent of the cost of installing a radon mitigation system to a maximum of \$500 per residence.



## 8. Energy Efficiency

The following guides, standards and programs include radon.

### 8.1 Energy Efficiency Guides

- [Keeping the Heat In, s. 1.4.3](#) (Natural Resources Canada, 2018.)
- [BC Housing Design Guidelines and Construction Standards](#)
- United States Environmental Protection Agency
  - [Energy Savings Plus Health: IAQ Guidelines for Single-Family Renovations](#)
  - [Energy Savings Plus Health: Indoor Air Quality Guidelines for Multifamily Renovations](#)
  - [Energy Savings Plus Health: Indoor Air Quality Guidelines for School Building Upgrades](#)

### 8.2 Home Renovation Subsidies and Incentives

- The Saskatchewan Provincial Government's [Home Renovation Tax Credit](#) allows homeowners to claim a 10.5% tax credit on up to \$20,000 of eligible home renovation expenses. The eligible expenses include the cost of labour, professional services, and the building materials required for radon reduction measures.
- [Habitation Durable](#) provides financial incentives for residents of Victoriaville, Dixville, Piessisville, Ham-Sud, Dixville, Petite-Rivière-St-François, St-Valérien, and Varennes. It includes both a range of energy efficiency upgrades as well as radon.

### 8.3 Financing for Energy Efficiency and Home Repairs

- [Yukon Housing Corporation Home Repair Loan](#) program with reduced interest up to \$50,000 at interest rates of prime + 1% amortized over 15 years.
- [Manitoba Hydro Energy Finance Plan](#) is an 'on-bill' financing program for upgrades to energy systems in homes. It includes financing for radon mitigation.

### 8.4 Green Certification Standards

The following standards include provisions for radon:

- Natural Resources Canada, 2012. [R-2000 Standard](#), 2012 Edition (see Appendix A).
- LEED. See [Direction on Radon Resistant Construction Techniques to Meet Prerequisite EQ 9.1 in LEED Canada for Homes](#) and [Reference Guide for Homes Design and Construction, page 364](#).
- [Exigences Techniques, Colets, Maison et Petit Bâtiment Multilogement](#) (French only)(Novoclimat) (sec. 2.2.3).
- [BOMA BEST Sustainable Buildings 3.0 Universal Questionnaire](#) (BOMA BEST Building Environmental Standards), Sec. 05.02.01 and 05.03.01.
- [WELL Building Standard v.2](#), at Section A01 Air Quality, Part 4, Radon.