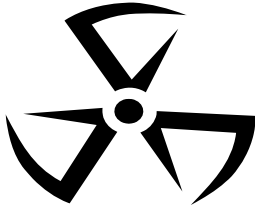


EH&S Fast Facts

RADIATION & HUMAN HEALTH



Radiation includes light, radio waves, and electric fields (non-ionizing radiations, whose energies are lower than ionizing radiation and don't affect matter the same way). Ionizing radiation changes the physical state of atoms it strikes causing them to become electrically charged or "ionized." Unstable atoms (radioisotopes) decay and emit radiation. We are all exposed to radiation from the sun and atmosphere; naturally occurring radioactive materials are present in the earth, houses, food, air, and our bodies (an inescapable radiation exposure called "natural background"). Radiation is created and used in medical diagnosis and treatment of injury and disease.

Main Types of Ionizing Radiation

- ✦ **Alpha Particles** consist of heavy, positively-charged particles emitted by atoms of heavy elements (naturally occurring uranium and radium and some human-made sources) that are completely absorbed by the outer dead layer of skin and is therefore not a hazard outside the body (alpha particles taken into the body by inhalation, food or water, can directly expose internal tissues and can be a hazard)
- ✦ **Beta Particles** (positively or negatively charged electrons), emitted from the nucleus during decay, are more penetrating than alpha particles and can sometimes penetrate the skin, but like alpha particles, are generally more hazardous when inhaled or ingested
- ✦ **Gamma** (photons) and **X-rays** are forms of electromagnetic radiations frequently used in medicine because they can easily penetrate the human body. Gamma rays come from the nucleus when materials decay. X-rays result from electron removal or rearrangement in atoms
- ✦ **Neutrons** are heavy, uncharged particles that cause the atoms that they strike to become ionized

Damage from Radiation Exposure

- ✦ **External Exposure** comes from a source outside the body (medical x-ray), harmful if radiation has enough energy to penetrate the body (time, distance and shielding affects radiation dose)
 1. Alpha particles are stopped by paper
 2. Beta particles are stopped by wood or plexiglass
 3. Gamma and X-rays (X) are stopped by lead or concrete
 4. Neutrons are absorbed by hydrogen-rich materials
- ✦ **Internal Exposure** occurs when a radioisotope enters the body by inhalation, ingestion, or through an open wound, directly harming living cells (damage depends on amount, type, physical characteristics of the element, half-life of radioisotope and length of time in the body)

Radiation Dose Effects - Low Exposure

- ✦ Stochastic (random) effects are when the probability of the effect, rather than its severity, increases with radiation dose (radiation-induced cancer and genetic effects) - the probability is higher after an acute exposure (100 rem than for 1 rem), but there will be no difference in the severity of the disease if it occurs

Radiation Dose Effects - High Exposure

- ✦ Deterministic effects occur when the radiation exposure is very high and the predominant biological effect is cell killing resulting in degenerative changes in the exposed tissue (not likely from diagnostic procedures or routine occupational exposure)

Visit www.ehs.ucr.edu for additional information or call EH&S at 827-5528 if you have any questions.