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STAR / IJB INVESTIGATION

The invisible threat inside your home: Dangerous levels of radon gas are being found in more houses across Canada than ever before

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KEY FACTS

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The prevalence of deadly radon gas is rising across Canada as lax building codes allow dangerously high levels to be trapped inside newly built homes.

Radon is an invisible, odourless radioactive gas that is naturally emitted from uranium in soil and enters homes, where it can concentrate. When radon is inhaled, it can damage DNA in the lungs and cause cancer.

The carcinogen is the second-leading cause of lung cancer in Canada, estimated to be responsible for more than 3,000 deaths a year — more than from motor vehicle collisions.

The scale of the problem has been captured in six years' worth of test results from 30,000 homes across Canada, believed to be the largest and most detailed body of results collected in this country.

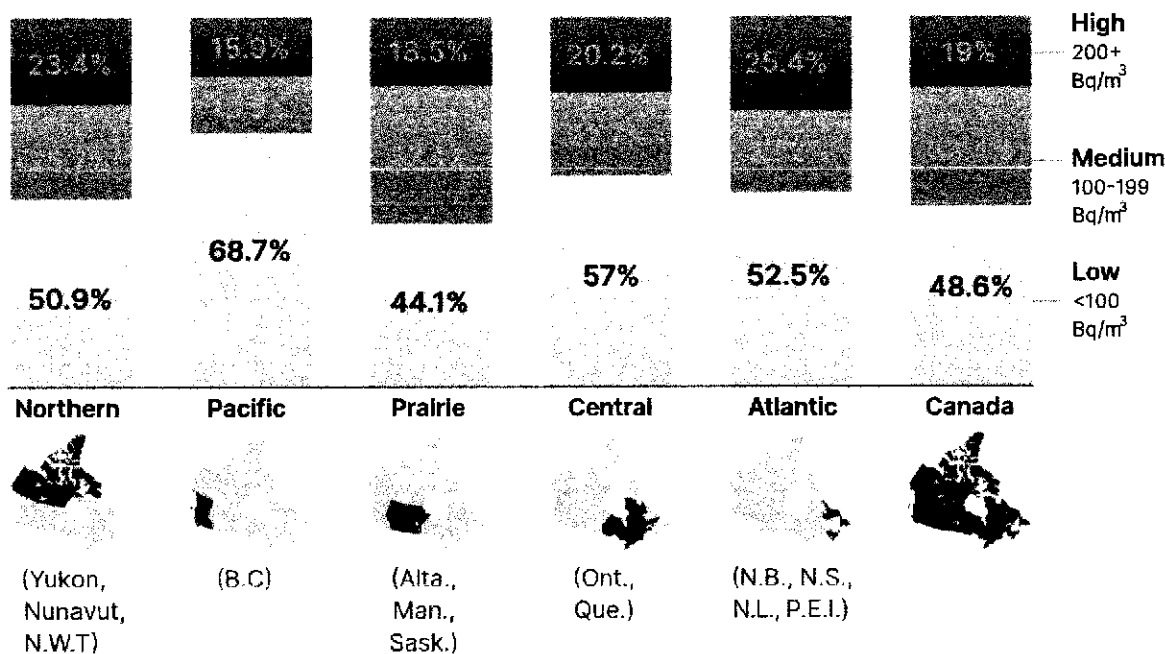
The data was exclusively shared with the Toronto Star and the Investigative Journalism Bureau (IJB), and the findings are being publicly shared here for the first time.

Canada has some of the highest measured rates in the world, with an estimated new case of radon-induced lung cancer diagnosed each day in the hardest-hit provinces.

One in five homes — 5,600 of the 30,000 tested nationwide — showed radon levels exceeding Health Canada's guideline of 200 becquerels per cubic metre (Bq/m³), according to data gathered by researchers from the University of Calgary collaborating with this investigation.

Using the World Health Organization's more stringent guideline of 100 Bq/m³, more than half of Canadian homes tested failed.

Radon levels found in homes across Canada



SOURCE: EVICT RADON NATIONAL STUDY

STAR GRAPHIC

"This is an avoidable public health crisis if we address it now," said University of Calgary associate professor Aaron Goodarzi, who is part of the team who collected the data. "We're not doing it."

Testing rates and radon awareness across the country remain low. There is little clarity on whether high radon levels are being disclosed to tenants and prospective homebuyers. And with new buildings posing the highest risks of elevated radon levels, the number of Canadians facing potential exposure is growing.

Modern construction methods have created the unintended consequence of trapping the gas inside.

A recent Canadian study shows young people and families moving into new homes in suburban areas where real estate is more affordable are among the most vulnerable.

The Prairies — Alberta, Saskatchewan and Manitoba — have the second-highest levels of residential radon in the world behind Poland. Northern, Central and Atlantic Canada are all also in the top 10.

"It's shocking how many people are affected by it — how many people are dying of it," said Pam Warkentin, executive director of the Canadian Association of Radon Scientists and Technologists.

"It's not killing people quickly and so it's not receiving the same attention on our politicians' priority list."

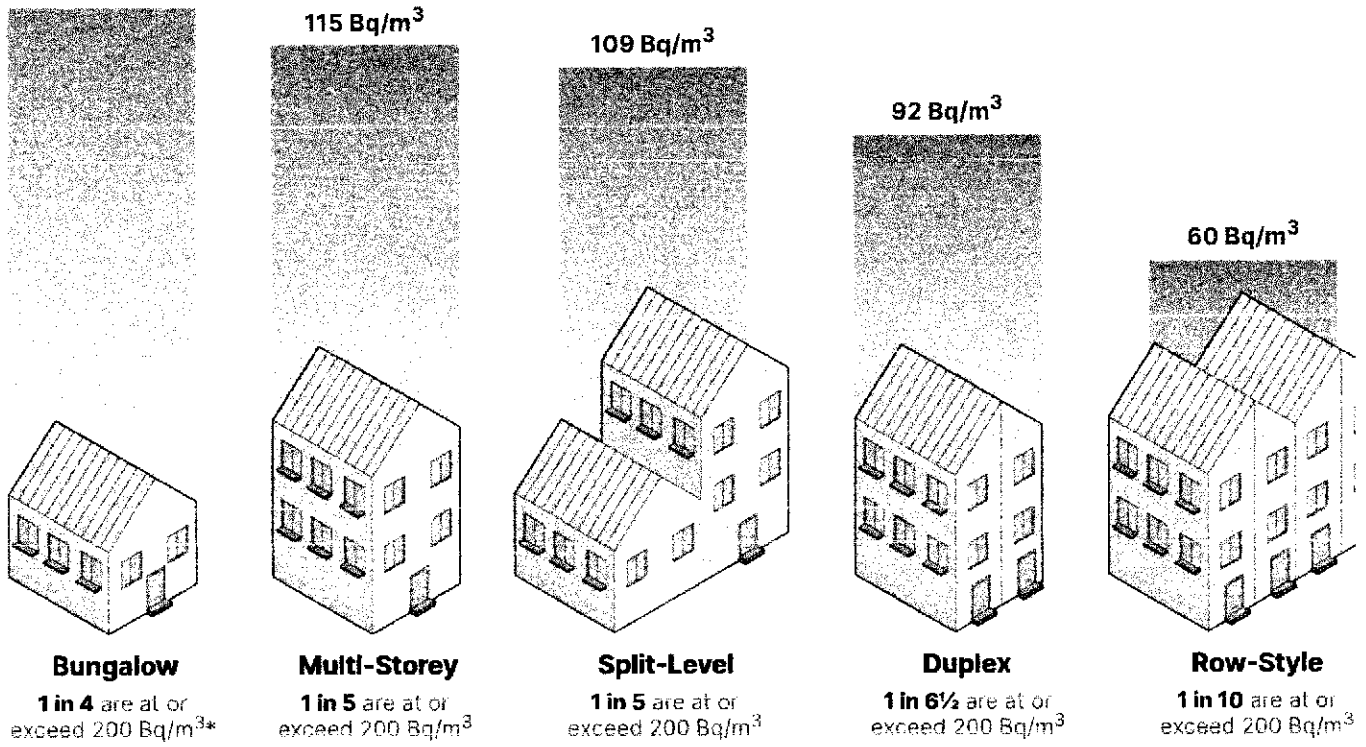
Exposure varies from province to province, city to city and even house to house, the data shows. No region surveyed was free of residential radon.

The type of house also makes a difference. Bungalows had the highest rate of radon exceedances across the country, with a quarter of all those tested coming above the Canadian guideline.

Radon exposure depends on what type of house you live in

Calculated from long term radon data and property metrics from 29,550 residential properties as part of the Evict Radon National Study

130 Bq/m³ ← Avg. radon level



*Health Canada's national radon guideline is 200 becquerels per cubic metre (Bq/m³)

SOURCE: EVICT RADON NATIONAL STUDY (WWW.EVICTRADON.CA)

STAR GRAPHIC

With the pandemic forcing much of the country to work and study at home, more Canadians are likely being exposed to the radioactive gas than ever before.

No province in Canada requires that radon mitigation systems be installed in all new buildings. There are no provincially mandated requirements anywhere in the country to test for radon in houses.

Kerri Tucker, a 43-year-old mother of three in Saskatoon, was diagnosed with lung cancer in October 2019 after never smoking in her life.

"(Doctors) said the only thing they can attribute it to is radon exposure," she said.

The real estate agent knew very little about radon before her diagnosis.

While a test on her current home showed low levels, Tucker believes she was exposed at the home she grew up in. She learned the original owner of the home died of lung cancer 17 years ago.

"A big problem with radon is it's really easy to not think about because ... it's something you can't see, taste or smell," she said. "Until you have a personal story of someone ... people don't think about it."

Tucker underwent surgery to remove the tumour, and finished her last round of chemotherapy immediately before the pandemic. She is currently in remission.



Radon-induced lung cancer currently costs the health-care system between \$140 million and \$320 million per year, according to a Star/IJB analysis.

A 2013 study estimated that hundreds of deaths could be prevented each year in Ontario alone if houses in the province with radon levels above 100 Bq/m³ were mitigated. An estimated 13 per cent of lung cancer deaths in Ontario are due to radon — the equivalent of 850 people a year.

Lung cancer is the most commonly diagnosed cancer in Canada. It kills more people than colorectal, pancreatic and breast cancers combined, with only one in five people surviving five years after diagnosis.

Radon exposure exponentially increases the risk of lung cancer in smokers.

Radon, which dates back to the Earth's formation, exists everywhere.

While it quickly dissolves in the air outdoors, it can accumulate to dangerous levels inside enclosed spaces such as homes. Once inhaled, it breaks down into radioactive particles that are absorbed by cells in the lungs and have potential to develop into cancer.

Have your say: Are you concerned with the possibility of high levels of radon in your home?

- Yes. I am concerned seeing as the carcinogen is the second-leading cause of lung cancer in Canada.
- Not necessarily. I ensure to keep my home properly tested for radon and have a good sense of awareness regarding it.

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The radon threat could be neutralized with simple and affordable technology.

A patchwork of building codes across the country and limited financial support from provincial and federal governments have largely failed to address the mounting problem.

Most provinces follow the national building code, which requires builders of new homes to install a radon mitigation “rough-in” into the foundations. These rough-ins make it easier to install mitigation systems at a later date.

The cost of a full mitigation system in new houses -- which generally involves a gravel pad under the foundation and a fan to vent the gas out of a side wall -- typically costs \$2,500 to \$5,000.

Twenty-two per cent of exceedances found in the data were in homes built in the 21st century.



“The issue is, you seal up a house super, super airtight, but you don’t let it breathe,” said Goodarzi, who is also scientific director of Evict Radon, a consortium of Canadian university scholars working on solutions to the Canadian radon problem. “The magic wand is you just put a radon mitigation device in every single house that’s built ... It’s a harmless no-brainer to do at build instead of a significant surprise cost to do later.”

Shifting the cost to unwitting homeowners after construction often means mitigation systems are never installed.

A third of residents who logged high radon readings in their homes told researchers they couldn’t install a mitigation system because it was too expensive, a 2018 survey of 2,500 participants in the Evict Radon study found.

"Do I want to spend this money to make sure my family is safe or do I not because I can't afford it? That wasn't an option. So I did it," said Jay Carnall, a 44-year-old public servant in Regina.

Carnall borrowed a friend's radon monitor on a whim to test the mid-century bungalow he and his family have been living in since 2011. The monitor's alarm began beeping and the readings showed a radon level of 1,309 Bq/m³.

"It was instant panic. I have a small family. I have a small child. They're telling you that anything over 200 is dangerous and I was at 1,309," said Carnall.

Carnall moved quickly, installing the \$4,000 mitigation system in his home just weeks after completing the test. Carnall wishes there were financial options to support this unexpected cost. Earlier this year, Saskatchewan announced a home renovation tax credit, which includes radon mitigation.

Only two other jurisdictions — Manitoba and the Yukon — said they offer homeowners financial support for radon mitigation.

"I think that's terrible," said Kathleen Cooper, a senior researcher at the Canadian Environmental Law Association (CELA), a legal aid clinic in Ontario which specializes in environmental and public health issues. "It's a leadership issue that they're not stepping up to at the provincial level and the federal level," she said.

A 2018 report by Cooper estimated that establishing a national tax credit program to help pay for radon mitigation would be revenue-neutral or increase tax revenues for federal and provincial governments.

R. William Field, a professor of occupational and environmental health at the University of Iowa and an internationally recognized expert on radon, said the cost of radon mitigation is a barrier for people with lower socioeconomic status.

"There are also the people that you try to get to test and then once they find out they have elevated concentrations, don't have the money to fix it," he said. "Sometimes you're creating a problem for these folks that they can't really address."

Women and children are among the most susceptible to the health impacts of radon. They're also the most likely to be living in houses built between 2006 and 2020, which have the highest levels of the harmful gas, according to a March 2021 study published in the academic journal *Scientific Reports*.

Canada "is likely to face an unprecedented increase in new lung cancers among those who are in the 'prime of life,'" concludes the study conducted by researchers at the University of Calgary and University of Saskatchewan.

The World Health Organization estimates that over time, the risk of lung cancer increases 16 per cent for every 100 Bq/m³ increase in average radon concentration.

Health Canada is the primary federal department tasked with addressing Canada's radon health risks.

The agency's most recent cross-country study of residential radon levels was conducted between 2009 and 2013. It found seven per cent of the 17,000 homes tested exceeded Health Canada's guideline.

Over the last 11 years, the federal department has spent nearly \$26 million on programs including education, outreach and drafting national policies and guidelines.

The growing risks of radon in new houses were unknown to the Abbas family when they bought their ideal home in an Ottawa suburb in October 2015.

Nizar Abbas, his wife and two young daughters noticed mould in their basement years after moving in and hired an inspector to see what the problem was. The inspection revealed something unrelated but no less troubling: elevated radon levels.

"It upset me because it puts my wife and my children in direct danger," said the 43-year-old electrical engineer. "They are playing with people's lives."

Their warranty eventually covered the radon mitigation system, which was under \$2,000, he said.

Abbas said he would like to see regulations around radon mitigation in Ontario so other families don't have to go through the experience he did.

"When we want to sell this home one day, at least we know the next family that moves in here is going to get a nice safe home."

In 2017, the Ontario Association of Certified Home Inspectors penned an open letter calling for mandatory home inspections — including radon testing — to be done in the pre-listing stage, rather than after a purchase.

The result, they said, would ensure homebuyers that the “risks of their home actually killing them because of radiation from radon are at best mitigated, or at the very least known,” the letter reads.

Rules around whether radon should be disclosed during a real estate transaction vary between jurisdictions. Most real estate associations and regulators say that radon gas is considered a material latent defect and should be disclosed if known.

In some provinces, like B.C. and Alberta, agents or brokers are only expected to disclose if levels are above 200 Bq/m³. Agents in Quebec must disclose known radon levels even if they're below Health Canada's guideline.

Nowhere in the country is a radon test required before or during a real estate transaction. Health Canada doesn't recommend testing for radon during the sale of a house, a process which takes at least 91 days and can stall a deal.

Alternative models exist.

In the United Kingdom, buyers and sellers can establish a “radon retention bond.”

The bonds are set aside by the seller for a set period to allow a three-month radon test to be completed. Once the results come back, the funds are either used to install a mitigation system or returned to the seller.

The U.K. has far lower rates of radon in homes than Canada, ranking 56 out of 69 other regions across the world.

The same scheme has been utilized sporadically across Canada.

Kurt Fisher and Elizabeth Girling wish mandatory pre-purchase radon testing was in place when they bought their dream home in Northwest Calgary in January 2020.

The couple's mid-century bungalow had the highest radon levels of the 30,000 homes tested across Canada.

The couple decided to test for radon -- something they have never been concerned about -- because of an offhand comment from the home inspector shortly after purchasing the home.

“I had heard of (radon) and had never really given it much thought,” said Fisher, a 54-year-old sales director with a rail supply company. “I had never heard anybody say they had had radon mitigation or that you should look into that.”

The first reading they got back after testing their house was 999 Bq/m³ -- the maximum amount the device could measure.

They got another radon monitor to try to learn the true level.

While working in his home office last fall, Fisher noticed the levels were 18,000 Bq/m³ -- 90 times higher than Health Canada's guideline. Another reading from a radon mitigation expert in the basement topped 173,000 Bq/m³.

The couple recently finished installing their full mitigation system.

There's a bag in their freezer filled with toenail clippings they're saving for the researchers at the University of Calgary.

Even among Canadians who have researched the issue, there remains confusion about what to do thanks to varying international safety guidelines.

Stephen Moser has been testing his Calgary home over the past year with levels generally sitting around 150 Bq/m³ -- a level that sits between the various international safety guidelines. He continues to test with two monitors but remains confused about what he calls the “contradictory” messaging from government officials and the scientific community.

“Nobody has a clue what's going on,” he said. “It would be beautiful if all the governments across the world could ... come to some agreement on what number is critical. The WHO is 100 (Bq/m³), the Americans are at 140 and (Canada) is at 200 ... I'll keep both (monitors) going for a year and then I guess I'll make a decision, but by then I may have cancer for Pete's sake.”

Many physicians and researchers also know little about the risks of radon since the health-related training in Canadian universities seldom addresses the issue, said Ebba Kurz, associate dean of health and science education at the University of Calgary.

Her interest stems from personal experience.

In 2013, Kurz tore down her existing house and rebuilt her dream home. At the suggestion of a colleague, she had her house tested. The results shocked her: 722 Bq/m³.

“I've been a cancer researcher for 30 years and I had not appreciated the risks until I was encouraged to measure the level in my house,” said Kurz, who takes it upon herself to insert radon related material for the undergraduate health science students she

instructs. "Until this becomes a common thing and we recognize the dangers, we're going to continue to have gaps in how we train future physicians and researchers."



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