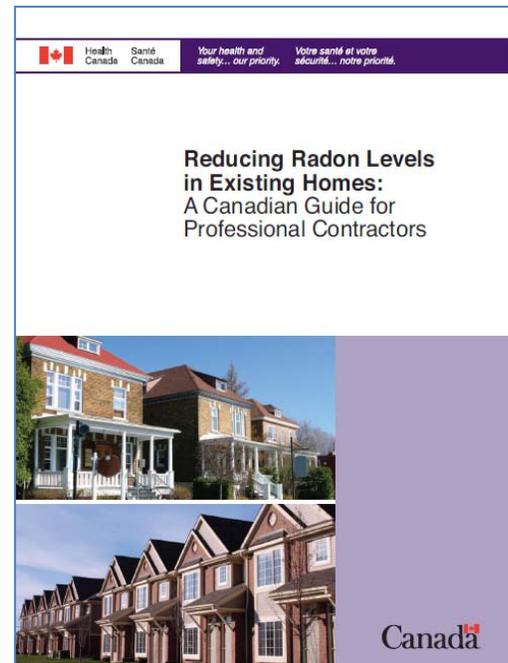


## Preview

# Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors

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As I stated in an earlier review of the new Swiss Radon Plan, it is helpful to be aware of what other countries are doing to address the risk of radon exposure. Here I summarize Health Canada's new radon mitigation guides. I admit my bias but I am a fan of how our Canadian radon colleagues have set about to develop an effort to reduce the loss of life from indoor radon exposure. Watch for the announcement of the release of the mitigation guides.



**Capping a two year effort, Health Canada is poised to release English and French versions of radon mitigation guidance documents.** The guides will join earlier publications produced in Sweden, Switzerland, United Kingdom, United States, and elsewhere.

**The guides were originally developed by Arthur Scott who brought active soil depressurization to the radon control efforts and who was a lead investigator on much of the U.S. Environmental Protection Agency's mitigation research and demonstration projects.** The Working Group Coordinator was Isabelle Vézina, a tireless colleague who has given important leadership to Health Canada's radon program including French-language outreach. At the risk of offending those not named, the Working Group members included a name well known in the building science aspects of indoor air quality: Don Fugler, Canada Mortgage and Housing Corporation.

**The 60 page guide is exceptionally well illustrated and clearly organized with 14 chapters:**

1. An Overview of Radon – 3 pages
2. Confirming the Radon Test was Carried Out Properly – 3 pages
3. An Overview of Radon Reduction Systems – 8 pages
4. Mitigation by Sub-Slab Depressurisation – 14 pages
5. Mitigation of Exposed Soil – 3 pages
6. Mitigation by Sump and Drainage System Depressurization – 5 pages
7. Mitigation by Ventilation Methods – 4 pages
8. Mitigation by Closing Entry Routes – 3 pages
9. Fan and Piping Installation – 5 pages
10. Combining Mitigation Systems – 2 pages
11. Building Codes and Radon Mitigation – 1 page
12. Combustion Appliance Backdrafting – 2 pages
13. Post Installation Testing – 2 pages
14. General Safety Precautions – 3 pages

The guides begin with a discussion of radon fundamentals as well as a brief history of the six years of Canada's renewed radon risk reduction.

**The radon testing review chapter reflects Health Canada's position that long-term measurements are required before a mitigation decision is made.** This position is shared by every country except the U.S. The chapter includes one example of an indoor radon concentrations that dramatically varied from 50 Bq/m<sup>3</sup> (1.4 pCi/L) to 2950 Bq/m<sup>3</sup>

(80 pCi/L) to underscore the need for long-term measurements. **I question how representative this one example is of radon dynamics in the larger housing stock.**

**The radon reduction system overview chapter is well done.** Two-one page tables concisely summarize radon mitigation options by foundation types and foundation floor characteristics. It is noted that the guides do not address radon in water mitigation. I wish there had been additional reference to radon entry point data documented by Lawrence Berkeley National Laboratory in this overview although there reference to this entry route later in chapter 4.

The chapter on mitigation by sub-slab depressurization is quite thorough and spans discussion from feasibility (pressure field extension) testing to details on system design: building pressure differences, fan flow estimate, system pressure drops, fan selection, and system examples. The discussion about house and sub-slab differential pressure and design suction temperature adjustment factors goes beyond that in much of the U.S. literature. **U.S. and other radon mitigation professionals can learn valuable lessons for these guides.**

Chapter 5, Mitigation of Exposed Soil, addresses submembrane depressurization with a good discussion of membranes and membrane attachment, permeable submembrane materials to create more uniform airflow, and fan sizing. The chapter (6) on mitigation by sump and drain or weeping tile depressurizations is very clear on the importance of sealing and offers good guidance on procedures to size the fan. **I find a diagram of a subsurface fan pit in an exterior draitile suction system curious since that approach is extremely rare below the 49<sup>th</sup> parallel especially in colder regions.**

The chapter on mitigation by ventilation methods is appropriately brief given energy penalties in heating dominated Canadian climates. However, **the discussion of exhaust, supply, and balanced ventilation, the latter via heat recovery ventilators, is a well done summary.**

**The discussion of mitigation by closing entry routes in chapter 8 begins with a powerful example: the total openings through passive barriers (e.g., caulked floor slabs) must be less than 1 cm<sup>2</sup> (1/16 square inch) in area if there was 10 Pascal pressure difference across the slab in a house with 400 Bq/m<sup>3</sup> (11 pCi/L) and the amount of radon in a square meter of soil gas. The guides also state that a 1% failure in sealing would render this approach ineffective.** Appropriately, closing entry routes as part of sub-slab depressurization is emphasized by another example: if an ASD fan produces 2 Pa of sub-slab depressurization and draws 40 m<sup>3</sup>/hour (23.4 cfm) of house air with 200 cm<sup>2</sup> (80 sq. in) of floor slab openings is reduced to 20 cm<sup>2</sup> (8 sq. in), the airflow from the house will be reduced to 4 m<sup>3</sup>/hour (2.3 cfm). The reduced air leakage into the system will reduce system noise, use less fan electricity, and reduce the ventilation energy penalty. **I hope these examples will drive both Canadian and U.S. mitigation towards greater energy efficiency! In my opinion, there is something very wrong with cheap radon mitigation systems that lack thorough air sealing.**

Chapter 9, Fan and Piping Installation, presents a clear rationale for mitigation system discharges near grade with indoor fans versus that prescribed by U.S. mitigation standards. While I have reservations about these specifications, the Canadian guides reflect practices common in Europe. The guides cite the limited experience in Canada with relative costs of interior vent routing. In essence according to the guides, the jury is still out on the questions of discharge and fan locations. I look forward to research into these questions. The guides present convincing arguments against exterior routed systems in cold climates.

Chapters 10 and 11 offer brief overviews of combination mitigation systems and building code considerations related to mitigation. **Chapter 12 offers a very good summary of the potential risk of radon mitigation interaction with combustion appliances and the resulting health risk of carbon monoxide exposure. All radon mitigation professionals need to seriously understand this risk at to take action that reduces the risk.**

Chapter 13 on post installation testing is similar to guidance in the U.S. although it goes beyond by specifically stating that **Health Canada does not recommend use of digital electronic radon monitors that integrate in periods longer than 1 hour.**

The final chapter on general safety precautions gives again a brief but good overview of safety considerations although **I find both Canadian and U.S. mitigation guidance woefully inadequate on worker health and safety.** This fall, the Midwest Universities Radon Consortium will offer a new continuing education course radon worker and safety.

In summary, Health Canada and other Canadian radon colleagues deserve to be congratulated on the new radon mitigation guide. The guide is an important addition to our global radon risk reduction effort. I look forward to other reviews of these new bi-lingual Canadian mitigation guides.

The guides will be available in the near future at:

- English version [www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_contractors-entrepreneurs/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_contractors-entrepreneurs/index-eng.php)
- French version [www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon\\_contractors-entrepreneurs/index-fra.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_contractors-entrepreneurs/index-fra.php)