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What is the Health of Your Home Concerning Lead And Radon?

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Lead

Health Leader Lesson

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Area 1— Switzerland County

The objective of this lesson is to look at your home concerning lead and radon levels. The source of the lesson is HENV-102-W and HENV-101-W, these publications are from the Department of Agronomy at Purdue University.

The following information is taken directly from HENV-101-W and HENV-102-W.

Lead is a versatile metal that has been widely used for 5,000 years. But overexposure to lead can lead to serious health consequences, especially in children. One study shows that the concentration of lead in the bodies of humans today is four to 10 times greater than lead levels in early man (Patterson et al., 1991). This lesson identifies sources of lead that are common in the home, describes the risks associated with lead exposure, and recommends ways to remove or reduce lead exposure.

Versatile, But Potentially Harmful

Lead has been a very commonly used metal because it resists corrosion and is one of the easiest metals to mold and shape. It has been used in everything from paints and gasoline to batteries, pipes, and canned goods. But this versatility has included some unnecessary risks. Lead can adversely affect the structure and function of various organs and tissues in children and to adults. Children ages 6 and under are more sensitive lead exposure because of their smaller size, greater rates of absorption of lead in the digestive tract (Casas and Sordo, 2006), and their ongoing physical and neurological development (Lanphear et al, 1998). According to the Indiana Department of Health 55,260 children 7 and younger were tested for lead in 2006. Of those, 520 had lead poisoning or elevated levels of lead. The human body cannot effectively distinguish between lead and calcium, which leads to harmful effects when the body uses lead in place of calcium (Casas and Sordo, 2006). After initial absorption, lead remains in the bloodstream for a few weeks and is eventually deposited in the bone structure where it can remain for a lifetime (U.S. EPA, 1998).

Changes in Lead Use

The last three decades have brought significant changes in lead use in the environment. Lead has been banned from use in many applications and government agencies routinely monitor lead levels in drinking water and the atmosphere. However, lead remains important, especially in making automotive batteries where up to 86 percent of old batteries are recycled to make new ones (Smith, 2004). This recycling helps reduce current lead pollution while still enabling its use.

Sources of Exposure

Lead in Drinking Water

Lead-contaminated water is of particular concern because the body more readily absorbs lead from water than from other sources (Casas and Sordo, 2006). Natural lead levels in water are usually less than 25 parts per billion (ppb), which is equivalent to 2 ounces of lead in an Olympic-size swimming pool. Municipal water treatment plants usually remove most lead from the water because the EPA requires lead levels to be 15 ppb or less. If a household's water supply is contaminated with lead, the contamination usually comes from the piping that transports water from the supply line throughout the house. If the pipes are made from lead, if they are held together with lead solder, or if there are brass fixtures, then the lead they contain can be leached into the water (U.S. EPA, 1998). Changes to the Safe Drinking Water Act in 1988 restricted the use of lead piping and components in residential homes, but those living in homes built before then may be at risk of exposure to high lead levels in their water.

Lead in Paint

Lead-based paints also are a significant source of lead exposure that can be found both on the interior and exterior of the home. Lead was used as a pigment and drying agent in paint until it was banned from residential use in 1978. According to the U.S. Centers for Disease Control and Prevention, 83 to 86 percent of homes built in the United States before 1978 contain lead-based paint which may contain 20 to 30 percent lead (Casas and Sordo, 2006). Children are frequently drawn to lead paint chips because of their sweet taste, and exposure to lead paint accounts for as much as 90 percent of childhood lead poisoning (Casas and Sordo, 2006). IDEM recommends testing all children for lead exposure who live or play on property built before 1978.

Preventing Lead Exposure

The EPA has made a number of recommendations for reducing lead exposure in the home:

- **Keep your home clean**
  Make sure that most surfaces are regularly dusted, washed, or vacuumed, especially if children are present. HEPA-filters, found in many vacuum cleaners, are equipped to trap lead particles.
- **Run cold tap water 15-30 seconds before use**
  Water resting in lead pipes may slowly accumulate lead. This will flush the water that has been sitting in the pipes. Using cold instead of hot water can reduce the amount of lead that may dissolve. Carbon, sand, and cartridge filters do not remove lead from water.
- **Eat a well balanced diet**
  Studies show that vitamins and minerals can either reduce the body's lead absorption or increase its release and excretion from the body. Diets high in fat can enhance lead absorption.
- **Test for lead**
  Hire a certified risk assessor or lead inspector who can test for lead in both your home and soil. A risk assessor can also make specific recommendations for reducing your risk of lead exposure.
- **Reduce bare soil**
  Grow grass in bare patches to cover the soil and reduce the amount of dust that can accumulate and be ingested.
- **Reduce sources of lead**
  Replace lead pipes or components and remove chipped or peeling lead-based paint carefully. Always wear a dust mask or respirator to minimize exposure.
- **Get a blood test**
  If you believe you or your family is at risk for lead exposure, get a blood test and consult your doctor about possible treatments.

Radon is an odorless, invisible, radioactive gas that is produced by the radioactive decay of its "parent" element, radium, which is naturally present in some soils and rocks. Radon can accumulate in the home and has been found to cause certain types of cancer. This lesson examines the effects of radon exposure, describes common sources of radon in the home, and discusses radon testing and mitigation.

Effects of Radon Exposure

Just as it is produced by radioactive decay, radon disappears by radioactive decay. In this process, it releases radiation in the form of alpha particles and transforms into a different element. The relative time this decay takes is based on radon's half-life, which is 3.8 days. Half-life is the time it takes half of the original amount of radon to decay. For example, if you started with 100 radon atoms, there would be 50 atoms remaining after 3.8 days, 25 atoms after another 3.8 days, and so on. Although radon has a short half-life, it is constantly replenished in the environment by the decay of the long-lived radium also present in some soils and rocks. Indoor levels of radon vary depending on the rate that radon is leaking in from outside (Brown et al., 2000). Inhalation is the most likely source of radon exposure in the home. Since the late 1960s this type of exposure has been known to cause lung cancer. Ingesting radon, usually from drinking water containing radon, is less likely (but still possible) and has been linked to stomach cancer and other cancers of the digestive tract (U.S. EPA, 2005a). The majority of the radiation involved is actually emitted from the radon decay products which alter or harm DNA in human tissues and lead to the development of cancer (Brown et al., 2000). Radon decay products are metallic elements that cling to small particles, allowing them to be inhaled and deposited in the lungs. Important health statistics related to home radon levels include:

- Radon causes an estimated 21,000 deaths each year from lung cancer (U.S. EPA, 2003).
- Radon is second only to medical X-rays as the most significant source of radiation exposure for most people.
- Radon is the second leading cause of lung cancer after smoking according to the U.S. Surgeon General (2005). Those who smoke and have homes with high radon levels are at even greater risk.

Factors Affecting Radon Levels

Radon levels in a home can vary over time and in different locations depending on the area's soil type and geology, the home's building materials and foundation, weather and season, and level of radon in the household water supply. Below are some basic facts about the factors that affect home radon levels.

Soil and Geology

Soil type and geology have the greatest effect on radon levels in the home, and is typically the largest source of radon. A major factor affecting radon flow is how porous the soil is beneath the home. Soils and rock that are more porous allow more radon to flow into a home. Glacial till soils derived from sandstones, limestones, and black shales common in the Midwest create a high radon potential.

Building Materials and Foundation

Some concretes and sheetrocks may contain materials with high levels of uranium that can continuously decay to radon (Brown et al., 2000). Some concrete foundations are more porous than others or may contain cracks. These factors allow radon from the soil and rock beneath the home to flow into the home at a faster rate.

Weather and Season

The weather and season also affect the amount of radon present in the home. Radon is not very water soluble, so rainfall entering the soil will temporarily block the pores in the soil and reduce the flow of radon into the home. In the winter, radon levels can increase. This is because heating systems can create a slight buildup of negative pressure between the inside and outside, causing more air (and more radon) to flow inside from beneath the home (Appleton, 2005).

Household Water Supply

Household water supplies also can be a source of radon. Water that comes from underground sources (such as aquifers or wells) is more likely to contain higher radon levels than water that comes from surface sources (such as lakes or reservoirs). This is because radon from groundwater does not have a chance to diffuse into the atmosphere like surface water does (U.S. EPA, 2005a). Once in the home, water with elevated radon levels can cause radon to diffuse into the indoor atmosphere and increase overall radon levels (Appleton, 2005).

Testing for Radon

The EPA and Surgeon General suggest radon testing blow the third floor for all structures. The maximum radiation level allowed by the EPA for any building is 4 pCi/L (picocuries of radon per liter of air). The average outdoor level is about 0.4 pCi/L and the average indoor level is around 1.3 pCi/L. It is estimated, however, that 1 in every 15 U.S. homes has radon levels greater than 4 pCi/L (U.S. EPA, 2005a). If the air in your home is above this level, mitigation efforts (see below) are strongly advised. The EPA developed a map that shows areas at the greatest risk from high radon levels based on a number of factors, including average indoor measurements, geology, aerial radioactivity, soil permeability, and types. These maps are only estimates, however, and the EPA recommends testing if:

- It has been more than two years since the last test
- You are buying a home
- Your home or yard was recently renovated

At least 18 million homes were tested for radon from the mid-1980s through 2003. Of those, 800,000 with elevated levels have installed mitigation systems (Gregory and Jalbert, 2004). According to data from the Indiana State Department of Health, certified radon professionals performed more than 45,000 radon tests around the state between 1994 and 2004. In those tests, one in three found elevated radon levels (levels greater than or equal to 4 pCi/L). Homeowners can test for radon by purchasing a test kit from a hardware or retail store, or hire a certified radon professional. There are short-term and long-term radon tests available. Short-term testing can take two to 90 days to complete and are good for quick results. If this test is going to be used, however, it should be followed by a second short-term test after the first one is completed (U.S. EPA, 2005a). Long-term testing usually takes longer than 90 days. Such tests can provide the most accurate results since, as mentioned earlier, radon levels in a home can vary over time.

Radon Mitigation Methods

The two main ways to reduce radon concentrations are to prevent radon from entering the home in the first place and to dilute the indoor air with ventilation from outside. To lower radon levels, homeowners can use passive or active mitigation methods (Brown et al., 2000).

Passive Mitigation Methods

Passive mitigation methods are the least expensive and are typically good for homes that have radon levels only slightly above the 4 pCi/L limit (Henschel, 1993). Such methods include sealing foundation openings and around areas where pipes enter the home — such measures can reduce radon levels by as much as 15 percent (Nielson et al., 1996). Other methods include applying coatings or membranes on walls to reduce permeability and installing a passive soil ventilation system. In these systems vents can be installed around a crawlspace to allow outside air to mix with air from the soil beneath the flooring.

Active Mitigation Methods

Active mitigation methods are typically more expensive than passive methods — anywhere between $500 and $2,500 to install, plus operating costs. (Appleton, 2005). However, such methods are important for structures with high radon levels (more than two or three times the 4 pCi/L limit), or if passive mitigation methods do not work. Active systems typically involve installing mechanical and electrical devices to reverse air flow and ventilate soil beneath the foundation. They are set up either to draw outdoor air toward the foundation or blow air in the soil away from the foundation (Henschel, 1993).

Precautions for Building Homes

When building a new home, there are also a number of measures that can be taken that cost less than installing a mitigation system in an existing home — $350-$500 during the construction of a new home vs. $500-$2,500 for installing a system in an existing home (Appleton, 2005). Builders can place plastic membranes beneath the foundation, use a more dense concrete mixture for the foundation, and use solid masonry blocks instead of hollow blocks for the foundation walls that can prevent air containing radon from penetrating the home (Brown et al., 2000).

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