

Appendix 4 Glossary

A

Absorbed dose - **a.** 1. The energy imparted to a unit mass of matter by ionizing radiation. The unit of absorbed dose is the rad. One rad equals 100 ergs per gram. 2. The amount of a substance absorbed into the body, usually per unit of time. The most common unit of dose is mg per kg body weight per day (mg/kg_day). **b.** Energy absorbed by matter from ionizing radiation per unit mass of irradiated material at the place of interest in that material. The absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 gray). **c.** The energy imparted to a unit mass of matter by ionizing radiation. The unit of absorbed dose is the rad or gray. One rad equals 100 ergs per gram. The amount of a substance absorbed into the body, usually per unit of time. The most common unit of dose is mg per kg body weight per day (mg/kg_day). **d.** The amount of a substance penetrating across an absorption barrier (the exchange boundaries) of an organism, via either physical or biological processes. Sometimes called internal dose. **e.** In exposure assessment, the amount of a substance that penetrates an exposed organism's absorption barriers (e.g., skin, lung tissue, gastrointestinal tract) through physical or biological processes. The term is synonymous with internal dose. **f.** The amount of pesticide entering systemic circulation after crossing a specific absorption barrier (e.g., the exchange boundary of the skin, lung, or digestive tract); normally expressed as mass per unit body weight per unit time (e.g., mg/kg/day). Internal dose is a more general term denoting the amount absorbed with respect to specific absorption barriers or exchange boundaries **g.** Dose resulting from the agent crossing the contact boundary and diffusing through a resisting boundary layer

Absorption - **a.** The process of taking in, as when a sponge takes up water. Chemicals can be absorbed through the skin into the bloodstream and then transported to other organs. Chemicals can also be absorbed into the bloodstream after breathing or swallowing. **b.** The penetration of a substance through a barrier (e.g., the skin, gut, or lungs). **c.** 1. The penetration of one substance into or through another. 2. Specifically, the penetration of a substance into the body from the skin, lungs, or digestive tract. **d.** The taking in of water and dissolved minerals and nutrients across cell membranes. Contrast with ingestion. **e.** A mode of entry of a toxic substance into the body in which the substance enters through the unbroken skin. **f.** The process by which a substance is transported across the skin permeability surface barrier and taken up into the living tissue of the body; generally synonymous with percutaneous absorption and with dermal uptake. **g.** The uptake of water, other fluids, or dissolved chemicals by a cell or an organism (as tree roots absorb dissolved nutrients in soil.)

Absorption barrier - **a.** Any of the exchange barriers of the body that allow differential diffusion of various substances across a boundary. Examples of

absorption barriers are the skin, lung tissue, and gastrointestinal tract wall. **b.** Any of the exchange sites of the body that permit uptake of various substances at different rates (e.g., skin, lung tissue, and gastrointestinal tract wall)

Absorption of radiation - The uptake of radiation by a solid body, liquid or gas. The absorbed energy may be transferred or reemitted.

Accumulation - Repeated doses of a chemical may result in its concentration in an organism, organ or tissue increasing progressively and the toxic effects may become more marked with successive doses. Factors involved in accumulation include selective binding of the chemical to tissue molecules, concentration of fat soluble chemicals in body fat, absent or slow metabolism, and slow excretion. Accumulation is a mass balance effect where input exceeds output.

Aerosol - **a.** Particles of solid or liquid matter that can remain suspended in air from a few minutes to many months depending on the particle size and weight. **b.** This is a very broad term applied to any suspension of solid or liquid particles in a gas. Particle diameters may range from about 0.001 micrometres to about 100 micrometres. Mass concentrations may range from 10^{-9} to 10 grams per cubic metre of gas. **c.** A suspension of liquid or solid particles in air. **d.** A suspension of microscopic solid or liquid particles in air. **e.** System in which the dispersion medium is a gas and the dispersed phase (composed of solid particles or liquid droplet) does not settle out under the influence of gravity. **f.** 1. Small droplets or particles suspended in the atmosphere, typically containing sulfur. They are usually emitted naturally (e.g., in volcanic eruptions) and as the result of anthropogenic (human) activities such as burning fossil fuels. 2. The pressurized gas used to propel substances out of a container. 3. A finely divided material suspended in air or other gaseous environment. **g.** [aerosols] Particles of matter, solid or liquid, larger than a molecule but small enough to remain suspended in the atmosphere. Natural sources include salt particles from sea spray and clay particles as a result of weathering of rocks, both of which are carried upward by the wind. Aerosols can also originate as a result of human activities and in this case are often considered pollutants.

Aerosol particles - One of the components of an atmospheric air parcel, comprised of minute solids particles part of which is almost certainly water **b.** Solid particles $<10^{-6}$ m in diameter, dispersed in gas.

Assessment - **a.** Survey of a real or potential disaster to estimate the actual or expected damages and to make recommendations for preparedness, mitigation and relief action **b.** Evaluation or appraisal of a process, program or activity to estimate its acceptability.

B

Background level (or levels) - **a.** (1) **anthropogenic**: concentrations of chemicals that are present in the environment due to human-made, non-site sources; (2) **naturally occurring**: ambient concentrations of chemicals that are present in the environment and have not been influenced by humans. **b.** A typical or average level of a chemical in the environment. Background often refers to naturally occurring or uncontaminated levels. **c.** Two types of background levels may exist for chemical substances: (1) Naturally occurring levels: Ambient concentrations of substances present in the environment, without human influence; (2) Anthropogenic levels: Concentrations of substances present in the environment due to human-made, non-site sources (e.g., automobiles, industries). **d.** (1) In air pollution, the level of pollutants present in ambient air from natural sources. (2) More generally, the level of pollution present in any environmental medium attributable to natural or ubiquitous sources. **e.** The concentration of substance in a defined control area during a fixed period of time before, during, or after a data-gathering operation. **f.** (1) The concentration of a substance in an environmental media (air, water, or soil) that occurs naturally or is not the result of human activities. (2) In exposure assessment the concentration of a substance in a defined control area, during a fixed period of time before, during, or after a data-gathering operation.

Benchmark dose (BMD) - **a.** A statistical IPCS Harmonization Project Glossary of Exposure Assessment-Related Terms: A Compilation lower confidence limit on the dose producing a predetermined, altered response for an effect. **b.** (also **benchmark concentration, BMC**) A statistical lower confidence limit on the dose that produces a predetermined change in response rate of an adverse effect (called the benchmark response or BMR) compared to background.

Bioaccumulants - Substances that increase in concentration in living organisms as they take in contaminated air, water, or food because the substances are very slowly metabolized or excreted.

Bioaccumulation - **a.** In ecology, the accumulation of toxic chemicals in living things through the consumption of food or water. **b.** Bioaccumulation is the process by which chemicals concentrate in an organism. For example, DDT concentrates in fish and birds that eat fish. This concentration effect is expressed as the ratio of the concentration of the chemical in an organism (like a fish) to its concentration in the surrounding medium (usually water). Bioaccumulation refers to the uptake of chemicals both from water (bioconcentration) and from ingested food and sediment. **c.** The process by which a contaminant accumulates in the tissues of an organism. **d.** The process whereby certain toxic substances collect in living tissues, thus posing a substantial hazard to human health or the environment.

Bioavailability - **a.** The state of being capable of being absorbed and available to interact with the metabolic processes of an organism. Typically a function of chemical properties, physical state of the material to which an organism is

exposed, and the ability of the individual organism to physiologically take up the chemical. Also, the term used for the fraction of the total chemical in the environmental which is available for uptake by organisms. **b.** The degree to which a substance becomes available to the target tissue after administration or exposure. **c.** The state of being capable of being absorbed and available to interact with the metabolic processes of an organism. Bioavailability is typically a function of properties of agents, physical state of the material to which an organism is exposed, and the ability of the individual organism to physiologically take up the agent. **d.** The state of being capable of being absorbed and available to interact with the metabolic processes of an organism. Bioavailability is typically a function of chemical properties, physical state of the material to which an organism is exposed, and the ability of the individual organism to physiologically take up the chemical. **e.** Degree of ability to be absorbed and ready to interact in organism metabolism.

Bioconcentration - **a.** The tendency of a chemical to accumulate in a living organism to levels in excess of the concentration in its surrounding environment. **b.** The accumulation of a chemical in tissues of a fish or other organism to levels greater than in the surrounding environment.

Biomagnification (biological magnification) - **a.** The process by which impurities found in water are concentrated in lower forms of life and reconcentrated substantially during their movement through the food chain. Due also to uptake of food which has progressively bioconcentrated that chemical in its environment. **b.** This is a general term applied to the sequence of processes in an ecosystem by which higher concentrations are attained in organisms of higher trophic level, i.e., of higher levels in the food chain. The process by which xenobiotics increase in body concentration in organisms through a series of prey_p predator relationships from primary producers to ultimate predators, often human beings. **c.** An increase in the concentration of a substance in each progressive link of the food chain. **d.** The concentration of certain substances up a food chain. A very important mechanism in concentrating pesticides and heavy metals in organisms such as fish. **e.** Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers or lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the chain. **f.** Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, workmedium.

Biological monitoring (biomonitoring) - **a.** Measuring chemicals in biological materials (blood, urine, breath, etc.) to determine whether chemical exposure in humans, animals, or plants has occurred. **b.** This is a procedure of periodic examination of biological specimens for the purposes of monitoring). It is usually applied to exposure monitoring but can also apply to effect monitoring. Analysis of the amounts of potentially toxic substances or their metabolites present in body

tissues and fluids, as a means of assessing exposure to these substances and aiding timely action to prevent adverse effects. The term is also used to mean assessment of the biological status of populations and communities of organisms at risk, in order to protect them and to have early warning of possible hazards to human health. **c.** A method of assessing the absorption of chemicals by measuring the parent compound or its metabolites in body fluids, usually blood, urine or exhaled breath. Woollen (1993) refined this term in the context of pesticides and assessment of absorbed dose for risk assessment: Measurement of a pesticide or its metabolites in the body fluids of exposed persons and conversion to an equivalent absorbed dose of the pesticide based on a knowledge of its human metabolism and pharmacokinetics. **d.** 1. The use of living organisms to test the suitability of effluents for discharge into receiving waters and to test the quality of such waters downstream from the discharge. 2. Analysis of blood, urine, tissues, etc., to measure chemical exposure in humans.

Biotransformation - **a.** The transformation of chemical compounds within a living system. **b.** In this process, a chemical is modified by a living organism in contrast to abiotic processes referred to earlier. The enzyme-mediated transformation of xenobiotics, frequently involving phase 1 and phase 2 reactions. **c.** compounds by organisms; includes biodegradation Conversion of a substance into other compounds by organisms; includes biodegradation.

C

Chronic - **a.** Occurring over a long period of time (more than 1 year). **b.** Occurring over a long period of time, several weeks, months or years. **c.** Having a persistent, recurring or long-term nature. As distinguished from acute. **d.** A toxic effect that occurs only after exposure to a material for a long time, usually months or years. The amount of exposure is usually very low, and often symptoms are not immediately noticeable. **e.** Having a persistent, recurring or long-term nature. As distinguished from acute. **f.** A disease or condition that has been present for several weeks or longer.

Climate model - A quantitative way of representing the interactions of the atmosphere, oceans, land surface, and ice. Models can range from relatively simple to quite comprehensive.

Climate modeling - The simulation of the climate using computer-based models.

Concentration - **a.** The amount of one substance dissolved or contained in a given amount of another. For example, sea water contains a higher concentration of salt than fresh water. **b.** The amount of material in the air, eg., 50 parts per million. May also refer to the amount of a substance in a mixture, eg., 10% ammonia in water. **c.** The relative amount of a substance mixed with another substance. An

example is five ppm of carbon monoxide in air or 1 mg/l of iron in water. **d.** Amount of agent per unit volume.

Cumulative dose - The total dose resulting from repeated exposures of ionizing radiation to an occupationally exposed worker to the same portion of the body, or to the whole body, over a period of time

Cumulative exposure - The sum of exposures of an organism to a pollutant over a period of time.

D

Distribution - **a.** This is a general term for the dispersal of a xenobiotic and its derivatives throughout an organism or environmental system. **b.** The complete summary of the frequencies of the values or categories of a measurement made on a group of persons. The distribution tells either how many or what proportion of the group were found to have each value (or each range of values) out of all the possible values that the quantitative measure can have. **c.** The pattern by which parasite numbers are partitioned amongst available hosts. If the fraction of the population who have i parasites is $p(i)$ then the distribution is the set of numbers $p(0), p(1), p(2), \dots$. Summary statistics of this distribution include prevalence ($1 - p(0)$) and mean intensity ($p(1) + 2p(2) + 3p(3) + \dots$). Useful distributions include the Poisson and negative binomial. **d.** A set of values derived from a specific population or set of measurements that represents the range and array of data for the factor being studied.

Dose - **a.** (1) **absorbed**: amount of a substance penetrating the exchange boundaries of an organism after contact. Calculated from intake and absorption efficiency, and expressed as mg/kg-day. (2) **administered**: mass of a substance given to an organism and in contact with an exchange boundary, expressed as mg/kg-day. (3) **applied**: amount of a substance given to an organism, especially through dermal contact. **b.** The amount of substance to which a person is exposed. Dose often takes body weight into account. **c.** The amount of a pollutant that is absorbed. A level of exposure which is a function of a pollutant's concentration, the length of time a subject is exposed, and the amount of the pollutant that is absorbed. The concentration of the pollutant and the length of time that the subject is exposed to that pollutant determine dose. **d.** (1) *pharmacology*. A quantity to be administered at one time, such as a specified amount of medication. (2) *radiobiology*. A general term denoting the quantity of radiation or energy absorbed. For special purposes it must be appropriately qualified. If unqualified, it refers to absorbed dose. Unit of absorbed dose is the rad. The SI unit is the gray ($1 \text{ Gy} = 1 \text{ J kg}^{-1} = 100 \text{ R}$). Origin: Gr. Dosis = a giving **e.** The amount of substance to which a person is exposed. Dose often takes body weight into account. For example, to receive equivalent doses of medicine, children are given smaller amounts than adults. **f.** The amount of a contaminant that is absorbed or deposited

in the body of an exposed organism for an increment of time—usually from a single medium. Total dose is the sum of doses received by a person from a contaminant in a given interval resulting from interaction with all environmental media that contain the contaminant. Units of dose and total dose (mass) are often converted to units of mass per volume of physiological fluid or mass of tissue. **g.** The amount of a pesticide systemically available **h.** The amount of substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism (see potential dose, applied dose, and internal dose definitions). The amount of the agent available for interaction by any particular organ or cell is termed the delivered dose for that organ or cell. **i.** The amount or concentration of undesired matter or energy deposited at the site of effect.

Drinking water exposure - Intake of a chemical into the body through the ingestion of drinking water.

E

Effective dose equivalent (HE) – The summation of the products of the dose equivalent received by specified tissues of the body (HT) and the appropriate weighting factors (WT) - that is ($HE = \sum a_T HT_T$). It includes the dose from radiation sources internal and/or external to the body. The effective dose equivalent is expressed in units of rem (or sievert).

Effective Dose (ED10) - The dose corresponding to a 10% increase in an adverse effect, relative to the control response.

Effluent - **a.** Treated or untreated liquid waste material that is discharged into the environment from a point source, such as a wastewater treatment plant or an industrial facility. **b.** Waste material discharged into the environment, treated or untreated. Generally refers to water pollution. **c.** Waste material discharged into the environment, treated or untreated. Generally refers to surface water pollution. **d.** Waste material being discharged into the environment, either treated or untreated. Effluent generally is used to describe water discharges to the environment, although it can refer to stack emissions or other material flowing into the environment **e.** Wastewater treated or untreated that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Emission - **a.** The release or giving out of a gas, light or heat. An automobile releases uncombusted or partially oxidized hydrocarbon emissions from its tailpipe when the engine is running. Atoms in an excited state often emit light in order to reach a lower energy state. These emissions can be used to determine the presence of the atoms in a sample. **b.** Like effluent but used in regard to air pollution. **c.** Pollution discharged into the atmosphere from smokestacks, other vents, and

surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts.

Emissions - **a.** Release of pollutants.

Environmental monitoring - A method of measuring the amount of a pesticide present in an environmental medium.

Exposure - **a.** Contact of an organism with a chemical or physical agent, quantified as the amount of chemical available at the exchange boundaries of the organism and available for absorption. Usually calculated as the mean exposure, and some measure of maximum exposure. **b.** Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short term (acute) or long term (chronic). **c.** The concentration of the pollutant in the air multiplied by the population exposed to that concentration over a specified time period. **d.** Normally external exposure: the amount of substance ingested, the amount in contact with the skin or either the amount inhaled or the concentration of the substance in the atmosphere (as appropriate). **e.** *radiobiology*. A quantitative measure of x or gamma radiation at a certain place, based on its ability to produce ionisation in air. The former special unit of exposure was the roentgen (R). $1R = 2.58 \times 10^{-4} \text{ C/kg}$. In the international system (SI unit), the special unit is coulomb per kilogram. (Exposure also is frequently used as a synonym for irradiation). **f.** Contact made between a chemical, physical, or biological agent and the outer boundary of an organism. Exposure is quantified as the amount of an agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut). **g.** An event that occurs when there is contact at a boundary between a human and the environment with a contaminant of a specific concentration for an interval of time; the units of exposure are concentration multiplied by time. **h.** Occurs when a person comes into contact with a chemical in their environment. May involve oral ingestion, inhalation, and absorption through the skin or the mucus membranes of the eyes, nose, or mouth. **j.** (1) The time integral of the concentration of a toxicant which is in the immediate vicinity of various ports of entry (such as lung, GI tract and skin). (2) Qualitatively, contact between a potentially harmful agent and a receptor (e.g., a human or other organism) that could be affected.

H

Half_life - **a.** The time in which the concentration of a chemical in the environment is reduced by half. **b.** The time required for half of a substance introduced to a living system or ecosystem to be eliminated or disintegrated by natural processes. **c.** the time required for half the amount of a substance to be eliminated from the body or to be converted to another substance(s). **d.** The time required for half of a sample of a given radioactive isotope to decay into another element or isotope. The half-life of an isotope is inversely related to its decay

constant. **e.** (1) The time in which half the atoms of a given quantity of a particular radioactive substance disintegrate to another nuclear form. Measured half-lives vary from millionths of a second to billions of years. (2) Similarly, the time in which half the molecules of a chemical substance disappear as a result of chemical or biochemical transformation. **f.** The time in which half the atoms of a radioactive substance will have disintegrated, leaving half the original amount. Half of the residue will disintegrate in another equal period of time. **g.** (1) The time required for a pollutant to lose one half of its original concentration. For example, the biochemical half-life of DDT in the environment is 15 years. (2) The time required for half of the atoms of a radioactive element to undergo self-transmutation or decay (half-life of radium is 1620 years). (3) The time required for the elimination of half a total dose from the body.

Household waste (domestic waste) – Solid waste, composed of garbage and rubbish, which normally originates in a private home or apartment house. Domestic waste may contain a significant amount of toxic or hazardous wastes.

Hygienic measures - those measures as to prevent diseases following a major disaster, because the infrastructure of the stricken area is non_ or malfunctioning.

I

Intake - **a.** A measure of exposure expressed as mass of substance in contact with the exchange boundary per unit body weight per unit time, i.e., mg/kg-day. (1) **acute**: intake averaged over a period less than two weeks; (2) **chronic** (daily) - *intake* averaged over a long period of time (seven years to lifetime); (3) **subchronic** - intake averaged over a period from two weeks to seven years. **b.** The amount of contact with a medium containing an agent. Used for estimating dose received from a particular medium. **c.** The process by which a substance crosses the outer boundary of an organism without passing an absorption barrier, e.g., through ingestion or inhalation.

Intake dose - Dose resulting from the agent crossing the contact boundary without subsequently diffusing through a resisting boundary layer

L

Lifetime - **a.** Covering the life span of an organism (generally considered 70 years for humans). **b.** [**atmospheric lifetime**] The lifetime of a greenhouse gas refers to the approximate amount of time it would take for the anthropogenic increment to an atmospheric pollutant concentration to return to its natural level (assuming emissions cease) as a result of either being converted to another chemical compound or being taken out of the atmosphere via a sink. This time depends on the pollutant's sources and sinks as well as its reactivity. The lifetime of a pollutant is often considered in conjunction with the mixing of pollutants in the atmosphere;

a long lifetime will allow the pollutant to mix throughout the atmosphere. Average lifetimes can vary from about a week (sulfate aerosols) to more than a century (CFCs, carbon dioxide).

M

Measure of exposure - **a.** A measurable stressor characteristic that is used to help quantify exposure. **b.** A measurable characteristic of a stressor (such as the specific amount of mercury in a body of water) used to help quantify the exposure of an ecological entity or individual organism. **c.** A measure of stressor existence and movement in the environment and its contact or co-occurrence with the assessment endpoint.

Measurement - The procedure of applying a standard scale to a variable or to a set of values.

Medium (pl. media) - **a.** Any one of the basic categories of material surrounding or contacting an organism (e.g., outdoor air, indoor air, water, soil, sediments) through which chemicals or pollutants can move and reach the organism. **b.** The environmental substance (e.g., air, water, soil) originally contaminated.

Mobile source - **a.** A source of air pollution, such as automobiles, motorcycles, trucks, off-road vehicles, boats, and airplanes. **b.** A moving object that releases regulated air pollutants, e.g. cars, trucks, buses, planes, trains, motorcycles, and gas-powered lawn mowers. **c.** A moving producer of air pollution, mainly forms of transportation: cars, motorcycles, planes. **d.** Any non-stationary source of air pollution such as cars, trucks, motorcycles, buses, airplanes, and locomotives.

N

Nonpoint source - **a.** A diffuse pollution source that is not recognized to have a single point of origin. **b.** A contributing factor to water pollution that cannot be traced to a specific spot; like agricultural fertilizer runoff, sediment from construction.

P

Permissible dose - The dose of a chemical that may be received by an individual without the expectation of a significantly harmful result.

Permissible exposure limit (PEL) -[sometimes, **permissible exposure level**] **a.** An occupational health standard to safeguard employees against dangerous chemicals or contaminants in the workplace. **b.** The legal limit for occupational exposure to airborne concentrations of several hundred agents. Established by OSHA (U.S. Occupational Safety and Health Administration). **c.** OSHA's number

that tells the concentration of a chemical in air that a worker may breathe for a given period of time, without experiencing adverse effects.

Pharmacokinetics - **a.** This is the science which describes quantitatively the uptake of drugs by the body, their biotransformation, their distribution, metabolism, and elimination from the body. Both total amounts and tissue and organ concentrations are considered. "Toxicokinetics" is essentially the same term applied to xenobiotics other than drugs. **b.** The processes of absorption, distribution, metabolism and excretion of a drug or vaccine. **c.** The study of the absorption, distribution, metabolism and excretion of a substance in any living system. **d.** The processes by which a chemical is handled, and transported within the body, including how it is absorbed into the body, how it is distributed in the body tissues, how it is transformed in the body to metabolites and other breakdown compounds, and how it is excreted. **e.** The study of the time course of absorption, distribution, metabolism, and excretion of a foreign substance (e.g., a drug or pollutant) in an organism's body. **f.** The field of study concerned with defining, through measurement or modeling, the absorption, distribution, metabolism, and excretion of drugs or chemicals in a biological system as a function of time.

Point source - **a.** Any confined and discrete conveyance from which pollutants are or may be discharged. These include pipes, ditches, channels, tunnels, conduits, wells, containers, and concentrated animal feeding operations. **b.** A single isolated stationary source of pollution. **c.** A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g., a pipe, ditch, ship, ore pit, factory smokestack.

Population - **a.** (1) All the inhabitants of a given country or area considered together; the number of inhabitants of a given country or area. (2) *sampling*. The whole collection of units from which a sample may be drawn; not necessarily a population of persons; the units may be institutions, records, or events. The sample is intended to give results that are representative of the whole population. **b.** A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area. **c.** An aggregate of individuals of a species within a specified location in space and time. **d.** A group of individuals with common ancestry that are much more likely to mate with one another than with individuals from another such group.

Population dose (population exposure) – The summation of individual radiation doses received by all those exposed to the source or event being considered.

Probabilistic analysis - Calculation and expression of health risks using multiple risk descriptors to provide the likelihood of various risk levels. Probabilistic risk results approximate a full range of possible outcomes and the likelihood of each, which often is presented as a frequency distribution graph, thus allowing uncertainty or variability to be expressed quantitatively.

R

Random sample - **a.** A sample that is arrived at by selecting sample units such that each possible unit has a fixed and determinate probability of selection. **b.** A sample selected from a statistical population such that each individual has an equal probability of being selected.

Range - The difference between the largest and smallest values in a measurement data set.

Response rate - The number of completed or returned survey instruments (questionnaires, interviews, etc.) divided by the total number of persons who would have been surveyed if all had participated. Usually expressed as a percentage. Nonresponse can have several causes, e.g., death, removal out of the survey community, and refusal.

Route of entry - Means by which a chemical enters the body: ingestion, inhalation, dermal absorption, or injection.

S

Sample - **a.** A selected subset of a population. A sample may be random or nonrandom and may be representative or non-representative. Several types of sample can be distinguished, including the following: *Cluster sample*: Each unit selected is a group of persons (all persons in a city block, a family, etc.) rather than an individual. *Grab sample* (Syn: sample of convenience): These ill-defined terms describe samples selected by easily employed but basically nonprobabilistic methods. "Man_inthe_street" surveys and a survey of blood pressure among volunteers who drop in at an examination booth are in this category. It is improper to generalize from the results of a survey based upon such a sample for there is no way of knowing what sorts of bias may have been operating. *Probability (random) sample*: All individuals have a known chance of selection. They may all have an equal chance of being selected, or, if a stratified sampling method is used, the rate at which individuals from several subsets are sampled can be varied so as to produce greater representation of some classes than of others. A probability sample is created by assigning an identity (label, number) to all individuals in the "universe" population, e.g., by arranging them in alphabetical order and numbering in sequence, or simply assigning a number to each, or by grouping according to area of residence and numbering the groups. The next step is to select individuals (or groups) for study by a procedure such as use of a table of random numbers (or comparable procedure) to ensure that the chance of selection is known. *Simple random sample*: In this elementary kind of sample each person has an equal chance of being selected out of the entire population. One way of carrying out this procedure is to assign each person a number, starting with 1, 2, 3, and so on. The 1

numbers are selected at random, preferably from a table of random numbers, until the desired sample size is attained. *Stratified random sample*: This involves dividing the population into distinct subgroups according to some important characteristic, such as age or socio-economic status, and selecting a random sample out of each subgroup. If the proportion of the sample drawn from each of the subgroups, or strata, is the same as the proportion of the total population contained in each stratum (e.g., age group 40-59 constitutes 20% of the population, and 20% of the sample comes from this age stratum), then all strata will be fairly represented with regard to numbers of person in the sample. *Systematic sample*: The procedure of selecting according to some simple, systematic rule, such as all persons whose names begin with specified alphabetical letters, bar on certain dates or located at specified points on a master list. A systematic sample may lead to errors that invalidate generalizations. **b.** A small part of something designed to show the nature or quality of the whole. Exposure related measurements are usually samples of environmental or ambient media, exposures of a small subset of a population for a short time, or biological samples, all for the purpose of inferring the nature and quality of parameters important to evaluating exposure.

Scenario evaluation - An approach to quantifying exposure by measurement or estimation of both the amount of a substance contacted, and the frequency/duration of contact, and subsequently linking these together to estimate exposure or dose.

Sensitivity - **a.** The degree to which a system will respond to a change in climatic conditions. **b.** The ability of a test to work on people you know have the infection. More precisely $TP/(TP+FN)$, where TP is the number of true positives and FN is the number of false negatives

Source - **a.** Any place or object from which air pollutants are released. Sources that are fixed in space are stationary sources and sources that move are mobile sources. **b.** The activity or entity from which an agent is released for potential human exposure. **c.** A place where pollutants are emitted, for example a chimney stack. **d.** An entity or action that releases to the environment or imposes on the environment chemical, biological, or physical stressor or stressors.

Stationary source - **a.** A non-mobile source such as a power plant, refinery, or manufacturing facility which emits air pollutants. **b.** A fixed source of regulated air pollutants (e.g. industrial facility). See also source; mobile sources. **c.** A pollution location that is fixed rather than moving. **d.** A fixed-site producer of pollution, mainly power plants and other facilities using industrial combustion processes.

T

Target - A physical, biological, or ecological object exposed to an agent.

Target organ - **a.** The biological organ(s) most adversely effected by exposure to a chemical substance. **b.** An organ (such as the liver or kidney) that is specifically affected by a toxic chemical.

Target organ dose - The target organ dose is the amount of a potentially toxic substance reaching the organ chiefly affected by that substance.

Threshold limit value (TLV) - The maximum permissible concentration of a material, generally expressed in parts per million in air for some defined period of time (often 8 hours). These values, which may differ from country to country, are often backed up by regulation and therefore may be legally enforceable.

Toxicokinetics - **a.** The absorption, distribution, metabolism, storage, and excretion of chemicals. **b.** See pharmacokinetics.

U

Uncertainty - **a.** The deviation in predicted values from the actual values; may result from lack of data or variability in the data. **b.** A lack of confidence in the prediction of a risk assessment that may result from natural variability in natural processes, imperfect or in complete knowledge, or errors in conducting an assessment. **c.** In the conduct of risk assessment (hazard identification, dose-response assessment, exposure assessment, risk characterization) the need to make assumptions or best judgments in the absence of precise scientific data creates uncertainties. These uncertainties, expressed qualitatively and sometimes quantitatively, attempt to define the usefulness of a particular evaluation in making a decision based on the available data. **d.** Uncertainty represents a lack of knowledge about factors affecting exposure or risk and can lead to inaccurate or biased estimates of exposure. The types of uncertainty include: scenario uncertainty, parameter uncertainty, and model uncertainty.

Uncertainty analysis - **a.** A process in which the sources of uncertainty in an estimate are identified, and an estimate made of the magnitude and direction of the resulting error. (1) **qualitative**: utilizes descriptive methods; (2) **semi-quantitative**: uses simple mathematical techniques such as *sensitivity analysis*; (3) **quantitative**: uses complex mathematical techniques such as *Monte Carlo* analysis. **b.** A detailed examination of the systematic and random errors of a measurement or estimate; an analytical process to provide information regarding the uncertainty.

Uncertainty factor (UF) - [sometimes also called **safety factor** or **modifying factor**] **a.** Used in converting NOAELs / LOAELs to RfDs and generally equal 10; account for (1) intra-species variation, (2) interspecies variation, (3) use of a RfD based on a different time period, or (4) use of a LOAEL rather than a NOAEL to develop a RfD. **b.** This term may be used in either of two ways depending upon the

context (i) Mathematical expression of uncertainty applied to data that are used to protect populations from hazards which cannot be assessed with high precision. (ii) With regard to food additives and contaminants, a factor applied to the no-observed effect level to derive acceptable daily intake (ADI) (the no-observed effect level is divided by the safety factor to calculate the ADI). The value of the safety factor depends on the nature of the toxic effect, the size and type of the population to be protected, and the quality of the toxicological information available. **c.** One of several, generally 10-fold factors, used in operationally deriving the RfD and RfC from experimental data. UFs are intended to account for (1) the variation in sensitivity among the members of the human population, i.e., inter-human or intra-species variability; (2) the uncertainty in extrapolating animal data to humans, i.e., interspecies variability; (3) the uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure to lifetime exposure, i.e., extrapolating from sub-chronic to chronic exposure; (4) the uncertainty in extrapolating from a LOAEL rather than from a NOAEL; and (5) the uncertainty associated with extrapolation from animal data when the data base is incomplete. **d.** Factors used to adjust for multiple sources of uncertainty encountered in using experimental animal data for predicting effects on humans, such as intra-species variation, interspecies variation, synergism, and different route of exposure (*i.e.* oral versus inhalation). **e.** One of several, generally 10-fold factors used in operationally deriving the reference dose (RfD) from experimental data. UFs are intended to account for (1) the variation in sensitivity among members of the human population; (2) the uncertainty in extrapolating animal data to the case of humans; (3) the uncertainty in extrapolating from data obtained in a study that is of less-than-lifetime exposure; and (4) the uncertainty in using LOAEL data rather than NOAEL data.

W

Whole body dose - The sum of the annual deep dose equivalent for external exposures and the committed effective dose equivalent for internal exposures.

Whole body - For the purposes of external exposure, head, trunk (including male gonads), arms above and including the elbow, or legs above and including the knee.

Worst case - A semi-quantitative term referring to the maximum possible exposure, dose, or risk, that can conceivably occur, whether or not this exposure, dose, or risk actually occurs or is observed in a specific population. Historically, this term has been loosely defined in an *ad hoc* way in the literature, so assessors are cautioned to look for contextual definitions when encountering this term. It should refer to a hypothetical situation in which everything that can plausibly happen to maximize exposure, dose, or risk does in fact happen. This worst case may occur (or even be observed) in a given population, but since it is usually a very unlikely set of circumstances, in most cases, a worst-case estimate will be

somewhat higher than occurs in a specific population. As in other fields, the worst-case scenario is a useful device when low probability events may result in a catastrophe that must be avoided even at great cost, but in most health risk assessments, a worst-case scenario is essentially a type of bounding estimate.

Worst-case scenario - a method of conducting an exposure assessment in which the most conservative value of each input parameter is selected. See also *reasonable maximum exposure*.