

GENERAL

A. APPLICATORS

Subject A: Should know the meaning of pest, pesticide, active ingredient, formulation, toxicity, hazard, and risk.

Subject B: May need to understand the concept of hazard classes. Should understand the importance of the label.

B. ALL OTHER GROUPS:

Subject A: In addition to the above, should know the meaning of pesticide names according to target species, systemic pesticides, and household pesticides. Details of names of types of formulation will be needed for most groups.

Subject B: Should know hazard classes, and classification by formulation, and the importance of the label. Sanitarians, agricultural extension officers, and regulatory staff should know all the contents of a label.

Note: The subjects of classification and labelling are introduced at an early stage of the course, other parts of the course are related to these concepts.

Section: I General
Subject: A Definitions
Number: 1 Pest, Pesticide

Main points:

A PEST IS AN ORGANISM WHICH IS DESTRUCTIVE, OR TROUBLESOME TO ITS HOST, OR CARRIES DISEASE TO PLANTS OR ANIMALS, INCLUDING MAN

A PESTICIDE USUALLY REFERS TO ANY CHEMICAL WHICH KILLS A PEST

Level: ADVANCED

Subsidiary points:

1. Some pests can also be controlled by **BIOLOGICAL CONTROL AGENTS**. These are either microbiological agents (viruses, bacteria and fungi of insect origin), or other insects or life-forms which prey on the pest.
2. Insect repellents are sometimes treated for regulatory purposes as pesticides, although they only repel insects and do not kill them. The international definition of a pesticide also includes a number of compounds which do not strictly kill pests. (See the definition below.)

For discussion:

How is 'pesticide' defined in this country?

Other information:

The following is the definition of 'pesticide' in the International Code of Conduct on the Distribution and Use of Pesticides:

Pesticide means any 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 during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or which may be administered to animals for the control of insects, arachnids, 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 and transport.

Suggested visual aid: Text, as indicated by capital letters in main points.

Section: I General
Subject: A Definitions
Number: 2 Pesticide names according to target species

Main point:

Pesticides are designed to kill only target species of pests, as far as this is possible. Their general names then denote the type of pesticide.

Examples: **INSECTICIDES** kill insects.
LARVICIDES kill larvae of insects and other species.
FUNGICIDES kill fungi (moulds).
RODENTICIDES kill rats, mice, and other rodents.
MITICIDES kill mites.
MOLLUSCIDES kill snails.
HERBICIDES or weedicides kill weeds.
AVICIDES kill birds.
NEMATOCIDES kill some types of parasitic worm.

For discussion:

What are the commonest types of pesticides used in this country?

Other information:

Specificity (the ability of a pesticide to affect only the target species) varies among the types of pesticides. Herbicides are among the most specific, while insecticides can rarely distinguish between target pests and beneficial insects.

Suggested visual aid: Text as indicated by capital letters under Examples.

Section: I General
Subject: A Definitions
Number: 3 Pesticide actions on target species

Main point:

Pesticides may act on target species in several ways,

Examples: A pesticide which kills the pest by first passing into it through the skin, cuticle, or exoskeleton, is a **CONTACT POISON**;

A pesticide which kills the pest by first passing into the stomach is a **STOMACH POISON**;

A pesticide which is distributed in the air is a **FUMIGANT**. It may act as a contact poison or be inhaled, according to target species.

Subsidiary point:

Fumigants strictly apply to pesticides in the form of a gas or a vapour, but sometimes when droplets of an aerosol impinge on flying pests and act as a contact poison, the pesticide has been described as having a fumigant action.

Other information:

These definitions and those in the next module are to enable participants to understand some of the phrases used on pesticide labels.

Suggested visual aid: Text, using the words in capital letters above.

Section: I General
Subject: A Definitions
Number: 4 Systemic pesticides

Main points:

**SYSTEMIC PESTICIDES CAN BE ABSORBED BY THE FOOD SOURCE OF A PEST,
AND KILL THE PEST WITHOUT AFFECTING THE SOURCE.**

**THEY ARE USUALLY INSECTICIDES, LARVICIDES OR FUNGICIDES APPLIED
TO THE LEAVES OF PLANTS OR TO THE SOIL AROUND THE PLANT
SO THAT THEY PASS INTO IT THROUGH THE ROOTS.**

Subsidiary points:

1. Other systemic pesticides may be designed to kill the plant itself if it is a weed. When the herbicide is applied to the leaves or to the soil, it is absorbed by the plant and kills the root also.
2. Systemic pesticides are not commonly applied to animals because of their toxicity in mammals, and the difficulty in controlling the dosage. The exceptions are 'pour-on' preparations applied in a strip to the backs of farm animals to protect the beasts from the effects of fly-strike by attempting to control the fly population in this way.

Other information:

Confusion sometimes arises over the use of the word 'systemic'. When it is used to describe a pesticide, it usually has the meaning given above. However, in toxicology it may refer to any poison which is absorbed by an organism and interferes with its metabolism.

Suggested visual aid: Text using the words in capital letters above.

Section: I General
Subject: A Definitions
Number: 5 Technical product, Active ingredient, Formulations (a).

Main points:

**THE TECHNICAL PRODUCT IS THE PESTICIDAL CHEMICAL
PLUS IMPURITIES WHICH ARE ASSOCIATED WITH IT IN ITS MANUFACTURE**

**THE PESTICIDE CHEMICAL IS ALSO KNOWN AS THE
ACTIVE INGREDIENT.**

**THE ACTIVE INGREDIENT IS USUALLY MIXED WITH OTHER CHEMICALS
TO FACILITATE ITS USE. IT IS THEN KNOWN AS A FORMULATION.
FORMULATIONS USUALLY NEED FURTHER DILUTION.**

Subsidiary points:

1. Active ingredients exist in various physical forms: solids, liquids or gases. The physical form of the active ingredient is not always the same as that of the formulations in which they are used.
2. While a formulation is designed mainly to facilitate use and increase the effectiveness of the active ingredient, it may also be modified to increase the safety of handling the pesticide. For example, the hazard of distributing a solid formulation may be less if it is a granule rather than a dust.

For discussion:

Can you give examples of a few formulations in different physical states which are used in this country?

Other information:

Examples of formulations are given in module I A 6.

Suggested visual aid: Text using the words in capital letters above.

Section: I General
Subject: A Definitions
Number: 6 Formulations (b)

Main point:

FORMULATIONS ARE COMPLEX CHEMICAL MIXTURES.

Only a selection of those in use are shown below.

Examples:

SOLIDS:

WETTABLE OR SOLUBLE POWDERS (WP, WS or SP) or GRANULES (SG) to be added to water;

GRANULES (GR), DUSTS or DUSTABLE POWDERS (DP), often applied as such;

PELLETS or PASTE (PA) used for baits (RB);

TABLETS (TB) for smoke, gas or vapour generation;

Pesticides can also be incorporated into other materials such as plastics and mosquito coils.

LIQUIDS:

EMULSIFIABLE CONCENTRATES (EC) to be added to water;

WATER IN OIL EMULSION (EO) or OIL MISCIBLE LIQUIDS (OL);

LIQUIDS (UL) for use in ULV application equipment;

AEROSOL GENERATORS (AE);

FOGGING CONCENTRATES (HN or KN);

'POUR-ONS' (PO) for direct application to skin of animals;

SHAMPOOS for humans.

Subsidiary points:

1. Gases are released either from tablets by exposure to air (e.g. cyanide), or from cylinders (e.g. methyl bromide). They are not usually formulated, but irritating or smelly agents may be added to warn of their presence.
2. Concentrations of active ingredients in formulations vary greatly. Whenever any formulation is specified, the concentration should also be stated.

For discussion:

In general, what types of formulations need special care to avoid accidental contamination of foodstuffs?

Other information: The letters in the main points are the codes frequently used on labels.

Suggested visual aid: Text, using the words in capital letters in the examples.

Section: I General
Subject: A Definitions
Number: 7 Household pesticide

Main point:

**A HOUSEHOLD PESTICIDE IS A FORMULATION INTENDED TO BE USED
FOR THE CONTROL OF COMMON HOUSEHOLD PESTS
BY THE OCCUPANTS OF A DWELLING**

Subsidiary point:

Also included under this heading are pesticidal formulations for the chemical treatment of household materials, such as wallpaper, mosquito coils, bednets or curtains in and around the dwelling.

For discussion:

Are household pesticides any different from other pesticides? Why should household pesticides be differently treated from other pesticides?

Other information:

The discussion should lead into the consideration of toxicity and hazard in the next two modules. See also module IV A 6.

Suggested visual aid: Text using the words in capital letters above.

Section: I General
Subject: A Definitions
Number: 8 Toxicity

Main point:

**THE TOXICITY OF A CHEMICAL IS ITS ABILITY
TO CAUSE A HARMFUL EFFECT IN A LIVING ORGANISM**

Subsidiary points:

1. Toxicity may vary greatly between species. It is obvious that if a pesticide is to be effective, it must be highly toxic to the target species.
2. The toxicity of a formulation usually varies with the concentration of the active ingredient in the formulation, but it can vary a) with non-pesticidal constituents of a formulation, or b) if impurities associated with the active ingredient exceed their average levels, e.g. after long storage.

Level: ADVANCED

3. Acute toxicity is quantified by the LD₅₀ value. This is a statistical estimate of the number of milligrams (mg) of a chemical per kilogram (kg) of bodyweight required to kill 50 per cent of test animals. The letters LD refer to the Lethal Dose administered to the group of animals, and a similar notation may be used for other percentages of kill, e.g. LD₁₀ or LD₁₀₀, or for other ways of administering the chemical, e.g. LC₅₀ (Lethal Concentration) in inhalation studies. In using these values, the test species, the sex of the animals and the route by which the chemical was administered should always be stated. To assess the likely toxicity of a chemical for humans, the rat is the test animal most commonly used.
4. Symbols are also used to describe other effects in toxicity in the stated species:

TD the lowest (Threshold) Dose producing toxicity in the stated species;

NOEL the highest dose administered at which No Observed Effects seen in the stated species at that Level.

LOEL the Lowest Observed Effect Level.

Other information:

In this module, 'dose' refers to the administered dose, or the amount of the chemical to which the test animal has been exposed. It must later be distinguished from the absorbed dose - see module II B 1.

Suggested visual aid: Text using the words in capital letters in the main point above.

Section: I General
Subject: A Definitions
Number: 9 Hazard, Risk

Main points:

HAZARD IS THE POSSIBILITY THAT TOXICITY MIGHT CAUSE A HARMFUL EFFECT.

RISK IS THE LIKELIHOOD THAT A HARMFUL EFFECT MIGHT RESULT FROM EXPOSURE TO A PARTICULAR HAZARD.

FOR A TOXIC HAZARD TO EXIST, THERE MUST BE EXPOSURE TO A TOXIC SUBSTANCE.

Subsidiary point:

The key to the safe use of chemicals is to reduce to a minimum the possibilities of exposure while handling them. That is what most of this course is about.

For discussion:

Can you think of chemicals (not pesticides) which are toxic but not hazardous at the dosage level to which people are normally exposed? What about oxygen, water, and salt?

Other information:

1. Oxygen is in the air at a concentration of 20.9%. Life is endangered if this concentration falls below about 12%. Pure (100%) oxygen is toxic, and causes harmful effects on lung function in adults, and to the eyes of new-born babies.
2. Forced feeding with water overloads the kidneys and upsets the biochemical balance of the body.
3. Salt can be very toxic to babies in the same concentration that might cause an adult to vomit.
4. The definition of hazard is restricted to its relevance to this course. A wider definition is "the intrinsic properties of a substance or process to inflict damage or harm".

Suggested visual aid: Text, using the words in capitals above.

Section: I General
Subject: B Classification and labelling
Number: 1 Hazard classes.

Main points:

Pesticides can be classified in several ways,
by toxicity, by hazard, by chemical class or by use.

**THE OBJECT OF CLASSIFICATION BY HAZARD IS
TO ENABLE THOSE HANDLING AND USING THE PESTICIDE
TO TAKE APPROPRIATE PRECAUTIONS TO MINIMIZE EXPOSURE.**

The classification which is used in many countries is the
WHO RECOMMENDED CLASSIFICATION OF PESTICIDES BY HAZARD.

This lists pesticidal technical products (active ingredients) as follows:

- | | | |
|---------|-----------|---|
| Table 1 | Class Ia | EXTREMELY HAZARDOUS; |
| Table 2 | Class Ib | HIGHLY HAZARDOUS; |
| Table 3 | Class II | MODERATELY HAZARDOUS; |
| Table 4 | Class III | SLIGHTLY HAZARDOUS; |
| Table 5 | Class III | PRODUCTS UNLIKELY TO PRESENT ACUTE HAZARD IN NORMAL USE. |

Subsidiary points:

1. Classification is necessary because pesticides are a general term for a large number of chemical compounds with widely varying properties and toxicity.
2. Any system for the regulation of the distribution and use of pesticides must be based on a classification.

For discussion:

What system of classification is in use in this country?

Other information:

If the national system should differ markedly from the above in the description of hazard classes, the visual aid should be adapted to describe the national system. This applies to all the modules in this course dealing with regulatory matters.

Suggested visual aid: Text using words in capital letters above, but see above under 'Other information'.

Section: I General
Subject: B Classification and labelling
Number: 2 Classification by formulation

Main points:

**THE HAZARD PRESENTED BY ANY PESTICIDE DEPENDS ON:
THE TOXICITY OF THE ACTIVE INGREDIENT, ITS CONCENTRATION
IN A FORMULATION; AND THE PHYSICAL FORM OF THE FORMULATION.**

**THEREFORE ALL CLASSIFICATION MUST BE BY CONCENTRATIONS OF THE
ACTIVE INGREDIENTS IN FORMULATIONS**

Subsidiary points:

1. In classification by physical state, liquid formulations are considered more hazardous than solid formulations. Pesticidal gases and vapours are not classified in the WHO Classification, but are listed in a special table (No. 7).
2. Classification by formulation enables the distribution of pesticides to be controlled. The degree of control should be apparent from the labelling.

Other information:

1. The Guidelines to the WHO Recommended Classification list the toxicity and physical state of the active ingredients (technical products) only, but emphasize that this is only a starting point on the road to classification by formulation.
2. The reference to active ingredients in the second of the main points above has been made because, in a few formulations, the hazard presented by solvents may exceed that of the active pesticidal ingredients.

Suggested visual aid: Text using the words in capital letters above.

Section: I General
Subject: B Classification and labelling
Number: 3 Importance of label

Main points:

**THE FIRST STEP IN THE SAFE AND EFFECTIVE USE
OF ANY PESTICIDE IS THE READING OF THE LABEL**

NEVER USE A PESTICIDE FROM AN UNLABELLED CONTAINER

**NEVER POUR PESTICIDE INTO AN UNLABELLED CONTAINER
UNLESS IT IS TO BE DILUTED AND USED IMMEDIATELY.**

Subsidiary point:

Labels should always be printed in a locally understood language.

For discussion:

How is the hazard shown on the labels used in this country?

What are the most important points to look for on a label?

Other information:

In order to help people with reading difficulties, more use is now being made of colour coding to denote hazard, and pictograms which are cartoon-style illustrations of application and safe handling practices.

Suggested visual aid: Examples of pesticide labels used nationally.

Section: I General
Subject: B Classification and labelling
Number: 4 Contents of a label

Main point:

A LABEL CONTAINS BOTH INFORMATION AND ADVICE

The following are the essential parts, in locally understood language:

- The trade name and the approved name of the pesticide, the active ingredients, and the hazard it presents (the classification of the formulation).
- The target pests.
- The safety precautions necessary when handling or using the pesticide, and the first aid treatment and/or medical treatment of intoxication, as appropriate.
- How, when, and where to use the pesticide.
- How to mix or dilute the pesticide.
- How to clean application or mixing equipment afterwards, and how to dispose of unwanted pesticide and the washings.
- Whether the formulation can be mixed with other pesticides or diluting agents.
- The laws and regulations that apply specifically to the use of the pesticide, including the period of restricted entry into a treated area (the re-entry period), and the withholding period to be observed between treatment and harvest of a crop, if any.
- The name and address in the country of the manufacturer, distributor, or agent, and the registration number of the pesticide.
- The date of manufacture and/or formulation.

Other information:

The list above is adapted from the FAO Guidelines on Good Labelling Practice for Pesticides, which is part of the International Code of Conduct on the Distribution and Use of Pesticides. The Guidelines provide more detail on the points above.

Suggested visual aid: Examples of pesticide labels used nationally.