Radon 222 is a chemically inert gas but with radioactive isotopes. It naturally exists in the environment and can enter the buildings through floor openings[1].

According to the World Health Organization, Radon has become the second leading cause of lung cancer. From the Radon Map, most of the Ontario region is under high or elevated radon hazard. Specifically, Toronto is in the elevated region of radon hazard[1].

Currently, there are no legal requirements in Ontario for radon testing and mitigation. The current Ontario Building Code (OBC) is inadequate to handle radon as a rising problem [2].

Current OBC

- The current Ontario Building Code has its limits when dealing with radon in Ontario [2].

According to 9.1.1.7 of Section 9.1 of the Building Code Act, 1992, the annual average radon 222 concentration of the following 3 areas cannot exceed 200 Bq/m³:
  1. The city of Elliot Lake in the Territorial District of Algoma
  2. The township of Faraday in the County of Hastings
  3. The geographic Township of Hyman in the Territorial District of Sudbury

The testing cost was allowed to vary from $50 to $3000, while the installation cost was allowed to vary from $1000 to $3000 per person.

A positive outcome was also achieved for certain cost ranges where benefits outweighed the costs.

As a matter of fact, the difference increased by 58% from the smallest to largest cost.

Funding

- A version of new laws and regulation was drafted in order to provide a logical roadmap for homeowners to rely on in the future.
- The final design was drafted to cover homes in Ontario and provide a logical roadmap for homeowners to rely on in the future.
- Through this, five cases were generated for the OBC outlining how to deal with different circumstances related to radon exposure.

A version of new laws and regulation was drafted in order to provide a new solution for OBC users across Ontario.

Introduction

- Radon 222 is a chemically inert gas but with radioactive isotopes. It naturally exists in the environment and can enter the buildings through floor openings[1].
- According to the World Health Organization, Radon has become the second leading cause of lung cancer. From the Radon Map, most of the Ontario region is under high or elevated radon hazard. Specifically, Toronto is in the elevated region of radon hazard[1].
- Currently, there are no legal requirements in Ontario for radon testing and mitigation. The current Ontario Building Code (OBC) is inadequate to handle radon as a rising problem [2].

Final Design

The proposed design consists of five cases, each of which will prompt a course of action to be enforced under the Ontario Building Code.

Case 1: Radon concentration is below 100 Bq/m³
  - Recommend installation of a Passive Sub-Slab Depressurization (SSD) system, the use of natural ventilation and sealing

Case 2: Radon concentration is between 100 and 125 Bq/m³
  - Recommend installation of Active SSD system
  - Recommend Block-wall Depressurization system alongside a Passive SSD for hollow block wall foundation homes
  - Recommend Sub-membrane Depressurization for homes with crawlspaces or tight basements

Case 3: Radon concentration is above 125 Bq/m³
  - Mandates the actions outlined in Case 2 Remediation Work is as follows:
    - If radon concentration is between 125 and 600 Bq/m³, OBC mandates that remediation work begins within two years
    - If above 600 Bq/m³, OBC mandates that remediation work begins within one year

Case 4: Radon concentration is not known
  - Mandate radon inspection and testing either through C-NRPP or do-it-yourself test kits

Case 5: Radon Concentration for new construction homes
  - Precautions should be taken before constructing the home, as recommended by U.S EPA and Health Canada
  - Testing should only take place after home is built.
  - Signage is provided accordingly.

Monitoring

- An alpha track detector, named Corentium 224 Digital Radon Monitor[3], was used as an example on how to interpret the results and the cases accordingly.
- It was installed in the basement of a team member’s house hold and allowed to take average readings for seven days.

Benefit-Cost Analysis (BCA)

- A BCA was performed for its simplicity and to estimate the costs and benefits of this project.
- The analysis led to a Net Present Value (NPV) of -$1.8 billion indicating that costs outweigh benefits.
- But, this is not completely accurate, because after performing a Sensitivity Analysis, it was seen that the NPV is incredibly sensitive to cost changes.
- The testing cost was allowed to vary from $50 to $100 per person, while the installation cost was allowed to vary from $1000 to $3000 per person.
- A positive outcome was also achieved for certain cost ranges where benefits outweighed the costs.
- As a matter of fact, the difference increased by 58% from the smallest to largest cost.

Conclusion

- The final design was based on extensive research pertaining to current findings on the impacts of radon on humans, radon mitigation techniques, and local and foreign radon legislation.
- The final design was drafted to cover homes in Ontario and provide a logical roadmap for homeowners to rely on in the future.
- Through this, five cases were generated for the OBC outlining how to deal with different circumstances related to radon exposure.
- A version of new laws and regulation was drafted in order to provide a new solution for OBC users across Ontario.

References


Ontario Building Code Amendments with Respect to Radon Gas

Lijing Qiu, Rolland Li, Saheb Dhody, Shayan Shafiei, Yening Luo,
Supervisor: Dr. Arthur Chan, PhD

Client: Toronto Worker’s Health and Safety Legal Clinic (Dr. Michael Grossman, Jeffrey Pariag)