



## U.S. Environmental Protection Agency

# Indoor Air - Radon

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## Health Risks

### **Exposure to Radon Causes Lung Cancer In Non-smokers and Smokers Alike**

**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. Smoking, radon, and secondhand smoke are the leading causes of lung cancer. Although lung cancer can be treated, the survival rate is one of the lowest for those with cancer. From the time of diagnosis, between 11 and 15 percent of those afflicted will live beyond five years, depending upon demographic factors. In many cases lung cancer can be prevented; this is especially true for radon.

**Smoking** is the leading cause of lung cancer. Smoking causes an estimated 160,000\* deaths in the U.S. every year (American Cancer Society, 2004). And the rate among women is rising. On January 11, 1964, Dr. Luther L. Terry, then U.S. Surgeon General, issued the first warning on the link between smoking and lung cancer. Lung cancer now surpasses breast cancer as the number one cause of death among women. A smoker who is also exposed to radon has a much higher risk of lung cancer.

**Radon** is the number one cause of lung cancer among non-smokers, according to EPA estimates. Overall, radon is the second leading cause of lung cancer. Radon is responsible for about 21,000 lung cancer deaths every year. About 2,900 of these deaths occur among people who have never smoked. On January 13, 2005, Dr. Richard H. Carmona, the U.S. Surgeon General, issued a national health advisory on radon. Visit [www.cheec.uiowa.edu/misc/radon.html](http://www.cheec.uiowa.edu/misc/radon.html) [EXIT disclaimer >](#) for more on a study by Dr. William Field on radon-related lung cancer in women.

**Secondhand smoke** is the third leading cause of lung cancer and responsible for an estimated 3,000 lung cancer deaths every year. About 1,000 of these are people that never smoked, and about 2,000 are former smokers. Smoking affects non-smokers by exposing them to secondhand smoke. Exposure to secondhand smoke can have serious consequences for children's health, including asthma attacks, affecting the respiratory tract (bronchitis, pneumonia), and may cause ear infections.

**Learning more about lung cancer.** The following sources provide a wide range of good information about lung cancer, prevention, and treatment.

- American Cancer Society -- [www.cancer.org](http://www.cancer.org) [EXIT disclaimer >](#)
- American Lung Association -- [www.lungusa.org](http://www.lungusa.org) [EXIT disclaimer >](#)
- National Cancer Institute -- [www.nci.nih.gov/](http://www.nci.nih.gov/) [EXIT disclaimer >](#)
- Vanderbilt-Ingram Cancer Center -- [www.mc.vanderbilt.edu/vicc](http://www.mc.vanderbilt.edu/vicc) [EXIT disclaimer >](#)
- Memorial Sloan-Kettering -- [www.mskcc.org/mskcc/html/44.cfm](http://www.mskcc.org/mskcc/html/44.cfm) [EXIT disclaimer >](#)

### For More Information, See Also...

[Radon Frequently Asked Questions](#)

[The Updated Radon Risk Assessment](#)

[Biological Effects of Ionizing Radiation \(BEIR\) VI Report: "The Health Effects of Exposure to Indoor Radon"](#)

[Radon Publications](#)

[Citizen's Guide to Radon](#)

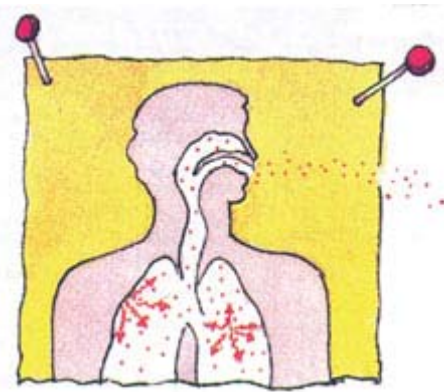
[Home Buyer's and Seller's Guide to Radon](#)

[Consumer's Guide to Radon Reduction](#)

Technical Support Document to the 1992 Citizens Guide - EPA 400-R-92-011, May 1992  
Copies can be ordered from [IAQINFO](#) 1-800-438-4318.

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Why is radon the public health risk that it is? EPA estimates that about 20,000 lung cancer deaths each year in the U.S. are radon-related. Exposure to radon is the second leading cause of lung cancer after smoking. 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. Lung cancer is the only known effect on human health from exposure to radon in air. Thus far, there is no evidence that children are at greater risk of lung cancer than are adults.



Radon in air is ubiquitous. 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 is 4 pCi/L (pico Curies per Liter) or more. Because there is no known safe level of exposure to radon, EPA also recommends that Americans consider fixing their home for radon levels between 2 pCi/L and 4 pCi/L. The average radon concentration in the indoor air of America's homes is about 1.3 pCi/L. It is upon this level that EPA based its estimate of 20,000 radon-related lung cancers a year upon. It is for this simple reason that EPA recommends that Americans consider fixing their homes when the radon level is between 2 pCi/L and 4 pCi/L. 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.

For smokers the risk of lung cancer is significant due to the synergistic effects of radon and smoking. For this population about 62 people in a 1,000 will die of lung-cancer, compared to 7.3 people in a 1,000 for never smokers. Put another way, a person who never smoked (never smoker) who is exposed to 1.3 pCi/L has a 2 in 1,000 chance of lung cancer; while a smoker has a 20 in 1,000 chance of dying from lung cancer. Figure A compares the risks between smokers and never smokers; smokers are at a much higher risk than never smokers, e.g., at 8 pCi/L the risk to smokers is six times the risk to never smokers.

The radon health risk is underscored by the fact that in 1988 Congress added Title III on Indoor Radon Abatement to the Toxic Substances Control Act. It codified and funded EPA's then fledgling radon program. Also that year, the Office of the U.S. Surgeon General issued a warning about radon urging Americans to test their homes and to reduce the radon level when necessary (U.S. Surgeon General).

Unfortunately, many Americans presume that because the action level is 4 pCi/L, a radon level of less than 4 pCi/L is 'safe'. This perception is altogether too common in the residential real estate market. In managing any risk, we should be concerned with the greatest risk. For most Americans, their greatest exposure to radon is in their homes; especially in rooms that are below grade (e.g., basements), rooms that are in contact with the ground and those rooms immediately above them.

***It's never too late to reduce your risk of lung cancer. Don't wait to test and fix a radon problem. If you are a smoker, stop smoking. Consider quitting. Until you can quit, smoke outside and provide your family with a smoke-free home ([www.epa.gov/smokefree](http://www.epa.gov/smokefree)). Take the Smoke-free Home Pledge today!***

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## Radon Risk If You Smoke

Radon Level	If 1,000 people who smoked were exposed to this level over a lifetime*...	The risk of cancer from radon exposure compares to** ...	WHAT TO DO: Stop smoking and...
20 pCi/L	About 260 people could get lung cancer	250 times the risk of drowning	Fix your home
10 pCi/L	About 150 people could get lung cancer	200 times the risk of dying in a home fire	Fix your home

<b>8 pCi/L</b>	About 120 people could get lung cancer	30 times the risk of dying in a fall	Fix your home
<b>4 pCi/L</b>	About 62 people could get lung cancer	5 times the risk of dying in a car crash	Fix your home
<b>2 pCi/L</b>	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing between 2 and 4 pCi/L
<b>1.3 pCi/L</b>	About 20 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)
<b>0.4 pCi/L</b>	About 3 people could get lung cancer	(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be lower.  
 \* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).  
 \*\* Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

### Radon Risk If You've Never Smoked

<b>Radon Level</b>	<b>If 1,000 people who never smoked were exposed to this level over a lifetime*...</b>	<b>The risk of cancer from radon exposure compares to**...</b>	<b>WHAT TO DO:</b>
<b>20 pCi/L</b>	About 36 people could get lung cancer	35 times the risk of drowning	Fix your home
<b>10 pCi/L</b>	About 18 people could get lung cancer	20 times the risk of dying in a home fire	Fix your home
<b>8 pCi/L</b>	About 15 people could get lung cancer	4 times the risk of dying in a fall	Fix your home
<b>4 pCi/L</b>	About 7 people could get lung cancer	The risk of dying in a car crash	Fix your home
<b>2 pCi/L</b>	About 4 person could get lung cancer	The risk of dying from poison	Consider fixing between 2 and 4 pCi/L
<b>1.3 pCi/L</b>	About 2 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)
<b>0.4 pCi/L</b>		(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be higher.  
 \* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).  
 \*\* Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

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This page was generated on Wednesday, March 8, 2006

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