

G. Biological Effects of Radiation

1. Radiation-induced injury is mainly caused by ionization within the tissues of the body. Ionizations and excitations are produced in either biological macromolecules or in the medium in which the cellular organelles are suspended when radiation interacts with a cell.
2. There are two primary exposure types connected with work involving radioactive materials: external and internal exposure to radiation.
3. *External exposure*: Arises when radiation from a source external to the body penetrates the body and causes a radiation dose. These exposures are dependent upon both type and energy of the radioactive material.
 - a. Beta particles: Most do not normally penetrate beyond the skin, but when sufficiently intense, they can cause skin and/or eye damage. Very energetic beta particles, such as those emitted by P-32, can penetrate several millimeters into the skin. Shielding is needed, typically a 3/8 inch thick sheet of Plexiglas, to reduce external radiation exposure.
 - b. Alpha particles: Rarely penetrate the outer dead layer of skin. Alpha particles are capable of traveling only a few inches in air due to higher mass, slower velocity, and greater electrical charge than beta particles.
 - c. Gamma and X-rays: Both types have no mass, are very penetrating, and usually must be shielded.
4. *Internal exposure*: Arises when radiation is emitted from radioactive materials present within the body. Radiation uptake may occur through one of three routes of entry; inhalation, ingestion, and skin contact. Internal exposures can occur from all forms of radiation.
5. Internal exposures are most likely to occur when radioactive material becomes airborne; is inhaled and absorbed by the lungs and deposited in the body; is present in contaminated food, drink, or other consumable products and is digested; is spilled or aerosolizes onto the skin and is absorbed or enters through breaks in the skin; or via contaminated hands, with subsequent eating or rubbing of eyes.