

## Glossary

**accelerator (*particle accelerator*)** - A machine that accelerates charged sub-atomic particles (electrons, protons, deuterons, etc.) to high speed and energy. These high-speed particles are often bombarded upon a suitable target and uncharged high-energy radiation is subsequently produced (neutrons or x-rays).

**ALARA** - An acronym formed from the phrase "As Low as Reasonably Achievable." The phrase refers to a radiation safety principle of keeping radiation doses and releases of radioactive material to the environment as low as can be achieved, based on technologic and economic considerations.

**alpha decay** - Alpha decay is a type of radioactive decay giving rise to the emission of alpha particles, and resulting from instabilities within the nucleus of atoms with high atomic number.

**alpha particle (*alpha ray*)** - A type of radiation emission given off during the decay of some high atomic number radionuclides. The alpha particle is a very densely ionizing radiation composed of a packet of two neutrons and two protons (exactly like the helium nucleus). This type of radiation readily interacts with matter, loses its energy very quickly while traveling through matter, and therefore is not very penetrating. Most alpha particles can be stopped with a thin sheet of paper.

**annual limit on intake (ALI)** - A mathematically derived intake limit for a single radionuclide taken into the body of an adult worker by inhalation or ingestion in a year. This derived limit is based on radionuclide emission characteristics, half life, and assumptions about typical human biology. The ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 0.05 Sv (5 rem) or a committed dose equivalent of 0.5 Sv (50 rem) to any individual organ or tissue. ALI values determined for intake by ingestion or inhalation of selected radionuclides are given in WAC 246-221-290.

**authorized investigator (AUI)** - A principle investigator authorized by the Radiation Safety Office who becomes legally responsible for the handling of radioactive material under their jurisdiction. The Authorized Investigator (AUI) is usually a faculty member or a medical doctor.

**beta decay** - Beta decay is a type of radioactive decay giving rise to the emission of beta particles, and resulting from an unstable proton to neutron ratio within the nucleus of an atom.

**beta particle (*beta ray*)** - A type of radiation emission given off by radionuclides having an unstable neutron to proton ratio. The beta particle is identical to an electron, except it is created within the nucleus of the atom during radioactive decay. A negatively

charged beta particle (negatron) is given off when beta decay results from too many neutrons within the unstable nucleus of an atom. A positively charged beta particle (positron) is given off when beta decay results from too many protons within the unstable nucleus of an atom.

**calibrate** - To check, adjust, or systematically standardize the graduations of a quantitative measuring instrument.

**contamination (*radioactive*)** - Deposition of radioactive material in any place where it is not desired.

**decay (*radioactive*)** - A spontaneous re-arrangement within the nucleons of an atom, converting it into another type of atom and resulting in the emission of radiation.

**dose (*absorbed dose*)** - Radiation dose refers to the concept of absorbed dose, or the amount of ionizing radiation energy absorbed per unit mass of material of interest. The historical unit of absorbed dose is the rad (100 erg/gram), but the SI unit of absorbed dose is the Gray (1 Gy = 1 Joule/Kg). Conversion between SI and traditional units yields 1 Gy = 100 rad.

**dose equivalent** - A concept which attempts to account for the different biological consequences resulting from different types and energies of radiation at the same absorbed dose. To apply this concept, the absorbed dose in gray or rad is multiplied by a quality factor (Q) related to the biological damaging ability of the radiation. A quality factor of 1 is given to x-rays, gamma rays, and beta particles. Alpha particles are given a quality factor of 20, and neutrons of unknown energy are given a quality factor of 10. The resulting units of dose equivalent are the sievert (Sv) in SI units or the rem in historical units.

**dosimeter** - A device that measures and indicates the amount of x-rays or other radiation absorbed.

**dosimetry** - The act of quantifying ionizing radiation under specified conditions.

**exposure** - Often used as a verb indicating being subjected to ionizing radiation or radioactive material. When used as a noun, exposure is the quotient of the absolute value of the total charge of ions of one sign produced in air when all the electrons liberated by photons in a given volume element of air are completely stopped in air. The special unit of exposure is the Roentgen (R). One Roentgen is equal to  $2.58 \times 10^{-4}$  Coulomb per kilogram of air. The SI unit of exposure is the Coulomb per kilogram.

**fluoroscopy** - A diagnostic x-ray procedure, which produces a "real-time" image. To produce this image, the x-ray equipment is energized continuously or in regularly timed pulses and the image is projected onto a fluorescent screen or the image is electronically manipulated for viewing on a television monitor.

**gamma (*gamma ray*)** - A high energy electromagnetic radiation emitted from the nucleus of an atom, resulting from release of residual energy after an atom undergoes a primary mode of radioactive decay (beta decay, alpha decay, or fission).

**gamma counter** - A radiation detection device that counts flashes of luminescence resulting from interactions of ionizing radiation with solid detection medium. This detection medium (scintillant) is often a specially grown transparent crystal. In addition to the detection medium, the gamma scintillation counter contains a light amplification device and electronics to convert light signals to electronic pulses. The pulses are registered on a counter or averaged over time on a ratemeter

**Geiger-Mueller counter (*Geiger Counter, G-M Counter*)** - A Geiger-Mueller counter is a radiation detection device useful for several types of radiations. The device contains a G-M tube, which produces a voltage pulse whenever an ionizing radiation event interacts with gasses in the sensitive volume of the tube. The total number of pulses are registered on a counter or averaged over time on a ratemeter.

**liquid scintillation counting (*LSC*)** - A radiation detection device that counts flashes of luminescence resulting from interactions of ionizing radiation with a liquid scintillation fluid medium (“liquid scintillation cocktail”). The radionuclides being measured are immersed in an intimate mixture with the LSC fluid. In addition to the detection medium, the liquid scintillation counter contains a light amplification device and electronics to convert light signals to electronic pulses. Liquid scintillation counters are particularly suitable for detecting low energy beta emitters that have very short range in matter.

**radiation** - Generic term meaning matter (particulate radiation) or energy (electromagnetic radiation) moving outward from a source of origin. Often used to mean ionizing radiation, or high-energy radiation capable of removing electrons from atoms.

**radioactive material** - A substance that contains one or more radionuclides, and which emits one or more types of radiation (alpha, beta, gamma, etc.).

**radionuclide** - An atom having a combination of neutrons and protons which cause the nucleus to be unstable.

**Roentgen** - A unit of exposure or ionization produced in a given volume of air by photons. One Roentgen is equal to  $2.58 \times 10^{-4}$  Coulomb per kilogram of air.

**scintillation counter** - A radiation detection device that counts flashes of luminescence resulting from interactions of ionizing radiation with various media. In addition to the detection medium, the scintillation counter contains a light amplification device and electronics to convert light signals to electronic pulses. The pulses are registered on a counter or averaged over time on a ratemeter. Also, see “gamma scintillation counters” and “liquid scintillation counters.”

**SI units** - The International System of Units (Le Systeme International d'Unites), which is an international unification of rules for units of measurement in the metric system.

**x-rays** - Ionizing electromagnetic radiation produced by: 1) the movement of electrons from higher to lower energy levels within the electron shells of an atom, or 2) from the loss of energy when high speed electrons are deflected by interactions with the atomic nucleus.