

## Basic Guide to Radon-Resistant New Construction (RRNC)

*Purpose: Prevent occupant lung cancer by preventing radon gas from entering home*

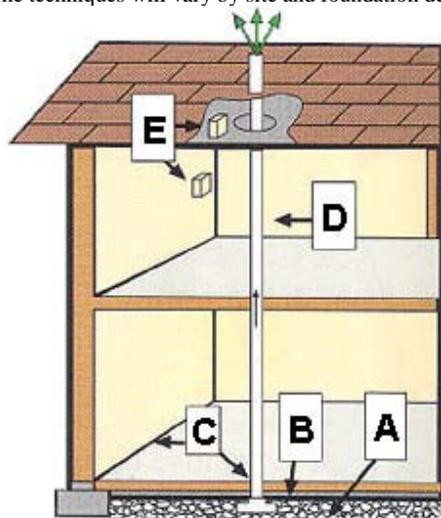
*What can be done to prevent radon exposure in a new home?*

Homebuilders can install features during new home construction to create a **passive radon-resistance system**. **If elevated radon levels persist the system can be upgraded to an active system by installing a fan (about \$300)**. Radon-resistant new construction is much more cost-effective than installing a radon reduction system in an existing home (\$350 - \$500 vs. \$800 - \$2,500). RRNC is also:

- o Consistent with energy-efficiency standards for weatherization
- o Included in the Energy Star Indoor Air Plus program
- o Standard practice in LEED for HOMES, Enterprise Communities' Green Criteria
- o Fulfills Appendix F of the International Residential Code

*How does radon-resistant new construction work?*

The techniques will vary by site and foundation design, but the basic elements are:



### **A. Gas Permeable Layer**

Place material such as a 4" layer of clean gravel beneath the slab or flooring system to allow the soil gas to move freely underneath the house.

### **B. Plastic Sheetting**

Place plastic sheeting (6 mil or better) on the gas permeable layer to block soil gas from entering the home. In crawlspaces, place sheeting over the crawlspace floor.

### **C. Sealing and Caulking**

Seal all openings in the concrete foundation floor to block soil gas.

### **D. Vent Pipe**

Run 3" or 4" gas-tight or PVC pipe from the gas permeable layer through the house to the roof to safely vent radon and other soil gases above the house.

### **E. Junction Box**

Install an extra electrical junction box in case a venting fan is needed later.

*What standards and guidance are available for builders?*

Appendix F of the International Residential Code is the standard for many jurisdictions. EPA has published guidance, "Building Radon Out: A Step-by-Step Guide," with detailed advice and examples of RRNC features, and "Radon Resistant Construction Architectural Drawings" (in .pdf and CAD-compatible program). **A new Code specific standard is being developed and is expected for release in 2012 – the ANSI-AARST RRNC 2.0 Standard.**

*How many homes are built with radon-reducing features?*

Since 1990, more than one million single-family detached homes have been built with radon-reducing features, according to the National Association of Home Builders. To date, about 875,000 homes have been with RRNC in Zone 1 (highest risk) areas of the country.

To contact your state's radon program, find a contractor, or learn more: <http://www.epa.gov/iaq/whereyoulive.html>

Call To Action - Radon Allies Information at [www.RadonLeaders.ORG](http://www.RadonLeaders.ORG)

## Basic Guide to Radon Mitigation in Existing Buildings

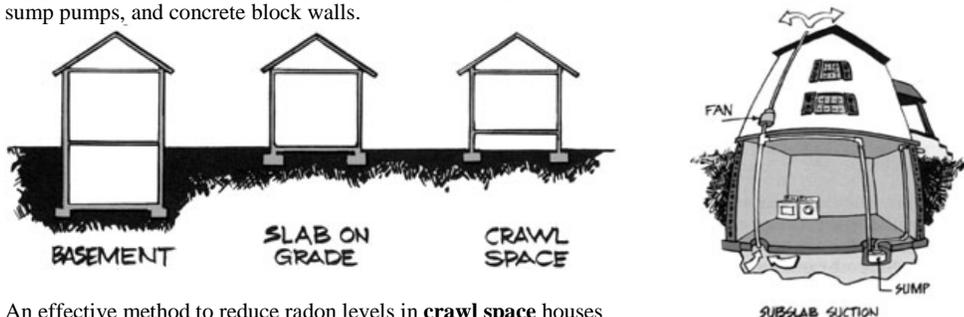
**Purpose: Prevent occupant lung cancer by preventing radon gas from entering home**

### What can be done if high radon levels are found in an existing home?

Radon mitigation can lower the levels of radon, and the risk of lung cancer, by drawing radon gas out from under the concrete floor, crawlspace, or foundation before it can enter the home. Installing a radon reduction system in an existing home generally costs \$800 - \$2,500, and requires special knowledge and skills (usually installed by a licensed or certified contractor). Radon mitigation is recognized as a standard practice for green building and is consistent with energy-efficiency weatherization.

### How does radon mitigation work?

The techniques vary by site and foundation style. For structures with a **basement** or **slab-on-grade** foundations, the most common method is **sub-slab suction** or “depressurization” – pipes are inserted through the basement floor or slab into the soil or crushed rock underneath, and a fan connected to the pipe pulls up the radon and releases it to the outside. Other methods for basement and slab construction apply suction on existing building components such as perforated drain pipes surrounding a foundation, sump pumps, and concrete block walls.



An effective method to reduce radon levels in **crawl space** houses involves covering the earth floor with a high-density plastic sheet and using a vent pipe and fan to draw the radon from under the sheet and vent it outdoors. This form of mitigation is called **submembrane suction**.

### What are the standards for radon mitigation?

“Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings,” ASTM E-2121, is the consensus-based standard for radon mitigation. One free printed copy can be ordered at <http://yosemite.epa.gov/ncepihom/nsCatalog.nsf/SearchPubs?OpenForm> (ask for EPA document number 402-K-03-007). The AARST Radon Mitigation Standard is another accepted consensus standard and can be found at <http://www.aarst.org/bookstore.shtml>

### Who can mitigate radon?

EPA recommends that property owners use a qualified radon mitigation contractor trained to fix radon problems. Many states require radon professionals to be licensed, certified, or registered, and to install radon mitigation systems that meet state requirements; radon programs in these states can provide a list of qualified providers. Private proficiency programs may have lists of certified radon professionals in states without licensing requirements. All contractors should follow their state regulations or such standards such as ASTM E-2121 or the AARST RMS and ensure that a radon test is performed to confirm the effectiveness of the mitigation.

Comment [jm1]: What is this?

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## Radon is Radioactive - Health Risks of Radon Exposure

### Is exposure to radon really the second leading cause of lung cancer?

Yes. Lung cancer kills thousands of Americans every year. The untimely deaths of Peter Jennings and Dana Reeve have raised public awareness about lung cancer, especially among people who have never smoked. Although lung cancer can be treated, the survival rate is one of the lowest for those with cancer. After diagnosis, only 11-15% of lung cancer victims live beyond five years.

- o **Smoking** is the leading cause of lung cancer. In 1964, the U.S. Surgeon General, issued the first warning on the link between smoking and lung cancer. Smoking causes an estimated 160,000 deaths in the U.S. every year (American Cancer Society, 2004). A smoker who is also exposed to radon has a much higher risk of lung cancer.
- o Radon is the second leading cause of lung cancer and **the number one cause of lung cancer among non-smokers**. Radon is responsible for about 21,000 lung cancer deaths every year. In 1988, the U.S. Surgeon General issued a warning about radon, urging Americans to test their homes and to reduce the radon level when necessary. In January 2005, the Surgeon General issued a national health advisory on radon. Two recent studies show definitive evidence of the association between residential radon exposure and lung cancer, confirming past evidence of radon's health risks to underground miners exposed to radon at work. There is no doubt about the risks that radon in the home presents to Americans or its association with lung cancer.
- o **Secondhand smoke**, the third leading cause of lung cancer, is responsible for an estimated 3,000 lung cancer deaths every year.

#### **The World Health Organization (WHO) says radon causes up to 15% of lung cancers worldwide.**

The WHO's radon project helps countries increase awareness, collect data and encourage action to reduce radon-related risks. EPA and other governmental agencies and countries support this international initiative. "Radon poses an easily reducible health risk to populations all over the world, but has not up to now received widespread attention," says Dr. Michael Repacholi of WHO's Radiation and Environmental Health Unit. "Radon in our homes is the main source of exposure to ionizing radiation, and accounts for 50% of the public's exposure to naturally-occurring sources of radiation in many countries."

### Why is radon such a public health risk?

Radon is an odorless, tasteless and invisible gas produced by the decay of naturally occurring uranium in soil and water. Radon is a form of ionizing radiation and a proven carcinogen. Radon is found in outdoor air and in the indoor air of buildings of all kinds. EPA recommends homes be fixed if the radon level in the indoor air is 4 pCi/L (picoCuries per Liter) or more. The average concentration of radon in outdoor air is .4 pCi/L or 1/10<sup>th</sup> of EPA's 4 pCi/L action level. Because there is no known safe level of exposure to radon, EPA also recommends that households consider fixing their homes for radon levels between 2 pCi/L and 4 pCi/L. The perception that, because the action level is 4 pCi/L, a radon level of less than 4 pCi/L is 'safe,' is incorrect. The greatest radon exposure risk is in the home, and especially in rooms that are below grade (e.g., basements) and in contact with the ground or immediately above such rooms.

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**What's the risk of getting lung cancer from radon exposure?**

Radon Level	*Of 1,000 non-smokers who are exposed to this level of radon over a lifetime, ...	**The risk of cancer from this level of radon exposure equals...
20 pCi/L	36 people could get lung cancer	35 times the risk of drowning
10 pCi/L	18 people could get lung cancer	20 times the risk of dying in a home fire
8 pCi/L	15 people could get lung cancer	4 times the risk of dying in a fall
4 pCi/L	7 people could get lung cancer	the risk of dying in a car crash
2 pCi/L	4 people could get lung cancer	the risk of dying from poison
1.3 pCi/L	2 people could get lung cancer	(Average <b>indoor</b> radon level)
0.4 pCi/L	[unknown]	(Average <b>outdoor</b> radon level)

Note: If you are a smoker or former smoker, your risk may be much higher.

\* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).  
 \*\* Comparison data based on the 1999-2001 National Center for Injury Prevention and Control Reports from CDC.

Comment [jm2]: I think this advice column is redundant and distracting

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**Testing A Home for Radon**

**A. Test Kits**

1. Online: <http://sosradon.org/test-kits> (or call 1-800-SOS-RADON).
2. Some state radon programs: <http://www.epa.gov/iaq/whereyoulive.html>
3. Most home improvement stores.

**B. To find a qualified testing contractor:**

1. Contact your state's radon program <http://www.epa.gov/iaq/whereyoulive.html> since some maintain lists of contractors available in their state.
2. If your state has no radon program or the program has no list of contractors, contact a National Radon Proficiency Programs:

National Environmental Health Association (NEHA-NRPP) *Radon Proficiency Program*  
 Toll Free: (800) 269-4174 or (828) 890-4117  
 Website: [www.neha-nrpp.org/](http://www.neha-nrpp.org/)  
 National Radon Safety Board (NRSB)  
 Toll Free: (866) 329-3474  
 Fax: (914) 345-1169  
 WebSite: [www.nrsb.org](http://www.nrsb.org)

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