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From **Discovery** to **Innovation…**

2010 NATIONAL MODEL CONSTRUCTION CODES

Radon

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Introduction

- Presentation is part of a series on the 2010 National Model Construction Codes
- Model codes developed by Canadian Commission on Building and Fire Codes
- These codes must be adopted by provincial/territorial authorities to become law

Key Messages

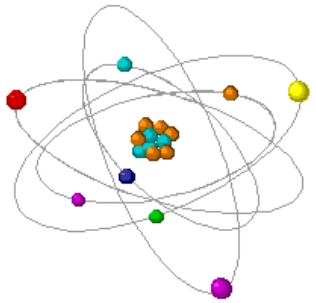
- Technical changes for radon address:
  - New Health Canada guideline for acceptable indoor concentration of radon
  - Basic protection of all houses and buildings
  - Specific provisions to address future radon mitigation in new housing and small buildings

- Information for existing houses and buildings
  - CMHC
  - Health Canada
  - EPA

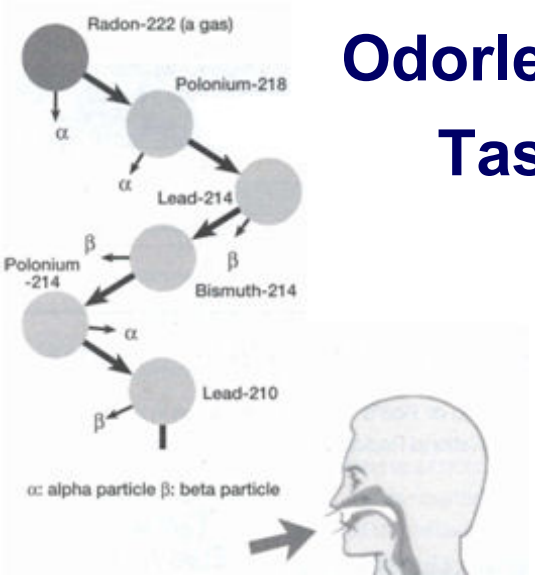
Outline

- General information on radon
- Development of proposed changes
- Proposed changes
  - Part 5
  - Part 6
  - Part 9

What is Radon?



- Radioactive gas, naturally occurring
- Produced by the decay of uranium
- During decay alpha particles are given off
- Inhalation of particles damages lungs

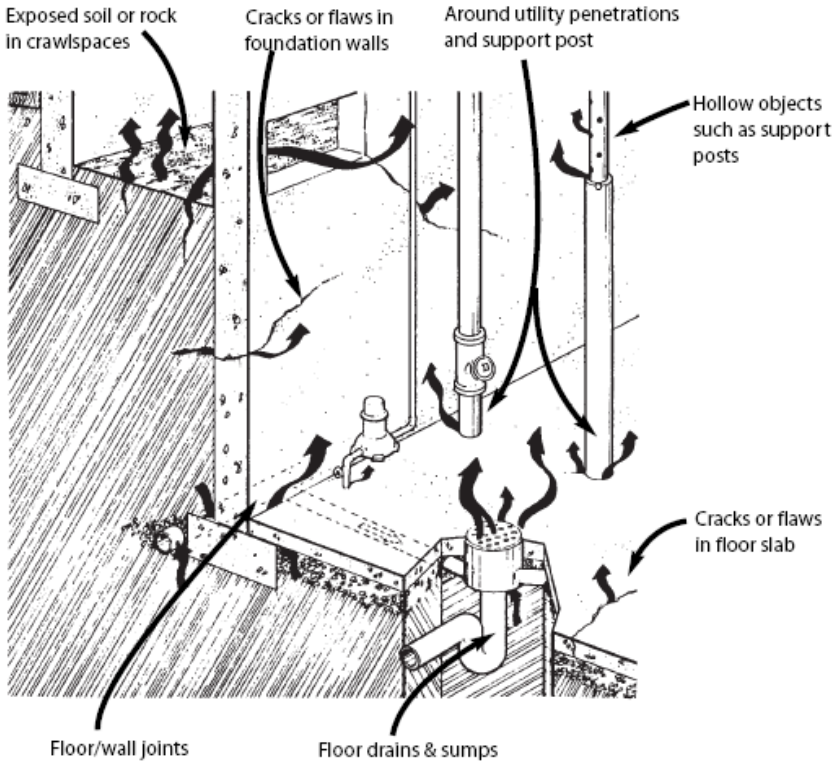


Odorless

Tasteless

Colourless

Where Does Radon Come From?



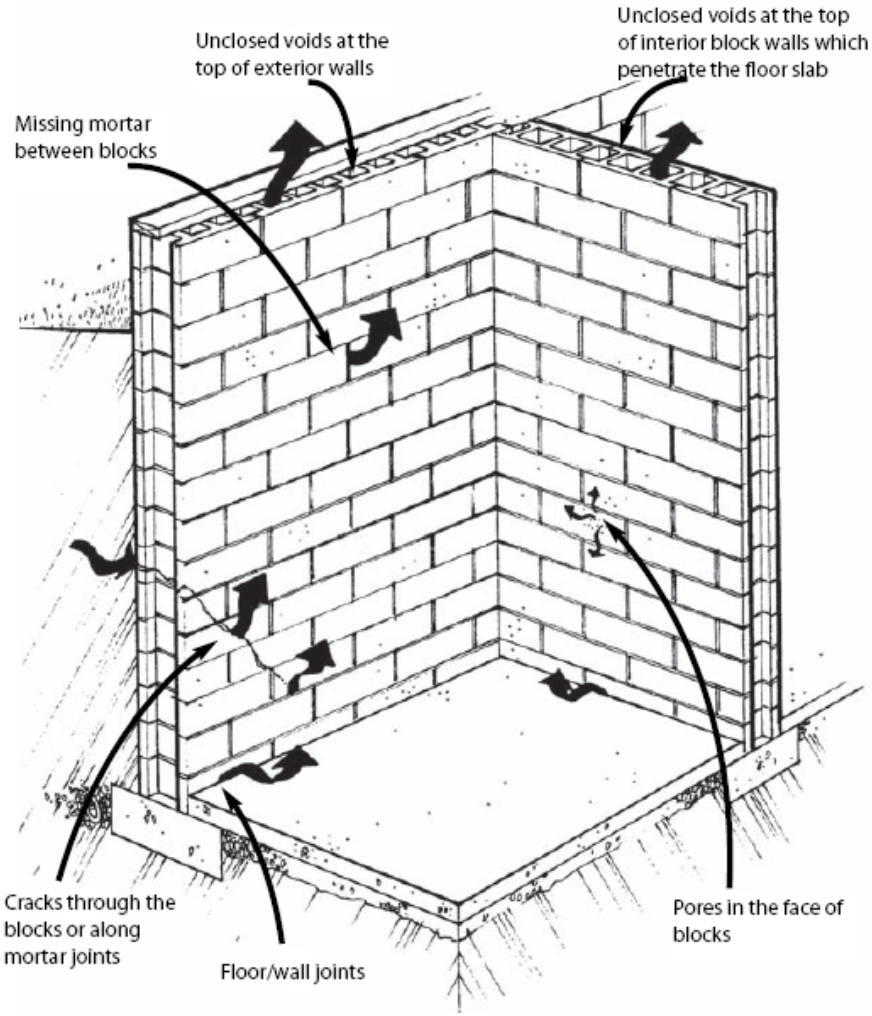
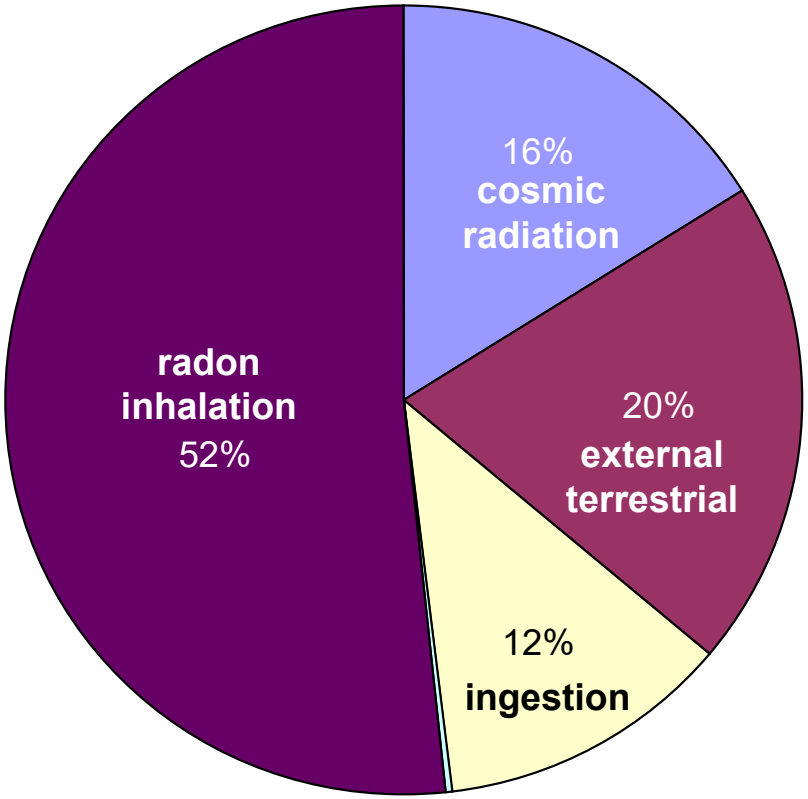


Illustration from: Radon - A Guide for Canadian Homeowners (CMHC –2007)

Why Should We Pay Attention?



Average worldwide exposure to radiation sources

- Health Canada estimates 1,900 lung cancer deaths per year are related to radon
- We spend more time indoors, including basements
- Tighter buildings
- Some geographical areas are known for high risk of radon in the ground

- **Health Canada reduced the permissible Canadian Action Level from ~~800~~ Bq/m³ to 200 Bq/m³**

How can Radon be Measured?

- Health Canada – radon test
  - Minimum 1 month during heating season
  - Average annual limit $\leq$ 200 Bq/m³
- Testing for codes …
  - not possible during construction
  - not enforceable at time of construction
  - not practical/economical for builders
- Responsibility to test
  - … rests with the owner

Task Group on Radon

- Mandate
  - Validate/review current requirements
    - Is protection by current construction adequate
      … for 800 Bq/m³?
      … for 200 Bq/m³?
    - What can be done to make current requirements more effective?
  - Develop changes on means of protection from radon ingress
  - Do not consider
    - Diffusion of radon through materials – small contributor
    - Soil testing pre-construction – no correlation to indoor concentration
    - Radon emanation from building materials – small contributor

Task Group on Radon

- Mini-data collection in high-risk areas
  - 3 high-risk locations tested in BC, MB, NS
  - 90+ newly constructed houses
  - Testing for 6 weeks in March/April 2008

- Two locations (60+ houses)
  - Current practice:
    - Sealing perimeter and penetrations as well as specific inspections <u>NOT common practice</u>
  - Results:
    - Increased levels of radon, many above 800 Bq/m³

Task Group on Radon

- One location (29 houses)
  - Current practice:
    - Sealing perimeter and penetrations by builders required
    - Inspections by officials common
  - Results:
    - Acceptable levels of radon (current guideline)
    - 50% of houses were within new guideline of 200 Bq/m³
    - Houses over 200 Bq/m³ had issues in the inspection protocol

- Conclusion
  - Current code provisions, when applied and inspected, provide acceptable basic protection

Radon in the 1995/2005 NBC

- Large buildings (design requirements) – 2005 NBC

  … as a system
  - Air barrier systems (Part 5)
  - Drainage & waterproofing (Part 5)
  - Ventilation systems (Part 6)
  - Air contaminants (Part 6)
  - Excavation (Part 4)

- Specifically on radon:
  - One sentence in Appendix Note in Part 5

Radon in the 1995/2005 NBC

- Part 5 – 2005 NBC
- Control of Air Leakage (performance targets)
  - … provide & maintain acceptable conditions
  - … minimize condensation and precipitation ingress
  - … avoid ice damming
  - … not compromise operation of building services

- Appendix Note
  - An air barrier system may be required in components and assemblies in contact with the ground to control the transfer of soil gases such as radon and methane

Code Changes

- Part 5 – **2010 NBC**
- Control of Air Leakage (performance targets)
  - … provide & maintain acceptable conditions
  - … minimize condensation & precipitation ingress
  - … avoid ice damming
  - … not compromise operation of building services
  - Minimize the ingress of airborne radon from the ground with an aim to controlling the indoor radon concentration to an acceptable level

Code Changes

- Part 5 – **2010 NBC**
- Appendix Note
  - …
  - In addition to an air barrier system, other measures may be required to reduce the radon concentration to a level below the guideline specified by Health Canada
  - Further information on protection from radon ingress can be found in:
    - "Radon: A Guide for Canadian Homeowners" (**CMHC/HC**)
    - "Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres)" (**HC**)
    - **EPA**/625/R-92/016, "Radon Prevention in the Design and Construction of Schools and Other Large Buildings"

Radon in the 1995/2005 NBC

- Part 6 – 2005 NBC
- Good Engineering Practice
  - Heating, ventilating and air-conditioning systems, including mechanical refrigeration equipment, shall be designed, constructed and installed in conformance with good engineering practice:
    - ASHRAE Handbooks and Standards, HRAI Digest, Hydronics Institute Manuals, NFPA Standards, SMACNA Manuals, Industrial Ventilation Manual published by the ACGIH, CSA-B214,Hydronic Heating Systems, CSA-Z317.2, HVAC Systems in Health Care Facilities

Code Changes

- Part 6 – **2010 NBC**
- Good Engineering Practice
  - Heating, ventilating and air-conditioning systems, including mechanical refrigeration equipment, shall be designed, constructed and installed in conformance with good engineering practice:
    - … and, EPA/625/R-92/016, "Radon Prevention in the Design and Construction of Schools and Other Large Buildings"

Code Changes

- Part 6 – **2010 NBC**
- New Appendix Note
- …
- Radon Control
  - Measures may be necessary to reduce the radon concentration to a level below the guideline specified by Health Canada
  - Further information on reducing the indoor concentration of radon can be found in the following Health Canada publications:
    - "Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres)"
    - "Radon: A Guide for Canadian Homeowners (CMHC/HC)

Radon in the 1995/2005 NBC

- Housing and small buildings (prescriptive) – 2005 NBC

  … as a system:
  - Excavation (9.12.)
  - Foundation wall and floor material (concrete) (9.3.)
  - Floors-on-ground (9.16.)
  - Dampproofing (9.13.)
  - Air barrier systems (9.25.)
  - Ventilation (9.32.)

- Specifically:
  - Protection from all soil gases including radon was addressed in **Subsection 9.13.4**.

Radon in the 1995/2005 NBC

- Part 9 – Basic Protection – 2005 NBC

- Applies to all housing and small buildings:
  - Air barrier requirements in 9.13.
    - For below-ground walls
    - Slab perimeter sealed to air barrier of wall
    - All penetrations (mostly pipes) sealed
  - Sump pit cover required (9.14.)
  - Requirements for ground cover (9.18.)
  - Exemption from fill under slab (9.16.)

Radon in the 1995/2005 NBC

- Part 9 – Basic Protection – 2005 NBC
  - Air-seal floor drains

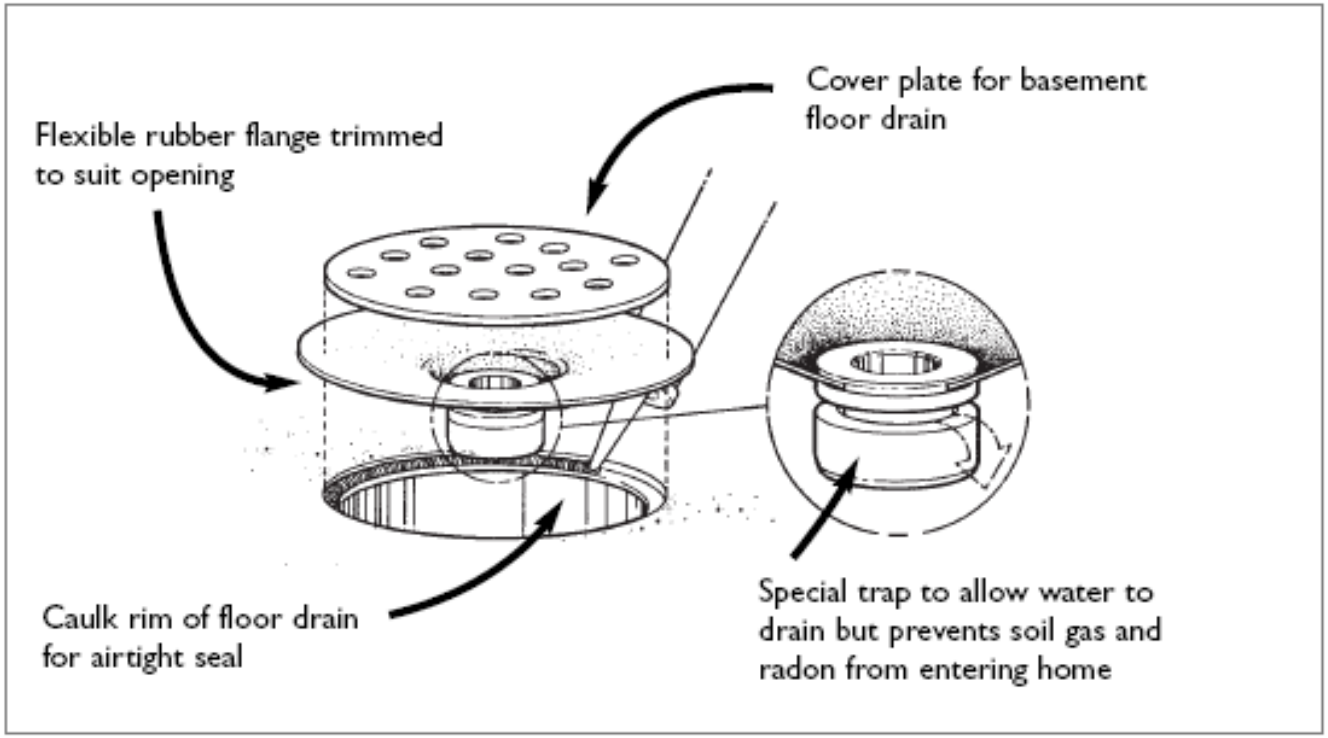


Illustration from: Radon - A Guide for Canadian Homeowners (CMHC –2007)

Radon in the 1995/2005 NBC

- Part 9 – Basic Protection – 2005 NBC
  - Air-seal hollow masonry

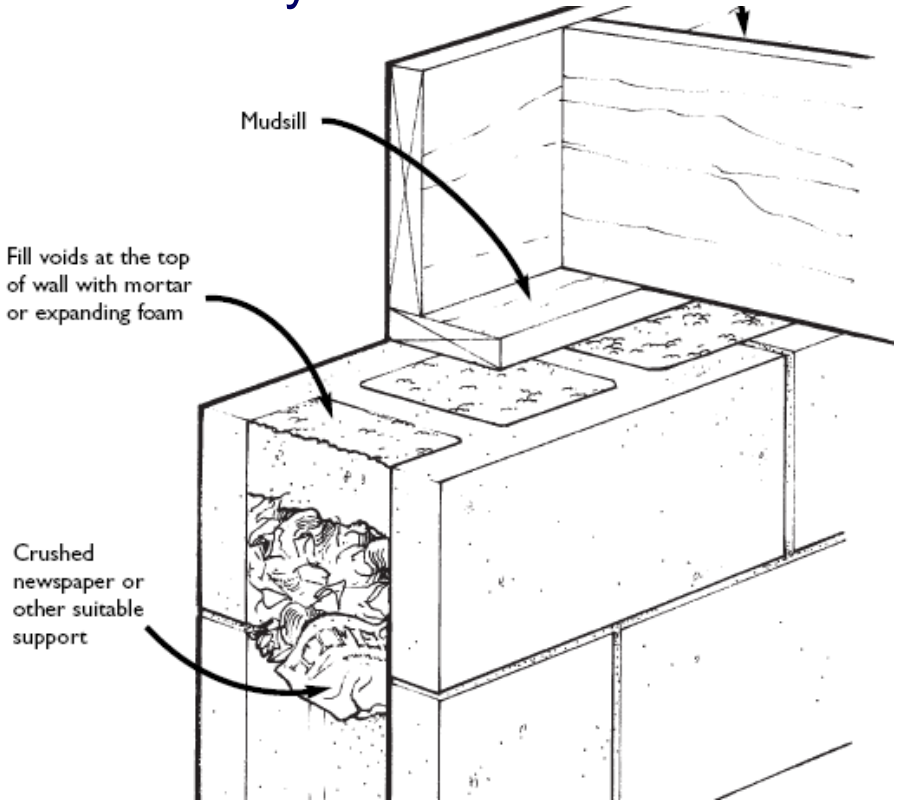


Illustration from: Radon - A Guide for Canadian Homeowners (CMHC –2007)

Radon in the 1995/2005 NBC

- Part 9 – Basic Protection – 2005 NBC
  - Seal slab perimeter

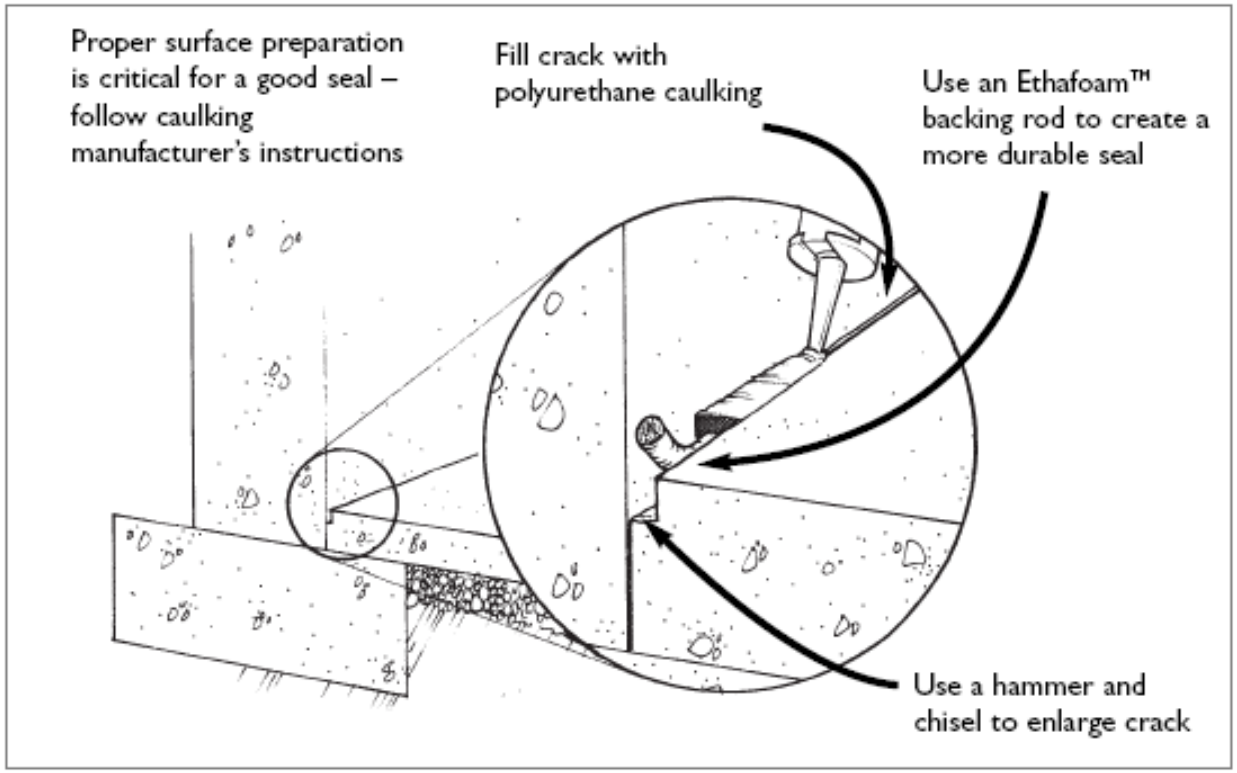
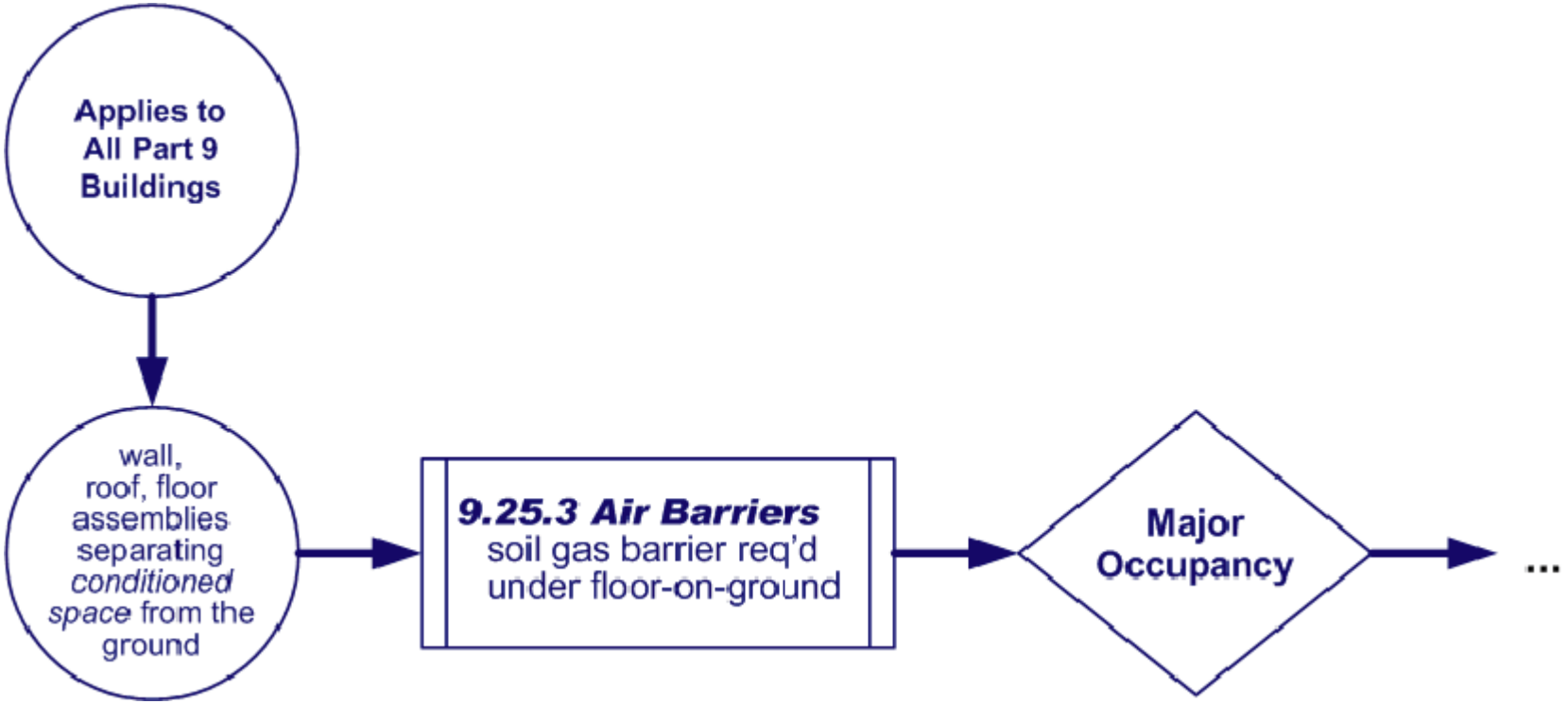


Illustration from: Radon - A Guide for Canadian Homeowners (CMHC –2007)

Code Changes

- Part 9 – Application – **2010 NBC**
  - Address Soil Gas Protection



Code Changes

- Part 9 – Basic Protection – **2010 NBC**

- Applies to all housing and small buildings:
  - Air barrier requirements moved from 9.13. to 9.25.
    - For below-ground walls
    - Polyethylene soil gas barrier required under slab
    - Slab perimeter sealed to air barrier of the wall
    - All penetrations (mostly pipes) sealed
  - Sump pit cover required to be airtight (9.14.)
  - Consistent requirements for ground cover (9.18.)
  - Exemption from fill under slab deleted (9.16.)

Code Changes

- Part 9 – Basic Protection – **2010 NBC**
  - Airtight sump pit covers

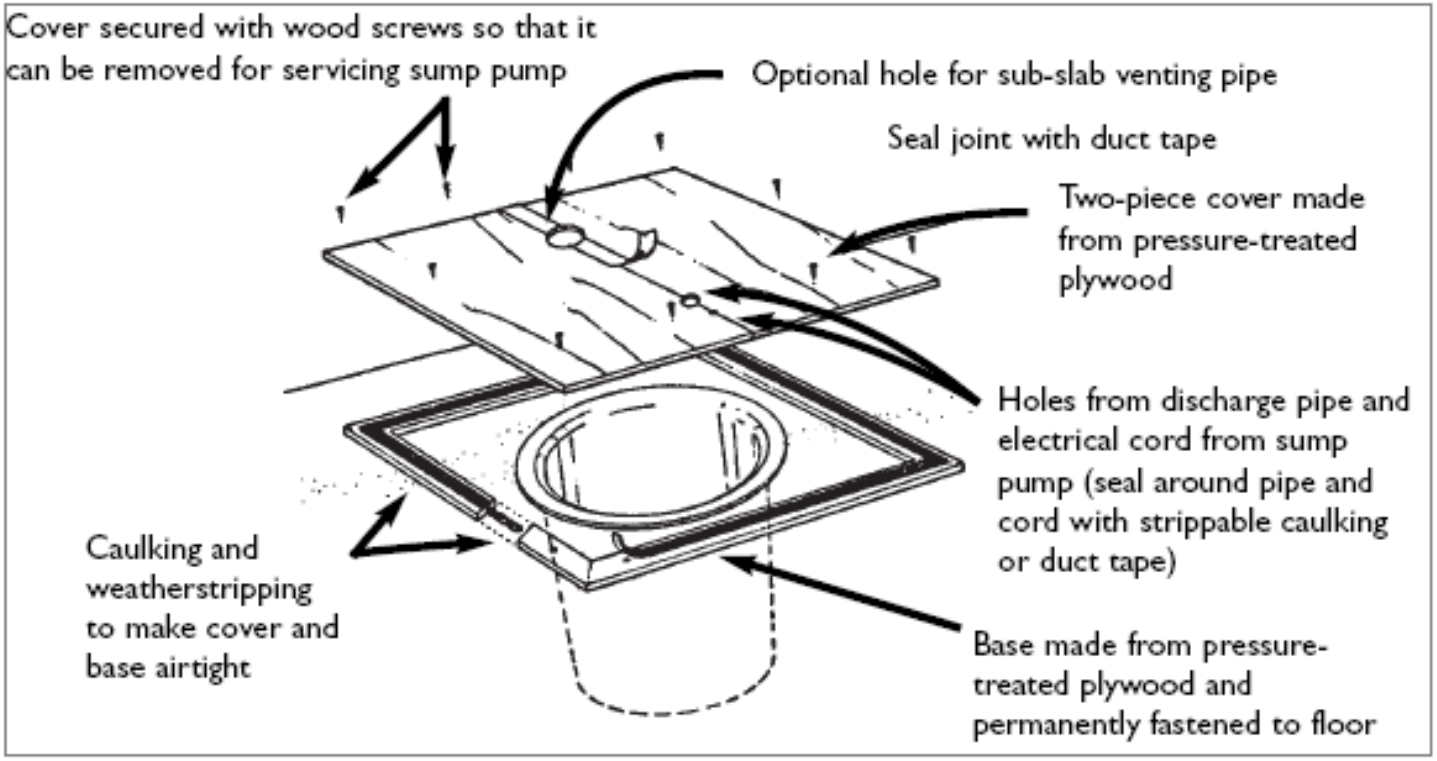
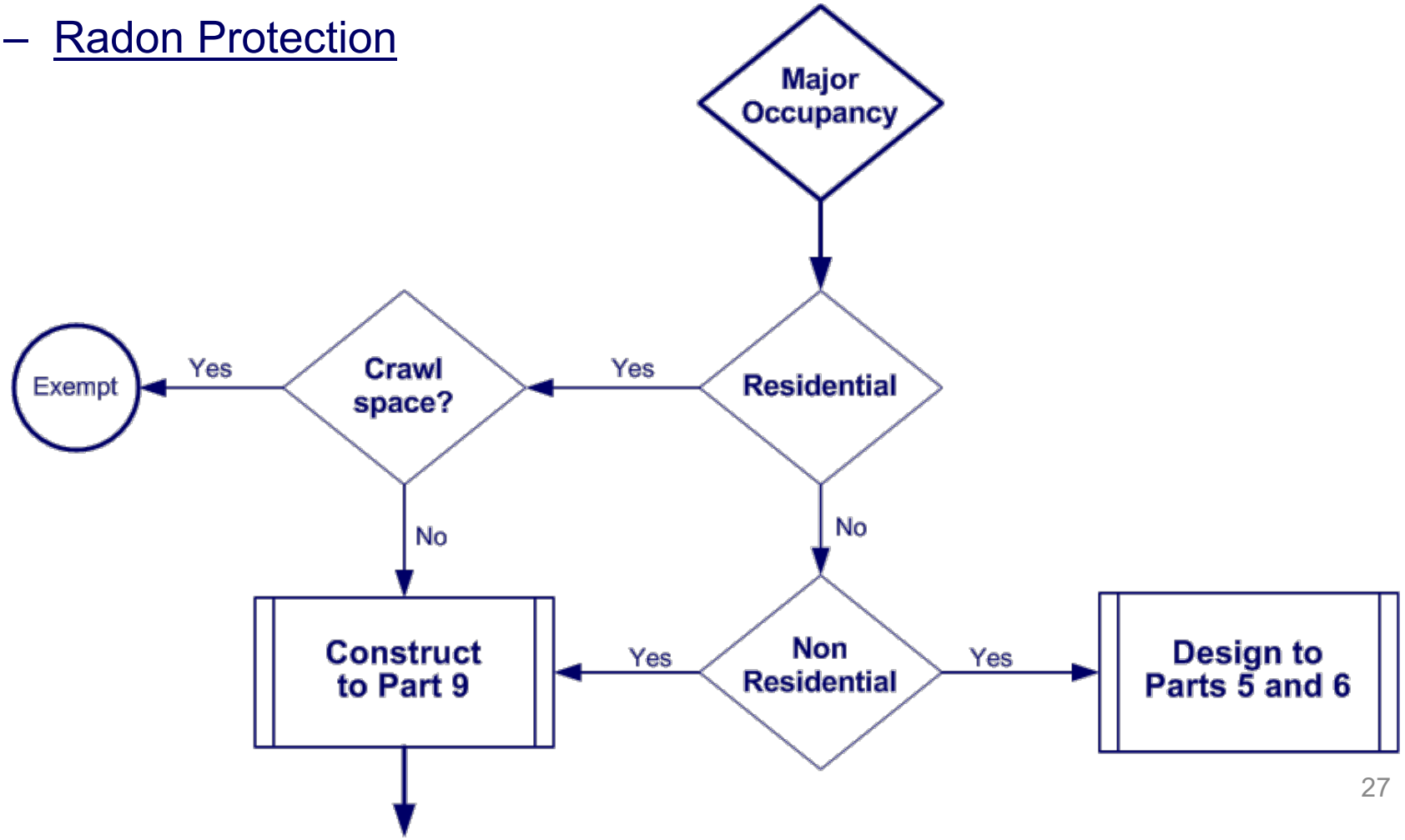


Illustration from: Radon - A Guide for Canadian Homeowners (CMHC –2007)

Code Changes

- Part 9 – Application – **2010 NBC**
  - Radon Protection



Code Changes

- Part 9 – Rough-in – **2010 NBC**

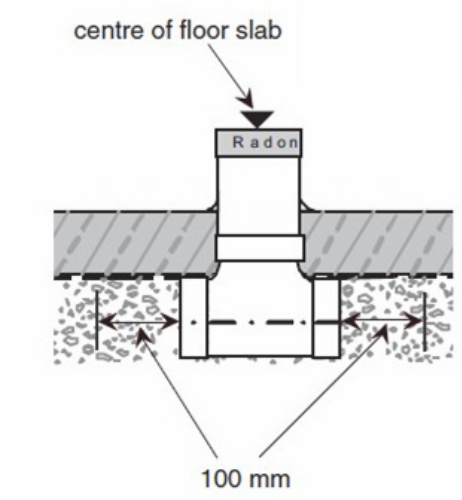
Provide the rough-in for a radon extraction system

Performance

- gas permeable layer beneath air barrier
- inlet allowing effective depressurization of the gas permeable layer
- sealed, labelled outlet in the *conditioned space* allowing connection to depressurization equipment

Prescriptive

- 100 mm gravel below slab
- 100 mm pipe stub at or near centre of slab
- sealed, labelled pipe



Radon in the 1995/2005 NBC

- Part 9 – Specific Provisions – 2005 NBC
  - Exemption
    - Where it can be demonstrated that radon is not a problem
  - Article 9.13.4.6. Subfloor Depressurization
    - as an option for dwelling units only
      - Granular fill under slab
      - Capped, labeled pipe
      - Bottom end located near centre of slab
      - Top end ready for active system
      - Testing required
      - Activating of system required on exceeding limit
  - Polyethylene under slab
    - as an option for dwelling units
    - required for all other buildings

Code Changes

- Part 9 – Specific Provisions – **2010 NBC**
  - Exemption
    - ~~Where it can be demonstrated that radon is not a problem~~
  - Article 9.13.4.6. Subfloor Depressurization
    - ~~as an option for dwelling units only~~
      - Granular fill under slab
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      - Top end ready for active system
      - ~~Testing required~~
      - ~~Activating of system required on exceeding limit~~
  - Polyethylene under slab
    - ~~as an option for dwelling units~~
    - required for all ~~other~~ buildings

Code Changes

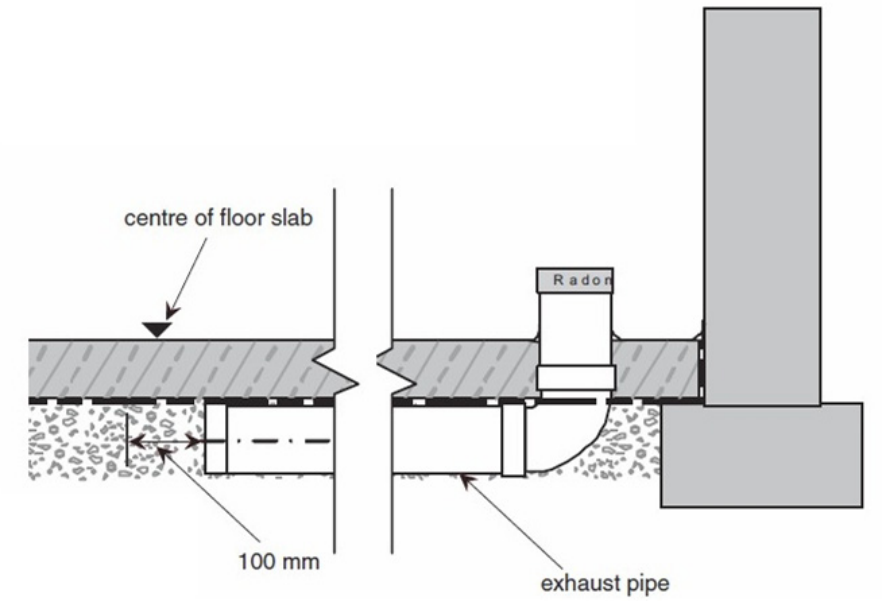
- Part 9 – Specific Provisions – **2010 NBC**
  - Exemption
    - Unheated crawl spaces
    - Accessible heated crawl spaces without slab
  - Rough-in for subfloor depressurization
    - Deemed-to-comply prescriptive solution
      - Granular fill under slab
      - Capped, labeled pipe
      - Bottom end located near centre of slab
      - Top end ready for active system
    - Performance solution
      - Can be used for structural slabs, innovative radon systems, other fills

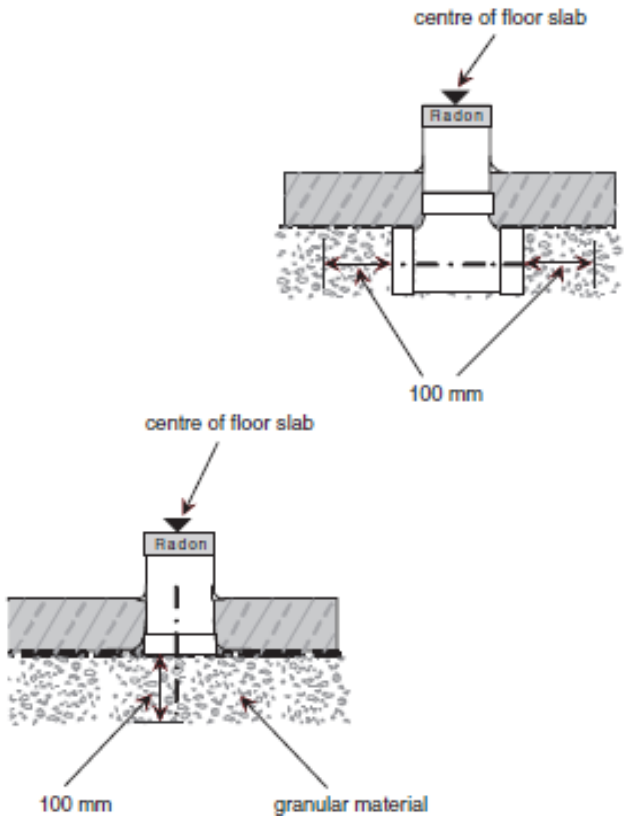
Code Changes

- Other Changes to Part 9 (Radon) – **2010 NBC**
  - Updated various Appendix Notes
  - Protection from depressurization
    - Deleted radon as a trigger for make-up air
    - Exempted radon fans from being counted as exhaust devices
  - Risk of freezing foundations
    - Moved from code into Appendix

Code Changes

- Other Changes to Part 9 (Radon) – **2010 NBC**
  - New Appendix Notes and Illustrations





Summary

- Radon is a health risk
  - Health Canada establishes that risk
- Buildings work as a system
  - Basic protection (soil gas)
  - Specific provisions (radon)
- NBC requirements
  - For housing and small buildings
  - Large buildings
- NBC applies to new construction only
- CMHC, HC, EPA provide guidance for existing buildings
- Effective solutions are available

More on Radon …

- CMHC Guide
  http://www.cmhc-schl.gc.ca/odpub/pdf/61945.pdf

- Health Canada - Environmental and Workplace Health
  http://www.hc-sc.gc.ca/ewh-semt/radiation/radon/index-eng.php

- U.S. Environmental Protection Agency
  http://www.epa.gov/radon

www.nationalcodes.ca

Questions?

Send them to us at codes@nrc-cnrc.gc.ca

Thank you!