

## RADIATION SAFETY: Definitions And Conversion Factors

**$\alpha$**  - alpha particle; energetic, double-charged helium nucleus ( ${}^4\text{He}^{2+}$ ) emitted by very heavy radioactive elements (e.g., uranium). Easily stopped by the dead layer of skin or a sheet of paper. Internal hazard only.

**$\beta$**  - beta particle; energetic, single-charged electron emitted by some radioactive nuclei. More penetrating than an  $\alpha$  particle. Can penetrate to living layer of skin. Internal and skin hazard.

**$\gamma$**  - gamma radiation; energetic photon (i.e., electromagnetic radiation) originating from an atom's nucleus. Very penetrating. Whole body exposure hazard.

**X-ray** - energetic photon originating outside the nucleus of an atom, otherwise same as a  $\gamma$ -ray.

**Absorbed Dose (D)** - energy imparted by ionizing radiation per unit mass of irradiated material; [units: rad and gray (Gy)]

**Activity** - rate of disintegration or decay of radioactive material; [units: Curie and Becquerel]

**Agreement State** - an agreement between a state and the NRC where the state takes over the responsibility of regulating by-product radioactive materials. Ohio is an Agreement State.

**ALARA** (As Low As Reasonably Achievable) - to make every reasonable effort to keep radiation doses as far below the dose limits as is practical, taking into account the state of technology, health and safety benefits, and economic considerations.

**Annual Limit on Intake (ALI)** - The regulatory limit for radioactive material taken into the body by a user in one year.

**AU** - Authorized User of radioactive materials.

**Background Radiation** - radiation from cosmic sources (mostly high energy protons), naturally occurring radioactive materials (e.g.,  ${}^{14}\text{C}$ ,  ${}^{40}\text{K}$ , Ra, Rn), and residual fallout (e.g.,  ${}^{90}\text{Sr}$ ). The average background in the Dayton area is about 300 mrem per year.

**Becquerel (Bq)** - unit of activity; one Bq = one disintegration per second (1 dps)

**Bioassay** - determination of activity in the human body

**CPM** (counts per minute) - radiation detector response not corrected for efficiency or background radiation.

**Curie (Ci)** - historical unit of activity; one Ci =  $3.7 \times 10^{10}$  dps =  $3.7 \times 10^{10}$  Bq

**mCi** (millicurie) - one thousandth ( $10^{-3}$ ) of a curie; one mCi =  $2.2 \times 10^9$  dpm =  $3.7 \times 10^7$  Bq

**$\mu\text{Ci}$**  (microcurie) - one millionth ( $10^{-6}$ ) of a curie; one  $\mu\text{Ci}$  =  $2.2 \times 10^6$  dpm =  $3.7 \times 10^4$  Bq

**Declared Pregnant Woman** - a woman who voluntarily informs her supervisor, in writing, of her pregnancy and estimated date of conception. The administrative action level for exposure review is reduced from 50 mrem to 20 mrem per month. Women are not required to declare their pregnancy. The lower dose only applies to declared pregnant women.

**Dose** - generic term implying absorbed dose or dose equivalent

**Dose Equivalent (H)** - biologically effective dose defined as absorbed dose (D) times a quality factor (Q) for the type of radiation { $H = DQ$ }, where  $Q = 1$  for beta particles, gamma rays, and x-rays; [units: rem and Sievert]

**Total Effective Dose Equivalent (TEDE)** - sum of exposure from internal (CDE) and external (DDE) sources.

**Deep Dose Equivalent (DDE)** - External whole body exposure measured at a tissue depth of 1 cm. [formerly referred to as whole body dose]

**Committed Effective Dose Equivalent (CEDE)** - Internal dose to organs or tissues from an intake of radionuclides.

**Shallow Dose Equivalent (SDE)** - external exposure to the skin or extremity measure at a tissue depth of 0.007 cm. [formerly referred to as skin dose]

**Eye Dose Equivalent (LDE)** - external exposure to the lens of the eye.

**DPM** (disintegrations per minute) - unit of activity; CPM corrected for detector efficiency and background count rate.

**DPS** - disintegrations per seconds

**Electron Volt (eV)** - unit of energy for the atomic scale; the amount of energy given to an electron that is accelerated by a potential difference of one volt; one eV =  $1.6 \times 10^{-19}$  Joules.

**keV** - one thousand electron volts; one keV =  $1.6 \times 10^{-16}$  J

**MeV** - one million electron volts; one MeV =  $1.6 \times 10^{-13}$  J

**Exposure** - amount of ionization produced by x or  $\gamma$  rays in air. [unit: roentgen or C/kg] or the general concept of being in the presence of a radiation field.

**FC** - facility coordinator (for radiation-producing devices)

**FO** - facility (RPD) operator

**FU** - faculty user (for radiation-producing devices)

**Gray (Gy)** - unit of absorbed dose; one Gy = 1 Joule/kilogram (J/kg) = 100 rad = 1000 mGy

**Half-Life** - the time required for the number of radioactive atoms (or activity) to decrease by one half.

**IU** - individual user for radioactive materials.

**Lockout/Tagout** - actions required by OSHA to prevent unexpected energizing or start up of a RPD or a component, or release of stored energy while maintenance or repair is being performed.

**MO** - medical RPD operator

**OAC** - Ohio Administrative Code

**OBRP** - Ohio Bureau of Radiological Protection, a section of the Ohio Department of Health (ODH) that regulates radioactive material and radiation-producing devices.

**ODH** – Ohio Department of Health

**OSLD** (Optically stimulated luminescent dosimeter) - device for measuring radiation exposure.

Consists of a crystalline material that emits light when stimulated by a laser. The amount of light is proportional to the level of radiation exposure.

**Rad** - unit of absorbed dose; one rad = 100 ergs/gram = 0.01 Gy

**Radioactivity** - The spontaneous emission of particulate (e.g.,  $\alpha$  or  $\beta$  particles) or electromagnetic (e.g.,  $\gamma$  rays) radiation from the nucleus of an unstable isotope. The emission of a particle or gamma ray releases energy placing the atom in a stable (or more stable) state.

**Rem** - unit of dose equivalent; one rem = 0.01 Joule/kilogram (J/kg) = 0.01 Sv = 1000 mrem

**RM** - radioactive material

**Roentgen (R)** - unit of exposure; most survey meters read in mR/hr;  
one R =  $2.58 \times 10^{-4}$  coulombs/kilogram (C/kg)

**RPD** - radiation-producing device; also called radiation-generating equipment (RGE) or radiation device.

**RSC** - Radiation Safety Committee

**RSO** - Radiation Safety Officer

**Sievert (Sv)** - unit of dose equivalent; one Sv = 100 rem

**Source of Radiation** - radioactive material licensed by ODH or radiation device registered by ODH

**SU** - supervised user

**Swipe** - survey for removable contamination of radioactive material; also called “wipe” or “smear”

**TLD** (thermoluminescent dosimeter) - device for measuring radiation exposure. Consists of a crystalline material that emits light when heated. The amount of light is proportional to the level of radiation exposure.

**VU** - visitor user for radioactive material.