COMMUNICATING THE HEALTH RISK OF RADON

A Physicians Guide

AMERICAN LUNG ASSOCIATION®
of the Upper Midwest

INTRODUCTION

Radon is a Class-A human carcinogen recognized as the leading cause of lung cancer in the United States among nonsmokers. The National Academy of Sciences (NAS) and the Surgeon General estimate that as many as 21,000 lung cancer deaths that occur in the U.S. annually may be a result of radon exposure. It is therefore essential that as part of its mission to promote lung health, the American Lung Association of the Upper Midwest should be able to disseminate information pertaining to radon risks.

This document will be definitive in detailing the physical and biochemical processes associated with radon. Also included are procedures and methods for correcting elevated indoor radon levels. Ultimately, these efforts are crucial in reducing the number of lung cancer deaths.

WHAT IS RADON?

Radon is a naturally occurring radioactive gas released during the decay of thorium and uranium, which are common elements found in varying amounts in rock, soil and water. Radon is also colorless, odorless and tasteless, making it undetectable to human senses. When radioactive elements such as radon decay, radiation is released. Products of radon decay like polonium-218 and polonium-214 emit alpha particles that are effective in damaging lung tissues. Research has established a causal relationship with alpha-emitters and lung cancer in humans.

It is estimated that thirty-seven percent of the radiation that people are exposed to comes from radon and radon decay products. The location of greatest exposure to radon is in the home. While uranium is the source of radon, factors that influence its concentration in indoor air will include radon in soil, building materials, and groundwater. Air pressure differences between soil and house as well as foundation openings cause radon gas to flow towards the foundation of a home. Indoor radon concentrations also depend on soil permeability and porosity (the type of material in which the gas passes), uranium and moisture content and home foundation type.

Radon can enter a home from the soil via cracks in floors and walls, floor drains, sump pumps and construction joints. Radon is usually more concentrated in basements and ground floor rooms that have contact with the soil. The design, construction details and building materials used can affect the pathways and sources that can draw radon into a home. Domestic water contaminated with radon can also contribute to indoor radon levels . Fortunately, water radon levels will contribute significantly less than soil radon levels to the indoor radon concentration.

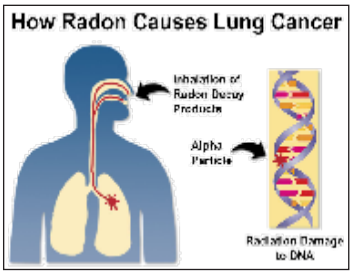
WHAT IS THE EVIDENCE?

Research on the risk of radon exposure and human health is more extensive than many studies on other human carcinogens. Most radon research was derived from epidemiological studies on underground miners. As early as the Middle Ages, miners in parts of Germany and Czechoslovakia were diagnosed with lung-related illnesses. The initial identification of this lung illness as cancer was in 1879. It was not hypothesized that radon was a cause of the lung cancers in the miners until 1924. Radon as a cause of the lung cancers in miners was not universally recognized until further epidemiological reports were issued in the 1950's and 1960's. During that time, it was also identified that it was alpha particles emitted from radon and its decay products that caused the lung cancer.

Human health risk models for predicting the risk of radon exposure by the public have been developed by the Committee on the Biological Effects of Ionizing Radiation (BEIR) under directive from the United States National Academy of Sciences. The preferred models derived by BEIR produced estimates of 15,400 or 21,800 radon-related lung cancer deaths in the United States per year. Additional data pooled from North American and European residential radon studies have also provided direct evidence of a statistically significant association between residential radon exposure and lung cancer.

THE HEATH RISK: HOW DOES RADON CAUSE LUNG CANCER?

The primary route of exposure to radon is by inhalation. Exposure to alpha radiation from radon and its decay products produces significant adverse health effects. Radiation in the form of alpha particles can damage cells and intercellular DNA and may reduce the cells capacity to repair itself.



When cells are damaged, they are repaired or destroyed. Damage of genetic material can result in varying forms of mutation due to the changes in information carried by DNA. Cell mutations have varying capabilities. They may not necessarily affect the cellular functions, may kill the cell or can allow the cell to reproduce without constraint and subsequently invade and damage areas reserved for other cells. It is the uncontrolled replication of mutated cells that increases the likelihood for further mutations.

THE HEATH RISK: HOW DOES RADON CAUSE LUNG CANCER? (CONT.)

Radon decay products (RDPs) are charged heavy metals and can be inhaled as attachments to atmospheric particles. Such atmospheric particles include dust, smoke or biological entities. The smaller the particles, the deeper into the respiratory tract the RDPs may travel. Within the respiratory system, particles may chemically or physically adhere to the mucus lining of the alveoli or bronchial regions. Adherence can increase the retention period for RDPs and also increase the probability of decay occurring while still inside the lungs because of their short half-lives. Decay and resulting emission of alpha particles may damage cells and initiate cellular mutations. Lung cancer due to inhalation of radon decay products constitutes the only known risk associated with radon.

According to some underground miner studies, variables such as age, duration of exposure, time since initiation of exposure and the use of tobacco have been found to influence individual risk. In fact, the use of tobacco has a synergistic effect on radon-induced lung cancer.

RISK COMMUNICATION

For physicians and public health professionals to successfully communicate radon risks, their patients must be made to effectively understand that while radon does pose a significant personal threat, it can also be mitigated relatively easily. Since it can be difficult to convince people to take voluntary action in measuring and/or remediating radon it is essential that physicians utilize the most appropriate risk communication strategies. The United States Environmental Protection Agency (USEPA) has researched the most appropriate strategies and this includes:

* Be prescriptive as well as informative
* Streamline guidelines on testing and mitigation to minimize barriers to public action
* Overcome public denial through the use of persuasive appeals such as concern for the family
* Provide an appropriate level of radon information, since too much or too little information may result in an undesired effect
* Personalize the radon threat with tangible, relevant comparisons to familiar risk
* Stress that radon problems can be corrected but do not overstate the ease of fixing them.

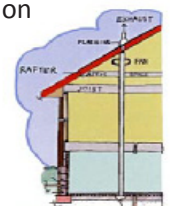
RADON MEASUREMENT

Short-term and long-term test kits are available at most hardware and department stores. State radon programs or local chapters of the American Lung Association can provide a list of licensed radon measurement professionals, and a list of businesses which offer testing kits through the mail. Over limited periods, free test kits may also be offered by the above organizations.

When testing, be sure to follow directions on placement and time period for testing closely and contact local state radon program, local American Lung Association office, or company that produced the kit with any questions regarding the testing procedure or interpreting the results.

REDUCING RADON LEVELS

Mitigation involves repairing or altering a building or building design for the purpose of reducing the concentration of radon in the indoor atmosphere.



Exact system design will vary from house to house dependent upon foundation type and building materials however most will consist of PVC pipe suction points attached to a van pulling air from under the slab foundation or membrane and disposing of it above the highest eve of the roof. This system depressurizes the house in comparison to the outside environment, reducing the levels of soil gas (and radon) being drawn into the house.

RADON INFORMATION AND RESOURCES

The following websites, hotlines and contacts provide additional radon information:

Websites:

American Lung Association of the Upper Midwest	(www.lungum.org)
United States Environmental Protection Agency	(www.epa.gov/iaq/radon)
World Health Organization	(www.who.int/ionizing_radiation/env/radon/en)

Hotlines:

American Lung Association Helpline	1-800-548-8252
National Hispanic Indoor Air Quality Hotline	1-866-528-3187
National Safety Council in partnership with USEPA	1-800-SOS-RADON (767-7236)

Resources:

American Association of Radon Scientists and Technologists	(www.aarst.org)
Conference of Radiation Control Program Directors	(www.crcpd.org)
National Radon Proficiency Program	(www.radongas.org)