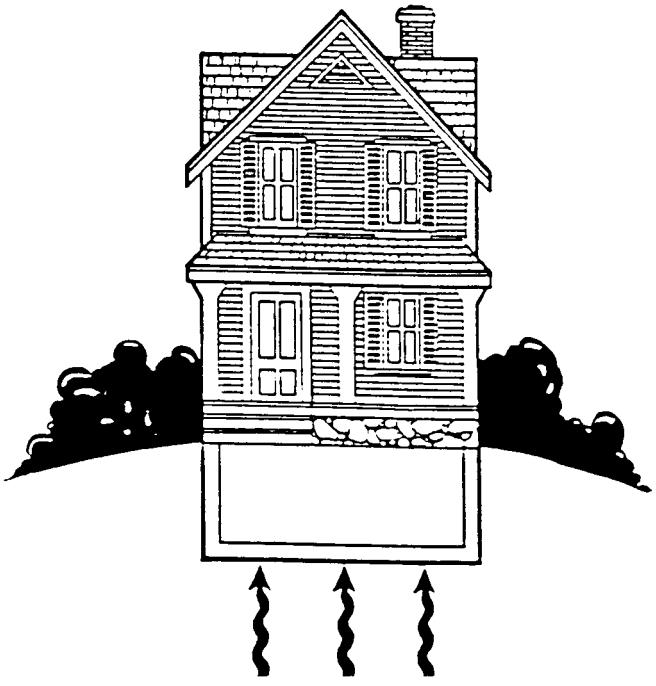
West Virginia University
Extension Service

SA 33.0

Agricultural
Engineering

Radon



What Is Radon?

Radon occurs from the decaying process of Uranium, a natural occurring element found in the rocks and soil. Uranium will decay after a few hundred thousand years into an atom of radium. Radium will then decay into another radioactive element called radon. The difference between radon and its predecessors is that radon is a gas. As a gas radon is colorless, odorless, and tasteless, and has the capability to find its way to the surface of the earth and into the atmosphere. In the atmosphere radon mixes with other components of air and is diluted. Radon decays within a few days (approximately 4) into what is known as radon daughters that have a life of an hour and then the radon daughters decay. The problem occurs when the radon gas comes up through the ground and into a house and then cannot escape out into the atmosphere. The radon gas then starts building up in the home and humans become exposed to this high concentration of radon gas. The radon daughters have a tendency to cling to dust particles in the air. This is how radon enters the sensitive area of our respiratory system. The radon daughters become attached to the linings of the lungs and bronchial tubes and then decay. During the decay process radiation energy is given off and causes damage to the linings of the lungs.

Health Effects Associated with Radon Gas

Radon gas is the second leading cause of lung cancer in the nation, between 5,000 and 20,000 cases per year. There is no concrete figure of how many deaths are caused by radon. Few homes in the United States have been tested for radon so we really do not know how many people are exposed to radon gas. Exposure to high levels of radon gas can be as hazardous to your health as smoking 4 packs of cigarettes a day. As for the effects of those who smoke and are exposed to radon gas there is no evidence to show that smokers develop lung cancer at a faster rate, although it is assumed that their risk should be somewhat higher.

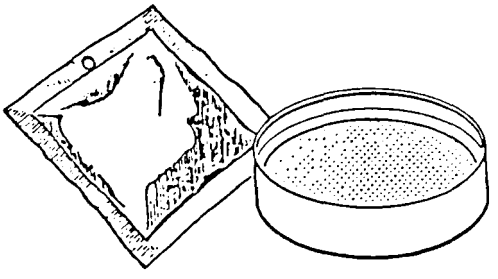
Radon causes lung cancer by the release of radioactive energy from the radon daughters. When in the lungs the radon daughters are within one thousandth of an inch to the most cancer-sensitive cells in the human body. The radon daughter in the decaying process emits an alpha particle which regrettably is 100 times more efficient than beta and gamma particles at inducing cancer. The reason alpha particles are so damaging is that they have ten times the energy of other particles and move ten times more slowly thus creating substantial damage to the molecules in which they come in contact. Radon is a unique problem in that most foreign particles will be expelled by the bronchial tubes but due to the short life of the radon daughter the damage is done before it can be dispelled from the lungs.

How to Test for Radon in Your Home

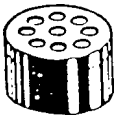
There are three common ways to test for radon in the home: grab sample, charcoal canister, and Alpha track detectors. The first method is really impractical since a grab sample is just what it is, a grab sample. The grab sample of air taken over a short period of time (hour or less) and then tested in a lab. A grab sample has to be taken usually by a professional and the test can be manipulated to show high concentrations of radon if the person taking the test was not honest. A dishonest person may set the grab sample air monitor near a crack in the floor or near a drain pipe that would give higher levels of radon and not a true test. A grab

sample is expensive compared to the usual test performed and should not be used.

The charcoal canister is the most popular and easy to use. The charcoal canister is left in the basement or other low lying areas of the house for three to seven days undisturbed. The canister is then sealed and mailed off to a laboratory (usually laboratory fees are included in the initial cost of the canister), for



Charcoal Canisters
Test Period: 3 to 7 days
Approximate Cost: $10 to $25 one canister



Alpha Track Detectors
Minimum Test Period: 2 to 4 weeks
Approximate Cost: $20 to $50 for one detector; discounts for multiple detectors

results. The test should be taken in early spring or fall when the house is usually closed up except for normal house entering and exiting and before the heating system is in operation constantly.

An Alpha Track detector is a method used for long term testing. The Alpha Track detector should remain in place from one month to a year and is mainly used to determine the amount of radon when the charcoal test shows a suspicious reading. Since the Alpha Track is a long term test, the reading will be more of a representation of the average concentration of radon in your home. Alpha Track detectors are also used to determine if the methods used to eliminate radon in the home have worked.

How to Read Test Results

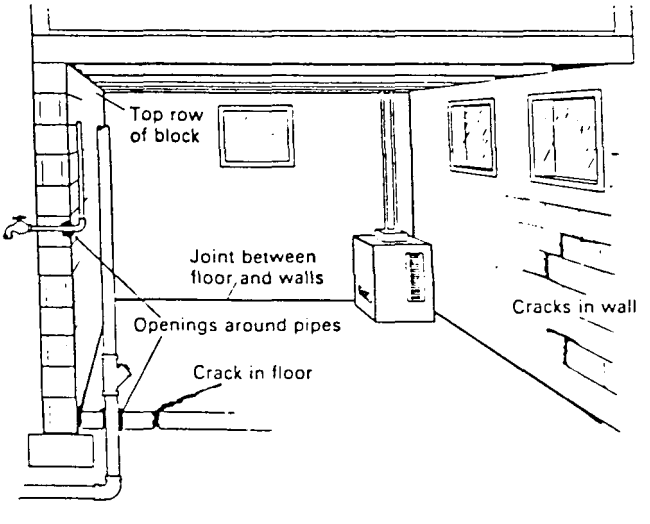
Once the test results are delivered to you, will you know how to read them or truly understand the result? Test results are given a majority of the time in two ways, in Picocuries per liter (pCi/L) or in working levels (WL). Picocuries per liter measures the level of radon gas in the home and working levels is a measurement of exposure to radon's radioactive daughter products. To truly understand the terms involved with Picocuries per liter a person would need a background in Physics, so to simplify the term as it is used for the purpose of reading a test result, one Picocurie per liter is equal to one radon atom per minute disintegrating in every quart of air in the room. The Picocurie per liter reading will give you guidelines on the amount of radon gas present and not the radon daughters that cause the health problems. This test will give you a baseline to compare to charts developed to determine your risk to radon. In general, 10 pCi/L of radon gas present is the same as smoking one pack of cigarettes per day.

Working Levels is a term that was developed for those who worked in Uranium mines and can be used for the measurement in household radon. Working Levels measure the amount of energy resulting from potential alpha activity (the decaying of radon daughters) in 1 liter of air, which means the amount of decaying radon daughters. In order to compare Working Levels with Picocuries per liter, 200 pCi/L is equal to 1 WL. The following are some examples of comparative reading and health risks as they compare to smoking: 1) 200 pCi/L or 1 WL is equal to smoking 4 packs of cigarettes per day. 2) 20 pCi/L or 0.1 WL is equal to smoking 2 packs of cigarettes per day. 3) 10 pCi/L or 0.05 WL is equal to smoking 1 pack of cigarettes per day.

How to Reduce the Amount of Radon in the Home

If your test comes back and the results show that your house is containing high concentrations of radon, there are some options that can be taken to reduce radon levels. Before you can reduce radon levels you will need to understand how radon enters the home.

Radon is a gas so it can seep through every opening that is in your basement wall. The home acts in many cases like negative air pressure or a chimney and attract the gas into your home. Areas to examine are the basement floor for cracks or if the floor is not finished, sump pump openings, areas around drain, and sewage pipes. Cracks in the lower walls of older



design such as stone or cinder blocks will be more porous.

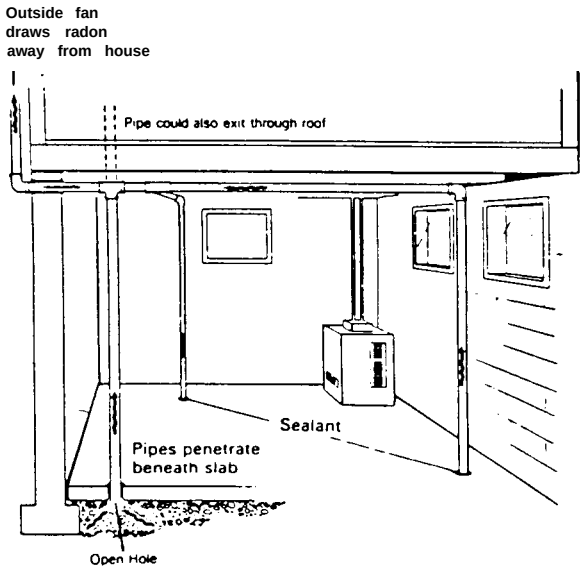
A homeowner should seal all cracks in the floor with a ready mix concrete or with some other type of caulking compound. Seal around drain areas, sump pump, and pipes that come through the basement floor, Seal around the joint between the wall and the floor, and seal off the top row of blocks. In cases where radon is not at a real high level this should bring it to a safe range.

When radon levels are high other methods must be used along with sealing all the open areas to assure the removal of radon gas from the home. As mentioned earlier, the home sometimes acts as a chimney and draws the radon gas into the home. One way to try to eliminate the gas is installing a fan in the basement and draw air into this area thus making it an area of high pressure. When the pressure is greater inside than outside the radon cannot enter. In order to create the high pressure the basement must be sealed in the areas mentioned previously.

Another method for reducing the amount of radon gas is forced ventilation. Forced ventilation is when a fan draws air from the outside, circulates within the basement and then escapes through open windows. This carries the radon to the outside but placement of the fan in reference to the windows is important in order to get full circulation of the air. However, this system is not feasible if you live in an area of cold climate, not unless a heat exchanger is utilized. A heat exchanger takes the heat out of the air being removed and uses it to heat the air coming in.

The most common and successful of the engineering methods for reducing radon gas in the home is sub-slab ventilation. In sub-slab ventilation, holes are drilled through the basement floor into the earth or aggregate below and pipes are installed to remove the radon before it can come into the home. Usually a pipe in each corner of the basement is connected into a single pipe that is equipped with an exhaust fan that creates a chimney effect. The radon in the pipes is then vented to the outside.

An engineering method not highly utilized but sometimes necessary is block wall ventilation. Block wall ventilation is used when radon is more than likely



entering the basement through the hollow areas of the blocks. A pipe can be inserted into a hollow area of each block wall and then connected together and drawn to the outside similar to the sub-slab design.

When building a home in an area suspected of high radon levels, it is a good idea to plan for radon elimination before you build. A sub-slab ventilation system for example could be added at a small cost to the construction price. It is more economical to design a system for the reduction of radon into your building plans than to have to do the job at a later date.

Radon has become more of an issue as health agencies have determined that radon is the second leading cause of lung cancer,.Although radon is a health threat, at least there is something that can be done to remove radon from our homes. With testing and correct mitigation procedures no one should have to worry about lung cancer due to radon.

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