

Appendix A: Glossary

Absorbed Dose: The energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the Gray (Gy).

Activity: The number of nuclear transformations occurring per unit time in a given quantity of material. The unit is the Curie (Ci).

Adult: An individual 18 or more years of age.

Alpha Particle: A strongly ionizing particle emitted from the nucleus during radioactive decay consisting of 2 protons and 2 neutrons with a double positive charge.

Annual Limit of Intake (ALI): The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. 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 5 rem (0.05 Sv) (Stochastic ALI or SALI) or a committed dose equivalent of 50 rem (0.5 Sv) (Non-Stochastic ALI or NALI) to any individual organ or tissue.

Attenuation: The process by which a beam of radiation is reduced in intensity when passing through some material. It is the combination of absorption and scattering processes.

Background Radiation: Radiation arising from sources other than the one under consideration. Background radiation, due to cosmic ray and natural radioactivity, is always present. There may also be background radiation due to the presence of radionuclide substances in other parts of the building, in the building material itself, etc.

Becquerel (Bq): Amount of activity equal to one nuclear disintegration per second.
(Note: 1 Bq=2.7 E-11 Ci)

Beta Particle: Charged particle emitted from the nucleus of an atom, having a mass and charge equal in magnitude to that of an electron.

Biological Half-life: The time required for the body to eliminate one-half of the administered dose of any substance by regular processes of elimination. This time is approximately the same for both stable and radioactive isotopes of a particular element.

Committed Dose Equivalent (CDE): The dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

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Committed Effective Dose Equivalent (CEDE): The weighted sum of the doses from internal exposures to all organs and tissues of the body over the 50 years after an intake of radioactive material into the body (measured by, for example, thyroid counting or urine radiochemistry).

Contamination: Radioactive material in undesirable location. Two types:

1. Fixed - not readily removed
2. Removable - that which can be easily removed

Count: The external indication of a device designed to enumerate ionizing events. It may refer to a single detected event or to the total registered in a given period of time.

Cumulative Dose: The total dose resulting from repeated exposures to radiation to the same region or the whole body.

Curie: The amount of activity, equal to $3.7 \text{ E}+10$ disintegrations per second (dps) ($2.22 \text{ E}+12$ dpm). (Note: 1 Curie = $3.7 \text{ E}+10$ Bq)

Cutie Pie: A radiation survey meter of the ion chamber type used to determine exposure rate.

Decay: Transformation of the nucleus of an unstable nuclide by the spontaneous emission of particles and/or photons.

Decontamination: Removal of radioactive contamination from where it is deposited. Soap and water is a good decontamination agent.

Deep Dose Equivalent (DDE): The dose from external exposure due to penetrating gamma, x-ray and/or neutron radiation (measured by, for example, the heavily shielded area of a film or TLD whole body dosimeter).

Detector: Material or device that is sensitive to radiation and can produce a signal suitable for measurement or analysis.

Dose or Radiation Dose: A generic term that could mean absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, or total effective dose equivalent.

Dose Equivalent: A quantity used in radiation protection expressing all radiation on a common scale for calculating the effective absorbed dose. The unit of dose equivalent is the rem, which is numerically equal to the absorbed dose in rads multiplied by the quality factor (# rems = rads x QF).

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Dose Rate: Radiation dose received per unit time.

Dosimeter: Instrument used to detect and measure an accumulated dose of radiation.

Effective Dose Equivalent (EDE): The sum of the products of the dose equivalent to the organ or tissue and weighting factors applicable to each of the body organs or tissues that are irradiated.

Effective Half-Life: Time required for a radioactive nuclide in a system to be diminished 50 percent as a result of the combined action of radioactive decay and biological elimination.

Efficiency: A measure of the probability that a count will be recorded when radiation is incident on a detector.

Exposure: A measure of the ionization produced in air by x or gamma radiation.

External Radiation: Radiation from a source outside the body, penetrating the skin.

Eye Dose Equivalent or Lens Dose Equivalent (LDE): Applies to the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 cm.

Film Badge: A pack of photographic film used for approximate measurement of radiation exposure for personnel monitoring purposes. The badge contains an array of filtering media that can be used to discriminate certain types of radiation.

Gamma Ray: Penetrating electromagnetic radiation of nuclear origin. Except for origin, gamma rays are identical to X-rays.

Geiger-Mueller (GM) Counter: Multipurpose instrument with a sensitive detector and associated circuitry used for radiation detection and measurement.

Gray (Gy): Unit of absorbed dose equal to 1 Joule/kg of any material.

Half-Life: The length of time required for half of the radioactive atoms present to decay.

Health Physics: That branch of radiological science dealing with the protection of personnel from harmful effects of ionizing radiation.

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Human Use: Internal or external administration of radioactive materials or ionizing radiation to human beings.

Internal Radiation: Radiation from a source within the body (as a result of deposition of radionuclides in the body tissues.)

Ionization: The process by which a neutral atom or molecule acquires either a positive or a negative charge.

Ionization Chamber (Ion Chamber): An instrument designed to determine the quantity of ionizing radiation by measuring the electric charge produced within a defined volume.

Ionizing Radiation: Radiation that interacts with matter to form ion pairs.

Isotopes: Nuclides having the same number of protons in their nuclei, and hence the same atomic number and chemical symbol, but differing in the numbers of neutrons, and therefore in the mass number.

Labeled Compound: A compound consisting of molecules which have one or more constituent radioactive atoms. Used to follow physical, chemical or biological processes.

Maximum Permissible Dose: Maximum dose of radiation that may be received by persons working with ionizing radiation.

Milliroentgen: A submultiple of the Roentgen equal to 1 one-thousandth (1/1000th) of a Roentgen. (See Roentgen)

Monitoring, Radiological: Periodic or continuous determination of the amount of ionizing radiation or radioactive contamination present in an occupied region as a safety measure for purposes of health protection.

Monitoring - Area: Routine monitoring of the level of radiation or of radioactive contamination of any particular area, building, room or equipment.

Monitoring - Personnel: Monitoring any part of an individual, his breath, excretions, or any part of his clothing. (See Radiological Survey)

Non-ionizing Radiation: Radiation that does not form ions when interacting with matter (i.e., microwaves, heat, light (lasers), ultraviolet, infrared).

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Nuclide: A species of atom characterized by the constituents of its nucleus (e.g. the number of neutrons and protons) capable of existing for a measurable length of time.

Photon: A quantity of electromagnetic energy (E) whose value in joules is the product of its frequency (ν) in hertz and Planck's constant (h). The equation is: $E = h\nu$.

Quality Factor: The linear-energy-transfer-dependent factor by which absorbed doses are multiplied to obtain (for radiation protection purposes) a quantity that expresses, on a common scale for all ionizing radiations, the effectiveness of the absorbed dose.

Rad: The unit of absorbed dose and equal to 100 ergs/gram of any material or 0.01 Joules/Kg.

Radiation: 1. The emission and propagation of energy through space or through a keep in medium in the form of waves, for instance, the emission and propagation of electromagnetic waves, or of sound and elastic waves. 2. The energy propagated through a keep in medium as waves, for example, energy in the form of electromagnetic waves. The term *radiation* or *radiant energy*, when unqualified, usually refers to electromagnetic radiation. Such radiation commonly is classified according to frequency as Hertzian, infrared, visible (light), ultraviolet, X-ray, and gamma ray. 3. By extension, corpuscular emissions, such as alpha and beta radiation, or rays of mixed or unknown type, as cosmic radiation.

Radioactivity: The spontaneous transformation of nuclei from a higher energy state to a lower energy state (can be thought of as a transformation from an unfavorable neutron to proton ratio to a more favorable one).

Radioisotope: The unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. A radioactive isotope.

Radiological Survey: Evaluation of the radiation hazards incident to the production, use or existence of radioactive materials or other sources of radiation under a specific set of conditions. Such evaluations customarily include a physical survey of the disposition of materials and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes using or affecting these materials to predict hazards resulting from expected or possible changes in materials or equipment.

Radionuclide: An unstable nuclide, one that decays or disintegrates spontaneously.

Radiotoxicity: Term referring to the potential of an isotope to cause damage to living tissue by absorption of energy from the disintegration of the radioactive material introduced into the body.

Rem: The special unit of dose equivalent. The dose equivalent in rems is numerically equal to the absorbed dose in rads multiplied by the quality factor.

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Restricted Area: Any area for which access is controlled by the licensee or registrant for purposes of protection of individuals from exposure to radiation and radioactive material. *Restricted area* shall not include any areas used for residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area.

Roentgen: The special unit of exposure equal to $2.58 \text{ E-}04$ coulombs/Kg of air.

Scattered Radiation: Radiation that during passage through matter has been deviated in direction.

Scintillation Counter: A counter in which light flashes produced in a scintillator by ionizing radiation are converted into electrical pulses by a photomultiplier tube.

Shallow Dose Equivalent (SDE): Applies to the external exposure of the skin or an extremity, is taken as the dose equivalent at a tissue depth of 0.007 cm averaged over an area of 1 cm^2 .

Shielding Material: Any material which is used to absorb radiation and thus effectively reduce the intensity of radiation, and in some cases eliminate it. Lead, concrete, aluminum, water, and plastic are examples of commonly used shielding material.

Sievert (Sv): Unit of dose equivalent numerically equal to the absorbed dose in Grays multiplied by the quality factor (# of Sieverts = # of Grays x QF).

Smear: A procedure in which a wipe, e.g., a circle of filter paper, is rubbed on a surface and its radioactivity measured to determine if the surface is contaminated with removable radioactive material.

Specific Activity: Total radioactivity of a given nuclide per gram of a compound, element, or radioactive nuclide.

Survey Meter: A hand held portable radiation detection instrument designed for surveying or monitoring an area for the presence of radioactive material or radiation.

Thermoluminescent Dosimeter (TLD): A dosimeter made of certain crystalline material which is capable of both storing a fraction of absorbed ionizing radiation and releasing this energy in the form of visible light when heated. The amount of light released can be used as a measure of radiation exposure to these crystals.

Total Effective Dose Equivalent (TEDE): The sum of the deep dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

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Total Organ Dose Equivalent (TODE): The sum of the deep dose equivalent (for external exposures) and the committed dose equivalent to the specified organ or tissue (for internal exposure).

Unrestricted Area: Any area for which access is not controlled by the licensee or registrant for purposes of protection of individuals from exposure to radiation and radioactive material, and any area used for residential quarters.

Wipe Test: Refer to SMEAR

X-rays: Penetrating electromagnetic radiations having wave lengths shorter than those of visible light. They are usually produced by bombarding a metallic target with fast electrons in a high vacuum. In nuclear reactions it is customary to refer to photons originating in the nucleus as gamma rays, and those originating in the extranuclear part of the atom as X-rays.

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