BACKGROUND INFORMATION ON RADON

Are there rays from radon?
or
What does your radio have to do with radioactivity?

What is Radioactivity?

What does having your radio on have to do with radioactivity? Actually very little! Radioactivity is the release of energy particles and rays from the breakdown or decay of atoms in certain elements. Let's review some background information about atoms, elements, radioactivity, radiation, and radon.

Atoms and Elements

Atoms are the smallest, unique component of an element. They are the building blocks of elements. Every atom contains a nucleus (center) with protons (positive charge) and neutrons (no charge). Circling the nucleus are electrons (negative charge) which always equal the number of protons contained in the nucleus.

Each element has its own unique atomic makeup (i.e., number of protons and an equal number of electrons). Hydrogen is listed as the first element because it has one proton and one electron. Hydrogen has an atomic number of one. Atomic number is based on the number of protons. Some other common elements are carbon (atomic number, 6), aluminum (atomic number, 11), and gold (atomic number, 79). In some cases, atoms will have the same number of neutrons as they do protons, but not always. Hydrogen can occur with one, two, or three neutrons, but in each case it has only one proton and one electron. Although it is still hydrogen, the varying number of neutrons categorize the atom as a particular isotope (type) of hydrogen. Isotopes of a particular element are identified by mass number (the total number of protons and neutrons in the nucleus).

Radioactivity and Radiation

Certain isotopes of elements can become unbalanced or unstable because of the increased number of neutrons present in their nuclei. These isotopes are subject to breakdown or decay. Quite simply, the atoms of these isotopes are seeking stability. As each atom decays in an effort to balance itself, energy is released from the atom in the form of particles and rays. The release or emission of this energy is radioactivity. Radioactive energy is called radiation.

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As an isotope of a particular element decays, the configuration of its nucleus will change and there will be corresponding changes to the orbiting electrons. As a result, the element decays into another element, and continues to decay until it reaches a stable form. For example, these lessons are about the radioactive element radon (the particular isotope radon-222). This element occurs about midway in the decay chain of uranium-238, and is the direct decay product of radium-226. Sometimes radioactive decay products are referred to as progeny or daughters. When the entire decay series of this particular form of uranium is complete, the stable (non-reactive) element that is formed is lead-206.

This process of decay is constantly occurring in our world. We are surrounded by radiation. The greatest percentage of our exposure to radiation is from natural, not man-made sources. We are struck over and over again by the energy particles and rays that are emitted during radioactive decay. This can definitely cause wear and tear, and may lead to serious health hazards. Because it is not possible to prevent radiation, we must instead work to reduce our exposure and that will help to reduce our risk. Radon is one radioactive element that can cause serious health damage, but we can reduce our exposure and consequently our risk.

Radon

Radon is a naturally occurring radioactive gas found in soils everywhere. It is unique among radioactive elements because it is the only one that occurs as a gas. This allows movement up through the soils and cracks in rocks until the gas escapes into the atmosphere. In the atmosphere it is very dilute. However, radon gas can move upward through the soil and enter buildings, such as your home. The gas can enter through cracks in the foundation, drain and sump pump openings, unsealed cinder block, and at floor and wall joints. Since the air pressure inside a building is usually lower than the air pressure outdoors, the pressure differential actively draws radon into the interior of the building. Once it has entered the building, it becomes trapped and can build up in concentration.

In addition to being a gas, radon is odorless, colorless, and tasteless. It is completely undetectable by human senses. It can only be detected by a special test. If the test results show elevated levels of radon gas, there are a number of very effective methods to correct the problem.

Why is there a concern about this radioactive gas? Because exposure to elevated levels of indoor radon gas can be a serious health hazard. Radon is the second leading cause of lung cancer.

Just as radon is a direct decay product of radium, it continues to decay and new radioactive products are formed. Radon's decay products are all solids. These solids adhere to other particles in' the air, such as smoke and dust, and they can be inhaled and trapped in the lungs. There they continue to decay, releasing energy particles which repeatedly strike sensitive lung tissue and cause damage that can increase the risk of lung cancer.

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Measurement and Reduction

Because radon is undetectable by human senses, special tests have been developed to measure the levels of indoor radon gas. Tests may be short term (2-7 days) or long term (3-12 months). An initial short term test will provide a "snapshot" of someone's potential exposure. In fact, short term tests should be done under conditions that will maximize what the highest radon levels would be.

What are high levels of radon gas? In the United States, the most common measurement of indoor radon gas is picocuries per liter of air (pCi/L). The federal Environmental Protection Agency has established a recommended "action level" of 4 picocuries per liter of air (4 pCi/L). At or above this level, people are urged to consider reducing their exposure by implementing mitigation or remediation procedures.

Methods of reducing indoor radon gas levels consist of steps such as sealing cracks and wall/floor joints, covering sump pumps, increasing ventilation, and drawing radon gas away from the building before it can enter. Whatever step or combination of steps that are used, always retest to be certain the radon levels have been reduced.

All of the following investigations are about radiation, radon, and risk (probability). All of the exercises may be done without computers.

You may contact your state radon program for more detailed information about radon gas. See the list in the Resources section

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