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Radiation Safety

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What Exactly is Radiation?

Simply put, radiation is energy that travels through the air. While there are many types of radiation, they all fall into one of two classes: ionizing or non-ionizing. The primary difference between the two is that ionizing radiation is able to change the atoms to which it is exposed by removing electrons. That's an important distinction because human cells are made up of atoms, so they can be affected by ionizing radiation.

Although non-ionizing radiation can cause atoms to move or vibrate, it cannot remove electrons. Non-ionizing radiation is all around us — in forms as diverse as radio waves and visible light — and we use many of those forms in our daily life. When you put a sandwich in a microwave oven, non-ionizing radiation causes the atoms in the sandwich to vibrate and warm up. While the temperature and texture of the sandwich changes, its atoms remain the same, so it's safe to eat. Similarly, when you place a call with a cell phone, non-ionizing radio waves travel from the phone to the nearest tower to connect you with other towers and, eventually, the person you're calling.

When people talk about the hazards of radiation, they're generally referring to ionizing radiation. It's called that because when it removes electrons from atoms it creates charged particles that are known as ions. If ions are used in a controlled manner they can serve very useful purposes, whether that's generating electricity or wiping out cancer cells in the body. When the body is exposed in other ways, those useful ions can become quite damaging.

There are three basic types of ionizing radiation: alpha particles, beta particles, and a group that includes gamma rays and x-rays. Each operates at different frequencies and has different effects. For example, when used with special film, x-rays can be sent through an object such as a person's arm or a welded pipe. Areas in the object that are denser will absorb the x-rays, so fewer of them will reach the film which creates a lighter image. The resulting dark areas can pinpoint problems such as fractures, whether that's in a pipe or a human bone.

How Does Radiation Affect People?

While all forms of ionizing radiation can have significant health effects, the potential impact depends upon the type of radiation and the amount to which a person is exposed. The different types of radiation affect different kinds of tissue in the body, primarily because of the amount of energy involved and the nature of each type of radiation. As an example, if a person is exposed to equal amounts of alpha and gamma radiation, the alpha particles will concentrate their energy in a much smaller area and the gamma rays will spread out.

Ionizing radiation can affect any type of living tissue in humans. The

severity of the damage from radiation depends upon both the amount of radiation being received and the amount of time involved.

Radiation in the Workplace

Ionizing radiation in the form of x-ray machines is used in healthcare facilities and manufacturing settings. In healthcare, radiation is also used in a wide variety of diagnostic devices, such as CT scanners, and concentrated for the treatment of tumors and cancers.

In industrial settings, radiation can be used in testing devices, for sterilization of products, for determining the level and flow of material, in weapons production, and in nuclear power plants. None of those uses are inherently dangerous, as long as all of the required safety devices and processes are in place and used properly. Those who work with radiation need to understand the safety procedures, the consequences of failing to follow them, and actions to take in the event of an incident.

Fortunately, the radiation levels encountered in the workplace tend to be very small. In fact, the levels that are high enough to cause non-stochastic health effects don't occur in workplaces. Even workers in towns close to the Fukushima Plant received daily doses that were smaller than what most people receive with a dental x-ray. That's why radiation safety focuses on protecting workers from long-term exposure to lower doses.

Being Safe Around Radiation

There are three ways workers can limit their exposure to radiation: maintaining a safe distance from the source, limiting the time around the source, and using shielding to limit the exposure. Workers should also know what to do when something goes wrong.

Like fire, radiation can be both a valuable tool and a serious danger. As with fire there's no need to be afraid of radiation, but it's good to develop a healthy respect for its power and to follow practices that minimize the potential danger.

