



**GLOSSARY OF TERMS**



**Activity pattern data** - Information on human activities used in exposure assessments. These may include a description of the activity, frequency of activity, duration spent performing the activity, and the microenvironment in which the activity occurs.

**Adherence factor** - The amount of a material (e.g., soil) that adheres to the skin per unit of surface area.

**Activity pattern (time use) data** - Information on activities in which various individuals engage, length of time spent performing various activities, locations in which individuals spend time and length of time spent by individuals within those various environments.

**Agricultural commodity** - Used by U.S. EPA to mean plant (or animal) parts consumed by humans as food. When such items are raw or unprocessed, they are referred to as "raw agricultural commodities."

**All water sources** - Includes water from all supply sources such as community water supply (i.e., tap water), bottled water, etc.

**Analytical uncertainty propagation** - Examining how uncertainty in individual parameters affects the overall uncertainty of the exposure assessment.

**Anthropometric** - The study of human body measurements for use in anthropological classification and comparison.

**As-consumed intake** - Intake rate based on the weight of the food in the form that it is consumed (e.g., cooked or prepared).

**Assessment** - A determination or appraisal of possible consequences resulting from an analysis of data.

**Average Daily Dose (ADD)** - Dose rate averaged over a pathway-specific period of exposure expressed as a daily dose on a per-unit-body-weight basis. The ADD is used for exposure to chemicals with non-carcinogenic non-chronic effects. The ADD is usually expressed in terms of mg/kg-day or other mass/mass-time units.

**Benchmark Dose (BMD) or Concentration (BMC)** - A dose or concentration that produces a predetermined change in response rate of an adverse effect (called the benchmark response or BMR) compared to background.

**Best Tracer Method (BTM)** - Method for estimating soil ingestion that allows for the selection of the most recoverable tracer for a particular subject or group of subjects. Selection of the best tracer is made on the basis of the food/soil (F/S) ratio.

**Bias** - A systematic error inherent in a method or caused by some feature of the measurement system.

**Bioavailability** - The rate and extent to which an agent can be absorbed by an organism and is available for metabolism or interaction with biologically significant receptors. Bioavailability involves both release from a medium (if present) and absorption by an organism.

**Biomarker model comparison** - A methodology that compares results from a biokinetic exposure model to biomarker measurements children blood. The method is used to confirm assumptions about ingested soil and dust quantities in this handbook.

**Basal Metabolic Rate (BMR)** - Minimum level of energy required to maintain normal body functions.

**Body Mass Index (BMI)** - The ratio of weight and height squared.

**Bootstrap** - A statistical method of resampling data use to estimate variance and bias of an estimator and provide confidence intervals for parameters.

**Bounding estimate** - An estimate of exposure, dose, or risk that is higher or lower than that incurred by the person with the highest or lowest exposure, dose, or risk in the population being assessed. Bounding estimates are useful in developing statements that exposures, doses, or risks are "not greater than" or "less than" the estimated value, because assumptions are used which define the likely bounding conditions.



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**Glossary**

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**Central tendency exposure** - A measure of the middle or the center of an exposure distribution. The mean is the most commonly used measure of central tendency.

**Chronic exposure** - Repeated exposure by the oral, dermal, or inhalation route for more than approximately 10% of the life span in humans (more than approximately 90 days to 2 years in typically used laboratory animal species).

**Chronic intake** - The long term period over which a substance crosses the outer boundary of an organism without passing an absorption barrier.

**Classical statistical methods** - Estimating the population exposure distribution directly, based on measured values from a representative sample.

**Coating** - Method used to measure skin surface area, in which either the whole body or specific body regions are coated with a substance of known density and thickness.

**Community water** - Includes tap water ingested from community or municipal water supply.

**Comparability** - The ability to describe likenesses and differences in the quality and relevance of two or more data sets.

**Concentration** - Amount of a material or agent dissolved or contained in unit quantity in a given medium or system.

**Confidence intervals** - An estimated range of values with a given probability of including the population parameter of interest. The range of values is usually based on the results of a sample that estimated the mean and the sampling error or standard error.

**Consumer-only intake rate** - The average quantity of food consumed per person in a population composed only of individuals who ate the food item of interest during a specified period.

**Contaminant concentration** - Contaminant concentration is the concentration of the contaminant in the medium (air, food, soil, etc.) contacting the body and has units of mass/volume or mass/mass.

**Creel study** - A study in which fishermen are interviewed while fishing.

**Cumulative exposure** - Exposure via mixtures of contaminants both indoors and outdoors. Exposure may also occur through more than one pathway. New directions in risk assessments in U.S. EPA put more emphasis on total exposures via multiple pathways.

**Deposition** - The removal of airborne substances to available surfaces that occurs as a result of gravitational settling and diffusion, as well as electrophoresis and thermophoresis.

**Dermal absorption** - A route of exposure by which substances can enter the body through the skin.

**Dermal adherence** - The loading of a substance onto the outer surface of the skin.

**Diary study** - Survey in which individuals are asked to record food intake, activities, or other factors in a diary which is later used to evaluate exposure factors associated with specific populations.

**Direct water ingestion** - Consumption of plain water as a beverage. It does not include water used for preparing beverages such as coffee or tea.

**Distribution** - 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.

**Doers** - Survey respondents who report participating in a specified activity.

**Dose** - The amount of a substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism. The potential dose is the amount ingested, inhaled, or applied to the skin. The applied



dose is the amount of a substance presented to an absorption barrier and available for absorption (although not necessarily having yet crossed the outer boundary of the organism). The absorbed dose is the amount crossing a specific absorption barrier (e.g., the exchange boundaries of skin, lung, and digestive tract) through uptake processes. Internal dose is a more general term denoting the amount absorbed without respect to specific absorption barriers or exchange boundaries. The amount of a chemical available for interaction by any particular organ or cell is termed the delivered dose for that organ or cell.

**Dose rate** - Dose per unit time.

**Dose-response assessment** - Analysis of the relationship between the total amount of an agent administered to, taken up by, or absorbed by an organism, system, or (sub)population and the changes developed in that organism, system, or (sub)population in reaction to that agent, and inferences derived from such an analysis with respect to the entire population. Dose-response assessment is the second of four steps in risk assessment.

**Dose-response curve**- Graphical presentation of a dose-response relationship.

**Dose-response relationship** - The resulting biological responses in an organ or organism expressed as a function of a series of doses.

**Dressed weight** - The portion of the harvest brought into kitchens for use, including bones for particular species.

**Dry weight intake rates** - Intake rates that are based on the weight of the food consumed after the moisture content has been removed.

**Dust Ingestion** - Consumption of dust that results from various behaviors including, but not limited to, mouthing objects or hands, eating dropped food, consuming dust directly, or inhaling dust that passes from the respiratory system into the gastrointestinal tract.

**Effect** - Change in the state or dynamics of an organism, system, or (sub) population caused by exposure to an agent.

**Energy expenditures** - The amount of energy expended by an individual during activities.

**Exposure** - Contact of a chemical, physical, or biological agent with the outer boundary of an organism. Exposure is quantified as the concentration of the agent in the medium in contact integrated over the time duration of the contact.

**Exposure assessment** - The determination or estimation (qualitative or quantitative) of the magnitude, frequency, or duration, and route or exposure.

**Exposure concentration** - The concentration of a chemical in its transport or carrier medium at the point of contact.

**Exposure duration** - Length of time over which contact with the contaminant lasts.

**Exposure event** - The occurrence of continuous contact between an agent and a target.

**Exposure frequency** - The number of exposure events in an exposure duration.

**Exposure loading** - The exposure mass divided by the exposure surface area. For example, a dermal exposure measurement based on a skin wipe sample, expressed as a mass of residue per skin surface area, is an exposure loading.

**Exposure pathway** - The physical course a chemical takes from the source to the organism exposed.

**Exposure route** - The way a chemical pollutant enters an organism after contact, e.g., by ingestion, inhalation, or dermal absorption.

**Exposure scenario** - A set of facts, assumptions, and interferences about how exposure takes place that aids



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**Glossary**

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the exposure assessor in evaluating estimating, or quantifying exposures.

**Fate** - Pattern of distribution of an agent, its derivatives, or metabolites in an organism, system, compartment, or (sub)population of concern as a result of transport, partitioning, transformation, or degradation.

**General population** - The total of individuals inhabiting an area or making up a whole group.

**Geometric mean** - The  $n^{\text{th}}$  root of the product of  $n$  values.

**Geophagy** - A form of soil ingestion involving the intentional ingestion of earths, usually associated with cultural practices.

**Hazard** - Inherent property of an agent or situation having the potential to cause adverse effects when an organism, system, or (sub)population is exposed to that agent.

**Hazard assessment** - A process designed to determine the possible adverse effects of an agent or situation to which an organism, system, or (sub)population could be exposed. The process typically includes hazard identification, dose-response evaluation and hazard characterization. The process focuses on the hazard, in contrast to risk assessment, where exposure assessment is a distinct additional step.

**High end exposure** - An estimate of individual exposure or dose for those persons at the upper end of an exposure or dose distribution, conceptually above the 90<sup>th</sup> percentile, but not higher than the individual in the population who has the highest exposure or dose.

**Homegrown/home produced foods** - Fruits and vegetables produced by home gardeners, meat and dairy products derived from consumer-raised livestock, game meat, and home caught fish.

**Human Equivalent Concentration (HEC) or Dose (HED)** - The human concentration (for inhalation

exposure) or dose (for other routes of exposure) of an agent that is believed to induce the same magnitude of toxic effect as the experimental animal species concentration or dose. This adjustment may incorporate toxicokinetic information on the particular agent, if available, or use a default procedure, such as assuming that daily oral doses experienced for a lifetime are proportional to body weight raised to the 0.75 power.

**Indirect water ingestion** - Includes water added during food preparation, but not water intrinsic to purchased foods. Indirect water includes for example, water used to prepare baby formulas, cake mix, and concentrated orange juice.

**Indoor settled dust** - Particles in building interiors that have settled onto objects, surfaces, floors, and carpeting. These particles may include soil particles that have been tracked into the indoor environment from outdoors.

**Inhalation dosimetry** - Process of measuring or estimating inhaled dose.

**Inhalation unit risk** - The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of  $1 \mu\text{g}/\text{m}^3$  in air for a lifetime.

**Inhaled dose** - The amount of an inhaled substance that is available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism.

**Insensible water loss** - Evaporative water losses that occur during breastfeeding. Corrections are made to account for insensible water loss when estimating breast milk intake using the test weighing method.

**Intake** - 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 rate** - Rate of inhalation, ingestion, and dermal contact depending on the route of exposure. For



ingestion, the intake rate is simply the amount of food containing the contaminant of interest that an individual ingests during some specific time period (units of mass/time). For inhalation, the intake rate is the rate at which contaminated air is inhaled. Factors that affect dermal exposure are the amount of material that comes into contact with the skin, and the rate at which the contaminant is absorbed.

**Inter-individual variability** - Variations between individuals in terms of human characteristics such as age or body weight, or behaviors such as location, activity patterns, and ingestion rates.

**Internal dose** - The amount of a substance penetrating across absorption barriers (the exchange boundaries) of an organism, via either physical or biological processes (synonymous with absorbed dose).

**Intra-individual variability** - Fluctuations in an individual's physiologic (e.g., body weight), or behavioral characteristics (e.g., ingestion rates or activity patterns).

**Key study** - A study that is useful for deriving exposure factors.

**Lead isotope ratio methodology** - A method that measures different lead isotopes in children's blood and/or urine, food, water, and house dust and compares the ratio of these isotopes to infer sources of lead exposure that may include dust or other environmental exposures.

**Lifestage** - A distinguishable time frame in an individual's life characterized by unique and relatively stable behavioral and/or physiological characteristics that are associated with development and growth.

**Lifetime Average Daily Dose (LADD)** - Dose rate averaged over a lifetime. The LADD is used for compounds with carcinogenic or chronic effects. The LADD is usually expressed in terms of mg/kg-day or other mass/mass-time units.

**Limiting Tracer Method (LTM)** - Method for evaluating soil ingestion that assumes that the maximum amount of soil ingested corresponds with the lowest estimate from various tracer elements.

**Long-term exposure** - Repeated exposure for more than 30 days, up to approximately 10% of the life span in humans (more than 30 days).

**Lowest-Observed-Adverse-Effect Level (LOAEL):** The lowest exposure level at which there are biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control group.

**Margin of safety** - For some experts, margin of safety has the same meaning as margin of exposure, while for others, margin of safety means the margin between the reference dose and the actual exposure.

**Mass-balance/tracer techniques** - Method for evaluating soil intake that accounts for both inputs and outputs of tracer elements. Tracers in soil, food, medicine and other ingested items as well as in feces and urine are accounted for.

**Mean value** - Simple or arithmetic average of a range of values, computed by dividing the total of all values by the number of values.

**Measurement error** - A systematic error arising from inaccurate measurement (or classification) of subjects on the study variables.

**Measurement end-point** - Measurable (ecological) characteristic that is related to the valued characteristic chosen as an assessment point.

**Median value** - The value in a measurement data set such that half the measured values are greater and half are less.

**Metabolic Equivalent of Work (MET)** - A dimensionless energy expenditure metric used to represent an activity level.



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**Glossary**

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**Microenvironment** - Surroundings that can be treated as homogeneous or well characterized in the concentrations of an agent (e.g., home, office, automobile, kitchen, store).

**Model uncertainty** - Uncertainty regarding gaps in scientific theory required to make predictions on the basis of causal inferences.

**Moisture content** - The portion of foods made up by water. The percent water is needed for converting food intake rates and residue concentrations between whole weight and dry weight values.

**Monte Carlo technique** - A repeated random sampling from the distribution of values for each of the parameters in a generic (exposure or dose) equation to derive an estimate of the distribution of (exposures or doses in) the population.

**Mouthing behavior** - Activities in which objects, including fingers, are touched by the mouth or put into the mouth except for eating and drinking, and includes licking, sucking, chewing, and biting.

**Non-dietary ingestion** - Ingestion of non-food substances, typically resulting from the mouthing of hands and objects.

**No-Observed-Adverse-Effect-Level (NOAEL)** - The highest exposure level at which there are no biologically significant increases in the frequency or severity of adverse effect between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered adverse or precursors of adverse effects.

**Outdoor settled dust** - Particles that have settled onto outdoor objects and surfaces due to either wet or dry deposition.

**Oxygen consumption (VO<sub>2</sub>)** - The rate at which oxygen is used by tissues.

**Parameter uncertainty** - Uncertainty regarding some parameter.

**Pathway** - The physical course a chemical or pollutant takes from the source to the organism exposed.

**Per capita intake rate** - The average quantity of food consumed per person in a population composed of both individuals who ate the food during a specified time period and those that did not.

**Pica** - Pica behavior is the repeated eating of non-nutritive substances, whereas soil-pica is a form of soil ingestion that is characterized by the recurrent ingestion of unusually high amounts of soil (i.e., on the order of 1,000 - 5,000 milligrams per day or more).

**Plain tap water** - Excludes tap water consumed in the form of juices and other beverages containing tap water.

**Population mobility** - An indicator of the frequency at which individuals move from one residential location to another.

**Population risk descriptor** - An assessment of the extent of harm to the population being addressed. It can be either an estimate of the number of cases of a particular effect that might occur in a population (or population segment), or a description of what fraction of the population receives exposures, doses, or risks greater than a specified value.

**Potential dose** - The amount of a chemical contained in material ingested, air breathed, or bulk material applied to the skin.

**Poverty/income ratio** - Ratio of reported family income to federal poverty level.

**Precision** - A measure of the reproducibility of a measured value under a given set of circumstances.

**Preparation losses** - Net cooking losses, which include dripping and volatile losses, post cooking losses, which involve losses from cutting, bones, excess fat, scraps and juices, and other preparation losses which include losses from paring or coring.



**Primary data/analysis** - Information gathered from observations or measurements of a phenomena or the surveying of respondents.

**Probabilistic uncertainty analysis** - Technique that assigns a probability density function to each input parameter, then randomly selects values from each of the distributions and inserts them into the exposure equation. Repeated calculations produce a distribution of predicted values, reflecting the combined impact of variability in each input to the calculation. Monte Carlo is a common type of probabilistic Uncertainty analysis.

**Questionnaire/survey response** - A “question and answer” data collection methodology conducted via in-person interview, mailed questionnaire, or questions administered in a test format in a school setting.

**Random samples** - Samples selected from a statistical population such that each sample has an equal probability of being selected.

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

**Ready-to-feed** - Infant and baby products (formula, juices, beverages, baby food), and table foods that do not need to have water added to them prior to feeding.

**Reasonable maximum exposure (or worst case)** - A semiquantitative term referring to the lower portion of the high end of the exposure, dose, or risk distribution. As a semiquantitative term, it should refer to a range that can conceptually be described as above the 90<sup>th</sup> percentile in the distribution, but below the 98<sup>th</sup> percentile.

**Recreational/sport fishermen** - Individuals who catch fish as part of a sporting or recreational activity and not for the purpose of providing a primary source of food for themselves or for their families.

**Reference Concentration (RfC)** - An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely

to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark concentration, with uncertainty factors generally applied to reflect limitations of the data used. Generally used in EPA's noncancer health assessments. Durations include acute, short-term, subchronic, and chronic.

**Reference Dose (RfD)** - An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark dose, with uncertainty factors generally applied to reflect limitations of the data used. Generally used in EPA's noncancer health assessments. Durations include acute, short-term, subchronic, and chronic.

**Relevant study** - Studies that are applicable or pertinent, but not necessarily the most important to derive exposure factors.

**Representativeness** - The degree to which a sample is, or samples are, characteristic of the whole medium, exposure, or dose for which the samples are being used to make inferences.

**Risk** - The probability of an adverse effect in an organism, system, or (sub)population caused under specified circumstances by exposure to an agent.

**Risk assessment** - A process intended to calculate or estimate the risk to a given target organism, system, or (sub)population, including the identification of attendant uncertainties, following exposure to a particular agent, taking into account the inherent characteristics of the agent of concern as well as the characteristics of the specific target system. The risk assessment process includes four steps: hazard identification, hazard characterization (related term: Dose-response assessment), exposure assessment, and risk characterization. It is the first component in a risk analysis process.

**Risk characterization** - The qualitative and, wherever possible, quantitative determination, including attendant



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**Glossary**

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uncertainties, of the probability of occurrence of known and potential adverse effects of an agent in a given organism, system, or (sub)population, under defined exposure conditions. Risk characterization is the fourth step in the risk assessment process.

**Risk communication** - Interactive exchange of information about (health or environmental) risks among risk assessors, managers, news media, interested groups, and the general public.

**Route** - The way a chemical or pollutant enters an organism after contact, e.g., by ingestion, inhalation, or dermal absorption.

**Sample** - 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 uncertainty** - Uncertainty regarding missing or incomplete information needed to fully define exposure and dose.

**Screening-level assessment** - An exposure assessment that examines exposures that would fall on or beyond the high end of the expected exposure distribution.

**Secondary data/analysis** - The reanalysis of data collected by other individuals or group; an analysis of data for purposes other than those for which the data were originally collected.

**Sensitivity analysis** - Process of changing one variable while leaving the others constant to determine its effect on the output. This procedure fixes each uncertain quantity at its credible lower and upper bounds (holding all others at their nominal values, such as medians) and computes the results of each combination of values. The results help to identify the variables that have the greatest effect on exposure estimates and help focus further information-gathering efforts.

**Serving sizes** - The quantities of individual foods consumed per eating occasion. These estimates may be useful for assessing acute exposures.

**Short-term exposure** - Repeated exposure for more than 24 hours, up to 30 days.

**Soil** - Particles of unconsolidated mineral and/or organic matter from the earth's surface that are located outdoors, or are used indoors to support plant growth.

**Soil adherence** - The quantity of soil that adheres to the skin and from which chemical contaminants are available for uptake at the skin surface.

**Soil ingestion** - The intentional or unintentional consumption of soil, resulting from various behaviors including, but not limited to, mouthing, contacting dirty hands, eating dropped food, or consuming soil directly. Soil-pica is a form of soil ingestion that is characterized by the recurrent ingestion of unusually high amounts of soil (i.e., on the order of 1,000 - 5,000 milligrams per day or more). Geophagy is also a form of soil ingestion defined as the intentional ingestion of earths and is usually associated with cultural practices.

**Spatial variability** - Variability across location, whether long- or short-term.

**Subsistence fishermen** - Individuals who consume fresh caught fish as a major source of food.

**Surface area** - Coating, triangulation, and surface integration are direct measurement techniques that have been used to measure total body surface area and the surface area of specific body parts. Consideration has been given for differences due to age, gender, and race. Surface integration is performed by using a planimeter and adding the areas.

**Surface integration** - Method used to measure skin surface area in which a planimeter is used to measure areas of the skin, and the areas of various surfaces are summed.



**Survey response methodology** - Responses to survey questions are analyzed. This methodology includes questions asked of children directly, or their care givers, about behaviors affecting exposures.

**Tap water from food manufacturing** - Water used in industrial production of foods.

**Temporal variability** - Variability over time, whether long- or short-term.

**Threshold** - Dose or exposure concentration of an agent below which a stated effect is not observed or expected to occur.

**Time-averaged exposure** - The time-integrated exposure divided by the exposure duration. An example is the daily average exposure of an individual to carbon monoxide. (Also called timeweighted average exposure.)

**Total tap water** - Water consumed directly from the tap as a beverage or used in the preparation of foods and beverages (i.e., coffee, tea, frozen juices, soups, etc.).

**Total fluid intake** - Consumption of all types of fluids including tapwater, milk, soft drinks, alcoholic beverages, and water intrinsic to purchased foods.

**Tracer-element studies** - Soil ingestion studies that use trace elements found in soil and poorly metabolized in the human gut as indicators of soil intake.

**Triangulation** - Method used to measure skin surface area in which areas of the body are marked into geometric figures, then their linear dimensions are calculated.

**Uncertainty** - 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, parameter, and model.

**Upper percentile** - Values in the upper tail (i.e., between 90th and 99.9th percentile) of the distribution of values for a particular exposure factor. Values at the upper end of the distribution of values for a particular set of data.

**Uptake** - The process by which a substance crosses an absorption barrier and is absorbed into the body.

**Variability** - Variability arises from true heterogeneity across people, places or time and can affect the precision of exposure estimates and the degree to which they can be generalized. The types of variability include: spatial, temporal, and inter-individual.

**Ventilation Rate (VR)** - Alternative term for inhalation rate or breathing rate. Usually measured as minute volume, i.e. volume (liters) of air exhaled per minute.

**Wet-weight intake rates** - Intake rates that are based on the wet (or whole) weight of the food consumed. This in contrast to dry-weight intake rates.

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Glossary entries adapted from:

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