Occupational Health and Safety Bulletin

Radon in the Workplace

Radon and the health effects of radon exposure

Radon is a colourless, odourless, tasteless radioactive gas found naturally in the environment. It is formed by the natural breakdown of uranium in soil, rock, and water. As a soil gas, radon can move freely through the ground, enabling it to escape to the atmosphere or seep into buildings. When radon is released into the air, it breaks down further into radioactive elements that can attach to dust and other particles in the air we breathe. Radon is found across Canada - there are no areas of the country that are "radon free." Concentrations vary greatly by region.

The only known health effect associated with exposure to radon is an increased risk of developing lung cancer. Radon exposure is linked to approximately 16% of lung cancer deaths in Canada. Long-term exposure to radon is the second leading cause of lung cancer after smoking and the leading cause of lung cancer for people who have never smoked. The risks of radon exposure are greater for people who smoke or who have smoked in the past, and for those who are exposed to second-hand smoke. For example, if a person is a lifelong smoker, their risk of developing lung cancer is 1 in 10. If long-term exposure to a high level of radon is added, their risk becomes 1 in 3. On the other hand, if a person is a non-smoker, their lifetime lung cancer risk at the same high radon level is 1 in 20. For non-smokers it's estimated that in Canada there are about 3000 lung cancer deaths related to radon each year.

The current Health Canada guideline for radon in indoor air is 200 becquerels per cubic metre (200 Bq/m^3). A becquerel means one radioactive disintegration per second. The guideline goes on to recommend:

1. Remedial measures should be undertaken in a building whenever the average annual radon concentration exceeds 200 Bq/m^3 in the normal occupancy area.

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2. The higher the radon concentration, the sooner remedial measures should be undertaken.
3. When remedial action is taken the radon level should be reduced to a value as low as practicable.
4. The construction of new buildings should employ techniques that will minimize radon entry and will facilitate post-construction radon removal, should this subsequently prove necessary.

What to do if you suspect you're exposed to radon in the workplace.

If you suspect that you or a co-worker may be exposed to radon at the work site, contact the Alberta Occupational Health and Safety Contact Centre at (toll free) 1-866-415-8690.

Where can you be exposed to radon at work?

There are industries where radon may be present in amounts sufficient to expose workers to significant radiation doses. Such industries include, but are not limited to:

- Oil and Gas Production: radon may be found in gases from hydrocarbon-bearing geological formations.
- Tunneling and Underground Workings: in areas where small amounts of indigenous radioactive minerals or gases may be present, such as in underground caverns, electrical vaults, tunnels, subways or sewer systems.
- Mining: exposure can occur from air in uranium and other underground mines that naturally have high levels of radon.
- Water Treatment Facilities: fresh or waste water is treated through sorptive media or ion-exchange resins to remove minerals and other impurities from the water being treated and may release radon.

Elevated levels of radon may occur in any enclosed work environment. The amount of radon in a building will depend on many factors including:

- Soil Characteristics: radon concentrations can vary enormously depending on the uranium content of the soil. Radon also flows more easily through some soils than others, for example sand versus clay.
- Construction Type: the type of building and its design affect the amount of contact with the soil, as well as the number and size of entry points for radon.
- Foundation Condition: foundations with numerous cracks and openings have more potential entry points for radon.

- Occupant Lifestyles: the use of HVAC systems, exhaust fans, and windows, for example, influences the pressure difference between the building and the soil. This pressure difference can draw radon indoors and influences the rate of exchange of outdoor and indoor air.
- Weather: variations in weather (e.g., temperature, wind, barometric pressure, precipitation, etc.) can affect the amount of radon that enters a building.

How to test for Radon

Radon levels in a building can vary significantly over time. In fact, it is not uncommon to see radon levels change by a factor of 2 to 3 over a 1-day period, with seasonal variations being even greater. Health Canada recommends that radon testing be undertaken for a minimum of three months during the fall or winter. A long-term measurement period gives a much better indication of the annual average radon concentration, and higher radon levels are usually observed during winter.

Two options for radon testing:

1. Purchase a do-it-yourself radon test kit by phone, from the internet, from home improvement retailers, or from certain local community health organizations or certified professionals. The radon test kits include instructions on how to set up the test and send it to a lab for analysis once the testing period is over. For a list of locations offering radon test kits for purchase, visit www.takeactiononradon.ca.
2. Hire a radon measurement professional. Make sure they are certified under the Canadian National Radon Proficiency Program (C-NRPP). For a list of certified measurement professionals please call 1-855-722-6777 or go to www.c-nrpp.ca.

Measurements in public buildings

Hospitals, long-term care residences and correctional facilities are occupied continually, so a long-term measurement will give a good estimate of the radon exposure of the occupants. Most schools are only occupied during the day, five days a week, for the school year (approximately 10 months), so a different approach is normally used.

In public buildings and workplaces the level of radon depends on the amount of ventilation and the nature of the work. Radon may be prevented from accumulating in buildings with a high influx of fresh air, but radon levels can vary greatly within a large building, and individual risk depends on the radon level in the different areas where staff spends most of their time. In some cases, higher radon concentrations have been found at upper levels, due to radon movement through elevators or other air shafts in buildings. Health Canada recommends testing every fifth floor in multi-level buildings.

Changes to the construction of a building or alterations to heating and ventilation can cause radon levels to vary over time. Re-testing should be considered whenever major renovations are performed that might substantially change the ventilation or airflow in the building or the use of the rooms in the lowest-occupied level. If a radon reduction system has been installed to reduce high levels those systems may also fail; therefore, radon levels should be checked periodically.

How can exposure be controlled?

Engineering Controls
Engineering controls are used to remove a hazard or place a barrier between the employee and the hazard. If radon levels are found to be above the Canadian guideline, remedial methods are available. Health Canada recommends that a professional certified under the C-NRPP be hired. Engineering controls include installing an active soil depressurization system, sealing major entry routes for radon - cracks and holes in foundation floors and walls, covering sump pumps and drains, and increasing air circulation by regularly opening windows or by installing mechanical ventilation.

Administrative Controls
Administrative controls are work practices and policies used to reduce or prevent exposure to workplace hazards. Work practices may also be altered to reduce radon exposure. The reduction of time spent by workers in areas where excess radon may be present is one example of such a control.

Personal Protective Equipment
PPE is the least effective means of protecting employees from exposures. Proper use of PPE requires a comprehensive and diligent program, as well as a high level of employee involvement and commitment to be effective. Where radon exposure has been recognized as a workplace hazard, and where engineering and administrative controls are insufficient, NIOSH-approved respirators for radionuclides and radon daughters may be used to reduce worker exposure.

More information

- Radon, Environmental and Workplace Health, Health Canada
  www.hc-sc.gc.ca/ewh-semt/radiation/radon/index-eng.php
- Guide for Radon Measurements in Public Buildings, Health Canada (2008)
  www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_building-edifices/index-eng.php
- Canadian National Radon Proficiency Program (C-NRPP) – Find a Professional
  www.c-nrpp.ca

- Take Action on Radon
  www.takeactiononradon.ca
- Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM), Federal Provincial Territorial Radiation Protection Committee (2011)
  www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/contaminants/norm-mrn/norm-mrn-eng.pdf

Contact us:

Province-Wide Contact Centre

Edmonton
780-415-8690

Other locations
1-866-415-8690
(Toll Free)

Deaf or hearing impaired
- Edmonton 780-427-9999
- Other locations 1-800-232-7215
(Toll Free)

Website

www.work.alberta.ca

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http://work.alberta.ca/occupational-health-safety/295.html

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Dial 310-0000, then the area code and telephone number you want to reach