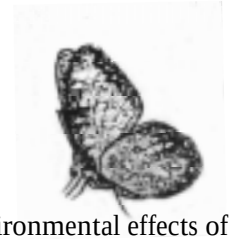


Glossary of Pesticide- (and Pest-) Related Terms

The following terms may be useful in your research about the health and environmental effects of pesticides, or about pesticide regulation and enforcement issues. Other glossaries of pesticide toxicology and related terms are available from: 1) Thomson Publications; PO Box 9335; Fresno, CA 93791 (authors Naeem Eesa and L.K. Cutkomp); 2) ExToxNet, accessible via the Internet using gopher client sulaco.oes.orst.edu or World Wide Web at http://www.oes.orst.edu.

Absorption: The uptake of liquids by solids or the passage of a substance into the tissues of an organism; e.g., the movement of a chemical into the bloodstream following exposure.
Acaricide: The class of pesticides use to kill mites and ticks; also known as a "miticide."
Acceptable Daily Intake (ADI): The estimated daily level of exposure to a particular substance that is anticipated to be without an appreciable risk of adverse effects to humans over the course of a lifetime. Set by EPA. Now called the Reference Dose.
Acetylcholinesterase: An enzyme present in nerve tissue, muscles and red blood cells that catalyzes the hydrolysis of acetylcholine to choline and acetic acid, allowing neural transmission across synapses to occur. This mechanism is used for neural transmission in insects, humans and other mammals, and other living creatures.

$$\underset{\text{acetylcholine}}{(CH_3)_3\overset{+}{N}CH_2CH_2OCO.CH_3} \xrightarrow{\text{acetylcholinesterase}} \underset{\text{choline}}{(CH_3)_3\overset{+}{N}CH_2CH_2OH} + \underset{\text{acetic acid}}{CH_3CO_2H}$$

Acetylcholinesterase inhibitor: A substance that interferes with the normal transmission of nerve impulses by inhibiting the acetylcholinesterase enzyme. This is the primary mode of action of carbamate and organophosphate insecticides.
Active Ingredient: The technical ingredients of a pesticide formulation that are listed on the label and are intended to kill the target organism. See also Inert ingredient.
Acute Health Effects: Having rapid onset, severe symptoms and a short course; not chronic.
Acute Toxicity: The potential of a substance to cause injury or illness after a single exposure or short-term exposure. One measure of acute toxicity is the lethal dose, or LD_{50} (see definition below.)
Additive effects: Combined effect of two or more chemicals equal to the sum of their individual effects.
Adsorption: Adhesion of substances to the surface of solids or liquids.
Adsorption coefficient (K_{oc}): A (unitless) measure of a material's tendency to adsorb to soil particles. High K_{oc} values indicate a tendency for the material to be adsorbed by soil particles rather than remain dissolved in the soil solution. Strongly adsorbed molecules will not leach or move unless the soil particle to which they are adsorbed moves (as in erosion). K_{oc} values of less than 500 indicate little or no adsorption and a potential for leaching.

$$K_{oc} = \frac{\text{concentration adsorbed/concentration dissolved}}{\text{\% organic carbon in the soil}}$$

Pesticide	$K^{\dagger}_{oc}$
aldicarb	8-32
atrazine	122
chlorpyrifos	4,381-8,800
2,4-D	20-136
diazinon	40-432
parathion	674-15,860
propoxur	41-72

† K_{oc} values from Howard. 1991. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals.* Chelsea, MI:Lewis Publishers.

Anti-microbials: Pesticides intended to kill unwanted microbes such as fungi, bacteria, or viruses. Also called disinfectants.
Arthropods: Organisms such as insects, arachnides (spiders and mites) and crustaceans which lack backbones.
Avicide: The class of pesticides used to kill birds.

Beneficial insects: Insects which are natural predators or parasitoids of harmful insect pests, or are important plant pollinators, etc. Examples include: lady beetles, lacewings, spined soldier bugs, social or parasitic wasps, bees, and ants.

Bioaccumulation: The uptake (via breathing, eating, drinking, direct absorption) and storage of a chemical in animal tissue. Over a period of time, a higher concentration of chemical may be found in the organism than in the environment.

Biochemistry: The branch of organic chemistry that deals with the chemical processes that occur in living organisms.

Biocide: A material that has the capacity to kill all forms of life.

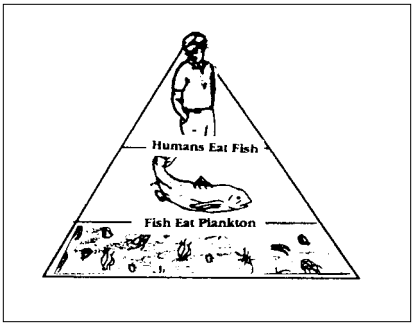
Bioconcentration: The increase in concentration of a chemical in the tissues of an organism relative to the levels in the surrounding environment (e.g., air, water).

Bioconcentration factor: The (unitless) measure of the tendency for a chemical to accumulate in (especially aquatic) organisms. The ratio of the concentration of a substance in a living organisms (mg/kg) to the concentration of that substance in the surrounding environment (mg/l for aquatic systems.) The BCF value is highest for hydrophobic (or lipophilic) chemicals.

$$BCF = \frac{\text{concentration in organism (mg/kg)}}{\text{concentration in environment (mg/l)}}$$

Biological Control: Any biological agent (parasite or parasitoid, natural predator, bacteria, virus, etc.) that adversely affects a pest species. Once introduced, parasitoids and predator populations can often become self-sustaining in the natural environment, providing permanent pest control. Examples of biological control agents: lady beetles (vs. aphids), cinnabar moth (vs. tansy ragwort plant), birds (vs. mosquitoes and many other insect pests), *B.t.* (vs. moths and butterflies)

Biomagnification: Process by which substances such as pesticides or heavy metals move up the food chain, becoming more concentrated with each succeeding step up the chain.



Broad spectrum pesticide: A pesticide which kills a wide range of pest species, as opposed to a pesticide which kills a single or limited number of species.

B.t. (Bacillus thurengiensis): a live microorganism (bacteria) that has insecticidal properties affecting a selective range of insects. At least 34 subspecies exist and are active against moth and butterfly caterpillars, mosquito and black fly larvae, beetle larvae, and more, respectively.

Cancer: The unregulated overgrowth of cells.

Carbamate pesticide: One of a group of pesticides formed primarily as esters of carbamic acid with the general formula (HO-CONH2). Certain of these compounds have insecticidal or herbicidal properties. The insecticides are cholinesterase inhibitors. Examples: carbaryl (Sevin), aldicarb (Temik), bendiocarb (Ficam).

Carcinogen: Any substance capable of producing cancer.

Carrier: A material added to a pesticide active ingredient to facilitate its preparation, storage and use.

Cholinesterase inhibitor: See Acetylcholinesterase inhibitor.

Chronic Health Effects: Describes symptoms or a disease that is of slow progression and long continuance. Opposite of acute.

Chronic Toxicity: The potential of a substance to cause injury or illness following repeated exposures over a period of time or long exposure.

Control: Experimental subjects not treated with a test chemical; also, a method or agent (may be biological, chemical, physical, or other) used to keep a pest population in check.
Contact dermatitis: Skin swelling due to either inital acute irritation from short-term contact substance, or from chronic sensitization that develops from long-term skin contact with an irritating substance.
Corneal opacity: Clouding of the transparent front portion of the eyeball.
Cost/benefit analysis: A quantitative evaluation of the economic, social, environmental and human health costs which would be incurred versus the economic, social, environmental and human health benefits of a proposed action such as the establishment of an acceptable dose of a toxic chemical.
Cumulative Effects (of Pesticides): The additive effects of exposures to a given pesticide from various sources (e.g., dietary, environmental), or to several pesticides simultaneously or over time. See also Synergism.
Data gap: Missing information; used to refer to those health or environmental effects studies which are required by the Environmental Protection Agency for registration of pesticides (but not yet completed by the pesticide manufacturer.)

Dermal: Of the skin; through or by the skin.
Diptera: An order of insects that includes flies and mosquitoes.
Dose: A measure of exposure. It is often expressed in milligrams per kilogram (mg/kg) or parts per million (ppm).
Dose-response relationship: A relationship such that with increasing levels of exposure to a factor, a corresponding rise in occurrence of disease or adverse effect is found.
Drift: The movement of air-borne particles from the intended contact area to other areas.
Efficacy (of a pesticide or pest control method): The effectiveness of a given pesticide or pest control method at controlling a particular pest species under a given set of conditions.
Endocrine disruptor: A chemical capable of disrupting the development or function of the reproductive system by mimicking or blocking the action of hormones.
Endocrine system: The system in humans and other animals comprised of the internally-secreting glands (e.g., the pituitary and thyroid glands), their (hormonal) secretions, and their target organs (e.g., prostate glands, testicles, ovaries, uterus, breasts, and others).

Selected pesticides reported to have reproductive and endocrine-disrupting effects:

alachlor	DBCP
aldicarb	DDT
atrazine	endosulfan
benomyl	lindane
carbaryl	parathion
chlordane	synthetic pyrethroids
2,4-D	tributyl tin

Environmental fate: What happens to a pesticide in the environment, including how long it persists in soil, water or foliage, how it moves (leaches) through the soil, how it degrades in water or light, how it is metabolized aerobically or anaerobically by organisms, how it accumulates in animals or plants.
Environmental Protection Agency (EPA): The federal agency with primary responsibility for enforcement of environmental regulations in the United States. The EPA regulates pesticides under FIFRA.
EPA: See Environmental Protection Agency.
Epidemiology: The study of the incidence and distribution of disease and/or toxic effects in a population.
Excretion: The removal of a chemical from the body in urine, feces or expired air.
Exposure: Contact with a chemical. Some common routes of exposure are dermal (via skin), oral (by mouth) and inhalation (breathing in).
FIFRA: See Federal Insecticide Fungicide and Rodenticide Act.
Federal Insecticide Fungicide and Rodenticide Act (FIFRA): The federal law regulating the usage and sale of pesticides. The EPA is responsible for its enforcement.

Formulation: The form in which a pesticide is packaged or prepared for use. A chemical mixture that includes active ingredients with "inert" ingredients. Inert ingredients may include solvents, surfactants, carriers, sticker/spreaders, and more.

Fungicide: A pesticide intended to kill fungi.

Half-life: The time required for a chemical to be reduced to half its original amount whether by excretion, metabolism or environmental degradation. Often abbreviated as $T_{1/2}$.

Herbicide: A pesticide intended to kill plants.

Hydrolysis: Any chemical reaction in which water is one of the reactants. A chemical decomposition in which molecules of a substance are split into simpler compounds through reaction with the elements in water.

Inert ingredient: Those intentionally added ingredients of a pesticide formulation that are not intended to have any pesticidal effect on the target organism. Such solvents, surfactants, carriers or sticker/spreaders and other inerts may (inadvertantly) be biologically active and hazardous. Many inert ingredients are known to be toxic, and some are even registered as active ingredients. Inert ingredients are not required to be listed on product labels, and manufacturers claim they are trade secrets.

Insect Growth Regulators (IGRs): Pesticides that kill or control insect pests by mimicking or interfering with the natural hormones that regulate the insect's developmental stages (e.g., egg, larva, pupa, adult). Examples: methoprene, which arrests the development of fleas at or before the pupal stage

Insecticide: A pesticide intended to kill insects.

Integrated Pest Management (IPM): An ecosystem approach to plant or insect problem management that determines if pest control is needed, when it should be initiated, where it should be applied, and what strategy and mix of tactics to use. It focuses on prevention of pest problems; utilization of the ecosystem's ability to control pests; establishment of levels of pests that can be tolerated; reliance, whenever possible, on nonhazardous biological and cultural controls; and minimized reliance on pesticides, avoidance of highly toxic pesticides, and utilization of pesticide applications that minimize damage to the natural controls and integrity of the ecosystem.

In vitro studies: Studies of chemical effects conducted in tissues, cells or subcellular extracts from an organism.

In vivo studies: Studies of chemical effects conducted in intact living organisms.

LC_{50}: Median lethal concentration; the concentration of a pesticide necessary to kill 50 percent of the test organisms. Defined in terms of a particular species of test animal. Usually expressed in terms of hours of exposure to parts per million (ppm) or milligrams per liter (mg/l) concentration of the pesticide. Used to quantify the toxicity of substances in water to fish or aquatic organisms, or the inhalation toxicity of airborne substances to animals. Note that smaller LC_{50} values indicate greater toxicity.

LD_{50}: Median lethal dose; the amount of a pesticide that is lethal to 50 percent of exposed test animals. This number is defined in terms of a particular species of test animal (e.g., rat, rabbit) and a particular route of exposure (e.g., dermal, oral). Usually expressed in milligrams of pesticide per kilogram of body weight (mg/kg.) Note that smaller LD_{50} values indicate greater toxicity.

Pesticide active ingredient	LD_{50} (oral, rat) (in mg/kg)
B.t.	>10,000
Chlorpyrifos	82 - 270
Cyfluthrin	16 - 647
2,4-D	350 - 500
Diazinon	66 - 697
Glyphosate	4,320
Insecticidal soap	>10,000

Leaching: The movement of a pesticide chemical downward through soil as a result of water movement, potentially causing contamination of groundwater.

Selected Chemicals on EPA's Priority List of Leaching Pesticides		
alachlor	aldicarb	atrazine
baygon	chlorothalonil	dacthal/DCPA
methomyl	picloram	propoxur

Least-toxic: Some use the term to mean those chemicals which have the lowest acute toxicity as measured by an oral or dermal LD_{50}. Others use it in a broader sense to denote those chemicals with the lowest acute and chronic toxicities and the least potential for disrupting the ecosystem in the short or long term.

Liability: A broad word for legal obligation, responsibility, or debt.

Liable: Responsible for something (such as harm done to another person); having a duty or obligation enforceable in court against you by another person.

Limitation: A time limit. For example, a 'statute of limitations' is a law that sets a maximum amount of time after something happens for it to be taken to court.

Metabolism: The biochemical processes by which a particular substance is broken down by an organism.

Microbial pesticides: Pesticides whose active ingredients are living microorganisms (e.g., bacteria, fungi, algae, viruses, parasitic nematodes) or the toxins that they produce. Usually highly selective in their action. Most must be consumed by the pest organisms in order to be effective. With a few exceptions (e.g., milky spore disease), microbial pesticides must be applied repeatedly to have continued effectiveness - they usually do not become permanently established in the environment as natural predators or parasitoids can. Examples: *B.t.*, milky spore disease, *steinernema feltiae* (nematode), nuclear polyhedrosis virus.

Miticide: A pesticide intended to kill mites. See also Acaricide.

Multiple Chemical Sensitivity (MCS): A controversial and poorly understood syndrome that causes affected individuals to react adversely to low levels of a wide range of chemicals and environmental agents, including pesticides, perfumes, household cleaners, and more. Symptoms may include severe headaches, joint pains, fatigue, heart arrhythmias, shortness of breath, and more.

Mutagen: Any agent that is capable of causing genetic mutations (changes in DNA) of either somatic or germinal cells.

Mutation: An alteration in genetic structure, such as a change in the base sequence of DNA, or structural or numerical chromosome abnormalities. Mutations carried in germ cells are inherited by future generations and may contribute to genetic disease. Mutations in somatic cells may be implicated in the development of cancer or other diseases.

Negligence: The failure to exercise a reasonable amount of care in a situation that causes harm to someone or something.

Neurotoxin: A chemical capable of damaging the structure or function of the nervous system (e.g., the brain, spinal cord, nerves or sensory organs). The nervous system controls movement, thought, vision, respiration, behavior, and numerous other physiological processes.

NOEL: No Observable Effect Level. The dose of a chemical that produces no observable toxicologically significant effects when administered to laboratory test animals.

Non-toxic: Not poisonous; a relative term.

Nuisance: Anything that annoys or disturbs unreasonably; hurts a person's use of their property; or violates the public health, safety or decency.

Organophosphate insecticide: A group of organic compounds identified by the presence of phosphorus atoms in the molecule, frequently linked with oxygen, sulphur, or both. Organophosphate insecticides

are cholinesterase inhibitors. Examples: parathion, malathion, chlorpyrifos, diazinon.
Parasitoid: Parasite-like organisms that kill their host. Many are host specific, attacking only one species of insect or mite pest. They usually lay their eggs on or in the host. The eggs hatch and develop into larvae, and begin to eat the host, causing its ultimate death.
Pediculocide: A pesticide intended to kill lice.

Persistence: The resistance of a pesticide to metabolism and environmental degradation.
Pest: Any organism (e.g., plant, rodent, insect, mite, bacteria) that is in a place where it is not wanted, whether for economic, health, aesthetic or nuisance reasons. A very subjective term.
Pesticide: A substance intended to prevent, kill or repel pests. Common classes of pesticides include insecticides, herbicides, fungicides, rodenticides, disinfectants, and wood preservatives.
Pesticide Registration: See Registered Pesticide.
Phenoxy herbicides (also called chlorophenoxy herbicides): These hormonal type compounds have a phenol ring to which is attached at least one chlorine atom. They mimic auxin, a plant growth hormone, and stimulate plants to literally grow themselves to death. Examples of phenoxy herbicides: 2,4-D, dicamba (Banvel), mecoprop.
Pheromone: Chemical signals emitted by insects and other organisms that enable them to communicate with others of the same species. Often used by insects to attract mates. Pheromones are used as attractants in traps, or applied in large amounts over a crop to confuse insects so they fail to find a mate and reproduce.
Photodecomposition: The breakdown of a substance by radiant energy (e.g., sunshine).
Physical controls: Manual removal or mechanical killing of pests (e.g., vacuuming, or using a hoe to remove weeds,) the use of barriers (e.g., screens, nets, caulking,) the setting of traps, or the use of heat or cold to destroy pests (e.g., flamers, freezing or cold storage of food or woolens.)
ppb: Parts per billion. One ppb is equivalent to one microgram of compound per liter of solution.
ppm: Parts per million. One ppm is equivalent to one milligram of compound per liter of solution.
ppt: Parts per trillion. One ppt is equivalent to one nanogram of compound per liter of solution.
RED (Reregistration Eligibility Decision): EPA's conclusion about whether a pesticide's uses are eligible for reregistation, and if so, what tests and data must be completed before a reregistration decision can be made.
Reentry interval: The EPA-designated period of time following the application of certain pesticides after which workers may return to the treated area without protective clothing.
Reference Dose: See Acceptable Daily Intake.
Registered Pesticide: A pesticide product that has been approved by the EPA for the uses listed on the label. Pesticide registration decisions are based primarily on EPA's evaluation of test data provided by the chemical manufacturers. Most EPA testing requirements focus on the active ingredients of the pesticide products only. EPA uses a risk/benefit analysis when deciding whether to approve a particular pesticide. This means that even if animal test results indicate that a pesticide is highly toxic, carcinogenic, teratogenic, or poses other health or environmental risks, the chemical may still be registered if certain economic, social, environmental or human health benefits are deemed to be greater than the risks.
Reregistration: A reassessment by EPA of previously registered pesticides according to current scientific standards. This process, mandated by Congress, is underway for approximately 20,000 pesticide products registered prior to 1972.
Residue: The quantity of a pesticide, its degradation products, and/or its metabolites remaining on or in a plant, animal tissues, soil, or surfaces after spraying or any other method of pesticide application.
Resistance: Natural or genetic ability of an organism to tolerate the poisonous effects of a pesticide.
Restricted use pesticide: A pesticide which may only be purchased and used by certified applicators. This designation is given by EPA to those pesticides deemed to pose the highest hazard to applicators,

the public, or the environment.

Resurgence: The rebounding of a pest population to higher than pre-treatment levels following a pesticide application. This is due to the effect of the pesticide in destroying or reducing populations of natural predators, parisitoids or pathogens that would otherwise control the pest. Any pest organisms that escape the pesticide's effects (or that arrive after the application) are then able to flourish unchecked.

Right-To-Know Laws: Laws, especially the new federal law, that allow citizen access to pesticide company hazard assessments and worst-case accident scenarios for toxic releases from their facilities.

Risk Assessment: A quantitative or qualitative evaluation of the environmental and/or human health risks resulting from exposure to a pesticide or other substance. Considers proposed or existing uses, exposure potential and toxicity factors.

Risk/Benefit Analysis: An approach that attempts to weigh the risks (e.g., to human health or the environment) of use of a certain pesticide against the benefits (e.g., social, economic) of its use. See also Registered Pesticide.

Risk Factors: Factors whose presence is associated with an increased probability that disease will develop later.

Rodenticide: A pesticide intended to kill rodents (e.g., rats and mice.)

Selective (pesticide or mode of action): A pesticide that kills specific undesireable pests without adversely affecting other species of desirable plants (in the case of an herbicide) or beneficial insects (in the case of an insecticide).

Sensitization: The development of a hypersensitive or allergic reaction upon reexposure to a substance. The reaction may be immediate or delayed and may be of short-term or chronic duration.

Signal word: One of three words (Danger, Warning, or Caution) which must appear on a pesticide label. Signal words indicate the level of acute toxicity posed by the pesticide product.

Hazard Level	I	II	III	IV
Signal Word	Danger	Warning	Caution	Caution
oral LD_{50}	up to 50 mg/kg	50-500 mg/kg	500-5,000 mg/kg	>5,000 mg/kg
inhalation LC_{50}	up to 0.2 ug/l	0.2-2 ug/l	2-20 ug/l	>20 ug/l
dermal LD_{50}	up to 200 mg/kg	200-2,000 mg/kg	2,000-20,000 mg/kg	>20,000 mg/kg
eye effects	corrosive, corneal opacity, not reversible w/i 7 days	corneal opacity reversible within 7 days; irritation persists 7 days	no corneal opacity; irritation reversible within 7 days	no irritation
skin effects	corrosive	severe irritation at 72 hours	moderate irritation at 72 hours	mild or slight irritation

Statute: A law passed by a legislature.

Strict Liability: The legal responsibility for damage or injury, even if you are not at fault or negligent.

Subchronic: Intermediate between acute and chronic toxicities; subchronic toxicity studies involve repeated daily exposures of animals to a chemical for part (not exceeding 10%) of a lifespan. In rodents, this period extends up to 90 days of exposure.

Surfactant: An agent that lowers surface tension; the active ingredient of detergents. Surfactants are frequently added to pesticide formulations.

Synergism: When the simultaneous action of separate chemicals together have a greater total effect than the sum of their individual effects. Examples of synergistic chemicals are: alcohol and certain drugs; Tagamet (ulcer medication) and diazinon (insecticide). Scientists are currently exploring the synergistic effects between DEET (insect repellant), permethrin (insecticide), chlorpyrifos (insecticide), and the anti-nerve gas agent used administered to Gulf War soldiers.

Synthetic pyrethroids: A diverse class of more than 1,000 broad-spectrum insecticides. Based on the

chemical structure and biological activity of pyrethrum (an extract from plants in the genus *Chrysanthemum*), but more toxic and less rapidly degraded in the environment than natural pyrethrum.

Systemic pesticide: Capable of being absorbed by plants into the plant sap, or by animals into the blood stream.

Teratogen: Anything which is capable of producing birth defects in exposed embryos or fetuses. Examples of chemicals for which there is evidence of teratogenicity: thalidomide (drug), mercury (pesticide, pollutant), rotenone (insecticide), aldrin (insecticide), dieldrin (insecticide), thiram (fungicide), xylene (solvent)

Teratogenesis: The development of abnormal structures or functional alterations in offspring during pregnancy. Teratogenic effects are not passed on to subsequent generations.

Tolerance Level or Threshold Pest Level: The population level at which a "pest" species becomes intolerable economically or aesthetically. Under an IPM program, this level determines when control measures are taken - the mere presence of an insect, pest or otherwise, does not warrant pesticide use.

Toxic: Harmful; poisonous.

Tort: A legal wrong which causes injury.

USDA: United States Department of Agriculture.

Volatile: Easily evaporated.

Water Solubility: Expresses the ability of a chemical to move into water or dissolve at a specific temperature and pH.

Wood Preservative: Pesticides intended to kill wood-decaying fungi.