

# RADON GAS IN AIR AND WATER

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## **PUBLIC HEALTH ISSUE:**

Long-term exposure to radon is linked to an increased risk of lung cancer, particularly among smokers. It is estimated that 100 lung cancer deaths per year in New Hampshire are due to radon exposure. The primary risk for exposure to radon gas is through breathing radon and radon's radioactive decay products. Drinking water, which has appreciable amounts of radon dissolved in it, may increase the risk of developing cancer in other parts of the body, such as the stomach. The lack of understanding among the general public about the health risks from exposure to radon creates an important opportunity to educate local residents about the benefits of testing for radon and "radon resistant" construction methods for buildings under construction.

## **ROLE OF THE HEALTH OFFICER:**

- Serve as a local and referral resource for radon information, such as health effects, testing procedures, where to get testing devices, and treatment options.
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## **BACKGROUND:**

Radon is a naturally occurring radioactive gas produced through the radioactive decay of uranium and radium in soil and rocks; it is colorless, odorless, and tasteless. Radon gas can enter a home directly from the soil beneath and around the building. When radon becomes trapped in an enclosed space (such as indoors) it can accumulate and pose a significant health risk. Radon gas can also dissolve in groundwater and later be released into the air during normal household activities such as showering. Radon gas is found in all types of wells, but particularly in bedrock (sometimes called "drilled" or "artesian") wells.

## **RADON IN AIR LEVELS:**

Radon gas in air or in water is measured in Picocuries per Liter (pCi/L). The U.S. Environmental Protection Agency (USEPA) has set a radon in air "Action Level" of 4.0 pCi/L for radon gas in indoor air. While not a health based standard, this level is a guideline for people to use in assessing the seriousness of their exposure. Above this level, a homeowner should take some remedial action to reduce the radon present in the air. The USEPA also states that with a radon in air level between 2.0 pCi/L and 3.9 pCi/L mitigation should be considered. Reducing radon levels below 2.0 pCi/L can be difficult. The average indoor level of radon in the United States is 1.3 pCi/L and the average outdoor level of radon is 0.4 pCi/L. Appropriate action to reduce radon in air is known as Active Sub-slab Depressurization (ASD).

## **RADON STANDARDS FOR WATER:**

Maximum Contaminant Levels (MCLs) for contaminants in drinking water are set by the U.S. Environmental Protection Agency (USEPA) for regulated public water supplies. These same USEPA MCLs are also used as guidelines for private well water quality analysis. There are no regulatory requirements for contaminants in private wells in New Hampshire. Currently there is no MCL for radon in water for public water supplies. In New Hampshire there is currently an “Advisory Level” of 2,000 pCi/L for radon in water, at which point mitigation for radon in water should be considered. For more information on radon in water please see DWGB Factsheet 3-12 <http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-3-12.pdf> or contact the DES Drinking Water & Groundwater Program at (603) 271-2513.

## **TESTING FOR RADON:**

Most radon-related risk to the population is from the inhalation of radon gas and radon’s radioactive decay products. Therefore, testing the air in a home for radon gas is usually more important than testing the water. However, testing of private well water for radon is highly recommended, regardless of the concentration of radon in the indoor air.

- (1) Radon in Air: A number of commercial laboratories perform air tests for radon gas. Test kits are available at hardware and discount stores; costs generally range from \$10-\$40 per testing device. Test kit instructions should be read thoroughly before performing the test.
- (2) Certified Radon Professionals: A certified radon professional can also be hired to perform radon in air and water testing. Certification for radon professionals is not currently required in New Hampshire but it is recommended that nationally certified radon professionals be used for radon measurement and mitigation. Nationally certified radon professionals in New Hampshire can be found at [www.radongas.org](http://www.radongas.org) and [www.nrsb.org](http://www.nrsb.org).
- (3) Radon in water: A test bottle for establishing the levels of radon in drinking water may be obtained at the NH Department of Health & Human Services (DHHS) Public Health laboratory in Concord, or from a number of state certified commercial labs. A list of the labs may be obtained from [www.des.nh.gov](http://www.des.nh.gov) A to Z Topics, “Laboratory Accreditation”, or direct link <http://www2.des.nh.gov/CertifiedLabs/Certified-Method.aspx>. DHHS laboratory sample processing takes approximately 3 weeks and costs \$20. A container for the radon water test may be obtained from the laboratory by calling (603) 271-3445 or 271-3446 or by ordering bottles online at [www.des.nh.gov](http://www.des.nh.gov) on the A to Z list under “Private Well Testing.” Additional information regarding other naturally occurring contaminants such as Arsenic and other Radionuclides, may also be obtained from the Private Well Testing webpage.

Radon tests can be conducted at any time of the year. However, because radon concentrations in indoor air vary during the year and are generally highest during the winter months, it is usually best to test the air during the winter. If a test is performed during the warmer months and the radon level is low then a follow up test should be performed during the colder months of the year to confirm the low level.

If an initial test reveals high levels during the winter, the homeowner may wish to take action immediately, or may decide to perform a long-term test (90 days to a year) to get a better representation of the average year-round concentration. If a short-term test reveals low levels of radon during the winter, then the levels are likely to be low during the summer. Also, when using short-term charcoal testing devices it is necessary to keep the windows closed throughout the home for 12 hours before starting the test and during the test. This is known as “Closed House Conditions.” Normal entrance and exit from the home is permissible during closed house conditions.

If a homeowner is testing his/her own house in order to determine if they are at risk, then the test should be conducted in the lowest **lived-in** level of the house. If the basement is used regularly for living space, then the test should be performed in the basement. If not used for living space, then the test should be performed on the next level of the home in a living room or bedroom. Testing should not take place in crawlspaces, bathrooms, closets or kitchens.

If the test is being conducted for a person who is considering buying a house, then the test should be conducted in the lowest portion of the house that the buyer intends to use for living space, regardless of whether the present owner uses that area as living space or not.

### **RADON REMOVAL FROM INDOOR AIR:**

In many cases, the removal of radon from indoor air originating from under the home is the most effective means of reducing one’s risk from exposure to radon. The most common method used for radon removal from the indoor air is Active Sub-slab Depressurization (ASD), which works by drawing away radon gas under and around the house and changing the pressure in the home from negative pressure (suction) to positive pressure. Preventive measures such as sealing off potential radon gas entry routes into the house (cracks in floors and walls) are used to increase the efficiency of an ASD system but should not be used as a stand alone method for radon reduction. In new construction the problem of radon gas entry from the soil may be avoided by building in radon-resistant features. “Radon-Resistant New Construction” (RRNC) methods add very little to the cost of a new home and are very effective at reducing radon levels. However, a radon in air test should always be conducted once the home is occupied to see if any further steps are needed to reduce radon in a home with RRNC features.

### **RADON REMOVAL FROM WATER:**

There are two technologies for removing radon from water:

- (1) Aeration of the water with special equipment and;
- (2) Adsorption using granular activated carbon (GAC)

Both methods can reduce radon in water, but radon and its decay products will collect and build up on the carbon filter. With time the spent carbon may create a radiation safety hazard of its own, and must be disposed of properly. For this reason state and federal experts recommend aeration as the preferred method for removing radon from water. Aeration treatment units are designed to remove over 99% of the radon gas, but do not remove uranium or radium from drinking water.

Costs for purchase and installation of the two types of devices are approximately \$1,500 to \$3,000 for the filtration system and \$3,000 to \$5,000 for the aeration system. However, the lower cost for GAC filtration does not include the cost for periodic carbon replacement or for low level radiation waste disposal. In addition, radon removals by carbon filtration may be inadequate if raw water levels are high.

For more information:

US Environmental Protection Agency, Region 1  
(888) 372-7341  
[www.epa.gov/radon](http://www.epa.gov/radon)