Radiation Fact Sheet

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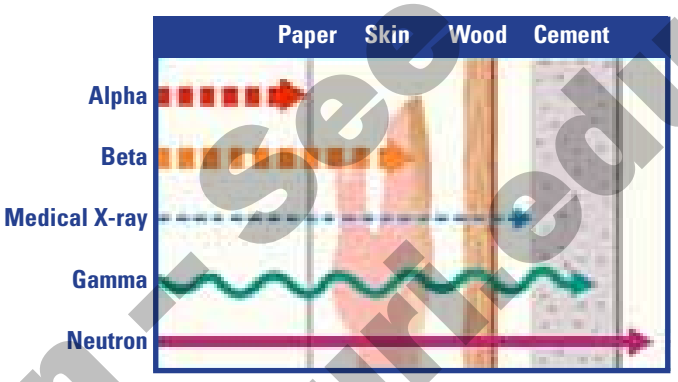
Types of radiation

There are four types of radiation released from atoms: alpha, beta, gamma and neutron radiation.

Alpha particles are highly charged and the heaviest of the nuclear radiations. Because of their size and weight they are unable to travel very far and have a limited ability penetrate. They cannot travel more than four to seven inches in the air and can be stopped by a sheet of paper or skin. They can be a hazard if they are inhaled or swallowed.

Beta particles are smaller and travel faster than alpha particles. They can travel several feet in the air and are able to penetrate skin, though they do not usually penetrate deep enough to reach vital organs. They can be stopped by a thin sheet of metal or plastic or a block of wood.

Gamma rays are not particles, but waves of radioactive energy. They travel much further and have more penetrating power than either alpha or beta particles. They can travel as much as a mile in open air and it takes several feet of concrete or several inches of a dense material such as lead to block them.



The penetrating power of radiation. (Image courtesy of the U.S. Nuclear Regulatory Commission)

Neutron radiation occurs when nuclear particles collide with other materials. Neutrons have an exceptional ability to penetrate other materials and are extremely hazardous. Fortunately, this type of radiation is generally only found in a nuclear power plant where it is shielded by steel, concrete and several feet of water.

Radiation can enter the body in the following ways:

- Inhalation — Gaseous or airborne particles, dust particulates, and matter with radioactive material may enter the body through the lungs. Remember that air itself is not radioactive; radiation is contained in particles carried by the air.
- Ingestion — Internal radioactive contamination may enter the body through the gastrointestinal tract by way of contaminated food or drink and by swallowing contaminated mucous from the nasal area.
- Absorption — Radioactive material may be absorbed through the skin or mucous membranes.
- Puncture or injection — Radioactive material can penetrate the body through cuts, wounds, and punctures in the skin.

Definitions

radiation Radiation is energy given off by matter in the form of high speed rays or particles. All matter is composed of atoms. These atoms constantly seek a strong, stable state. As they convert from an unstable to stable form they release excess atomic energy in the form of radiation.

radiation sources Radiation can come from either natural or man-made sources. We are naturally exposed to radiation every day of our lives. Cosmic radiation reaches the Earth from the sun. The rock and soil of the Earth contain radioactive elements such as uranium and thorium. Our bodies also contain small amounts of radioactive elements which become incorporated into our tissues. Radioactive carbon originates in the atmosphere and radioactive potassium can be found in food and water. You may have heard of Carbon-14 testing used by scientists to determine the age of fossils. This is only possible because every living thing has radioactive carbon in its tissues. Most exposure to man-made radiation comes from medical uses, such as radiology.

NORM This is the acronym for natural sources of radioactive materials and stands for Naturally Occurring Radioactive Material. At normal levels, this radiation poses little threat to our health. Also, the fact that our bodies are constantly exposed to radiation helps us to be able to withstand elevated levels for short periods of time with no measurable effects.

radioactive decay The process by which a radioactive material emits energy as it converts to a stable state. The term "half-life" is used to describe approximately how long it takes for half of a mass of radioactive material to undergo decay.

Reducing radiation exposure

Time, distance and shielding are the three primary methods of reducing or eliminating exposure to radioactive materials.

- Time — Minimize time spent near a radioactive source or radioactive contamination. The less time exposed to the source of radiation, the lower the dose received.

- Distance — Maximize the distance from a radioactive source or radioactive contamination. Keep as much distance as possible between oneself and the source of radiation. The farther one is from the source, the lower the dose received.
- Shielding — Shielding simply means having something that will absorb radiation between you and the source of the radiation. Keep as much protection between oneself and the source as possible.

What should I do if there is a radioactive incident near me?

The first and most important rule is: *Listen to and follow the instructions of your local emergency personnel.* Emergency personnel have been trained in how to respond in the event of an incident, including those involving radiological materials. They will provide instructions on how to keep yourself and your family safe.

Shouldn't I just try to get as far away from the radiation source as possible?

Not necessarily. In a radiological incident, quite often residents will be instructed to remain in their homes, a concept known as "shelter-in-place." The reason for this is that, if an incident involves alpha or beta particles, your home will provide a tremendous amount of safety as it will block the penetration of these particles. Move to an interior room with few windows or the basement. Turn off all air conditioners and ventilation systems. If you have the materials available, you should seal any cracks in your home where particles may be able to enter. Duct tape and plastic sheeting work well for this purpose. Although you will have to open up the room occasionally to allow fresh air in, you will likely receive much less exposure than if you left your home where you might inhale radioactive materials. According to the Federal Emergency Management Agency (FEMA), "Ten square feet of floor space per person will provide sufficient air to prevent carbon dioxide build-up for up to five hours, assuming a normal breathing rate while resting."

How can I prepare for an emergency or disaster?

For all disasters, you and your family can take the following three steps, which will be extremely helpful.

1. **Put together an emergency kit.** Your emergency kit should contain enough materials to sustain you, your family, and those who may shelter with you for a minimum of three days. In addition to food, water and other supplies, you should include a battery-powered or hand-crank radio and a NOAA weather radio with tone alert, and extra batteries for both. At a minimum, you should check your emergency kit every six months.
   >> Disaster Supplies Kit, ***http://extension.missouri.edu/publications/DisplayPub.aspx?P=EMW1012***
   >> List of recommended items to include in an emergency kit, ***http://www.ready.gov/america/getakit/kit-print.html***
2. **Develop and practice a family emergency plan.** Know where in your home to go during an emergency and how to contact members of your family. For all emergencies you should have a plan for if you stay at home or if you evacuate.
   >> Family Disaster Plan, ***http://extension.missouri.edu/publications/DisplayPub.aspx?P=EMW1011***
3. **Be informed.** Learn about possible hazards and how to respond to each of them. Find out where shelters operate in your community. Be aware of the local emergency messaging and alert systems. Learn about the emergency plans that have been established by your state and local government.

Thanks to the U.S. Nuclear Regulatory Agency; Federal Emergency Management Agency; U.S. Environmental Protection Agency; and Ray Burde, associate director, Center for Agriculture and Food Security and Preparedness, University of Tennessee, for much of the information included here.

University of Missouri Extension is a partner in the Extension Disaster Education Network.

ADDITIONAL INFORMATION

Radiation Protection (U.S. Nuclear Regulatory Commission), ***http://www.nrc.gov/about-nrc/radiation.html***
Radiation Emergencies (U.S. Centers for Disease Control and Prevention), ***http://emergency.cdc.gov/radiation***
Radiation Protection (U. S. Environmental Protection Agency), ***http://www.epa.gov/radiation***
Extension Disaster Education Network, ***http://eden.lsu.edu***
Ready (Federal Emergency Management Agency), ***http://www.ready.gov***

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