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CHEMISTRY AND THE ENVIRONMENT DIVISION*

GLOSSARY OF TERMS RELATING TO PESTICIDES

(IUPAC Recommendations 2006)

Prepared for publication by
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Glossary of terms relating to pesticides

(IUPAC Recommendations 2006)

Abstract: The glossary contains definitions of more than 500 terms frequently used in relation to the chemistry, mode of action, regulation, and use of pesticides. A wide range of disciplines is involved in this field, and the glossary was developed as a step in facilitating communication among researchers, government regulatory authorities, and chemists in associated professional areas. The range of terms relates to pesticide residue analysis, sampling for analysis, good laboratory practice, metabolism, environmental fate, effects on ecosystems, computer simulation models, toxicology, and risk assessment. The number of important, "pesticide-related" terms has more than doubled since 1996, when the first IUPAC glossary of this type was developed [1], an indication of how this field has become so integrated with many other scientific and regulatory disciplines.

Keywords: IUPAC Chemistry and the Environment Division; glossary; pesticides; regulation; pesticide residue analysis; sampling for analysis; good laboratory practice; metabolism; environmental fate; risk assessment.

CONTENTS

PREFACE

Pesticides are a broad class of bioactive compounds important for food and crop production and for human health. The development, production, use, and regulation of pesticides encompass a very wide range of disciplines including synthetic chemistry, chemistry of formulations and residues, biological and environmental fate, soil and plant science, toxicology, ecotoxicology, and risk assessment. Biotechnology, good laboratory practice, and computer simulation modeling are also very important to this field. There is a high degree of interest within regional and national government authorities as well as within international organizations. Educational institutions, media for mass communication, nongovernmental organizations (e.g., consumer associations, environmental groups, and the general public) are also concerned with the complex issues surrounding pesticides. The need for good communication among all the groups involved with, or interested in, pesticides is obvious. This IUPAC project develops a new glossary on pesticide nomenclature, terminology, and definitions which will also be published electronically to assist in this process. It is an update of an earlier IUPAC glossary of terms related to pesticides that was published in 1996 [1].

The glossary has drawn on a wide variety of sources. Some of the general definitions have been put into a pesticide context. However, in all cases, the aim has been to preserve the core meaning. Definitions for a number of formulation terms are inconsistent between different authorities, and we

have largely followed those of the FAO. The definitions and recommended abbreviations for the most commonly used formulations of pesticides are provided. The full list of over 60 formulation types defined by GIFAP [2,62] is available. The modes of action for a few fungicides, insecticides, and herbicides are presented, as examples, but there is no intent to be all-inclusive in this area. Furthermore, as research continues, these mechanisms will be understood more precisely. Whenever accurate and helpful, with respect to pesticides, definitions of terms in the online version of the *IUPAC 1997 Compendium of Chemical Terminology* [3] are used as the preferred definitions. Toxicology definitions are also consistent with those recommended by the IUPAC Commission on Toxicology in their very comprehensive glossary [4]. However, we have not been able to examine all potentially relevant IUPAC glossaries for IUPAC-approved definitions of terms that appear here. Terms related to pesticide risk assessment are consistent with those developed by OECD and IPCS to advance their efforts for international harmonization and understanding in that field. Widely used abbreviations are given in the body of the glossary and can be readily found through the alphabetically ordered definitions or via cross references. Separate lists of abbreviations and acronyms of terms and national or international bodies with direct relevance to pesticides are provided.

This project demonstrates a long-term commitment by IUPAC to the periodical updating of glossaries by incorporating user as well as expert feedback. This publication ensures transparency and is an important quality control mechanism. The Web-based INFOCRIS version provides a transition mechanism and means to gauge client use. In addition, extensive mark-up language procedures encourage reuse of the glossary by other information systems. See the FAO/IAEA Web site for an example [5].

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ALPHABETICAL ENTRIES

abiotic

Not associated with living organisms [3].

abiotic degradation

Degradation of a pesticide via purely physical or chemical mechanisms. Examples include *hydrolysis* and *photolysis*.

absorption

1. *Penetration* of a substance into an organism by various processes, some specialized, some involving expenditure of energy (active transport), some involving a *carrier* system, and others in-

volving passive movement down an electrochemical gradient: In mammals, *absorption* is usually through the respiratory tract, or skin [6].

2. The process of one material (absorbent) being retained by another (absorbate); this may be the physical solution of a gas, liquid, or solid in a liquid, attachment of dissolved molecules of a gas, vapor, liquid, or dissolved substance to a solid surface by physical forces, etc. In spectrophotometry, absorption of light at characteristic wavelengths or bands of wavelengths is used to identify the chemical nature of molecules, atoms, or ions and measure the concentrations of these species [3].

acaricide

Pesticide used for the control of ticks or mites.

accelerated degradation

See *enhanced degradation*.

acceptable daily intake (ADI)

Estimate of the amount of a substance in food or drinking water, expressed on a body-mass basis which can be ingested daily over a lifetime by humans without appreciable health risk [3].

See also *reference dose (RfD).*

accumulation

See *bioaccumulation*.

accuracy (of measurement)

Closeness of agreement between the result of a measurement and the (conventional) true value of the measure [8].

Note 1: Use of the term *precision* for *accuracy* should be avoided.

Note 2: True value is an ideal concept and, in general, cannot be known exactly.

acetolactate synthase (ALS) inhibitor

Herbicidal inhibitior of acetolactate synthase, the enzyme that catalyzes the first step in the synthesis of the amino acids, leucine, isoleucine, and valine [9].

Note: Herbicidal inhibitors of this enzyme in plants include chlorimuron, imazethapyr, diclosulam, pyribenzoxim, flucarbazone, and related herbicides.

acetyl CoA carboxylase (ACCase) inhibitor

Herbicidal inhibitors of *ACCase*, the first enzymatic step in fatty acid biosynthesis [9].

Note 1: Fatty acids are the building blocks for lipids, essential components in cell membranes.

Note 2: The multidomain enzyme found in the Gramineae is particularly sensitive to inhibition by various types of herbicides, including fenoxaprop-ethyl, sethoxydim, and related herbicides.

acetylcholinesterase inhibitor

Compound that blocks the action of the enzyme, acetylcholinesterase, thereby interfering with the transmission of impulses between nerve cells in insects, causing an overstimulation of the nervous system.

Note: Examples of insecticidal inhibitors of this enzyme include carbamates (e.g., carbaryl and aldicarb) and organophosphates (e.g., malathion and chlorpyrifos) [10].

acetylcholine, nicotinic receptor agonist

Compound that simulates acetylcholine and binds at its site on the post-synaptic nerve in insects causing excitation, then paralysis and death [11].

Note: Example agonists include the chloronicotinyl compound, imidacloprid, and the thionicotinyl compound, thiamethoxan.

acetylcholine receptor antagonist

Compound that blocks the nicotinic receptor of acetylcholine, resulting in paralysis and death of insects [11].

Note: At low doses, atropine acts as an antidote for excess levels of acetylcholine but at high doses it can cause paralysis.

acid equivalent (ae)

1. For those pesticides that are acids, *acid equivalent*, abbreviated as *ae*, is the amount of *active ingredient* expressed in terms of the parent acid.
2. The theoretical yield of parent acid from a pesticide active ingredient which has been formulated as a derivative (e.g., salt or ester) [12].

acropetal

Toward the apex of a plant organ, generally upward in shoots and downward in roots [12].

action level (regulatory)

1. For food commodities, an administrative *maximum residue limit* used by regulatory authorities to initiate action where no legally defined *maximum residue limit* has been established.
2. For the environment, concentration of a pesticide in air, soil, or water at which emergency measures or preventative actions are to be taken. After [4].

action limits (analytical quality control)

Limits for measurements on *reference material* or *spiked samples* that indicate when an analytical procedure is not performing adequately and requires immediate action before data can be reported.

activation

1. Processes of chemical modification that make a pesticide more toxic [12].
2. Process by which a pesticide that is applied to the soil surface is moved into the soil where it can be absorbed by weed seedling or insect pests, normally as a result of rainfall, irrigation, or tillage but not necessarily chemical modification. After [14].

active ingredient (ai)

1. Component of a pesticide formulation contributing to the direct or indirect *biological activity* against pests and diseases, or in regulating metabolism/growth, etc. [13].

   Note 1: A single *ai* may be comprised of one or more chemical or biological entities which may differ in relative activity.
   Note 2: A formulation may contain one or more *ai's.*
   Note 3: The equivalent EU term is *active substance.*

2. The ingredient(s) of a control product to which the effects of the pest control product are attributed, including synergists but not solvents, diluents, emulsifiers, or components that by themselves are not primarily responsible for the effects of the product [14].

active transport

Energy-expending mechanism by which a cell moves a chemical across a cell membrane from a point of lower concentration to a point of higher concentration against a concentration gradient or electrochemical gradient.

acute exposure

Contact between a pesticide and a target occurring over a short time (e.g., less than a day) [15].

acute reference dose (ARfD)

Estimate of the amount of a substance in food and/or drinking water, normally expressed on a body weight basis, that can be ingested in a period of 24 h or less without appreciable health risk to the consumer on the basis of all known facts at the time of the evaluation [16].

acute toxicity

Adverse effects of finite duration occurring within a short time (up to 14 d) after administration of a single *dose* (or exposure to a given concentration) of a test substance or after multiple doses (exposures), usually within 24 h of a starting point (which may be exposure to the toxicant, or loss of reserve capacity, or developmental change, etc.) [6].

additive effect

Consequence that follows exposure to two or more physicochemical agents which act jointly but do not interact. The total effect is the simple sum of the effects of separate exposure to the agents under the same conditions [6].

adjuvant

1. Substance added to a pesticide formulation or to the spray tank to modify pesticide activity or application characteristics. After [12].
2. In pharmacology, a substance added to a drug to speed or increase the action of the main component.
3. In immunology, a substance (such as aluminum hydroxide) or an organism (such as bovine tuberculosis bacillus) which increases the response to an antigen [3].

adsorption

An increase in the concentration of a dissolved substance at the interface of a condensed and a liquid phase due to the operation of surface forces. Adsorption can also occur at the interface of a condensed and a gaseous phase [3].

Note: With pesticides, it is normally the increase in the concentration of a pesticide at the interface of soil colloidal clay or organic matter.

Antonym: *desorption*

adverse effect

Change in the morphology, physiology, growth, development, reproduction or life span of an organism, system, or subpopulation that results in impairment of the capacity to compensate for additional stress, or an increase in susceptibility to other influences [3,7].

aerobic

1. Requiring molecular oxygen (dioxygen) [3].
2. Conditions under which molecular oxygen serves as the terminal electron acceptor in respiration or in metabolic oxygenation.

See also *redox potential*.

aerosol

Mixtures of small particles (solid, liquid, or a mixed variety) and the carrier gas (usually air). Owing to their size, these particles (usually less than 100 μm in diameter) have a comparatively small settling velocity and hence exhibit some degree of stability in the earth's gravitational field. An aerosol may be characterized by its chemical composition, its radioactivity, the particle size distribution, the electrical charge, and the optical properties [3].

Note: Fine solid or liquid particles may be created during pesticide spraying by shearing of the carrier (usually water or oil) after forcing it under pressure through a small orifice. *Aerosol* cans using an inert compressed propellant are a common means of dispensing insecticides for domestic use.

See also *nebulization*.

AFID

Alkali flame ionization detector or detection for gas chromatography (cf. NPD and TID).

aged residue

Residues of a pesticide or its degradates in soil that have diffused into intra-particulate regions following application and have become less accessible to mass transfer and bioabsorption processes, although still amenable to solvent extraction.

aggregate exposure

Sum total of all exposure to pesticides through inhalation, dermal, oral, or optic contact.

aggregate sample

Sample made up of set proportions of other samples, typically an average by weight.
See also *composite sample*.

aglycon

Non-sugar compound remaining after replacement of the *glycosyl* group from a glycoside by a hydrogen atom. From [3].
See also *exocon*.

agrochemical

Agricultural chemical used in crop and food production including *pesticide*, feed additive, chemical fertilizer, veterinary drug, and related compounds.

algicide

Pesticide used for the control of *algae*.

aliquot (analytical chemistry)

Known amount of a homogeneous material, assumed to be taken with negligible *sampling error* [3].
Note 1: The term is usually applied to fluids.
Note 2: The term "aliquant" has been used when the fractional part is not an exact divisor of the whole (e.g., a 15-ml portion is an aliquant of 100 ml).
Note 3: When an aliquot is taken of a laboratory sample or test sample or the sample is otherwise subdivided, the samples have been called *split samples.*

allelopathy

The adverse effect on the growth of plants or microorganisms caused by the action of chemicals produced by other living or decaying plants [12].

anaerobic

1. Not requiring molecular oxygen (dioxygen) [3].
2. Condition under which reductive conditions prevail.

See also *redox potential.*

analytical portion

See *test portion*.

analytical range

Measurement range of a test method where the performance has been validated, and quality standards such as *action limits* have been developed.

analytical sample

See *test sample*.

analytical standard

Pesticide reference material of high and defined purity (generally >95 %) for preparation of calibration standards.

anion

A monoatomic or polyatomic species having one or more elementary charges of the electron [3].

antagonism

Combined effect of two or more factors (e.g. pesticides), which is smaller than the solitary effect of any one of those factors [3].

Note: In bioassays, the term may be used when a specified effect is produced by exposure to either of two factors, but not by exposure to both together.

antibody

Protein (*immunoglobulin*) produced by the immune system of an organism in response to exposure to a foreign molecule (*antigen*) and characterized by its specific binding to a site of that molecule (antigenic determinant or *epitope*) [3].

antidote

1. Substance used as a medical treatment to counteract pesticide poisoning.
2. Chemical or substance applied as a *protectant* to prevent the phytotoxic effect of a specific herbicide on desirable plants [12].

See also *safener*.

antifouling paints

Products or coatings used to control aquatic organisms, e.g., barnacles, mussels, molluscs, and algae on ships, small boats, and other surfaces in freshwater or marine environments [14].

apoplast

Total non-living continuum in a plant, including cell walls, intracellular spaces, and the xylem vessels, that form a continuous permeable system through which water and solutes may move [12].

application rate

Mass of *pesticide active ingredient* applied over a specific area or per unit volume of an environmental component (air, water, soil). After [12].

assay

Set of operations having the object of determining the value of a quantity. In analytical chemistry, this term is synonymous with measurement [3].

assimilation

Incorporation of materials acquired by the digestion of food or by photosynthesis into the body of an organism. In plants and algae, the term is also applied to the absorption of light energy and its utilization in internal chemical reactions [17].

attractant

Chemical or substance intentionally used to attract organisms for monitoring or other purposes related to control (e.g., *pheromones*).

autoradiograph

Radiograph of an object containing a radioactive substance (e.g., a radiolabelled pesticide) produced by placing the object (organism or tissue) adjacent to a photographic plate or film or a fluorescent screen. After [3].

auxin hormone mimic

Synthetic *analog* of *auxin hormones* (e.g., indoleacetic acid, IAA) that regulates growth and differentiation in plants with its concentration being regulated by synthesis, conjugation, and degradation. After [9].

Note: Synthetic auxin herbicides such as phenoxy carboxylic acids (e.g., 2,4-D, MCPA), benzoic acids (e.g., dicamba), pyridinecarboxylic acids (e.g., clopyralid, picloram), and quinolinecarboxylic acids (e.g., quinclorac) can readily accumulate to phytotoxic levels in plants.

avicide

Pesticide used for the control of birds.

Bacillus thuringiensis (Bt)

Gram-positive bacteria that produce proteinaceous, parasporal, crystalline inclusions during sporulation. Suspensions of the living or dead bacterial cells can be applied as a *biopesticide* to control, larval, leaf-feeding insects. Upon ingestion by insects, the crystalline inclusions are solubilized in the mid-gut, releasing proteins. After *activation* by proteases in the mid-gut, the protein endotoxins cause membrane disruption and leakage in the epithelium of the mid-gut which leads to death of the insect [18].

Note: There are different subspecies of Bt that are uniquely active for the control of different orders and species of insect pests.

background level

Amount of a pesticide in a medium (e.g., water, soil) that is not attributed to the source(s) under investigation [15].

Note: *Natural background level* is the concentration that occurs naturally or is not the result of human activities.

bactericide

See *bacteriostatic agent*.

bacteriostatic agent

Substance or *agent* that inhibits bacterial growth and multiplication. Similarly, other static agents inhibit multiplication and growth of other specific groups of microorganisms [14].

bait

Food, pheromone, or other substance used to attract and expose a pest to a pesticide, pathogen, or hormone for the purpose of control.

band treatment

Pesticide applied to a linear restricted strip on or along crop rows rather than continuous over the field area [12].

basipetal

Toward the base of a plant organ: generally downward in shoots and upward in roots [12].

batch

Quantity of material that is known or assumed to be produced under uniform conditions [3].

Note: Some vocabularies assume the terms "lot" and "batch" to be synonymous. The distinction made here with respect to knowledge of production history permits a lot to consist of one or more batches and is useful in interpreting the results of analysis.

benthos

Non-planktonic animals (not being suspended in water) associated with freshwater substrata (upper layer of the sediment in rivers and ponds) at the sediment–water interface [19].

bioaccumulation

Progressive increase in the amount of a substance in an organism or part of an organism that occurs because the rate of intake exceeds the organism's ability to remove the substance from the body [6].

See also *bioconcentration*.

bioactivation

Metabolic *conversion* of a *xenobiotic* to a more toxic derivative [6].

bioassay

Procedure for estimating the *concentration* or biological activity of a pesticide by measuring its effect on a living system compared to a standard system [6].

bioavailability

Rate and extent to which a pesticide or metabolite can be absorbed by an organism and is available for metabolism or interaction with biologically significant receptors [15].

Note: It involves both release from a medium (if present) and absorption by an organism.

biocidal products

Active substances (or *active ingredients* and preparations) containing one or more active substances, put up in the form in which they are supplied to destroy, deter, render harmless, prevent the action of, or otherwise exert a controlling effect on any harmful organism by chemical or biological means [20].

bioconcentration

Uptake of a pesticide residue from an environmental matrix, usually through partitioning across body surfaces to a concentration in the organism that is usually higher than in the environmental matrix.

bioconcentration factor (BCF)

Ratio between the concentration of pesticide in an organism or tissue and the concentration in the environmental matrix (usually water) at apparent equilibrium during the uptake phase. After [21].

biocontrol

Use of other organisms to reduce or suppress the population of a pest organism.

biodegradation

Conversion or breakdown of the chemical structure of a pesticide catalyzed by enzymes in vitro or in vivo, often resulting in loss of biological activity.

biological assessment of exposure

Assessment of exposure of a living organism to pesticides using biological specimens (blood, urine, etc.) taken in the environment (workplace, field, etc.) with analysis either directly by chemical determination of parent or metabolite, or indirectly by measurement of a relevant biochemical parameter (e.g., plasma cholinesterase activity for organophosphorus compounds) [4].

biological half-life

For a substance, the time required for the amount of that substance in a biological system to be reduced to one-half of its initial value by biological processes, when the rate of removal is approximately exponential [6].

Note: This assumes that "initial value" is from the first measurement that was made, which could have been at "zero time".

biological indicator

Species or group of species that is representative and typical for a specific status of an ecosystem, which appears frequently enough to serve for monitoring and whose population shows a sensitive response to changes, e.g., the appearance of a pesticide in the ecosystem [22].

biomagnification

Bioaccumulation of a pesticide through an ecological food chain by transfer of residues from the diet into body tissues. The tissue concentration increases at each trophic level in the food web when there is efficient uptake and slow elimination [23].

biomarker

Indicator signalling an event or condition in a biological system or *sample* and giving a measure of *exposure*, effect, or susceptibility [6].

Note: Such an indicator may be a measurable chemical, biochemical, physiological, behavioral, or other alteration within an organism.

biomass

Material produced by the growth of microorganisms, plants, or animals [3].

biometer flask

Experimental apparatus commonly used in laboratory studies of pesticide degradation in soil. Contains separate compartments for aerobic incubation of soil and for media to trap carbon dioxide and volatile products.

biopesticide

Biological agents with pesticidal activity (e.g., *Bacillus thuringiensis*).

bioremediation

1. Process of using the enzymatic actions of microbes to degrade contaminants [23].
2. Process of transforming pesticide waste to less toxic products using microbial activity.
3. Use of plants to remove pollutants from soil or water by root or foliar uptake followed by removal and disposal of the plant.

biosensor

Device that uses specific biochemical reactions mediated by isolated *enzymes*, immunosystems, tissues, *organelles*, or whole cells to detect chemical compounds, usually by electrical, thermal, or optical signals [3].

biotransformation

Chemical conversion of a substance that is mediated by living organisms or *enzyme* preparations derived therefrom [3].

biotransformation pathway

Sequence of the changes occurring in the structure of a pesticide when it is introduced into a specific biological test system.

biotype

Population within a species that has a distinct genetic variation [12].

blank value (in analysis)

Reading or result originating from the matrix, reagents, and any residual bias in the measurement device or process, which contributes to the value obtained for the quantity in the analytical procedure [3].

body burden

Total amount of substance of a chemical present in an organism at a given time [3].

botanical pesticide

Chemical with *pesticidal* activity that is produced naturally within a plant.

bound residue

Residue associated with one or more classes of endogenous macromolecules that cannot be disassociated by extraction or digestion without alteration [25].

breakdown

See *degradation*.

broad-spectrum pesticide

Chemical or substance that kills a wide range of pest species [10].

buffer zone

Strip of land of specified minimum width between the edge of an area where pesticide application is permitted and sensitive non-target areas, e.g., watercourses, wetlands, woodlands, sensitive crops, schools, hospitals.

carcinogen

Agent (chemical, physical, or biological) that is capable of increasing the incidence of malignant neoplasms or cancer in animals [6].

carotenoid biosynthesis inhibitors

Inhibitors of the biosynthesis of carotenoid pigments cause a subsequent photolytic destruction of chlorophylls and other pigments in chloroplasts [9].

Note 1: Various types of herbicides, (e.g., amitrole, clomazone, or fluoridone and related compounds) are known to inhibit one or more of the enzymes in the mevalonic acid pathway that leads to the biosynthesis of carotenoids.

Note 2: The isoxazoles (e.g., isoxaflutole) inhibit the production of plastoquinones which are cofactors for phytoene desaturase, one of the enzymes that is involved in carotenoid biosynthesis.

carrier

Gas, liquid, or solid substance used to absorb, adsorb, dilute, or suspend a pesticide during application [12].

carry-over (chemistry)

Process by which materials are carried into a reaction mixture to which they do not belong. These materials can be either parts of a specimen, or reagents including the diluent or wash solution. In such cases, *carry-over* means the transfer of material (specimen or reagents) from one container, or from one reaction mixture, to another one. It can be either unidirectional or bidirectional in a series of specimens or assays. The term *carry-over effect* is used for carry-over from specimen to specimen [3].

carry-over (field)

Persistence of pesticide residues in soil after use in one crop, such that injury may occur in a subsequent more sensitive crop.

catabolism

1. Reactions involving the oxidation of organic substrates to provide chemically available energy (e.g., ATP) and to generate metabolic intermediates.
2. Generally, the process of breakdown of complex molecules into simpler ones, often providing biologically available energy [3].

catchment

Landform that collects precipitation and retains it in an impoundment or drains it through a single outlet.

cation

Monatomic or polyatomic species having one or more elementary charges of the proton [3].

cation exchange capacity (CEC)

The sum total of exchangeable *cations* that a soil can adsorb, expressed as mole or mmole of negative charge per kg of soil (or other exchange material) [12].

certified reference material

Reference material, accompanied by a certificate, whose pesticide concentrations are certified by procedures which establish their traceability and for which each certified concentration is accompanied by

an uncertainty at a stated level of confidence. Storage conditions and period for which the certification remains valid may also be included for unstable materials [26].

chelating agent

Organic compounds having the ability to withdraw ions from their water solutions into soluble complexes by bi-, tri-, or polydentate ligand binding [23].

chloracne

Acne-like eruption of the skin caused by excessive contact with certain chlorine-containing compounds [23].

chloride channel activator

Compound (e.g., avermectins) with insecticidal activity that acts by increasing membrane conductance to chloride ions, blocking electrical activity at neuromuscular junctions, causing paralysis and death. The effect is similar to that of gamma amino butyric acid (GABA) but is essentially irreversible [27].

chronic effect

Consequence that develops slowly and/or has a long lasting course: may be applied to an effect that develops rapidly and is long-lasting [6].

chronic exposure

Continued or intermittent long-term contact between an agent and a target [15].

chronic toxicity

1. Adverse effects following *chronic exposure*.
2. Effects that persist over a long period of time whether or not they occur immediately upon exposure or are delayed [6].

Codex maximum residue limit (Codex MRL, CXL)

The maximum concentration of a pesticide residue (expressed as mg kg^{-1}), recommended by the Codex Alimentarius Commission to be legally permitted in or on food commodities and animal feed. It is based on *good agricultural practice* data and food derived from commodities that comply with the respective *maximum residue limits* intended to be toxicologically acceptable [28].

colloidal

1. Referring to a state of subdivision, implying that the molecules or polymolecular particles dispersed in a medium have at least in one direction a dimension roughly between 1 nm and 1 μm, or that in a system discontinuities are found at distances of that order [3].
2. Composed of extremely small-size particles (<1 nm) which are not removed by normal filtration [23].

co-metabolism

Microbial metabolism of a pesticide where the derived energy is not used to support microbial growth.

common moiety

Molecular subunit that is common to the structures of several pesticides or metabolites.

common name

See *pesticide common name.*

community

Assembly of *populations* of different species of living organisms, quite often interdependent on and interacting with each other within a specified location in space and time [22].

See also *ecosystem.*

compartment

Part of an organism or *ecosystem* considered as an independent system for purposes of assessment of uptake, distribution, and *dissipation* of a pesticide [22].

compatibility

The characteristic of a substance, especially a pesticide, of being mixable in a formulation or in the spray tank for application in the same carrier without undesirably altering the characteristics or effects of the individual component [12].

compliance (GLP)

See *GLP compliance statement*.

compliance (residue)

Meeting of official *maximum residue limit* standards for food. Approved methods of sampling and testing are employed to confirm that pesticide residues in food do not exceed the *maximum residue limits.*

composite sample

Combined *increment samples*, or combined replicate samples, or combined samples from replicate trials. Preferred term to "bulk sample", which is ambiguous [29].

See also *aggregate sample, primary sample*.

compost

1. Relatively stable humus material that is produced through controlled biological *decomposition* of organic material in the presence of air. Composting proceeds via the activities of a succession of microbial populations and usually involves a significant thermophilic period.

2. Mixtures of garbage and degradable trash with soil in which certain bacteria in the soil break down the garbage and trash into organic fertilizer [23].

concentration

1. Group of four quantities characterizing the composition of a mixture with respect to the volume of the mixture (*mass*, *amount*, volume, and *number concentration*) [3].
2. Short form for *amount (of substance) concentration* (*substance concentration* in clinical chemistry) [3].
3. Amount of a material, agent (e.g., pesticide) dissolved or contained in unit quantity in a given medium or system [7].

concentration-effect relationship

Relationship between the exposure, expressed in concentration, of a given organism, system or (sub-) population to a pesticide or agent in a specific pattern during a given time and the magnitude of a continuously graded effect to that organism, system, or (sub-) population [15].

conjugate

1. Molecular species produced in living organisms by covalently linking two chemical moieties from different sources.
   Example: Conjugate of a pesticide or metabolite with groups such as glutathione, sulfate, or glucuronic acid making it more soluble in water and facilitating its compartmentalization within the cell.
2. Material produced by attaching two or more substances together, e.g., a *conjugate* of an antibody with a fluorochrome or enzyme [6].

   See also *phase II metabolism.*

contact dermatitis

Skin swelling due to either initial acute or long-term irritation from short- or long-term contact with irritating substances [10].

contact poison

1. Chemical that injures the target organism through physical contact rather than through ingestion or inhalation [10].
2. Pesticide (herbicide) that causes injury to only the plant tissue to which it is applied or which is not appreciably translocated within plants [12].

contaminant

1. Minor impurity in a substance.
2. Extraneous material added to a sample prior to or during chemical or biological analysis.
3. Unintended pesticide residue in an agricultural commodity or environmental compartment (e.g., ground water).

   See also *pollutant.*

control sample (field)

Sample from a field test plot to which no pesticide was applied (a zero rate sample) or which received chemical treatments identical to the test plots except for the test chemical.

critical concentration (for a cell or organ)

Concentration of a substance at and above which adverse functional changes, reversible or irreversible, occur in a cell or an organ [6].

critical load

Amount of a pesticide leading to a *critical concentration* when received by an environmental *compartment* [22].

cross-resistance

One organism or biotype that confers resistance to two or more pesticides due to a single resistance mechanism [12].

cumulative effect

Overall change which occurs after repeated *doses* of a substance or radiation [6].

cumulative risk

Probability of any defined harmful effect occurring through a common toxic effect associated with concurrent exposure by all relevant pathways and routes of exposure to a group of chemicals that share a common mechanism of toxicity [30].

cut-off value

Numerical value set by regulatory authorities representing the limit of acceptability for a property or behavior of a compound for the final step in tiered assessment schemes.

See also *trigger value*.

cuticle

Waxy covering produced by the epidermal (outer) cells of plant leaves. Protects from excessive water loss. Comprised of cutin and waxes to form a hydrophobic physical barrier to the penetration of virus particles, fungal spores, etc. Adjuvants can be added to pesticide formulations to facilitate better cuticular penetration of the *active ingredient*.

cytochrome P450

Member of a superfamily of heme-containing monooxygenase (oxidizing) enzymes involved in pesticide or *xenobiotic* metabolism, cholesterol biosynthesis, and steroidogenesis, in eukaryotic organisms found mainly in the endoplasmic reticulum and inner mitochondrial membrane of cells. P450 refers to a feature in the carbon monoxide absorption difference spectrum at 450 nm caused by the presence of a thiolate in the axial position of the heme opposite to the carbon monoxide ligand [3].

decomposition

Breakdown of a single phase into two or more phases. The term applies also to chemical entities such as a normal molecule and a reaction intermediate [3].

See also *degradation.*

defoliant

Chemical that causes the leaves to abscise from a plant [12].

degradate

Chemical product resulting from *degradation* of a pesticide.

degradation

Process by which a pesticide is broken down to simpler structures through biological or *abiotic* mechanisms.

See also *biodegradation*, *mineralization*.

Synonyms include *breakdown* and *decomposition.*

dermal toxicity

Ability of a pesticide or other chemical to poison people or animals by contact with the skin [23].

desiccant

1. Drying agent.
2. In agriculture, a substance used for drying up crop stems and foliage to facilitate their mechanical harvesting [3].

desorption

Decrease in the amount of adsorbed substance (e.g., pesticide) at the interphase of the soil colloids (clay or organic matter) [3].

Antonym: *adsorption.*

detoxification

1. Process or processes of a chemical modification that make a toxic molecule less toxic.
2. Treatment of patients suffering from poisoning in such a way as to promote physiological processes which reduce the probability or severity of harmful effects [6].

diffusion

1. Spreading or scattering of a gaseous or liquid material. Eddy diffusion in the atmosphere is the process of transport of gases due to turbulent mixing in the presence of a composition gradient. Molecular diffusion is the net transport of molecules that results from their molecular motions alone in the absence of turbulent mixing. It occurs when the concentration gradient of a particular gas in a mixture differs from its equilibrium value. Eddy diffusion is the most important mix-

ing process in the lower atmosphere, while molecular diffusion becomes significant at the lower pressures of the upper atmosphere [3].

2. Movement of suspended or dissolved particles or molecules from a more concentrated region to a less concentrated region as a result of random movement of individual particles. Diffusion tends to distribute particles uniformly throughout the available volume [10].

diluent (*pesticide* applications)

Liquid or solid material used to dilute a concentrated pesticide formulation prior to application. Most commonly water for spray application.

diluent (solvent extraction)

The liquid or homogeneous mixture of liquids in which extractant(s) and possible modifier(s) may be dissolved to form the solvent phase [3].

Note 1: The term "carrier", which implies an inert diluent, is not recommended.

Note 2: Although the diluent may well be a single liquid or even the major portion of the extracting phase, the term "solvent" should not be used in this sense as it has a much wider meaning in the context of liquid–liquid extraction, although the term "cosolvent" may be used in certain circumstances.

Note 3: The diluent by itself does not extract the main (extractable) solute appreciably.

dioxin

Colloquial (short) name of a toxic by-product (and sometimes contaminant) of chlorophenol-derived herbicides; the full name of one of the most toxic species is: 2,3,7.8-tetrachloro dibenzo[*b,e*] [1,4-dioxin]. From [3].

Note: The major source of dioxins in the environment is the burning of organic materials.

dislodgeable foliar residue (DFR)

Portion of a pesticide residue on treated vegetation that is readily removable and may be used as an index for exposure of farm workers.

Note: Generally measured by the residue removed when leaf-discs are shaken briefly in water or by scuffling the treated area with cloth-covered devices [31].

Synonym: *transferable residue.*

dispersible granule

Dry granular pesticide formulation that will separate or disperse to form a suspension when added to water [12].

dissipation

Loss of pesticide residues from an environmental compartment due to *degradation* and transfer to another environmental compartment.

dissipation time 50 % (DT_{50})

Time required for one-half the initial quantity or concentration of a pesticide to dissipate from a system. No assumption as to the rate equation is made.

See also *half-life*, $t_{1/2}$.

dormancy

State of inhibited seed germination or growth of a plant organ when in an environment normally conducive to growth [12].

dose

Total amount of a pesticide or agent administered to, taken up or absorbed by an organism, system, or (sub-) population [7].

See also *application rate*.

dose–effect relationship

Relationship between the total amount of an agent administered to, taken up or absorbed by an organism, system, or (sub-) population and the magnitude of a continuously graded effect to that organism, system, or (sub-) population [7].

dose–response relationship

Relationship between the amount of a pesticide administered to, taken up or absorbed by an organism, system, or (sub-) population and the change developed in that organism, system, or (sub-) population in reaction to the pesticide (or agent) [7].

drift control agent

Formulant that controls the distribution of spray droplet sizes and prevents production of excessive fines.

dry weight basis

Pesticide residue concentration reported as if the residue were wholly contained in the dry matter of the sample.

Note 1: Analytical results are often corrected for the water content of the *test sample*.

Note 2: Residues in soils and feeds and *maximum residue limits* for feedstuffs are expressed on a *dry weight basis*.

dustable powder (DP)

Free-flowing powder suitable for dusting [2].

EC_{50}

See *median effective concentration*.

ECD

See *electron capture detector.*

ecdysone agonist

Compound that disrupts the normal molting process in insects by inducing a lethal, premature molt. One example is the diacylhydrazine, tebufenozide.

ecosystem

Assembly of populations of different species (often interdependent on and interacting with each other) together with non-living components of their environment [21].

See also *community.*

ecotoxicologically (environmentally) relevant concentration (ERC)

Concentration of a pesticide (*active ingredient, formulations*, and/or relevant *metabolites*) that is likely to affect a determinable ecological characteristic of an exposed system [after 22].

Note: It is related to the toxicity characteristics, generally the *no-observed-effect concentration*, to the most sensitive species or groups of species.

ecotype

Population with a species that has developed distinct morphological or physiological characteristics in response to a specific environment and that persists when individuals are moved to a different environment [12].

effect assessment

Combination of analysis and inference of possible consequences of the exposure to a particular agent (e.g., pesticide) based on knowledge of the dose–effect relationship associated with that agent in a specific target organism, system, or (sub-) population [7].

efficacy (pest control)

Ability of a product to fulfil the claims of pest control made on the label. From [32].

electron capture detector (ECD in gas chromatography)

A small radioactive source containing ^{3}H or ^{63}Ni ionizes the molecules of the carrier gas (nitrogen or argon–methane) and a potential difference creates a small current. This current is reduced when an electronegative substance (such as a halocarbon) is introduced. The reduction in current is a measure of the concentration of the electronegative substance [3].

elicitor

Molecule produced by the host (or pathogen) that induces a response by the pathogen or host.

Note: Many *Pythium spp.* produce large protein elicitor molecules which serve as virulence factors by attacking host cell walls.

ELISA

See *immunoassay.*

emergence

The event in seedling establishment when a shoot becomes visible by pushing through the soil surface [12].

emulsifiable concentrate (EC)

Single-phase, homogeneous, liquid pesticide formulation that forms an emulsion when added to water [12].

emulsifier

1. S*urfactant* which, when present in small amounts, facilitates the formation of an *emulsion*, or enhances its *colloidal* stability by decreasing either or both of the rates of aggregation and coalescence [3].
2. Substance that promotes the suspension of one liquid in another liquid with which it is not normally miscible [12].

enantiomer

One of a pair of molecular entities which are mirror images of each other and non-superimposable [3].
See also *racemate*.

encapsulated formulation

Pesticide enclosed in capsules (or beads) of material to control the rate of release of *active ingredient* and thereby extend the period of activity [12].

endangered species

Animals, birds, fish, plants, or other living organisms threatened with extinction by man-made or natural changes in their environment. In some jurisdictions, *endangered species* is defined in legislation, e.g., in the United States, the requirements are contained in the Endangered Species Act [23].

endocon

Portion of a conjugated metabolite that is derived from a natural product of the metabolizing organism such as a sugar, amino acid, or other organic acid.
See also *exocon*, *phase II metabolism* [3].

endpoint

Measurable ecological or toxicological characteristic or parameter of the test system (usually an organism) that is chosen as the most relevant assessment criterion (e.g., death in an acute test or tumor incidence in a chronic study).

end-use product (EP)

Product containing *active ingredient(s)* and usually formulants that has been manufactured, packaged, and labelled with instructions for direct pest control use or application in a form that is usable by the consumer [14].

enforcement method

See *regulatory method*.

enhanced degradation

Increased rate of degradation of a pesticide in soil or other environmental matrix by a population of microorganisms that has adapted to metabolize it through previous exposure to it or a similar chemical.

Synonyms include *accelerated degradation* and *enhanced biodegradation*.

enolpyruvyl shikimate acid phosphate synthase (EPSPS) inhibitor

Herbicide (e.g., glyphosate) that inhibits the enzyme, EPSPS, involved in the production of aromatic amino acids such as phenylalanine, tyrosine, and trytophan in plants [9].

Note: These amino acids are precursors for compounds that have numerous essential functions in plants.

enterohepatic circulation

Cyclical process in which a pesticide residue is absorbed and transported to the liver, metabolized (often including conjugation), transported to the intestine by the bile, reabsorbed (often after deconjugation), and transported back to the liver for further metabolism [4].

environmental fate

Destiny of a pesticide or chemical after release to the environment involving considerations such as transport through air, soil, or water, bioconcentration, degradation, etc. [10].

environmental impact assessment

Assessment of the potential releases of a pesticide to the environment and their potential effects upon the environment and its components, including humans.

See *risk assessment*.

environmental risk

Probability that an *adverse effect* on humans or the environment will be observed for a given *exposure* to a pesticide based on the probability of that exposure and the sensitivity of the system.

See *risk assessment*.

epidemiology

Study of the incidence and distribution of disease or toxic effects within a population [10].

epinasty

"State" or "condition" in which faster growth on the upper side of a plant organ or part (especially the leaf) causes it to bend or curl downward [12].

estimated environmental concentration (EEC)

Predicted concentration of a pesticide within an environmental *compartment* based on estimates of quantities released, discharge patterns, and inherent disposition of the pesticide (fate and distribution) as well as the nature of the specific receiving ecosystems [22].

See also *expected environmental concentration* (*EEC*).

excretion

Elimination of an absorbed pesticide or its metabolites through some tissue of the body and its appearance in urine, feces, or other products normally leaving the body.

exocon

Portion of a conjugated metabolite that is derived from the parent pesticide [3].

See also *aglycon*.

expected environmental concentration (EEC)

Calculated concentrations of a pesticide in various environmental compartments based on maximum-exposure scenarios [33].

Note 1: EEC models assume a maximum number of applications per growing season at the maximum rate of application according to the application methods stated on the product label.

Note 2: The equivalent EU term is *potential environmental concentration* or *PEC*.

exposure

Concentration or amount of a pesticide (or agent) that reaches a target organism, system, or (sub-) population in a specific frequency for a defined duration [15].

exposure assessment

Evaluation of the exposure of an organism, system, or (sub-) population to a pesticide or agent (and its derivatives). Exposure assessment is the third step in the process of risk assessment [7].

exposure surface

Surface on a target where a pesticide or agent is present [15].

Note: With mammals, examples of outer exposure surfaces include the exterior of an eyeball, the skin surface, and a conceptual surface over the nose and open mouth. Examples of inner exposure surfaces include the gastrointestinal tract, the respiratory tract, and the urinary tract lining.

extractability (in solvent extraction)

A property that qualitatively indicates the degree to which a substance (e.g., pesticide) is extracted from a matrix (e.g., soil, water, tissue) [3].

Note: The term is imprecise and generally used in a qualitative sense. It is not a synonym for fraction extracted.

extraneous maximum residue limit (EMRL)

Maximum concentration of a pesticide residue, arising from environmental sources (including former agricultural uses), other than from the use of a pesticide directly or indirectly on the commodity, that is recommended or permitted in or on a feed or food commodity. After [37].

fat basis

Residues and *maximum residue limits* of fat-soluble pesticides in animal commodities may be expressed in terms of their concentration in the fat rather than the whole product.

fate

Pattern of distribution of an agent (e.g., pesticide) its derivatives or metabolites in an organism, system, compartment (e.g., of the environment), or (sub-) population.

fetotoxicity

Toxic effect on the fetus [10].

field drainage

Removal of excess water from soil and transport to surface waters in order to improve soil productivity and traffic ability.

flame ionization detector (FID, in gas chromatography)

Gases emerging from the column are fed into a hydrogen flame across which an electrical potential is placed. Certain molecules ionize easily in the flame, and current produced is proportional to the instantaneous flow rate of the eluted component. The detector is relatively insensitive to inorganic molecules and is mostly used for organic compounds [3].

flame photometric detector (FPD, in gas chromatography)

Eluent from the column is fed into a hydrogen-rich flame and produces light emission. Optical filters are used to select the wavelength range of the emission, which is characteristic of specific atoms (usually sulfur or phosphorus). The detector is very specific, depending on the choice of optical filters. The FPD can detect compounds containing sulfur and phosphorus, but the response is nonlinear for sulfur [3].

flowable

See *suspension concentrate*.

food chain—primary consumers

Heterotrophic organisms (e.g., filter-feeding invertebrates such as daphnia species) using organic substances directly from *primary producers* (e.g., algae) as a carbon and energy source.

food chain—primary decomposers

Heterotrophic organisms (e.g., bacteria) using dead organic matter from all trophic levels as a carbon and energy source.

food chain—primary producers

Autotrophic organisms (e.g., algae, higher plants) that convert inorganic compounds during the process of photosynthesis or chemosynthesis into organic compounds (cell material) of higher energy content. These organisms represent the first trophic level of the food chain.

food chain—secondary consumers

Heterotrophic organisms (e.g., predator animals) feeding on *primary consumers*.

food chain—secondary decomposers

Heterotrophic organisms (e.g., certain soil fungi, collembola, worms) using already partially decomposed organic matter as a carbon and energy source.

food chain—secondary producers

Heterotrophic organisms (e.g., animals) using organic substances as a carbon and energy source.

Food Quality Protection Act (FQPA)

1996 update/amendment to the U.S. Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Federal Food Drug and Cosmetic Act (FFDCA). FQPA fundamentally changes the way EPA regulates pesticides to "establish a more consistent, protective regulatory scheme, grounded in sound science". FQPA mandates a single, health-based standard for all pesticides in all foods; provides special protections for infants and children; expedites approval of safer pesticides; creates incentives for the development and maintenance of effective pesticides; and requires periodic re-evaluation of pesticide registrations and tolerances to ensure that the scientific data supporting pesticide registrations will remain up to date in the future [30].

formulant

Any added material in a pesticide formulation other than the biologically *active ingredient(s).* This may include a *carrier* or other substances that enhance the biological activity or physiochemical properties of the formulation [33].

See also *adjuvant*, *diluent*, *inert*, *sticker*, *surfactant*, *vehicle*.

formulate

Process of combining a *pesticide active ingredient* with various *carriers*, *adjuvants*, *solvents*, etc. to develop the end-use product.

formulation

1. Pesticide preparation supplied by a manufacturer for practical use.
2. Process, carried out by manufacturers, of preparing pesticides for practical use [12].

Note: For a complete list of different formulation types, see [62].
See also *pesticide formulation*.

fortified sample

See *spiked sample*.

FPD

See *flame photometric detector*.

fresh weight basis

Pesticide residues are reported on the laboratory sample as it is received, with no allowance for the moisture content. *maximum residue limits* and pesticide residues in food commodities are expressed in this way.

Freundlich isotherm

Empirical relationship describing the *adsorption* of a solute from a liquid or gaseous phase to a solid in which the quantity of material adsorbed per unit mass of adsorbent is expressed as a function of the equilibrium concentration of the sorbate.

See also K_d.

frozen storage stability

See *storage stability test*.

FTIR

Fourier transform infrared spectroscopy.

fumigation

Use of a pesticide in gas or vapor form.

fungicide

Pesticide used for the control of *fungi*.

GABA antagonist

Insecticidal compound that binds to the chloride channel in nerves and blocks the action of the neurotransmitter, gamma-aminobutyric acid (GABA). This effect results in the hyper-excitation of the central nervous system (CNS) in insects and mites [27].

Note: The cyclodiene, endosulfan, and the phenylpyrazole, fipronil, have this effect in insects but act at slightly different sites in the channel.

gas chromatography (GC)

A separation technique in which the *mobile phase* is a gas. Gas chromatography is always carried out in a column containing a stationary phase (liquid or solid) [3].

Note: Separation of components is based on differential partitioning between the stationary phase and the carrier gas.

GC/EC

Gas chromatography with electron capture detector.

GC/MS

Gas chromatography/mass spectrometry.

GC/MSD

Gas chromatography with mass-selective detection (usually low-resolution mass spectrometry) using selected ions.

generic pesticide

Pesticide for which the original manufacturer's patent on the *active ingredient* has expired in a certain geographic area and production is now also occurring via one or more secondary manufacturers.

genotoxic

Capable of causing a heritable change to the structure of DNA, thereby producing a mutation [6].

GLC

Gas–liquid chromatography.

GLP

See *good laboratory practice*.

GLP archive facilities

Facilities that provide for the storage and retrieval of the study plan, raw data, final reports, sample of test items, and specimens. Derived from [35].

Note: Archive design and conditions should protect contents from untimely deterioration.

GLP chain of custody

Set of procedures and traceable records that demonstrate an unbroken control over, or custody of, a document, or raw data, or a sample from its collection through to its final disposition. Derived from [35].

GLP compliance statement

Signed and dated statement on the final report to indicate acceptance of responsibility for the validity of the data and to indicate the extent to which the study complies with the principles of *GLP*. Derived from [35].

GLP compliance status

The level of adherence of a test facility to the *GLP* principles as assessed by the national *GLP* monitoring authority. Derived from [35].

GLP principal investigator

In the event of a multi-site study, management designates a person who is appropriately trained, qualified, and experienced to supervise the delegated phase(s) of the study. The principal investigator will ensure that the delegated phases of the study are conducted in accordance with the applicable principles of *GLP*. Derived from [35].

GLP protocol

See *GLP study plan*.

GLP quality assurance program

Statement prepared by the *QAU*, to be included with the final report, which specifies types of inspections and their dates and including the phase(s) of the study inspected, and the dates inspection results were reported to management and the study director and principal investigator, if applicable. This statement serves to confirm that the final report reflects the raw data. Derived from [35].

GLP quality assurance statement

Statement prepared by the *QAU* specifying the dates inspections were made and any findings that were reported to management and to the study director. This statement is part of the final report of a study. Derived from [35].

GLP quality assurance unit (QAU)

Subsection of the test facility, separate from actual testing, responsible for internal audits of the facility and its *study reports* to ensure compliance with *GLP*. The *QAU* is also generally responsible for the administration and training in all aspects of the quality assurance system. Derived from [35].

GLP standard operating procedure (SOP)

Written procedure, authorized by management, that describes how to perform a certain routine test or activity normally not specified in detail in study plans or test guidelines, e.g., arrival, identification, and

storage of samples, standards, or reagents; operation, maintenance, and calibration of apparatus; preparation of reagents; quality assurance procedures. Derived from [35].

GLP study

Experiment or set of experiments conducted under *GLP*. Derived from [35].

GLP study audit

Review by the *QAU* of an interim or final report, including raw data from a study, confirming that the study was carried out in accordance with the study plan and *SOPs* and that it has been accurately and completely reported in compliance with *GLP*. Derived from [35].

GLP study director

Person responsible for the overall conduct of a study, i.e., ensuring that all phases of the study are conducted under *GLP* according to the study plan. Derived from [35].

GLP study plan

Document that determines the entire scope of a study conducted under *GLP*. A written study plan must be completed and approved by the *study director* before a study starts. It contains information such as the title of study; name or code of test and reference substances; name and address of sponsor, test facility, study director, and principal investigators; dates for start and end of study; methods including relevant *SOPs*; list of material to be archived. Derived from [35].

GLP test facility inspection

Check of a test facility, a study, or parts of a study by an internal or external authority to ensure compliance with *GLP* guidelines. Internal inspections are carried out by the *QAU*. Derived from [35].

See also *GLP study audit*.

glucuronides

Components resulting from the conjugation of a pesticide or its metabolite with glucuronic acid.

glutamine synthetase (GS) inhibitor

Chemical that inhibits *GS*, an enzyme which has many important functions in plants including ammonia assimilation, ammonia recycling, synthesis of amino acids, photorespiration, and maintaining low levels of glyoxalate to prevent inhibition of ribulose-1,5-bisphosphate carboxylase (RUBISCO), a key enzyme in carbon fixation [9].

Note 1: Inhibitors of this enzyme are toxic to most plants.

Note 2: Phosphinothricin, a natural microbial product, and glufosinate, its synthetic analog, are two herbicidal inhibitors of this enzyme.

glycosides

Mixed acetal (ketal) conjugates resulting from the attachment of a *glycosyl group* (on a saccharide or saccharide derivative) to a non-acyl group RO- (e.g., on a pesticide or its metabolite) which itself may

be derived from a saccharide and chalcogen replacements thereof (RS-, RSe). In plants and insects, the saccharide *endocon* is commonly an aldohexose. After [3].

good agricultural practice (GAP)

In the use of pesticides, *GAP* includes the officially recommended or nationally authorized uses of pesticides under actual conditions necessary for effective and reliable pest control. It encompasses a range of levels of pesticide applications up to the highest authorized use applied in a manner which leaves a residue that is the smallest amount practicable [36].

good experimental field practice

The formalized process for designing and recording the practices used in the performance of field investigations with pesticides, and which assure the reliability and integrity of the data.

See *GLP*.

good laboratory practice (GLP)

The formalized process and conditions under which laboratory studies on pesticides are planned, performed, monitored, recorded, reported, and audited. Studies performed under *GLP* are based on the national regulations of a country and are designed to assure the reliability and integrity of the studies and associated data. Derived from [35].

Note 1: The US-EPA *GLP* definition also covers field experiments.

Note 2: For Europe, see EPPO Guidance Notes [61].

See also *good experimental field practice*.

GPC

Gel permeation chromatography.

See also *size-exclusion chromatography* (*SEC*).

graminicide

Pesticide (*herbicide*) used for the control of grasses (Gramineae) [12].

granular

Dry pesticide formulation consisting of discrete particles generally <10 mm^3 and designed to be applied without a liquid carrier [12].

ground water

Water present in the saturated subsurface zone of the soil profile, where all open spaces/pores in the sediment and rock are filled with water.

growth regulator

Chemical, often a natural or synthetic hormone, used to modify or control the growth and development of a plant or insect, sometimes for the purpose of control.

guarantee

Amount of *active ingredient* contained in a product, expressed as either a percentage or a concentration, e.g., g kg^{-1} or g L^{-1} [14].

Note 1: Most regulators require that the *guarantee* be stated on all pesticide labels.

Note 2: In Canada, the *guarantee* statement represents an expression of the nominal value (or typical concentration) of the *active ingredient* within a representative sample of a pesticide as required on the registered product label.

guideline level

Maximum concentration of a pesticide residue in or on a feed or food commodity, resulting from a use reflecting *good agricultural practice*, but where an *acceptable daily intake* has not been estimated.

guideline value

Maximum recommended pesticide residue in an environmental medium that ensures aesthetically pleasing air, water, or food and does not constitute a significant risk to the user [4].

half-life ($t_{1/2}$)

For a reactant in a given reaction, the time required for its concentration to reach a value that is the arithmetic mean of its initial and final (*equilibrium*) values. For a single reactant that is entirely consumed (e.g., *pesticide degradation*), it is the time taken for the reactant concentration to fall to one-half its initial value. The *half-life* of a reaction has meaning only in special cases:

For a first-order reaction, the *half-life* of the reactant may be called the *half-life* of the reaction.

For a reaction involving more than one reactant, with the concentrations of the reactants in their stoichiometric ratios, the *half-life* of each reactant is the same, and may be called the *half-life* of the reaction. If the concentrations of reactants are not in their stoichiometric ratios, there are different *half-lives* for different reactants, and one cannot speak of the *half-life* of the reaction [3].

hazard

Inherent property of an agent (e.g., pesticide) or situation having the potential to cause adverse effects when an organism, system, or (sub-) population is exposed to that agent or situation [7].

hazard assessment

Process that includes hazard identification and characterization and focuses on the hazard in contrast to risk assessment where exposure assessment is a distinct additional step [7].

hazardous distance for the most sensitive effect (HDSE)

Statistically determined safety margin corresponding to a distance from treated areas at which protection of the terrestrial environment can be adequately achieved as measured by the most sensitive non-target species.

See also *buffer zone*, *margin of safety.*

health advisory level (HAL)

Estimate of upper concentration limit for a pesticide in drinking water that can be consumed for a lifetime without *adverse effects*.

Note: *HALs* generally do not have formal legal significance but have been used, particularly in the United States, for preliminary *risk assessment*.

herbicide

Pesticide used for the control of unwanted plants or weeds.

hormone

Chemical substance produced and secreted in one part of an organism and transported to another part of that organism where it has a specific effect [10].

See also *growth regulator*.

HPLC

High-performance liquid chromatography.

HPTLC

High-performance thin-layer chromatography.

HRGC

High-resolution gas chromatography (GLC) with narrow-bore capillary columns.

hydrolysis

Solvolysis by water [3].

hydrophilic

"Water loving". The capacity of a molecular entity or of a substituent to interact with polar solvents, particularly water, or with other polar groups [3].

hydrophobic

"Water avoiding". The capacity of a molecular entity or of a substituent to interact with nonpolar solvents or with other nonpolar groups [3].

hydroxyphenyl pyruvate dioxygenase (HPPD) inhibitor

Herbicidal inhibitor of the HPPD enzyme which converts hydroxyphenyl pyruvate into homogentisate, a key step in plastoquinone biosynthesis in plants. Plastoquinone is a cofactor of the enzyme, phytoene desaturase (PDS) in the carotenoid biosynthetic pathway that converts phytoenes to lycopenes that eventually become carotenoids in plants [9].

Note 1: Leaves of plants injured by inhibitors of this enzyme can lack both carotenoid and chlorophyll pigments and are white in color.

Note 2: *Herbicidal inhibitors* of this enzyme include isoxazoles (e.g., isoxaflutole), triketones (e.g., mesotrione), and pyrazoles (e.g., pyrazoxyfen).

identification

Process of unambiguously determining the chemical identity of a pesticide or metabolite in experimental or analytical situations.

immobilization

1. Process leading to restricted mobility of a pesticide in a plant or soil due to strong binding.
2. Incorporation of terminal pesticide *degradates* into complex organic forms in microbial or plant tissue.

immunoassay

Ligand-binding assay that uses a specific *antigen* or *antibody*, capable of binding to the analyte, to identify and quantify substances. The antibody can be linked to a radioisotope (radioimmunoassay, RIA) or to an enzyme that catalyzes an easily monitored reaction (enzyme-linked immunosorbent assay, ELISA), or to a highly fluorescent compound by which the location of an antigen can be visualized (immunofluorescence) [3].

impurity

By-product of the manufacture or storage of a pesticide. Any substance in a control product other than an *active ingredient* or a formulant (e.g., contaminants), residual starting materials, reaction products, degradation products, or products added for purposes of extraction or purification. After [15].

Note: Impurities require definition, evaluation, and regulation if toxicologically significant.

increment sample

Individual portion (unit) of material collected by a single operation of a sampling device from bulk materials or large units [29].

incurred residue

Residue in a commodity resulting from specific use of a pesticide, consumption by an animal, or environmental contamination in the field, as opposed to residues from laboratory fortification of samples.

inert ingredient

Any intentionally added ingredient in a pesticide product which is not pesticidally active.

Note 1: This does not include impurities.

Note 2: Although *inert ingredients* are not normally pesticidal, they may have biological activity.

in-life phase

Phase of a study following treatment in which the test system is alive/growing.

insect growth regulator (IGR)

See *growth regulator* or *hormone*.

insecticide

Pesticide used for the control of *insects*.

instrumental analysis solvent

High-purity solvent intended for use in pesticide residue analysis (e.g., HPLC, etc.).
See also *reagent purity.*

intake

Process by which a pesticide or agent crosses an outer exposure surface of a target without passing an absorption barrier, i.e., through ingestion or inhalation [15].

integrated pest management (IPM)

Use of pest and environmental information in conjunction with available pest control technologies to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to persons, property, and the environment [30].

international estimated daily intake (IEDI)

Prediction of the long-term daily intake of a pesticide residue on the basis of the assumptions of average daily food consumption per person and median residues from supervised trials, allowing for residues in the edible portion of a commodity and including residue components defined by the JMPR for estimation of dietary intake [28].

international estimated short-term intake (IESTI)

Prediction of the short-term intake of a pesticide residue on the basis of the assumptions of high daily food consumption per person and highest residues from supervised trials, allowing for residues in the edible portion of a commodity and including residue components defined by the JMPR for estimation of dietary intake. It is expressed in milligrams of residue per kg body weight [16].

invert emulsion

Suspension of minute water droplets in a continuous oil phase [12].

in vitro

"In glass", referring to a study in the laboratory usually involving isolated organ, tissue, cell, or biochemical systems [3].

in vivo

"In the living body", referring to a study performed on a living organism [3].

See *soil partition coefficient*.

isomer

One of several species (or *molecular entities*) that have the same atomic composition (molecular formula) but different *line formulae* or different *stereochemical formulae* and hence different physical and/or chemical properties [3].

IUPAC name

Name of a *chemical* according to the rules of nomenclature of the International Union of Pure and Applied Chemistry (IUPAC) [12,63–65].

See also *systematic name*, *trivial name*, *pesticide trivial name.*

K_d

See *soil partition coefficient*.

K_{oc}

See *soil organic partition coefficient*.

K_{ow}

See *octanol–water partition coefficient*.

label

1. A marker, tag, or indicator distinguishable by the observer but not by the system and used to identify a *tracer* [3].
2. Legally registered text as part of the registration process which governs the use of the product [32].

See also *radiolabelled.*

laboratory sample

Sample or subsample sent to or received by the laboratory.

lacrimation

Secretion and discharge of tears [23].

lag phase

1. Growth interval (adaption phase) between inoculation and start of the exponential phase during which there is little or no growth [3].

2. Period that may precede commencement of rapid degradation of a pesticide by a microbial population. It is the period needed either for induction of microbial enzymes or for growth of the microbial population to adequate size.
   See also *enhanced degradation*.

lateral movement

Movement of a pesticide through soil, generally in a horizontal plane, from the original site of application [12].

LC_{50}

See *median lethal concentration*.

LD_{50}

See *median lethal dose.*

leachate

Aqueous phase percolating through a soil profile or a soil column.

leaching

1. Removal of materials in solution from the soil or other substances.
2. Downward movement of pesticides into a soil profile with soil water (the pesticide may or may not be in true solution and may or may not move from the soil) [12].

limit of detection (LOD)

Lowest concentration of a *pesticide residue* in a defined *matrix* where positive identification can be achieved using a specified method.

limit of quantitation (LOQ)

Lowest concentration of a *pesticide residue* in a defined *matrix* where positive identification and quantitative measurement can be achieved using a specified analytical method.

limit of reporting

Practical limit of residue quantitation at or above the *LOQ*. The conservative limit of quantitation for a defined matrix and method which may vary between laboratories or within the one laboratory from time to time because of different equipment, techniques, and reagents. Commonly either the lower limit of the calibrated range of the method or the lowest level at which quantitative recovery of the analyte has been demonstrated.

lipophilic

Literally "fat-loving". Applies to molecular entities (or parts of molecular entities) having a tendency to dissolve in fat-like (e.g., hydrocarbon) solvents [3].

lot

Quantity of material that is assumed to be a single population for sampling purposes [3].
See also *batch*.

lowest-effective-use rate (LER)

Minimum application rate required to provide effective control of a target pest, in terms of level, duration, and consistency across a broad range of conditions in which the product will be applied [32].
Note: The LER will be specific to site/pest combination and management practices.

lowest-observed-adverse-effect level (LOAEL)

Lowest *concentration* or amount of a substance (dose), found by experiment or observation, which causes an *adverse effect* on morphology, functional capacity, growth, development, or life-span of a *target* organism distinguishable from normal (control) organisms of the same species and strain under defined conditions of *exposure* [6].

lysimeter

1. Laboratory column of selected representative soil or a protected monolith of undisturbed field soil with which it is possible to sample and monitor the movement of water and substances [3].
2. Device for measuring leaching losses from a column or block of soil. The simplest lysimeters may be devices for sampling a portion of the water *leaching* through a natural sediment or soil (e.g., suction lysimeter) whereas more elaborate lysimeters may involve the confinement of an entire segment of soil from which all *leachate* is collected (e.g., monolithic lysimeter).

macropore

1. Pore with width exceeding about 0.05 μm or 50 nm (500 Å) [3].
2. Soil pore larger than 1 mm in diameter including interparticle void, earthworm or rodent burrow, drying crack, and decayed root channel.
See *preferential flow*.

margin of safety (MOS)

Ratio of the highest estimated or actual level of exposure to an agent (e.g., pesticide) and the highest nontoxic dose threshold (usually the *NOEC* or *NOEL*) [22].
See also *uncertainty factor*.

market basket survey

Pesticide residue monitoring on a wide range of food items collected from consumer points of sale and in proportions approximating consumption patterns in the local population.
Note: Samples are prepared for analysis according to Codex guidelines, i.e., minimal preparation.
See also *total diet study*.

material preservatives

Pesticidal products that are usually applied during the manufacture of various materials to protect them against bacterial or fungal deterioration. Materials may include textiles, leather, aqueous emulsions, paints, packaging materials, plastics, vinyls, rubber, waxes, dyes, etc. [14].

material safety data sheet (MSDS)

Document or form containing the properties of a particular substance. It is intended to provide workers and emergency personnel with the procedures for handling that substance in a safe manner [14,59].

Note 1: *SDS* or *safety data sheet* is a more accurate term.

Note 2: The *MSDS* must include information such as physical data (e.g., melting point, boiling point, flash point, etc.) toxicity, health effects, first aid, reactivity, storage, *disposal*, *personal protective equipment*, and spill handling procedures.

Note 3: As "controlled substances", each pesticide must have an *MSDS.*

matrix (in analysis)

Components of the sample other than the analyte [3].

Note: The material or component sampled for *pesticide residue* studies.

maximum permissible daily dose

Maximum daily dose of substance whose penetration into a human body during a lifetime will not cause diseases or health hazards that can be detected by current investigation methods and will not adversely affect future generations [3].

See also *no-observed-adverse-effect level* (*NOAEL*).

maximum residue limit (MRL)

Maximum concentration of a residue that is legally permitted or recognized as acceptable in, or on, a food, agricultural commodity, or animal feedstuff as set by Codex or a national regulatory authority [37].

Note 1: The term *tolerance* used in some countries is, in most instances, synonymous with *maximum residue limit*.

Note 2: Normally expressed as a mass ratio = mass/(fresh mass) (usually units mg kg^{-1}) for food commodities and as mass ratio = mass/(dry mass) (usually units mg kg^{-1}) for animal feedstuffs.

See also *Codex maximum residue limit*.

maximum tolerated dose (MTD)

High *dose* used in *chronic toxicity* testing that is expected on the basis of an adequate *subchronic* study to produce limited *toxicity* when administered for the duration of the test period [6].

Note 1: It should not include: overt toxicity, for example, appreciable death of cells or organ dysfunction, or toxic manifestations that are predicted materially to reduce the life span of the animals except as the result of neoplastic development, or 10 % or greater retardation of body weight gain as compared with control animals.

Note 2: In some studies, toxicity that could interfere with a carcinogenic effect is specifically excluded from consideration.

median effective concentration (EC_{50})

Statistically derived concentration of a pesticide in an environmental medium expected to produce a certain effect in 50 % of the test organisms in a given population under defined conditions [4].

median lethal concentration (LC_{50})

Statistically derived concentration of a substance in an environmental medium expected to kill 50 % of test organisms in a given population under defined conditions [6].

median lethal dose (LD_{50})

Statistically derived *dose* of a chemical or physical agent (radiation) expected to kill 50 % of test organisms in a given population under a defined set of conditions [6].

medium

Material (e.g., air, water, soil, food, consumer products) surrounding or containing a pesticide or agent [15].

mesocosm

See *model ecosystem*.

metabolism

1. The entire physical and chemical processes involved in the maintenance and reproduction of life in which nutrients are broken down to generate energy and to give simpler molecules (*catabolism*) which by themselves may be used to form more complex molecules (*anabolism*). In case of *heterotrophic organisms*, the energy evolving from catabolic processes is made available for use by the organism [3].
2. Sum total of all physical and chemical processes that take place within an organism; in a narrower sense, the physical and chemical changes that occur in a substance within an organism [6].

   Note: It includes uptake and distribution within the body of a substance, the changes (*biotransformation*) undergone by such a substance, and the *elimination* of the substance and or its *metabolites*.

metabolite

Any intermediate or product resulting from *metabolism* [3].

microbial pesticide

Microorganism that is used to control a pest [23].

microcapsule suspension

Suspension in which the solid particles consist of the *active ingredient(s)* within microcapsules that allow a slow release of the *active ingredient(s).*

microcosm

See *model ecosystem*.

micro-environment

Surroundings that can be treated as homogeneous or well characterized in the concentrations of a pesticide or other agent (e.g., home, office, automobile, kitchen, store). This term is generally used for estimating exposure [15].

mineralization

Conversion of an element from an organic form to an inorganic form. Mineralization of pesticides most commonly refers to the microbial degradation to carbon dioxide as a terminal metabolite.

See also *immobilization*.

minor consumption crop

Crop that makes a *minor* or negligible contribution to the total dietary intake of a given population.

minor use crop

Crop that is grown on a small area and therefore uses amounts of pesticides that are too small to justify standard pesticide registration.

miticide

Pesticide used for the control of *mites*.

mitosis inhibitor

Herbicidal inhibitor that disrupts cell division in germinating plant seedlings. It can act by interfering with the organization of microtubules necessary in the formation of mitotic spindles along which chromosomes separate during *mitotic* cell division [9].

Note 1: Affected tissues have cells in which *mitosis* has been arrested at various stages as well as cells with micro-nuclei or cells with two or more nuclei in which new cell wall formation has been disrupted.

Note 2: Herbicides known to have this mode of action include the dinitroanilines (e.g., trifluralin, pendimethalin), pyridines (e.g., dithiopyr and thiazopyr), and benzamides (e.g., tebutam).

mode of action (pesticide)

Biochemical effect that occurs at the lowest dose or concentration or is the earliest among a number of biochemical effects that could, understandably, lead to the death of the pest.

Note 1: The above is more precisely, the *primary mode of action of a pesticide*. However, there may also be other biochemical effects that occur later or at higher doses (i.e., *secondary modes of action*) that also may contribute to the death of the pest.

Note 2: Numerous modes of pesticide action are described in the alphabetical list.

model

Experimental or mathematical simulation of chemical or biological behavior in a specific environment [38].

model calibration

Testing of a model with known input and output information for adjustment or estimation of factors for which data are not available [38].

model (computer)

Assembly of numerical techniques (algorithms), bookkeeping, and control language (i.e., the computer program) comprising a mathematical *model* and which carries out acceptance of input data and instructions through to delivery of output. After [38].

model (conceptual)

Qualitative depiction of a specific environment that describes the linkages between the different compartments. A *conceptual model* is required before a quantitative simulation model can be developed [39].

model ecosystem

Man-made study system containing associated organism and abiotic components that is large enough to be representative of a natural *ecosystem*, yet small enough to be experimentally manipulated. There is some subjective differentiation between larger, outdoor *model ecosystems* (mesocosms) and smaller, generally indoor *model ecosystems* (microcosms).

model validation

Comparison of model results with numerical data independently derived from experiments or observations of the environment [38].

model verification

Examination of the numerical technique in the computer code to ascertain that it truly represents the conceptual model and that there are no inherent numerical problems with obtaining a solution [38].

molluscicide

Pesticide used for the control of snails, slugs, and other *molluscs*.

monoclonal antibodies (Mabs)

Single species of *immunoglobulin* molecules produced by culturing a single clone of a hybridoma cell. *Mabs* recognize only one chemical structure, i.e., they are directed against a single epitope of the antigenic substance used to raise the antibody [3].

Note: *Mabs* are commonly used in immunoassays (e.g., ELISA test kits) to identify and characterize pesticide residues or metabolites within complex matrices (e.g., ground water, soil, etc.).

multiple resistance

Situation in which two or more mechanisms of resistance to pesticides are present in an organism.

multi-residue method

Analytical method designed to effectively determine a number of pesticide residues simultaneously.

multi-site fungicide

Product that inhibits several enzyme systems in fungi [40].

Note: Thiocarbamates (e.g., thiram, nabam) and phthalimides (e.g., captan, difolatan) as well as chlorothalonil are potent inhibitors of numerous enzymes with exposed thiol (–SH) groups in fungal spores. This property gives them excellent "protectant" activity on leaf surfaces and reduces the probability for fungal pathogens to develop resistance. Similar results can be achieved with products containing two or more *active ingredients* with different modes of action.

mutagen

Agent that can induce heritable changes (*mutations*) of the *genotype* in a cell as a consequence of alterations or loss of genetic material [6].

mycotoxin

A toxin produced by a fungus under special conditions of moisture and temperature. Mycotoxins are common contaminants of harvested food and feed crops which can have dramatic adverse effects on humans and animals.

national estimated daily intake (NEDI)

Prediction of the daily intake of a pesticide residue which is based on the most realistic estimate of residue levels in food and the best available data on food consumption for a specific population [28].

nebulization

Formation of an aerosol of very small liquid particles (fog) or solid particles (smoke) from a pesticide formulation, generally for fumigation of an enclosed space such as a glass-house.

necrosis

Sum of morphological changes resulting from cell death by *lysis* and/or enzymatic degradation, usually affecting groups of cells in a tissue [3].

negative cross-resistance

The situation where one organism or biotype is more sensitive than the wild type to two or more pesticides due to a single mechanism.

negative resistance

Situation where one organism or biotype is more sensitive than the wild type to a given pesticide.

nematicide

Pesticide used for the control of *nematodes* (roundworms).

NMR

Nuclear magnetic resonance spectroscopy.

non-selective herbicide

Herbicide that is generally toxic to all plants treated. Some *selective* herbicides may become *non-selective* when used at very high rates [12].

non-target organism

Organism affected by a pesticide or exposed to a pesticide although not an intended object of its use.

non-target species

See *non-target organism*.

no-observed-adverse-effect level (NOAEL)

Greatest *concentration* or amount of a substance, found by experiment or observation, which causes no detectable adverse alteration of morphology, functional capacity, growth, development, or life span of the target organism under defined conditions of exposure [3].

no-observed-effect concentration/level (NOEC/NOEL)

Greatest concentration or amount of a substance, found by experiment or observation, that causes no alterations of morphology, functional capacity, growth, development, or life span of target organisms distinguishable from those observed in normal (control) organisms of the same species and strain under the same defined conditions of exposure [3].

NPD

Nitrogen-phosphorus detector for gas chromatography.
See also *thermionic detector* (*TID*).

octanol/water partition coefficient (K_{ow})

Partition coefficient for a pesticide in the two-phase system octan-1-ol/water.

Note: The K_{ow} indicates the relative *lipophilicity* of a pesticide and its potential for *bioconcentration* or *bioaccumulation*.

oncogenic

Capable of producing tumors in animals, either benign (noncancerous) or malignant (cancerous) [12].

organically grown

Food, feed crops, and livestock grown within an intentionally diversified agro-ecosystem. In practice, farmers build up nutrients in the soil using compost, agricultural wastes, and cover crops instead of synthetically derived fertilizers to increase productivity, rotate crops, weed mechanically, and reduce dramatically their dependence on the entire family of pesticides. Farmers must be certified to characterize crops as organically grown and can only use approved natural and synthetic biochemicals, agents, and materials for three consecutive years prior to harvest. Livestock must be fed a diet that includes grains and forages that have been organically grown and cannot receive hormones, sub-therapeutic antibiotics, or other growth promoters [30].

Note 1: In various governmental definitions of *organically grown*, there is not yet a consistent policy for inclusion or exclusion of various types of genetically modified crops in this type of food production.

Note 2: In some countries, *organically grown* is defined in law and various requirements must be met before the term can be used for crops to be sold.

organochlorine pesticide (OC)

Generic term for pesticides containing chlorine but commonly used to refer to older persistent materials including aldrin, BHC, chlordane, DDT, dieldrin, heptachlor, lindane, or toxaphene.

organophosphorus pesticide (OP)

Generic term for pesticides containing phosphorus but commonly used to refer to insecticides consisting of acetylcholinesterase inhibiting esters of phosphate or thiophosphate including parathion, chlorpyrifos, diazinon, and malathion.

overtop application

Broadcast or banded treatment, applied over the canopy of crops such as by airplane or by a raised spray boom of ground equipment [12].

oxidative phosphorylation uncoupler

In most biological systems, the oxidation process is "coupled" with the process of phosphorylation and ATP production on the inner side of mitochondrial membranes. A pesticide that *uncouples* this process destroys the integrity of these membranes and protons leak back into the matrix of the mitochondrion without passing through an ATP synthase system [41].

Note: Dinitrophenol herbicides, insecticides, and fungicides as well as the herbicide, bromoxynil, are examples of pesticides that have this mode of action.

partition coefficient

Ratio of the concentrations of a substance in solution in two phases which are in equilibrium.
See K_{oc}, P_{ow}.

parts per billion (ppb)

Ratio of quantities expressed as parts pesticide per 10^9 sample. Strictly, the quantities should be the same, i.e., mass to mass (mass fraction solids) or volume to volume (volume fraction or volume concentration, liquids or gasses), e.g., 1 ppb = 1 μg kg^{-1} [42].

Note: A common usage is for mass to volume, but to avoid confusion, it is recommended that SI units are used rather than *ppb* for this quantity.

parts per million (ppm)

Ratio of quantities expressed as parts pesticide per 10^6 sample; e.g., 1 ppm = 1 mg kg^{-1}.

Note: As with *ppb*, it is recommended that SI units are used rather than ppm, particularly for mass concentrations (mass to volume), e.g., 1 ppm = 1 mg L^{-1}.

pathogen

Disease-causing agent, usually applying to living organisms [10].

pelleted formulation

Dry pesticide formulation consisting of discrete particles usually larger than 10 mm^3 and designed to be applied without a liquid carrier [10].

persistence

Residence time of a chemical species (pesticide and/or metabolites) subjected to degradation or physical removal in a soil, crop, animal, or other defined environmental *compartment*.

persistent organic pollutant (POP)

Persistent organic chemicals, including pesticides and industrial chemicals, scheduled to be eliminated from world-wide use by the United Nations because of their potential for adverse human and ecological risks, long-range transport, and bioaccumulation in the environment [43].

Note: Chemicals on the list include aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls, and DDT.

personal protective equipment (PPE)

Equipment designed to be worn or held by a worker to protect against hazards posed by pesticide exposure, e.g., gloves, boots, aprons, coveralls, and respirators.

pest

Organism in a place (or at a population) where it is not wanted by humans.

pesticide

1. Strictly, a substance intended to kill pests: in common usage, any substance used for controlling, preventing, or destroying animal, microbiological, or plant pests [3].
2. Substance or mixture of substances intended for preventing, destroying, or controlling any *pest*, including vectors of human or animal disease, unwanted species of plants or animals causing harm or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood, wood products, or animal feedstuffs, or which may be administered to animals for the control of insects, mites/spider mites, or other pests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage or transport [4].

   See also *agrochemical*, *plant protection agent*.
   The following types of pesticides are named according to their target species:

Class	Pest organism
acaricide	mites, ticks
algicide	algae
antifouling point	barnacles, molluscs
avicide	birds
bactericide	bacteria
defoliant	unwanted plant foliage
desiccant	unwanted crop foliage
fungicide	fungi
graminicide	weedy grasses
growth regulator	insect or plant growth
herbicide	weeds
insecticide	insects
miticide	mites
molluscicide	snails, slugs
nematicide	nematodes
piscicide	fish
repellent	insects, birds, other vertebrates
rodenticide	mice, rats, other rodents
slimicide	slime molds
virucide	viruses

pesticide common name

Semisystematic (*trivial*) name of a *chemical pesticide* [66].

Note: Common names of pesticides are listed by the ISO (International Organization for Standardization).

See also *IUPAC name*, *systematic name*, *trivial name.*

pesticide formulation

Pesticide product offered for sale. It generally comprises *active ingredient(s)*, *adjuvant(s)*, and other *formulants* combined to render the product useful and effective for the purpose claimed. From [44].

Note: For a complete list of various formulation types, see [62].

pesticide residue

Substance which remains in or on a feed or food commodity, soil, air, or water following use of a pesticide. For regulatory purposes, it includes the parent compound and any specified derivatives such as degradation and conversion products, metabolites, and impurities considered to be of toxicological significance [44].

See also *residue.*

pesticide residue enforcement

Pesticide residue monitoring program where the intention is regulatory action against noncomplying consignments.

pesticide residue monitoring

Sampling and analyses of pesticide residues in biological and environmental samples taken according to prearranged schedules.

pesticide trade name

Proprietary name assigned to a pesticide or its formulations by the company manufacturing or selling it. In some jurisdictions, pesticide trade names attain legal (registered trademark status).

pesticide trivial name

See *trivial name*.

pH

$pH = -\lg(a_{H+}) = -\lg(m_{H+}\,\gamma_{m,\,H+}/m^{\ominus})$, where a_{H+} is the activity of hydrogen ion (hydrogen 1+) in aqueous solution, $H^+(aq)$, $\gamma_{m,\,H+}$ is the activity coefficient of $H^+(aq)$ (molality basis) at molality m_{H+}, and $m^{\ominus} = 1$ mol kg^{-1} is the standard molality [54–58].

Note 1: Measure of acidity or alkalinity of an aqueous solution, from 0–14. Neutral solutions have a pH of 7; solutions with a pH less than 7 are acidic, solutions with a pH greater than 7 are basic or alkaline. Typical natural waters and soil waters have a pH between 4 and 9.

Note 2: pH cannot be measured independently because calculation of the activity involves the activity coefficient of a single ion. Thus, it can be regarded only as a notional definition.

Note 3: The establishment of primary pH standards requires the application of the concept of "primary method of measurement", assuring full traceability of the results of all measurements and their uncertainties. Any limitation in the theory of determination of experimental variables must be included in the estimated uncertainty of the method.

Note 4: Practical pH measurements generally use cells with liquid junctions in which, consequently, liquid junction potentials, E_j, are present. Measurements of pH are not normally performed using the Pt|H_2 electrode, but rather the glass (or other H^+-selective) electrode, whose response factor (dE/dpH) usually deviates from the Nernst slope. The associated uncertainties are significantly larger than those associated with fundamental measurements using the Harned cell. Nonetheless, incorporation of the uncertainties for the primary method, and for all subsequent measurements, permits the uncertainties for all procedures to be linked to the primary standards by an unbroken chain of comparisons.

Note 5: Reference values for standards in D_2O and aqueous-organic solvent mixtures exist.

pharmacodynamics

Process of interactions of pharmacologically active substances with *target* sites in living systems, and the biochemical and physiological consequences leading to therapeutic or *adverse effects* [6].

pharmacokinetics

1. Process of the uptake of substances (e.g., pesticides or drugs), by the body, the biotransformations they undergo, the distribution of the parent compounds and/or metabolites in the tissues, and their elimination from the body over a period of time.
2. Study of such processes. After [6].

phase I reaction (of biotransformation)

Enzymatic modification of a substance by oxidation, reduction, hydrolysis, hydration, dehydrochlorination, or other reactions catalyzed by enzymes of the cytosol, of the endoplasmic reticulum (microsomal enzymes), or of other cell organelles [6].

phase II reaction (of biotransformation)

Binding of a substance, or its metabolites from a *phase I reaction*, with endogenous molecules (conjugation), making more water-soluble derivatives that may be excreted in the urine or bile [6].

Note: The conjugation of herbicides with sugars or amino acids in plants may facilitate their compartmentalization within vacuoles in the cell.

pheromone

1. Substance used in olfactory communication between organisms of the same species eliciting a change in sexual or social behavior [3].
2. A subgroup of *semiochemicals* that affect behavior between members of the same species. In insects, these are predominantly mixtures of straight-chain unsaturated aliphatic alcohols, aldehydes, and esters [32].

See also *semiochemical.*

phloem

Living tissue in plants that functions primarily to transport metabolic compounds from the site of synthesis to the sites of storage and/or utilization [12].

photolysis

Cleavage of one or more covalent bonds in a molecular entity resulting from absorption of light, or a photochemical process in which such cleavage is an essential part [3].

Note: The term is used incorrectly to describe irradiation of a sample, although in combination flash photolysis, this usage is accepted.

photosynthesis

Metabolic process involving plants and some types of bacteria in which light energy absorbed by chlorophyll and other photosynthetic pigments results in the reduction of carbon dioxide followed by

the formation of organic compounds. In plants, the overall process involves the conversion of carbon dioxide and water to carbohydrates and the release of oxygen [3].

photosystem II inhibitor

Chemical inhibitor of photosystem II, that is the series of photo-induced electron transport and phosphorylation reactions in which light energy absorbed by chlorophylls in plants is first converted to the energy of excited electrons and ultimately to ATP and reduced pyridine dinucleotides (e.g., NADPH) which are essential for the reduction of carbon dioxide and the biosynthesis of carbohydrates. Oxidized chlorophyll molecules are restored by electrons generated by the cleavage of water molecules, a reaction that also leads to the evolution of oxygen. From [9,41] with modification.

Note: A large number of herbicides including the phenylureas (e.g., diuron, linuron), triazines (e.g., atrazine and simazine), uracils (e.g., bromacil), and anilides (e.g., propanil) are known to inhibit *photosystem II* in plants.

phototoxicity

Toxicity resulting from exposure to a photosensitizing agent followed by exposure to sunlight.

phytoalexin

Chemical produced by the host plant that inhibits the growth of a pathogenic fungus [17].

phytotoxic

Injurious or lethal to plants [12].

piscicide

Pesticide used for the control of fish.

pK_a

The negative of the base-10 logarithm of the acid dissociation equilibrium constant, K_a, of a compound.

Note: The smaller the number, the more acidic the compound.

pK_b

The negative of the base-10 logarithm of the basic reaction equilibrium constant of a compound.

Note: The lower the number, the more basic (alkaline) the compound.

plant growth regulator (PGR)

Natural or synthetic substance used for controlling or modifying plant growth processes without reducing nutritive value or causing severe phytotoxicity. After [12].

plant protection product

Active substances and preparations containing one or more active substances, put up in the form in which they are supplied to the user, intended to (a) protect plants or plant products against all harmful

organisms or prevent the action of such organisms, (b) influence the life processes of plants, other than as nutrients (e.g., plant growth regulators), preserve plant products, destroy undesired plants (e.g., herbicides), or destroy parts of plants, check or prevent undesired growth of plants [45].

pollutant

Undesirable substance introduced into a solid, liquid, or gaseous environmental medium totally or partially by human activities [4].

See also *contaminant*.

POP

See *persistent organic pollutant.*

population

1. Total number of persons inhabiting a country, city, district, or area.
2. Assemblage of individual organisms of defined ages and growth stages belonging to one species within a specified location in space and time [22].

post-emergence treatment (POST)

Applied after emergence of the specified weed or crop [12].

potentiation

Ability of a substance to increase the toxic effect(s) of another compound [10].

precipitation

1. Sedimentation of a solid material (a precipitate) from a liquid solution in which the material is present in amounts greater than its solubility in the liquid [3].
2. Chemical precipitation: Chemical process in which a chemical in solution reacts with another chemical introduced to that solution to form a third substance which is partially or mainly insoluble and therefore appears as an insoluble solid.
3. Falling products of condensation in the atmosphere as rain, snow, or hail.

precision

Closeness of agreement between independent test results obtained by applying the experimental procedure under stipulated conditions. The smaller the random part of the experimental errors which affect the results, the more precise the procedure [3].

Note: *Precision* is sometimes misused for *accuracy*. *Precision* relates only to dispersion, not to deviation from the (conventional) true value. Imprecision has been defined as "standard error of the reported value".

predicted environmental concentration (PEC)

See *estimated environmental concentration.*

predicted no-effect concentration (PNEC)

Estimated *no-observed-effect concentration* for an aquatic species of ecosystem based on extrapolated experimental exposure/response data.

pre-emergence

Period before a specified crop or pest has emerged [12].

pre-emergence treatment (PRE)

Pesticide applied before the emergence of the specified crop or weed, generally applied to timing of herbicide applications [12].

preferential flow

Leaching phenomenon whereby water and a dissolved pesticide percolating down through the soil profile move more rapidly through soil macropores or sand/gravel lens than through the network of smaller pores in the bulk soil.

pre-harvest interval (PHI)

Time interval in days between the last application of a pesticide to a crop and harvest to meet the relevant *maximum residue limits* for a particular crop [33].

Note: Also known as the *harvest interval* in some countries (e.g., UK).

pre-plant incorporated treatment (PPI)

Pesticide applied and blended into the soil before seeding or transplanting the crop, usually by tillage [12].

primary feed commodity

Product in or nearly in its natural state intended for sale to: the stock farmer as feed which is used without further processing for livestock animals or after silaging or similar farm processes; or the animal feed industry as a raw material for preparing compounded feeds (used for the purpose of Codex Alimentarius) [13].

primary food commodity

Product in or nearly in its natural state intended for processing into food for sale to the consumer or as a food without further processing. It includes irradiated primary food commodities and products after removal of certain parts of the plant or parts of animal tissue. Also known as a raw agricultural commodity [13].

primary sample

Collection of one or more increments or units initially taken from a population [3].

Note: Portions may be combined (*composited* or *aggregated sample*) or kept separate (gross sample).

prior informed consent (PIC)

Agreement of the designated national authority in a participating country required before international shipment of a banned or severely restricted chemical can proceed for the purpose of protecting human health or the environment. From [44] with modification.

processed food

Product resulting from the application of physical, chemical, or biological processes, or combinations of these (e.g., canning), to a primary food commodity, and intended for sale to the consumer, for use as an ingredient in the manufacture of a food product or for further processing.

processing factor

Residue level of a specific pesticide in the processed product divided by the residue level in the starting commodity, usually a *raw agricultural commodity* (*RAC*). Processing factor = residue level (mg kg^{-1}) in processed product/residue level (mg kg^{-1}) in *RAC* [16].

Note: Alternative terms sometimes used for processing factor are "concentration factor" when residue levels increase and "reduction factor" (inverse of processing factor) when residue levels decrease.

product stewardship

Responsible and ethical proactive management of a product during manufacturing, storage, distribution, use, and disposal.

pro-pesticide

Chemical not active as a pesticide, but becoming active once it enters an organism and undergoes chemical modification.

prophylactic application

Preventive application.

protoporphyrinogen oxidase (PPO) inhibitor

Chemical that inhibits the enzyme PPO which catalyzes the last step in the synthesis of chlorophyll and heme. Its inhibition causes the accumulation of high levels of chlorophyll precursors that lead to the generation of highly reactive oxygen radicals in the cytosol. The plasma membrane is destroyed and cells die. From [9] with modification.

Note: Herbicidal inhibitors include the aryltetrahydrophthalimides (e.g., oxadiazon and flumioxazin), the diphenyl ethers (e.g., oxyfluorfen), the phenylpyrazoles (e.g., fluazolate), the thiazoles (e.g., thidiazimin), the oxadiazoles (e.g., oxadiazon), the triazolinones (e.g., azafenidin), and oxazolidinediones (e.g., pentoxazone).

pyrethroid insecticide

Synthetic analog (often modified by addition of halogens) of natural pyrethrin insecticides including permethrin, cypermethrin, deltamethrin, and a number of others.

quality assurance

Guarantee that the quality of a product (analytical data set, etc.) is actually what is claimed on the basis of the *quality control* applied in creating that product [3].

Note 1: *Quality assurance* is not synonymous with *quality control*, it is meant to protect against failures of *quality control*.

Note 2: *Quality assurance* has a wider meaning in a number of European countries where it covers every aspect of plant or animal production, from farm through food processor and distributor to the eventual retailer.

quality control

1. Maintenance and statement of the quality of a product (data set, etc.) specifically, that it meets or exceeds some minimum standard based on known, testable criteria [3].
2. A system of procedures, checks, audits and corrective actions to ensure that all technical, operational, monitoring, and reporting activities are of the highest achievable quality [30].

quantitative structure–activity relationship (QSAR)

Building of structure–biological activity models by using regression analysis with physicochemical constants, indicator variables or theoretical calculations [3].

Note: The term has been extended by some authors to include chemical reactivity, i.e., activity is regarded as synonymous with reactivity. This extension is however, discouraged.

racemate

Equimolar mixture of a pair of enantiomers. It does not exhibit *optical activity*. The chemical name or formula of a racemate is distinguished from those of the enantiomers by the prefix (±)- or rac- (or racem-) or by the symbols *RS* or *SR* [3].

radiolabelled pesticide

Pesticide *labelled* with a radioactive isotope that can be followed or detected in an intact organism, excised tissue, or other abiotic degradation tests.

Note: Studies may also be carried out using pesticides containing a "stable" isotope, e.g., deuterium. Stable isotopes are often used as internal standards in analytical studies.

random sample

Subset of a sampling population that is arrived at by selecting units such that each possible unit has a fixed and determinate probability of selection.

raw agricultural commodity (RAC)

Part of a crop used as a food or feed commodity directly from the harvested crop without *processing*.

raw data

All original laboratory records and documentation, or verified copies thereof, including data directly entered in a computer. They are the results from the original activities and observations in a *GLP study*.

reagent purity

Reagent-grade chemicals are those that conform to the *purity* specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available. Whenever possible, only reagents of approved purity should be used in studies with pesticides.

recovery

1. In toxicology, the process leading to partial or complete restoration of a cell, tissue, organ, or organism following its damage from exposure to a harmful substance or agent.
2. In analytical and preparative chemistry, the fraction of the total quantity of a substance recoverable following a chemical procedure [3].

redox potential

Any oxidation/reduction (redox) reaction can be divided into two half-reactions: one in which a chemical species undergoes oxidation and one in which another chemical species undergoes reduction. If a half-reaction is written as a reduction, the driving force is the reduction potential. If the half-reaction is written as oxidation, the driving force is the oxidation potential related to the reduction potential by a sign change. So the *redox potential* is the reduction/oxidation potential of a compound measured under standard conditions against a standard reference half-cell. In biological systems, the standard *redox potential* is defined at pH –7.0 vs. the hydrogen electrode and partial pressure of hydrogen = 1 bar [3,60].

Note: Electrical potential indicating the relative activity of oxidized and reduced species. The *redox potential* of an environmental matrix is a measure of the extent to which oxidizing species are present to act as terminal electron acceptors in *respiration.*

reduced risk pesticide

Pesticide product, the use of which, in comparison with generally available products, yields comparatively lower risks to human health and/or the environment.

re-entry interval

Minimum time between pesticide application and human re-entry to a treated area, established by a regulatory authority to assure human safety with respect to risks of pesticide exposure.

reference dose (RfD)

Term used for an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime [6].

See also *acceptable daily intake* (*ADI*).

reference material

Substance or mixture of substances, the composition of which is known within specified limits, and one or more of the properties of which is sufficiently well established to be used for the calibration of an apparatus, the assessment of a measuring method, or for assigning values to materials [3].

Note: Reference materials are available from national laboratories in many countries [e.g., National Institute for Standards and Technology (NIST), USA; Community Bureau of Reference, UK].

See also *certified reference material*.

registrant

Organization or individual that holds the certificate of registration and is thereby responsible for a given pesticide product. A *registrant* can be a chemical company, government agency, importer, or any person wishing to market a pest control product within a given jurisdiction. The registrant's name and address must appear on the product label as a legal requirement.

registration

Process whereby the responsible national or regional government authority approves the sale and use of a pesticide following the evaluation of comprehensive scientific data demonstrating that the pesticide is effective for the purposes intended and not unduly hazardous to human or animal health or the environment [47].

registration number

Distinct number (e.g., four or five digits) assigned to each registered pest control product within a specific country. Unless expressly exempt by regulation under local regulations, all pest control products must be registered and be issued a registration number before being permitted for sale, import, or use in a given country [14,33].

regulatory method

Validated analytical method that can be applied using commonly available laboratory equipment and instrumentation.

Note: A regulatory method has the precision, specificity, limit of determination, etc., needed to test compliance with the regulations.

relative risk

Ratio of the risk of disease or death among the exposed to the risk among the unexposed [6,46].

Note: The term is also used for comparing the risks of various stressors and management actions.

Synonym: *risk ratio.*

repeatability

Closeness of agreement between independent results obtained with the same method on identical test material, under the same conditions (same operator, same apparatus, same laboratory) and after short intervals of time. The *measure of repeatability* is the standard deviation. In some contexts, repeatability may be defined as the value below which the absolute difference between two single test results obtained under the above conditions, may be expected to lie within a specified probability [3].

See also *reproducibility.*

repellent

Chemical or substance that causes insects, undesirable birds, or other pests to *avert* or *avoid* contact with humans, domestic animals, or desirable plants.

reproducibility

Closeness of agreement between independent results obtained with the same method on identical test material but under different conditions (different operators, different apparatus, different laboratories, or after different intervals of time) [3].

Note 1: The *measure of reproducibility* is the standard deviation qualified with the term *reproducibility* as *reproducibility standard deviation*.

Note 2: In some contexts, *reproducibility* may be defined as the value below which the absolute difference between two single test results on identical material obtained under the above conditions, may be expected to lie within a specified probability.

Note 3: A complete statement of reproducibility requires specification of the experimental conditions which differ.

See also *repeatability*.

residue of concern (ROC)

Identified pesticide residue (e.g., either parent molecule or metabolite) that represents the moiety which has the greatest potential to accumulate or result in the greatest toxicological concern in harvested food/feed.

residue (pesticide)

Specified substances in or on food, agricultural commodities, or animal feed resulting from the use of a pesticide [36].

Note 1: The term includes any derivatives of a pesticide, such as conversion products, metabolites, reaction products, and impurities considered to be of toxicological significance.

Note 2: *Pesticide residue* includes residues from unknown or unavoidable sources as well as from known uses of the chemical.

resistance

Inheritable ability of some pest biotypes within a given population to survive a pesticide treatment that should, under normal use conditions, effectively control populations of that pest.

resistance management

Use of pesticides and alternate pest control measures so as to minimize or delay the development of *resistance* in the target pest.

respiration

Energy-generating process in an organism where an organic or inorganic compound serves as the electron donor and an inorganic compound (e.g., oxygen) serves as the electron acceptor.

retention

Proportion of pesticide, applied as a spray, that remains on plant leaves or mulch.

retention sample

Sample that is stored for a specified period in case of a need for re-evaluation of data obtained from the main *laboratory samples*.

riparian zone

Area adjacent to a river or stream with a high density, diversity, and productivity of plant and animal species [46].

Note 1: Management of *riparian zones* is often used in agricultural regions as a means of protecting surface water quality from agricultural runoff.

Note 2: These zones act as a trap for sediments and nutrients, shade streams, thereby lowering water temperature, protect stream banks from collapse, reduce soil erosion, and provide habitat for birds, reptiles, and mammals of the region.

risk

1. Probability of an adverse effect in an organism, system, or (sub-) population caused under specified circumstances by exposure to an agent [7].
2. Expected frequency of occurrence of a harmful event arising from such an exposure [3].

risk assessment

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 pesticide or agent of concern as well as the characteristics of the specific target system. It is the first component in a risk analysis process [7].

Note: The risk assessment process includes four steps: hazard identification, hazard characterization (related term: dose–response assessment), exposure assessment, and risk characterization.

risk characterization

The qualitative and, wherever possible, quantitative determination, including attendant 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 [7].

risk management

Decision-making process involving considerations of political, social, economic, and technical factors with relevant risk assessment information relating to a hazard so as to develop, analyze, and compare regulatory and nonregulatory options and to select and implement appropriate regulatory response to that hazard [7].

Note: Risk management comprises three elements: risk evaluation; emission and exposure control; and risk monitoring.

risk quotient

Comparison of exposure with effects as an index to express the risk posed by a particular chemical. From [49].

Synonym: *hazard quotient*.

rodenticide

Pesticide used for the control of mice, rats, or other *rodents.*

rotational crop

Crop grown in sequence of two or more different crops.

route of exposure

Means by which a chemical enters an organism after contact (e.g., ingestion, inhalation, or dermal absorption [30].

run-off

1. Transport of water and sediment from the surface of an agricultural field to a non-target area such as a stream due to a precipitation event.
2. Loss of a pesticide formulation off the plant foliage during spray application, particularly at high volume.

Note: Run-off from agricultural production fields may contain residues of nutrients and pesticides that have been applied to the soil or plant canopy.

safener

Chemical or agent that reduces toxicity of a herbicide to a specific crop plant by a physiological mechanism [12].

See also *antidote*.

safety factor

See *margin of safety.*

sample

Portion of material selected from a larger quantity of material so that it is representative of the whole [3].

Note 1: The term *sample* implies the existence of *sampling error*, i.e., the results obtained on the portions taken are only estimates of the concentration of a constituent (e.g., pesticide) or the quantitiy of a property present in the parent material. If there is no or negligible sampling error, the portion removed is a test portion, *aliquot*, or specimen.

Note 2: The term "specimen" is used to denote a portion taken under conditions such that the sampling variability cannot be assessed (usually because the population is changing and is assumed for convenience to be zero).

Note 3: The term needs to be qualified as to *type of sample* (see below).

Note 4: The manner of selection of the *sample* should be prescribed in a *sampling plan*.

See also *aggregate sample*, *aliquot*, *composite sample*, *control sample*, *increment sample*, *random sample*, *subsample*, *test portion*, and *test sample.*

sample cleanup

Post-extraction procedure included in an analytical method to remove potential interferents from a sample extract prior to analysis.

sampling plan

Predetermined procedure for the selection, collection, preservation, transportation, and preparation of the portions to be removed from a population as samples [3,29].

SAR

See *structure–activity relationship* and *QSAR* as well as *systemic acquired resistance*.

secondary food commodity

Primary food commodity which has undergone simple processing, such as removal of certain portions, drying, husking and comminution, which do not basically alter the composition or identity of the product [16].

Note 1: *Secondary food commodities* may be processed further or may be used as ingredients in the manufacture of food or may be sold directly to the consumer.

Note 2: *Seconday food commodity* is an important term for the purposes of Codex Alimentarius, JMPR Report 1979, Annex.

selective herbicide

Chemical that is more toxic to some plant species than to others [12].

semiochemical

Message-bearing substance produced by plants or animals, or synthetic analogs thereof, that evoke a behavioral response in individuals of the same or other species (e.g., *allomones*, *kariomones*, *pheromones*, and *synomones*) [14].

size-exclusion chromatography (SEC)

A separation technique in which separation mainly according to the hydrodynamic volume of the molecules or particles takes place in a porous non-adsorbing material with pores of approximately the same size as the effective dimensions in solution of the molecules to be separated.

slimicide

Pesticide (usually a *fungicide*) used to control a *slime mold*.

slow-release pesticide formulation

Pesticide product that releases the *active ingredient* into the environment more slowly than typical solutions, emulsions, or powders so that exposure of target organisms is extended over a longer period.

soil incorporation

Application of a pesticide to soil by mixing or injection into the soil body.

soil organic carbon partition coefficient (K_{oc})

Ratio of a pesticide concentration sorbed in the organic matter component of soil or sediment to that in the aqueous phase at equilibrium. The K_{oc} is calculated by dividing the K_d value by the fraction of organic carbon present in the soil or sediment

See also *soil organic matter*.

soil organic matter

Organic fraction of the soil, including both fresh and aged residues (e.g., humus of biological origin).

Note: Organic carbon refers to that portion of the soil measured as carbon in organic forms, and the organic matter content of soil is assumed to be approximately 1.72 times that of the organic carbon content.

soil partition coefficient (K_d)

1. Experimental ratio of a pesticide's concentration in the soil to that in the aqueous (dissolved) phase at equilibrium.
2. Distribution coefficient reflecting the relative affinity of a pesticide for adsorption by soil solids and its potential for *leaching* through soil.

Note: The K_d is valid only for the specific concentration and solid/solution ratio of the test.
See also K_{oc}.

solid-phase extraction (SPE)

Method of sample preparation that concentrates and purifies analytes from solution by sorption onto a disposable solid-phase cartridge, followed by elution of the analyte with a solvent appropriate for instrumental analysis [50].

soluble concentrate

Liquid formulation that forms a solution when added to water [12].

soluble granule

Dry granular formulation that forms a solution when added to water [12].

soluble powder

Dry formulation that forms a solution when added to water [12].

solupak

Formulation of a pesticide into individual water soluble packages or bags containing a defined *active ingredient* weight that can be directly added to a spray mixture.

Note: A *solupack* formulation is considered a closed system.

SOP

Standard operating procedure.

sorption

Removal of pesticide from solution by soil or sediment via mechanisms of *adsorption* and *absorption.*

specimens

Samples collected from a system for examination, analysis, or storage.

spiked sample (fortified sample)

Control sample with a known amount of pesticide added. Used to test the accuracy (especially the efficiency of *recovery*) of an analytical method. After [29].

spray drift

Downwind movement of airborne spray droplets beyond the intended area of application originating from aerial or ground-based spraying operations [12].

spreader

See *wetting agent*.

standard solution, primary

Standard prepared by dissolving a weighed amount of an *analytical standard pesticide* in a known volume of the final solution.

standard solution, secondary

Standard prepared by dilution of an aliquot of a *primary standard solution* with a known volume of solvent, or by subsequent serial dilutions; or a standard solution measured by reference to a *primary standard solution*.

sterol biosynthesis inhibitor

Chemical that inhibits synthesis of ergosterol, a sterol of major importance in most fungi, including the *Ascomycetes*, *Basidiomycetes*, and *Fungi Imperfecti* [40].

Note 1: Propiconazole and other triazole *fungicides* inhibit ergosterol biosynthesis in these fungi by inhibiting *Cytochrome P450*, multifunction oxidase enzymes. These fungicides are

systemic and can translocate upward in plants. They also have hormonal activity and can act as growth retardants.

Note 2: Lack of ergosterol, leads to a loss of membrane integrity and death of the organism. These fungicides are systemic and can translocate upward in plants.

sticker

Formulant that increases the adhesiveness of a formulation applied to a surface.

See also *wetting agent*.

storage stability test

1. For a *pesticide formulation*, a test which measures the chemical and physical stability of the product stored under defined, elevated-temperature conditions.
2. For *pesticide residues*, a test which measures stability of residues in stored analytical samples, usually held under frozen conditions at a specified temperature.

structure–activity relationship (SAR)

Association between specific aspects of molecular structure and defined biological action [6].

See also *QSAR*.

subsample

1. Portion of the *sample* obtained by selection or division.
2. Individual unit of the lot taken as part of the *sample*.
3. Final unit of multistage sampling [29].

supercritical fluid chromatography (SFC)

A separation technique in which the mobile phase is a fluid above and relatively close to its critical temperature and pressure [3].

Note: In general, the terms and definitions used in gas or liquid chromatography are equally applicable to supercritical fluid chromatography.

supercritical fluid extraction (SFE)

Extraction of a material using a supercritical fluid. The extracted material is usually recovered by reducing the temperature or pressure of the extraction fluid and allowing the volatile components of the mobile phase to evaporate. It can be used either as an on-line sample introduction method for a chromatographic separation or as an off-line sample preparation method [51].

supervised trials

Scientific studies for estimating *maximum residue limits* in which pesticides are applied to crops or animals according to specified conditions intended to reflect commercial practice after which harvested crops or tissues of slaughtered animals are analyzed for pesticide residues. Usually, specified conditions are those which approximate existing or proposed *good agricultural practice* [16].

supervised trials median residue (STMR)

The expected residue level (expressed in mg kg^{-1}) in the edible portion of a food commodity when a pesticide has been used according to maximum *good agricultural practice* conditions. The *STMR* is estimated as the median of the residue value (one from each trial) from supervised trials conducted according to maximum *good agricultural practice* conditions [16].

supervised trials median residue-processed (STMR-P)

The expected residue in a processed commodity calculated by multiplying the *STMR* of the *raw agricultural commodity* by the corresponding *processing factor*, or derived directly from a series of processing trials [16].

Note: The *STMR-P* is expressed in units of mg kg^{-1}.

surface water

All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water [23].

surfactant

Formulant that improves the emulsifying, dispersing, spreading, or other properties of a liquid by modifying its surface characteristics [12].

surveillance

Systematic sampling and residue analysis of commodities, and collation and interpretation of data, in order to ensure compliance with established *maximum residue limits*. Surveillance may be directed at domestic, imported, or exported commodities.

suspension concentrate (SC)

Formulation in which the *active ingredient* is in the form of a stable dispersion of fine particles in water or organic liquid [2].

sustainable agriculture

A farming system that utilizes the available earth's resources for food production without depleting the resources or polluting the environment.

symplast

The total mass of continuous living cells in a plant interconnected by plasmodesmata and including the phloem [12].

synergism

Pharmacological or toxicological interaction in which the combined biological effect of two or more substances is greater than expected on the basis of the simple summation of the toxicity of each of the individual substances [3].

synergist

Substance, which, at the rate applied, is formally inactive or weakly active and can significantly enhance the activity of the other *active ingredient* in a formulation.

systematic name

Name composed wholly of specially coined or selected syllables, with or without numerical prefixes, e.g., pentane, oxazole [3].

systemic acquired resistance (SAR)

Activation of defenses in uninfected parts of a plant. As a result, the entire plant is more resistant to a secondary infection [52].

Note 1: *SAR* is long-lasting and often confers broad-based resistance to different pathogens.

Note 2: Salicylic acid may be a signalling compound involved in transmission of the defense response throughout the plant to produce *SAR*.

systemic effect

Consequence that is either of a generalized nature or that occurs at a site distant from the point of entry of a substance [3].

systemic pesticide

Pesticide or substance that is capable of being translocated to sites other than where it was absorbed in sufficient quantities to be biologically effective [10].

Note 1: *Systemic* herbicides move within plants, affecting parts of a plant that were not directly exposed at application.

Note 2: *Systemic* fungicides move within plants and have toxic effects on pathogens within plant cells and tissues.

Note 3: *Systemic* insecticides move within plants or in the blood stream of vertebrates to kill sucking insects.

target, biological

Organism, organ, tissue, cell, or cell constituent that is subject to the action of an agent [3].

technical material

Commercial grade of the pesticide as it comes from the manufacturing plant comprising the active ingredient and associated impurities. It may also contain small quantities of additives necessary for stability.

teratogen

Substance capable of producing structural abnormalities of prenatal origin, present at birth, or manifested shortly thereafter [10].

test guideline

Guideline published by an appropriate authority for the order or conduct of certain tests.

test portion (analytical portion)

Subsample, of proper size for a chemical analysis or other test, removed from the *test sample*. After [29].

test sample (analytical sample)

Homogenous sample, prepared from the *laboratory sample* by mixing, grinding, blending, fine-chopping, etc., from which *test portions* are removed for analysis with minimal sampling error. After [29].

test substance

Pesticide as a chemical substance or mixture which is under investigation in a *GLP study*.

test system

Each system (animal, plant, microbial, other cellular, subcellular, chemical, or physical combination thereof) used in a study.

theoretical maximum daily intake (TMDI)

A prediction of the maximum daily intake of a pesticide residue, assuming that residues are present at the *maximum residue limits* and that average daily consumption of foods per person is represented by regional diets [28].

Note: *TMDI* is calculated for the various regional diets and is expressed in milligrams of residue per person per day.

thermionic detector (TID)

Gas chromatographic detector based on the phenomenon that a metal anode will emit positive ions when heated in a gas [53].

Note: A detector commonly used in gas chromatography for the selective determination of organic compounds containing nitrogen and phosphorus atoms. The *TID* evolved from the earlier alkali flame ionization detector (*AFID*) and is also known as the nitrogen-phosphorous detector (*NPD*).

thin-layer chromatography (TLC)

Chromatography carried out in a layer of *adsorbent* on a support, e.g., a glass plate [3].

threshold

The highest dose of a substance to which an organism can be exposed without expecting the stated effect to occur. After [7].

See also *no-observed-adverse-effect level* (*NOAEL*).

tolerable daily intake (TDI)

Analogous to *acceptable daily intake* (*ADI*) [7].

Note: The term *tolerable* is used for pesticides or other contaminants which are not deliberately added to food.

tolerance, residue

See also *maximum residue limit* (*MRL*).

total diet study

Pesticide residue monitoring to establish the pattern of residue intake by a person consuming a defined diet.

Note: Primary sampling is as for a *market basket survey*, but the samples are further processed as for domestic consumption, i.e., further trimming and cooking as appropriate to local practice.

total terminal residue

Summation of levels of all the compounds comprising residues of a pesticide in a food.

See also *pesticide residue*.

toxic equivalency factor (TEF)

Ratio of the toxicity of a chemical to that of another structurally related chemical (or index compound) chosen as a reference.

toxicity

1. Capacity to cause injury to a living organism defined with reference to the quantity of substance administered or absorbed, the way in which the substance is administered and distributed in time (single or repeated doses), the type and severity of injury, the time needed to produce the injury, the nature of the organism(s) affected, and other relevant conditions [3].
2. Adverse effects of a substance on a living organism defined with reference to the quantity of substance administered or absorbed, the way in which the substance is administered (inhalation, ingestion, topical application, injection) and distributed in time (single or repeated doses), the type and severity of injury, the time needed to produce the injury, the nature of the organism(s) affected, and other relevant conditions [3].
3. Measure of incompatibility of a substance with life: this quantity may be expressed as the reciprocal of the absolute value of median lethal dose ($1/LD_{50}$) or concentration ($1/LC_{50}$) [3].

toxicity exposure ratio (TER)

Ratio of the measure of the effects (e.g., LD_{50}, LC_{50}, NOEL) to the estimated exposure.
Note: It is the reciprocal of a *risk quotient* or *hazard quotient*.

toxicology

Scientific discipline involving the study of the actual or potential danger presented by the harmful effects of substances on living organisms and ecosystems, of the relationship of such harmful effects to exposure, and of the mechanisms of action, diagnosis, prevention, and treatment of intoxications [6].

toxification

See *bioactivation*.

transferable residue

See *dislodgeable foliar residue.*

transformation product

Chemical species resulting from environmental, chemical, or metabolic processes on a pesticide.
See also *degradation product*, *metabolite*.

translocation

Movement of a substance within the *test system* or organism.
Note: Most often used for plants.

transpiration

Evaporation of water from a leaf into the air.

treated solution

Test solution that has been subjected to reaction or separation procedures prior to measurement of some property.

trigger value

Numerical value for a property of a pesticide, set by regulatory authorities, which determines the sequence and type of tests in a tiered assessment scheme.
See also *cut-off value*.

trivial name

Name having no part used in a systematic sense [3].

trophic level

Functionally similar organisms such as algae and plants as primary producers are grouped into trophic levels based on similarities in the patterns of food production and consumption.

ultra-low-volume (ULV) spray

Rate of spray application such that the total volume rate of spray application is very low (5 litres per hectare or less).

Note: ULV pesticide formulations are usually specially developed for the purpose and are applied undiluted.

ultraviolet absorption detector (UVD)

Detector commonly used with *HPLC* for the analysis of organic chemicals with molecular structures containing a chromophore. It is designed to measure the loss in intensity of monochromatic ultraviolet light as it passes through the solution exiting an *HPLC* column. The loss in intensity is expressed as *absorbance (A)*, and it is linear in relation to concentration as per Beer's Law, $A = \varepsilon bc$, where ε is the molar absorptivity, b the path length of the cell, and c the amount concentration of the analyte. From [48] with modification.

uncertainty factor

Reductive factor by which an observed or estimated *no-observed-adverse-effect level* of a pesticide is divided to arrive at a criterion or standard that is considered safe or without appreciable risk [7].

uncertainty of measurement

Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the quantity of the *measurand* [3].

validation

1. Process by which the reliability and relevance of a particular approach, method, process, or assessment is established for a defined purpose [7].
2. In pesticide residue analysis, the process for establishing that analytical methods or equipment will provide reliable and reproducible results.

vapor pressure

Pressure exerted by a saturated vapor above its own liquid in a closed container [23].

Note: Units of measure are usually mmHg or Pa at a temperature of 20 °C unless otherwise stated.

vehicle

See *carrier*.

very long chain fatty acid (VLCFA) biosynthesis inhibitor

Chemical that inhibits the synthesis of *VLCFAs* which are the main constituents of hydrophobic polymers in the leaf surface lipids, storage lipids in seeds, components of membranes, etc. of higher plants. Most herbicidal inhibitors of this process affect the fatty acid elongase enzymes (FAEs) involved in the biosynthesis of *VLCFAs* [9].

Note: Example herbicides include the chloroacetamides (e.g., acetochlor, metolachlor), acetamides (e.g., diphenamid), oxyacetamides (e.g., flufenacet), and tetrazolinones (e.g., fentrazamide).

virucides

Substances used for the control of viruses [14].

volatilization

1. Conversion of a solid or liquid to a gas or vapor by application of heat, reducing pressure, chemical reaction, or a combination of these processes [3].
2. Evaporation of pesticides during and after application.

voltage-dependent sodium channel blocker

Insecticidal compound that prevents closure of and prolongs current flow though sodium channels in peripheral, sensory, and motor nerves and in interneurons within the nervous system of insects [27].

Note: Examples of insecticides that have these effects include DDT and its analogs as well as pyrethroids (synthetic and natural).

volume median diameter (VMD)

Median diameter in a distribution of spray particles such that half of the volume of spray contains particles greater than the *VMD* and half the volume contains particles less than the *VMD*.

watershed

A boundary between adjacent catchments.

See *catchment*.

water-dispersible granule (WG)

1. Formulation containing granules which readily disperse in water to form a suspension [2].
2. Granular formulation, possibly in dry flowable form, that forms a suspension in water for application as a spray [14].

water-dispersible powder (WP)

Pesticide in a dry form with surfactant, often mixed with, or coated on, a fine solid carrier, for dispersion in water to form a suspension [2].

water-soluble powder

Powder formulation to be applied as a true solution of *active ingredient* after mixing with water, but which may contain insoluble *inert ingredients* [2].

wettable powder

See *water-dispersible powder.*

wetting agent

Surfactant for use in spray formulations to assist dispersion of a powder in the *diluent* or spreading of spray droplets on surfaces. May also incorporate functions of a *sticker.*

withholding period

1. Minimum permissible time between the last application of a pesticide to a crop (including pasture) and harvesting for human consumption or grazing with livestock.
2. Minimum permissible time between the final application of a pesticide to an animal and the collection of eggs or milk, or slaughter, for human consumption.

See also *pre-harvest interval*.

wood preservative

Products applied to wood that prevent deterioration caused by various wood-destroying pests. Various categories of these products are defined by their use areas, e.g., lumber-anti-sapstain, pressure treatments, joinery products, ground-line treatments, and stains [14].

xenobiotic

Compound with a chemical structure foreign to a given organism.

Note: The term is normally restricted to man-made compounds [6].

xylem

Part of the plant's vascular system adapted to the transport of water and solutes from the roots to aerial parts [12].

See also *apoplast.*

zero tolerance

Situation in which any residues of a pesticides at or above the *LOD* are deemed to be illegal when no *maximum residue limits* have been established.

ANNEX 1. ABBREVIATIONS OF NATIONAL AND INTERNATIONAL BODIES

AAEE	American Academy of Environmental Engineers
AOAC	Association of Official Analytical Chemists
APVMA	Australian Pesticides and Veterinary Medicines Authority
ASTM	American Society for Testing and Materials
BBA	Biologische Bundesanstalt für Land und Forstwirtschaft (Germany)
BCPC	British Crop Production Council
CAC	Codex Alimentarius Commission
CAS	Chemical Abstracts Service
CCPR	Codex Committee on Pesticide Residues
CIPAC	Collaborative International Pesticide Analytical Council
CLI	CropLife International
COLEACP	Comité de Liaison Europe, Afrique, Caribes, Pacifique
DG SANCO	The Health and Consumer Protection Directorate General (European Commission)
DPR	Department of Pesticide Regulation (California, USA)
ECB	European Chemicals Bureau
ECPA	European Crop Protection Association
EFSA	European Food Safety Authority (European Commission)
EPA	Environmental Protection Agency (USA)
EPPO	European and Mediterranean Plant Protection Organization
EUREP	Euro-Retailer Produce Working Group
EXTOXNET	The Extension Toxicology Network
FAO	Food and Agriculture Organization of the United Nations
GCPF	Global Crop Protection Federation
GEMS	Global Environmental Monitoring System
GIFAP	Groupement International des Associations Nationales de Fabricants de Produits Agrochimiques
IAEA	International Atomic Energy Agency—a specialized agency of the United Nations
IAPPS	International Association for the Plant Protection Sciences
IARC	International Agency for Research on Cancer, World Health Organization
INFOCRIS	Food Contaminant and Residue Information System
IPCS	International Programme on Chemical Safety, World Health Organization
ISO	International Organization for Standardization
IUPAC	International Union of Pure and Applied Chemistry
JMPR	Joint FAO/WHO Meeting on Pesticide Residues
JMPS	Joint Meeting on Pesticide Specifications
MAFF	Ministry of Agriculture, Forestry, and Fisheries (Japan)
OECD	Organisation for Economic Co-operation and Development
PAN	Pesticide Action Network
PMRA	Pest Management Regulatory Agency (Canada)
PSD	Pesticides Safety Directorate (UK)
SCFCAH	Standing Committee on the Food Chain and Animal Health (European Commission)
SETAC	Society of Environmental Toxicology and Chemistry
UKACP	United Kingdom Advisory Committee on Pesticides
UKCVMP	United Kingdom Committee for Veterinary Medicine
UNEP	United Nations Environment Programme

USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration
WHO	World Health Organization of the United Nations
WHOPES	Pesticide Evaluation Scheme, World Health Organization

ANNEX 2. ABBREVIATIONS AND ACRONYMS RELATED TO PESTICIDES

ACCase	acetyl CoA carboxylase
ADI	acceptable daily intake
ae	acid equivalent
AFID	alkali flame ionization detector
ai	active ingredient
ALS	acetolactase synthase
ARfD	acute reference dose
BCF	bioconcentration factor
Bt	*Bacillus thuringiensis*
CDA	controlled droplet applicator
CEC	cation exchange capacity
Codex MRL/CXL	Codex maximum residue limit
COPR	Control of Pesticides Regulations 1986
COSHH	Control of Substances Hazardous to Health Regulations
DFR	dislodgeable foliar residue
DP	dustable powder
DT_{50}	dissipation time 50 %
EBDC	ethylene-bis-dithiocarbamate fungicide
EC	emulsifiable concentrate
EC_{50}	median effective concentraion
ECD	electron capture detector
EEC	expected (estimated) environmental concentration
ELISA	enzyme-linked immunosorbent assay
EMRL	extraneous maximum residue limit
EP	end-use product
EPSPS	enolpyruvyl shikimate acid phosphate synthase
ERC	ecotoxicologically (environmentally) relevant concentration
FEPA	Food and Environment Protection Act 1985
FID	flame ionization detector
FPD	flame photometric detector
FQPA	Food Quality Protection Act
FTIR	Fourier transform infrared spectroscopy
GABA	gamma aminobutyric acid
GC	gas chromatography
GC/EC	gas chromatography with electron capture detector
GC/MS	gas chromatography/mass spectroscopy
GC/MSD	gas chromatography with mass-selective detection
GLC	gas–liquid chromatography
GLP	good laboratoy practice
GS	glutamine synthetase
HAL	health advisory level
HBN	hydroxybenzonitrile herbicide

HDSE	hazardous distance for the most sensitive effect
HI	harvest interval
HPLC	high-performance liquid chromatography
HPPD	hydroxyl phenyl pyruvate dioxygenase
HPTLC	high-performance thin-layer chromatography
HRGC	high-resolution gas chromatography
ICM	integrated crop management
IEDI	international estimated daily intake
IESTI	international estimated short-term intake
IGR	insect growth regulator
IPM	integrated pest management
K_d	soil partition coefficient
K_{oc}	soil organic partition coefficient
K_{ow}	octanol–water partition coefficient
LC_{50}	median lethal concentration
LD_{50}	median lethal dose
LER	lowest-effect use rate
LERAP	local environmental risk assessment for pesticides
LOAEL	lowest-observed-adverse-effect level
LOD	limit of detection
LOQ	limit of quantitation
MBC	methyl benzimidazole carbamate fungicide
MEL	maximum exposure limit
MOS	margin of safety
MRL	maximum residue limit
MSDS	material safety data sheet
MTD	maximum tolerated dose
NEDI	national estimated daily intake
NOAEL	no-observed-adverse-effect level
NOEC/NOEL	no-observed-effect concentration/level
OC	organochlorine pesticide
OES	occupational exposure standard
OLA	off-label approval
OP	organophosphorous pesticide
PEC	predicted environmental concentration
PGR	plant growth regulator
PHI	pre-harvest interval
PIC	prior informed consent
PNEC	predicted no effect concentration
POP	persistent organic pollutant
POST	post-emergence treatment
ppb	parts per billion
PPE	personal protective equipment
PPI	pre-plant incorporated treatment
ppm	parts per million
PPO	protoporphyrinogen oxidase
PPPR	plant protection product regulation
PRE	pre-emergence treatment
QAU	quality assurance unit
QSAR	quantitative structure–activity relationship

RAC	raw agricultural commodity
RfD	reference dose
ROC	residue of concern
SAR	structure–activity relationship
	systemic acquired resistance
SC	suspension concentrate
SEC	size-exclusion chromatography
SFC	supercritical fluid chromatography
SFE	supercritical fluid extraction
SOLA	specific off-label approval
SOP	standard operating procedure
SPE	solid-phase extraction
STMR	supervised trials median residue
STMR-P	supervised trials median residue-processed
$T_{1/2}$	half-life
TDI	tolerable daily intake
TEF	toxic equivalency factor
TER	toxicity exposure ratio
TID	thermionic dectector
TLC	thin-layer chromatography
TMDI	theoretical maximum daily intake
ULV	ultra-low-volume
UVD	ultraviolet absorption detector
VLCFA	very long chain fatty acid
VMD	volume median diameter
WG	water-dispersible granule
WP	water-dispersible powder

ANNEX 3. SOURCES

Note: This Annex lists all of the publications quoted and cited in the text as well as most of the additional glossaries that were consulted to assess current usage of the terms defined.

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