

APPENDIX A

GLOSSARY

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Absorbed Fraction (AF) – The fraction of energy emitted as a specified radiation, R, in a specified source tissue, S, which is absorbed in a specified target tissue, T. [AF (T←S)R]

Accuracy – The comparison of a measurement to the true value of a parameter. It is a function of both bias and precision.

Activity Median Aerodynamic Diameter (AMAD) - The diameter in an aerodynamic particle size distribution for which the total activity above and below this size are equal. A log-normal distribution of particle sizes is assumed.

Activity Median Thermodynamic Diameter (AMTD)– The particle Diameter, D_{tn} (thermodynamically classified) for which 50 percent of the total airborne activity, is associated with particles of thermodynamic diameter is greater than the AMTD.

Aerodynamic Diameter (d_{ae}) – The diameter (μm) of a unit density (1 g cm^{-3}) sphere that has the same terminal settling velocity in air as the particle of interest. Same as AED.

Aerodynamic Equivalent Diameter (AED) - The diameter of a sphere, in μm , of unit density (1 g cm^{-3}) that has the same terminal settling velocity in air as the particle of interest (a $1 \mu\text{m}$ AED particle has 1000 times the volume of a $0.1 \mu\text{m}$ AED particle).

Aerosol – A suspension of fine solid or liquid particles in a gaseous medium.

Airborne Concentration – The activity of particulate matter or material in a unit volume of aerosol, usually expressed in $\mu\text{Ci cm}^{-3}$, $\mu\text{Ci mL}^{-1}$ or $\mu\text{Ci m}^{-3}$.

Annual Limit on Intake (ALI) – The activity in μCi of a radionuclide which taken alone would irradiate a person represented by reference man, to a limit established by a regulatory agency for each year of occupational exposure.

Becquerel (Bq) – the International System of Units adopted unit for radioactivity. One Bq is equal to a radioactivity of 1 nuclear transformation per second (ntps).

Biokinetic Model – A set of mathematical relationships formulated to relate the intake of a material to the uptake, distribution, and retention of the material or radionuclide in various organs and tissues of the body. Some models include subsequent excretion from the body by various pathways.

Breathing Zone – The region adjacent to a worker's nose and mouth from which air is drawn into the lungs while he/she performs the assigned work.

CINDY – Code for Internal Dosimetry is a computer program that addresses the radiation protection aspects of Department of Energy orders and Nuclear Regulatory Commission regulations by implementing the approach described in ICRP Publication 30.

Class – The lung or inhalation classification scheme, developed in ICRP Publication 30, for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D (days) of less than 10 days; for Class W (weeks) from 10 days to 100 days; and Class Y (years) of greater than 100 days.

Clearance Pathway – The route by which material that is deposited in the lungs can move into the blood, lymph nodes or bronchi.

Committed Dose Equivalent (CDE) ($H_{T,50}$) – The dose equivalent to organs or tissues (targets) of reference (T) that will be received from an intake of radioactive material by an individual during the 50 year period following the intake.

Committed Effective Dose Equivalent (CEDE) ($H_{E,50}$) – The sum of the products of the tissue weighting factor and the radiation weighting factor or quality factor applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues. [$H_{E,50} = \sum w_t (H_{t,50})$].

Curie (Ci) – A unit of radioactivity. One Ci is equal to that quantity of radioactive material in which there are 3.7×10^{10} nuclear transformations per second (ntps) or 3.7×10^{10} Becquerels (Bq). One microcurie (1 μ Ci) is equal to 3.7×10^4 ntps or one-millionth part of a Ci.

Derived Air Concentration (DAC) – The concentration of a radionuclide in air, which breathed or inhaled alone for 1 work yr (2000 hrs) would irradiate reference man to the radiation safety limit for occupational exposure. The DAC equals the ALI of the radionuclide divided by the volume of air inhaled by reference man in a working year (i.e., 2.4×10^3 m³).

Detriment – The identification and where possible the quantification of all the deleterious effects of exposure to ionizing radiation. Total detriment is the sum of the contributions due to fatal cancers, non-fatal cancers, and severe hereditary disorders weighted for life lost.

Disintegrations per Minute (dpm) – A rate of spontaneous emission of particles and energy from the unstable nucleus of an atom. The curie is a unit of activity quantifying this process of radioactive decay.

Dose Assessment – The process of assessing/estimating the radiological dose and associated uncertainty based on best available information. Included in this dose estimate, through use of exposure scenarios, source term data, bioassay results, monitoring or radiological survey data, and pathway analysis.

Effective Half-Life – The time required for the amount of a contaminant deposited in a living organism to be diminished to 50 percent as a result of the combined action of radioactive decay and biological elimination.

Elimination – The removal of material from the body via urine, feces, sweat or exhalation. Excretion usually refers to elimination via urine or feces.

Equilibrium, Radioactive – The state that prevails in radioactive series when the ratios between the activities of two or more successive members of the series remains constant.

Equivalent Diameter – The diameter of the sphere that would have the same value of a particular physical property as that of the irregular particle.

Exposure – The act of being exposed to a contaminant.

Exposure Assessment – The process of assessing/estimating the exposure to a contaminant and associated uncertainty, based on best available information. Included in this exposure estimate, through use of exposure scenarios, source term data, bioassay results, monitoring data, and pathway analysis.

Extrathoracic Fraction – The mass fraction of the inhaled particles which do not or fail to penetrate beyond the larynx.

Geometric Standard Deviation – For a log-normal distribution, the exponential of the standard deviation of the associated normal distribution (always ≥ 1).

Inhalability – The ratio of the number concentration of particles with a particular diameter inspired through the nose or mouth to the number concentration of particles with the same aerodynamic diameter present in the inspired volume of ambient air.

Inhalable Fraction – The mass fraction of the total airborne particles which are inhaled through the nose and mouth.

Intake – The total amount of material that enters the body through the principal exposure routes of inhalation, ingestion, or skin wounds.

Log-Normal Distribution – A distribution in which the logarithms of a variable (such as particle size) is normally distributed.

Lower Limit of Detection (LLD) – The smallest amount of mass or radioactivity that yields a statistically significant net result above the laboratory method background.

LUDEP – Lung Dose Evaluation Program is a computer program developed by the National Radiological Protection Board of the United Kingdom that implements the Respiratory Tract Model recommended by the ICRP's Task Group on Lung Dynamics as adopted in 1993 and published in ICRP Publication 66.

Mass Concentration – The mass of particulate matter or material in a unit volume of aerosol, usually expressed in $\mu\text{g m}^{-3}$, mg m^{-3} , or g m^{-3} .

Mass Median Aerodynamic Diameter (MMAD) – The aerodynamic diameter of a particle having a median mass i.e., the masses of particles above and below this diameter are equal.

Maximum Permissible Concentration (MPC) – A concentration for a radionuclide (established in ICRP-2) in air or water set to keep dose to the critical organ from exceeding the annual limit. The annual limit applied over an intake period of 50 years.

Maximum Permissible Body Burden (MPBB) – A limit associated with Maximum Permissible Concentration that was the amount of material in the body that would not cause an organ dose to exceed the annual limit to the critical organ.

Metabolic Model – A mathematical description of the behavior of inhaled or ingested radionuclides in the metabolic process of cells, tissues, organs and organisms (humans). It is most frequently used to describe its distribution among tissues/organs and elimination/excretion.

Micrometer (μm) – A unit of measure. One micrometer ($1 \mu\text{m}$) is one millionth of a meter ($1 \times 10^{-6} \text{ m}$).

Non-Stochastic Effects – Those effects for which the severity of the effect varies with the dose received and for which a threshold may exist. The following are examples of non-stochastic somatic effects that are specific to particular tissues; cell depletion in the bone marrow causing hematological deficiencies, and gonadal cell damage leading to impairment of fertility. For these changes to occur, the severity of the effect depends on the magnitude of the dose received, and there is a threshold of dose below which no detrimental effects are observed.

Parent – A radionuclide that, on nuclear transformation (disintegration), forms a specified nuclide either directly or as a later member of a radioactive series.

Particle Density – The mass of the particle itself per unit volume, usually expressed in g cm^{-3} , mg m^{-3} .

Particle Dissolution Rate – The rate at which the change of a particle from a solid to a liquid form takes place.

Particle Transport – The process that clear material from the respiratory tract to the gastrointestinal tract and to the lymph nodes, and move material from one part of the respiratory tract to another.

Precision – The repeatability or reproducibility of a measurement. Precise results have small random errors.

Progeny – The decay product or products resulting after a radioactive decay or a series of radioactive decays of the parent radionuclide. The progeny can also be radioactive, and the decay chain will continue until a stable nuclide is formed.

Rad - The special unit of absorbed dose. One rad is equivalent to an absorbed dose of 0.01 J kg^{-1} or 0.01 Gray (Gy).

Reference Man – A male individual between 20 to 30 years of age weighting 154 pounds (70 kg) is 5.6 feet (1.7 m) in height, and lives in a climate with an average temperature of 50°F to 68 F (10°C to 20°C). He is a Caucasian and is a Western European or North American in habitat and custom (ICRP Publication No. 23; updated by ICRP Publication No. 66 and ICRP Publication No. 70).

Rem - The special unit of any of the radiation quantities expressed as dose equivalent. The dose equivalent in rem is equal to the absorbed dose in rad multiplied by the quality factor or radiation weighting factor. One rem equals 0.01 sievert (Sv). (1 millirem (mrem) is 1/1000 of a rem.)

Respirable Fraction (RF) – The mass fraction of the inhaled particles which penetrate to the unciliated airways of the respiratory tract.

Respiratory Tract Clearance – The removal of material from the respiratory tract by particle transport and by absorption into blood.

Respiratory Tract Deposition – The initial process determining how much of the material in the inspired air that remains in the lungs after exhalation. Deposition of material may occur during both inspiration and inhalation.

Respiratory Tract (Lung) Model – The model that describes the behavior of particles in the respiratory tract of man. This model was developed by the ICRP's task group on lung dynamics and published in ICRP Publication 30. This model is used in the CINDY program; however, LUDEP (an alternate computer program also used) uses the ICRP's new lung model published in ICRP Publication 66.

Resuspension - The transport of particles from surfaces (inside and environmental) back into the atmosphere.

Risk – The characterization of a situation or action wherein two or more outcomes are possible, the particular outcome that will occur is unknown, and at least one of the possibilities is

undesired. Risk is also the sum of the possible alternative numbers of injuries or fatalities weighted by their probabilities.

Sensitivity Analysis – The sensitivity of the model prediction to selected perturbation of model parameters.

Solubility - The ability of a substance to form a solution with another substance. Normally lung or tissue fluid is considered the fluid of choice.

Source Tissue – Tissue (may be a body organ) that contains a significant amount of a radionuclide following an intake of that radionuclide into the body.

Specific Absorbed Fraction – The fraction of energy that is emitted as a specified radiation type (alpha, beta, electron or photons) in a source organ/tissue that is absorbed in 1 g of a target organ/tissue.

Stochastic Effect – Those effects for which the probability of an effect occurring, rather than its severity, is regarded as a function of dose. Both hereditary effects and carcinogenesis are stochastic effects.

Target Tissue – Tissue (which may be a body organ) in which radiation is absorbed.

Thoracic Fraction – The mass fraction of the inhaled particles which penetrate beyond the larynx.

Tracheobronchial Fraction – The mass fraction of the inhaled particles which penetrate beyond the larynx, but which do not or fail to penetrate to the unciliated airways of the respiratory tract.

Transfer Compartment – The compartment introduced (for mathematical convenience) into the biokinetic model to account for the translocation of radioactive material through the body fluids from where they are deposited in tissues or excreted.

Translocation – The movement of material, that has been deposited respiratory tract, by dissolution and absorption into the blood.

Transportable Half-Time – The amount of time for half of the contaminant to be transferred to a transfer compartment.

Transuranic (TRU) – An element with an atomic number greater than that of uranium. Neptunium has an atomic number of 93 and plutonium has an atomic number of 94.

Uncertainty Analysis – The analysis of the uncertainty in model prediction. The production of a Probability Density Function (PDF) that describes the confidence with which it can be claimed that some characteristic of risk (probability, severity, episodic frequency, or total number of effects) lies between two values.

Uptake – That quantity of material that is taken up or enters the body from the location of intake. The routes of entry into the body are from the respiratory tract, gastrointestinal tract, absorption through the intact skin, injection, or via a wound.

Weighting Factors –

- **Organ or tissue weighting factor (w_t)** – The multiplication factor by which the committed dose equivalent (CDE) in an organ/tissue is multiplied to yield the Committed Effective Dose Equivalent (CEDE). This factor represents the relative contribution of that organ or tissue to

the total detriment due to these effects resulting from uniformed irradiation of the whole body. (The w_t values are those given in ICRP Publication No. 26 for CINDY assessments and in ICRP Publication 60 for LUDEP assessments.)

- Radiation Weighting Factor (w_R) – A factor [quality factor (Q)] which is dependent on the type and energy of the radiation and is independent of the exposed organ/tissue. As used in the calculation the average quality factor is used for both external and internal radiation. (The Q values are those given in ICRP No. 26.)
- Least Squares Regression Weighting Factor (w_i) – A factor that determines the relative significance of the i^{th} data point in a least squares regression analysis. The factor is generally user selected to represent a measure of the confidence or estimated error of the data point.