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* cancer 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.

For More Information on Radon Health Risks:

Radon Frequently Asked Questions

EPA's 2003 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 EPA's National Center for Environmental Publications (NSCEP) www.epa.gov/nscep

Indoor Air Quality (IAQ)

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 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. 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 EXIT Disclaimer
- American Lung Association -- www.lungusa.org EXIT Disclaimer
- National Cancer Institute -- www.nci.nih.gov/ EXIT Disclaimer
- Vanderbilt-Ingram Cancer Center -- www.mc.vanderbilt.edu/vicc EXIT Disclaimer
- Memorial Sloan-Kettering -- www.mskcc.org/mskcc/html/44.cfm EXIT Disclaimer

Studies Find Direct Evidence Linking Radon in Homes to Lung Cancer - Two studies show definitive evidence of an association between residential radon exposure and lung cancer. Two studies, a North American study and a European study, both combined data from several previous residential studies. These two studies go a step beyond earlier findings. They confirm the radon health risks predicted by occupational studies of underground miner's who breathed radon for a period of years. Early in the debate about radon-related risks, some researchers questioned whether occupational studies could be used to calculate risks from exposure to radon in the home environment. "These findings effectively end any doubts about the risks to Americans of having radon in their homes," said Tom Kelly, Director of EPA's Indoor Environments Division. "We know that radon is a carcinogen. This research confirms that breathing low levels of radon can lead to lung cancer."

- Read the University of Iowa press release about the North American study at www.uihealthcare.com/news/news/2005/03/21radon.html EXIT Disclaimer
- Abstract of the pooling of *North American Residential Radon studies* (PDF) (2 pp, 22KB, About PDF).
- Abstract of the pooling of the *European Residential Radon studies* (PDF) (1 page, 21KB, About PDF).

World Health Organization Launches International Radon Project

The World Health Organization (WHO) says radon causes up to 15% of lung cancers worldwide. In an effort to reduce the rate of lung cancer around the world, the World Health Organization (WHO) launched an international radon project to help countries increase awareness, collect data and encourage action to reduce radon-related risks. The U.S. EPA is one of several government agencies and countries supporting this initiative and is encouraged by WHO's attention to this important public health issue. "Radon poses an easily reducible health risk to populations all over the world, but has not up to now received widespread attention," said Dr. Michael Repacholi, coordinator of WHO's Radiation and Environmental Health Unit. He went on to say that "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."

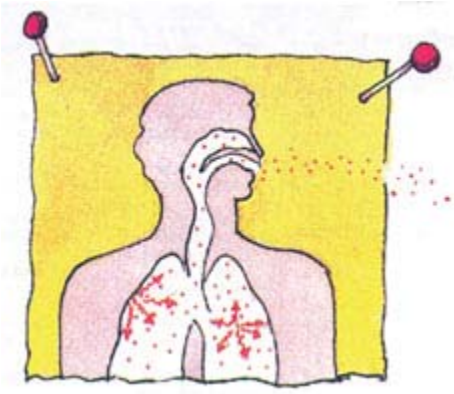
- Read the WHO Press Release EXIT Disclaimer
- Read the EPA News Release
- Visit the World Health Organization's International Radon Project site - www.who.int/ionizing_radiation/env/radon/en/index.html EXIT Disclaimer

The U.S. Surgeon General, Richard Carmona, Issues National Health Advisory on Radon

The Surgeon General of the United States issued a Health Advisory in 2005 warning Americans about the health risk from exposure to radon in indoor air. The Nation's Chief Physician urged Americans to test their homes to find out how much radon they might be breathing. Dr. Carmona also stressed the need to remedy the problem as soon as possible when the radon level is 4 pCi/L or more. Dr. Carmona noted that more than 20,000 Americans die of radon-related lung cancer each year.

- Read the Surgeon General's News Release EXIT Disclaimer

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 1/10th 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).*
> *Take the Smoke-free Home Pledge today!*

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	250 times the risk of	Fix your home

	lung cancer	drowning	
10 pCi/L	About 150 people could get lung cancer	200 times the risk of dying in a home fire	Fix your home
8 pCi/L	About 120 people could get lung cancer	30 times the risk of dying in a fall	Fix your home
4 pCi/L	About 62 people could get lung cancer	5 times the risk of dying in a car crash	Fix your home
2 pCi/L	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 20 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)
0.4 pCi/L	About 3 people could get lung cancer	(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be lower.
pCi/L (pico Curies per Liter)
* 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

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

Note: If you are a former smoker, your risk may be higher.
pCi/L (pico Curies per Liter)
* 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.