THE BUILDING INSPECTOR OF CONNECTICUT

PROFESSIONAL HOME INSPECTIONS
www.building-inspections.com

SERVING CONNECTICUT
FOR OVER 20 YEARS

MORE THAN 7500
INSPECTIONS PERFORMED

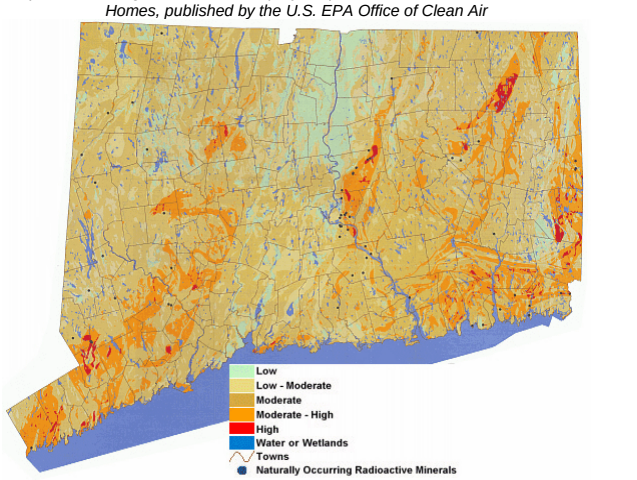
1.5 BILLION DOLLARS
WORTH OF PROPERTY
INSPECTED

1-800-255-8383

F . Y . I
RADON

Health Risk or Hype?
Questions and Answers About Radon

By Environmental Protection Agency
An excerpt from Building Radon Out, a Step-by-Step Guide on How to Build Radon-Resistant Homes, published by the U.S. EPA Office of Clean Air



CLICK TO ENLARGE

Radon is a radioactive gas. It comes from uranium and radium in soils, which can be found everywhere in the world. Uranium is present in rocks such as granite, shale, phosphate and pitchblende. Uranium breaks down to radium, which then decays into radon. This gas can easily move up through the soil into the atmosphere. Natural deposits of uranium and radium, not man-made sources, produce most of the radon present in the air. Radon is in the soil and air everywhere in varying amounts. People cannot see, taste, feel or smell radon. There is no way to sense the presence of radon.

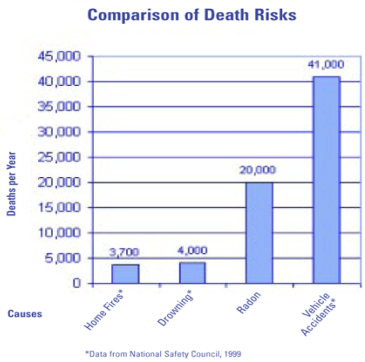
Radon levels are commonly expressed in picocuries per liter of air (pCi/L), where a picocurie is a measure of radioactivity

The national average of indoor radon levels in homes is about 1.3 pCi/L

Radon levels outdoors, where radon is diluted, average about 0.4 pCi/L.

Radon in the soil can be drawn into a building and can accumulate to high levels. Every building or home has the potential for elevated levels of radon, even those built with radon-resistant features. EPA recommends taking action to reduce indoor radon levels when levels are 4 pCi/L or higher

Is radon a significant health risk?



When radon enters a home, it decays into radioactive particles that have a static charge, which attracts them to particles in the air. These particles can get trapped in your lungs when you breathe. As the radioactive particles break down further, they release bursts of energy which can damage the DNA in lung tissue. In some cases, if the lung tissue does not repair the DNA correctly, the damage can lead to lung cancer. Not everyone exposed to elevated levels of radon will develop lung cancer, but your risk of getting radon-induced lung cancer increases as your exposure to radon increases (either because the radon levels are higher or you are in the home longer). Smokers who have high radon levels in their homes are at especially high risk for getting radon-induced lung cancer.

The following is a sample of organizations that state radon is a health threat in homes:

- U.S. Surgeon General
- American Medical Association
- American Lung Association
- Centers for Disease Control
- National Cancer Institute
- National Academy of Sciences
- Environmental Protection Agency

How does radon enter a home?

Four main factors drive radon entry into homes. All of these factors exist in most homes throughout the country.

1. Uranium is present in the soil nearly everywhere in the United States.

2. The soil is permeable enough to allow radon to migrate into the home through the slab, basement or crawlspace.

3. There are pathways for the radon to enter the basement, such as small holes, cracks, plumbing penetrations or sumps. All homes have radon entry pathways.

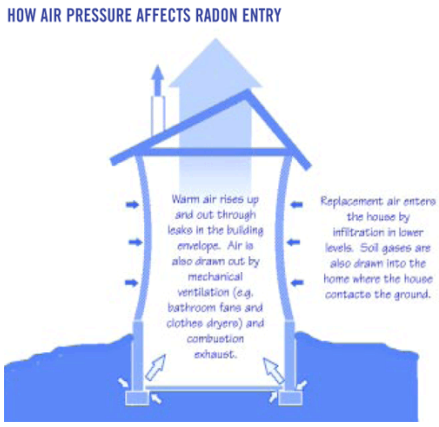
4. An air pressure difference between the basement or crawlspace and the surrounding soil draws radon into the home.

Is there a safe level of radon?

There is no known safe level of radon. As your exposure to radon is increased, so is your risk for developing lung cancer. Even radon levels below 4 pCi/L pose some risk.

How does air pressure affect radon entry?.

The air pressure in a house is generally lower than in the surrounding air and soil, particularly in the basement and foundation levels. This difference in pressure causes a house to act like a vacuum, drawing air containing radon and other soil gases in through foundation cracks and other openings. Some of the replacement air comes from the underlying soil and can contain radon



One reason why this pressure difference occurs is because exhaust fans remove air from inside the house. When this air is exhausted, outside air enters the house to replace it. Another cause for a pressure difference is that warm air rises and will leak from openings in the upper portion of the house when temperatures are higher indoors than outdoors. This condition, known as “stack effect,” causes unconditioned replacement air to enter the lower portion of the house. Mechanical systems, such as the furnaces or central air conditioners, may also contribute to the difference in air pressure. In areas with very short mild winters, mechanical systems can be the dominant driving force. Air handlers and leaky return ducts can not only draw in radon, they can also distribute it throughout a home.

What can you do to reduce radon in new homes?

Install a sub-slab (or sub-membrane) depressurization system
The objective of these systems is to create a vacuum beneath the foundation which is greater in strength than the vacuum applied to the soil by the house itself. The soil gases that are collected beneath the home are piped to a safe location to be vented directly outside.

Use mechanical barriers to soil gas entry
Plastic sheeting and foundation sealing and caulking can serve as barriers to radon entry, entry of other soil gases and moisture.

Reduce stack effect
Sealing and caulking reduce stack effect, and thus reduce the negative pressure in lower levels in the home.
Install air distribution systems so that soil air is not “mined”
Air-handling units and all ducts in basements and, especially, in crawlspaces should be sealed to prevent air, and radon, from being drawn into the system. Seamless ducts are preferred for runs through crawlspaces or beneath slabs. Any seams or joints in ducts should be sealed.

Does foundation type affect radon entry?

Because radon can literally be sucked into a home, any home can potentially have a radon problem. All conventional house construction types have been found to have radon levels exceeding the action level of 4 pCi/L.

Basement
Radon can enter through floor-to-wall joints and control joints and cracks in the slab

Slab-On-Grade
Radon can enter a home regardless of whether or not there is a basement. Slabs built on grade can have just as many openings to allow radon to enter as do basements.

Crawlspace
The vacuums that exist within a home are exerted on the crawlspaces causing radon and other gases to enter the home from the earthen area below. Even with crawlspace vents, a slight vacuum is still exerted on the crawlspace.
Measurements in homes with crawlspaces have shown elevated radon levels.

Manufactured Homes
Unless these buildings are set up on piers without any skirting placed around them, interior vacuums can cause radon to enter these types of homes as well.

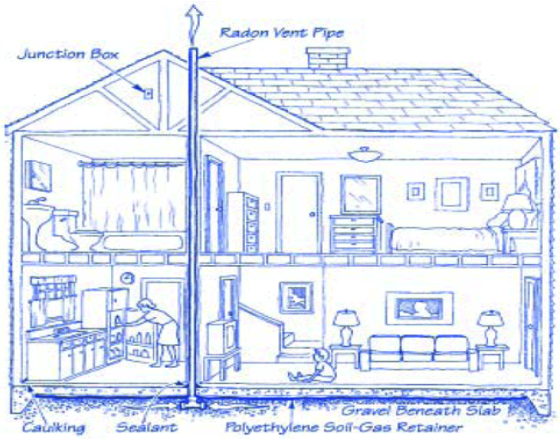
Can we keep radon out by sealing the cracks?

Sealing large cracks and openings is important to do when you build a home, both in the lower portion of the home to reduce radon entry points, and in the upper portion of the home to reduce stack effect. However, field research has shown that attempting to seal all of the openings in a foundation is both impractical and ineffective as a stand-alone technique. Radon can enter through very small cracks and openings. These small cracks and openings are too small to locate and effectively seal. Even if all cracks could be sealed during construction, which would be costly, building settlement may cause new cracks to occur. Therefore, sealing large cracks and openings is one of the key components of radon-resistantconstruction, but not the only technique that should be employed.

What are the radon-resistant features?
The techniques may vary for different foundations and site requirements, but the basic elements of the passive sub-slab depressurization system follow.
In many parts of the country, the gravel beneath the slab (gas-permeable layer), plastic sheeting and sealing and caulking are already employed for moisture reduction. In these cases, simply adding the vent pipe and junction box is extremely cost-

effective for reducing radon, and so cost-effective that even a cost-conscious builder like Habitat for Humanity has been adding these features in many of its homes.

Radon-Resistant Features



Gas-permeable layer
Usually a 4-inch layer of clean, coarse gravel is used beneath the slab to allow the soil gas to move freely underneath the house. Other options are to install a loop of perforated pipe or soil gas collection mat (also known as drainage mat or soil gas matting).

Plastic sheeting
Polyethylene sheeting is placed on top of the gas permeable layer to help prevent the soil gas from entering the home. The sheeting also keeps concrete from clogging the gas-permeable layer when the slab is poured.

Vent pipe
A 3- or 4-inch (recommended) PVC or other gas-tight pipe (commonly used for plumbing) runs from the gas-permeable layer through the house and roof to safely vent radon and other soil gases above the house. Although some builders have used 3-inch pipe, field results have indicated that passive systems tend to function better with 4-inch pipe.

Junction box
An electrical junction box is wired in case an electrical venting fan is needed later to activate the system.

Sealing and caulking
All openings in the concrete foundation floor are sealed to prevent soil gas from entering the home. Also, sealing and caulking the rest of the building envelope reduces stack effect in the home.

What pulls the soil gas through the pipe?

If the pipe is routed through warm space (such as an interior wall or the furnace flue chase, following local fire codes), the stack effect can create a
natural draft in the pipe. Because this method requires no mechanical devices, it is called a passive soil depressurization system.
If further reduction is necessary to bring radon levels in a home below the action level of 4 pCi/L or even lower, an in-line fan can be installed in the pipe to activate the system. The system is then called an active soil depressurization system.

If there is a topic that you would like to see in future publications, please let us know by emailing us at:
tamaria@building-inspections.com
