



TOXICOLOGY IN THE CLASSROOM

Teacher's Edition

Toxicology

IN THE CLASSROOM

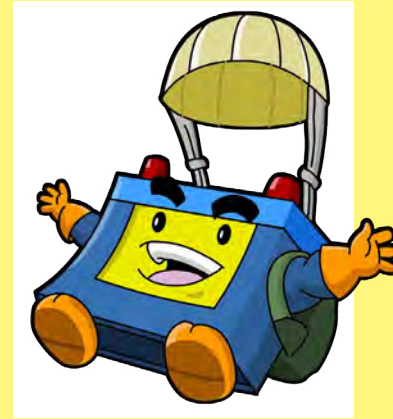


**UNDERSTANDING CHEMICAL
RISKS TO HUMAN HEALTH
AND THE ENVIRONMENT**

TEACHER'S EDITION

Introduction

Infants and children are particularly vulnerable to pesticides and other toxic chemicals because their bodies are smaller and still developing. Children also face greater exposures than adults due to their hand-to-mouth behaviours. Children living in farming areas or whose parents work in agriculture suffer greater pesticide exposure than other children.



Non-chemical methods exist to prevent or manage pests. Integrated Pest Management (IPM) and Integrated Vector Management (IVM) apply different methods, trying to reduce the use of chemicals to a minimum. Despite this, pesticides are much used in farming economies of today, and for managing vectors of disease, especially in developing countries and countries with economies in transition. Pesticides are applied to kill pests, but they can also adversely affect non-target organisms, including humans.



Objective

The project aims to raise awareness among young students about potential side effects of chemicals and help to reduce careless use and handling of pesticides and other chemicals. The book will help teachers to provide basic understanding of toxicology and awareness of the need for protective and precautionary measures to minimise adverse effects on human health and the environment. In addition, this book will be supplemented with 'Guide on Teaching Activities' which has been designed to assist teachers to organise and structure their classroom teaching.

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This book is for use by chemistry/ biology/ science teachers. The material is targeted to pupils at the end of primary school and/or the beginning of secondary or middle school to teach them to understand the action and dangers of pesticides and the importance and principles of safe handling and protection of themselves and others from harmful effects of pesticides.

Who developed the tool?

This teaching tool has been developed by the United Nations Environment Programme (UNEP) and the National Poison Centre of Universiti Sains Malaysia (NPC-USM).

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Learning Outcomes

1. What are Chemicals?

The student is able to:

- state at least three (3) examples of chemicals used in everyday life

2. What are Potentially Hazardous Chemicals?

The student is able to:

- describe the characteristics of toxic chemicals
- describe how we can tell if a chemical is toxic
- name at least three examples of toxic chemicals or pesticides that could be found in the:
 - house
 - garden or play area
 - farm or work place

3. What is Poisoning?

The student is able to:

- state the meaning of poisoning
- state at least three (3) toxic chemicals that can cause poisoning
- describe the effects of poisoning on human health

4. What is Toxicology?

The student is able to:

- explain what Paracelsus said about poisons
- state the meaning of toxic, toxicity and toxicology
- describe two factors that affect toxicity
- state the meaning of dose, acute exposure and chronic exposure
- perform a (virtual) experiment on the dose response relationship

5. What is a Pest?

The student is able to:

- state what a pest is
- state the different types of pests
- describe non-chemical methods of managing pests

6. What is a Pesticide?

The student is able to:

- state what a pesticide is
- state at least three (3) examples of pesticides
- describe briefly the types/classes of pesticides and their uses
- describe what to do before using pesticides

7. Use of Pesticides

The student is able to:

- explain the role of pesticides in agriculture, vector control and the house
- describe briefly two problems with pests that can occur with pesticide use
- state ways in which pesticide use can be minimised
- explain briefly what integrated pest management is
- explain the meaning of the restricted use of pesticides

8. Effects of Pesticide on People

The student is able to:

- state at least three examples of the effects of poisoning by pesticides
- state at least three examples of signs and symptoms of acute and chronic poisoning by pesticides

9. What to do in Case of Poisoning

The student is able to:

- explain the general steps that should be taken in case of poisoning

10. How Poisons can get into your Body?

The student is able to:

- state three ways in which poison can get into the human body

11. Pathways Through the Environment

The student is able to:

- state the components in the pesticide life cycle
- describe briefly how pesticides can be transferred through the three pathways

12. How to Identify a Toxic Compound, Product and Understand the Label

The student is able to:

- describe at least three risky situations where people can be exposed to pesticides/ chemicals
- suggest ways to avoid risks

13. Risky Situations with Chemicals/ Pesticides

The student is able to:

- state that skin should be protected from contact with pesticides and that three parts of the body need extra protection

14. Personal Protection when using Pesticides

The student is able to:

- state that skin should be protected from contact with pesticides and that three parts of the body need extra protection

15. Protecting Younger Children, Sisters and Brothers

The student is able to:

- state at least three (3) ways of protecting children, sisters and brothers while they are (e.g. playing, sleeping, eating, etc) in the:
 - house
 - garden or other places where they play
 - farm
- evaluate and suggest ways to protect children, sisters and brothers in a given case scenario
- state 3 reasons why children are vulnerable to toxic chemicals

16. Protecting the Environment

The student is able to:

- describe at least one implication of pesticides that affect:
 - ✓ aquatic organisms, fish
 - ✓ pollinators (e.g. bees, butterflies)
 - ✓ predators (e.g. predatory insects, spiders, bats, birds, amphibians eating insects)
 - ✓ beneficial insects (silkworms and honey-bees)
 - ✓ micro-organisms/ small organisms living in the soil (e.g. earthworms)
 - ✓ other wildlife
 - ✓ domestic animals
- explain the need to protect animals and wildlife from an ecological perspective
- name places that should be protected from pesticides
- suggest and evaluate ways in which the environment can be protected from pesticides

17. Disposal of Toxic Wastes

The student is able to:

- state that to reduce the amount of toxic wastes, it is necessary to avoid buying more than what is needed
- state that it is important to separate toxic wastes from other wastes
- explain how to dispose of them in a correct manner

1 What are Chemicals?

Chemicals around us

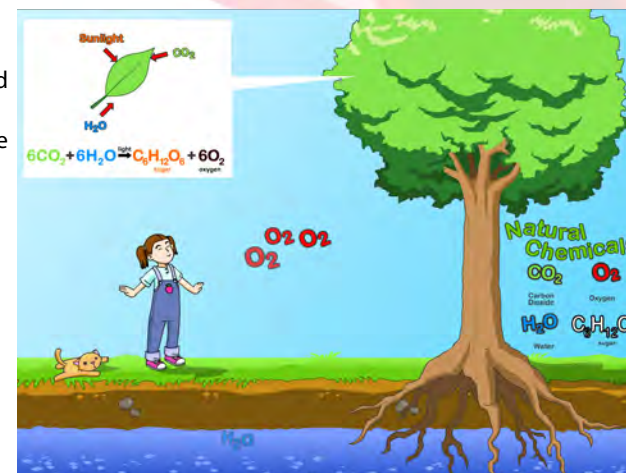
Do you know that all of us are exposed to a number of chemicals in our daily life?

Chemicals are everywhere

Everything is made of chemicals. We are all made of chemicals. There are many chemical processes going on in our bodies.

Plants can transform simple chemicals like carbon dioxide (in the air around us), water and minerals from the soil into the building stones of life. There are more complicated chemicals like sugar, proteins and fats.

Plants and animals are continuously making and breaking down chemicals. They use chemicals to send messages or to prevent other animals from eating them. People use many naturally made chemicals.



What are chemicals?

Over the centuries, people have become very good at making chemicals. We make clothes from artificial fibres and dyes to colour them. We have detergents to clean our house and use flame retardants to stop things from burning. There are chemicals in the cosmetics we use every day, from nail polish to hand lotions. We make pesticides to kill pests.



We use chemicals in many products, for example, mercury in energy saving lamps. We use chemicals when making products like electronics or during dry cleaning processes. Sometimes we create chemicals indirectly, like dioxins that form when burning chlorine containing materials such as PVC plastics and municipal waste at low temperatures.



Chemicals such as those that are used to kill pests, to clean the toilets, sinks and drains, as well as those for washing are potentially dangerous.



Chemicals should be stored out of reach of children, preferably in a locked cabinet.



You may also be exposed to chemicals outside your house in places where you play. Beware of garbage with unused chemicals or empty containers, and freshly sprayed fields. You can be harmed by these chemicals!

2 What are Potentially Hazardous Chemicals?

What are toxic chemicals?

Chemicals can be toxic to both humans and the environment. Toxic chemicals have the risk of causing harmful health and environmental effects. Their effects can be seen immediately or may occur after a period of time. Some chemicals are hazardous because of their physical properties: they can explode, burn or react easily with other chemicals.

Chemicals that are persistent, bio-accumulative, carcinogenic, mutagenic or toxic to reproduction are of high concern. Persistent Organic Pollutants (POPs) are examples of toxic chemicals (see What is Pesticide).



How do we know which are the toxic ones?



Scientists study the toxic effects of chemicals on lab animals, ecosystems and people who are exposed to them. Toxicity of a chemical is usually determined with tests on animals and ecosystems. After such tests chemicals are classified and labeled according to their toxicity.



Some people and age groups such as children, elderly, pregnant women and fetus may be more sensitive to some chemicals. These issues should be taken into consideration when classifying chemicals. Use of highly toxic substances is often under state control and may be restricted to certain uses.

What chemicals should people be concerned with at home?

Pesticides are examples of toxic chemicals found at home that people should be concerned with. These include:

- rodenticides (poisons for rats and mice)
- insecticides, (sprays and baits against cockroaches, termites, ants or moths)
- shampoos against lice
- insect repellents
- weed killers (herbicides)
- products used against mould or mildew (fungicides)
- flea and tick shampoos, powders, and dips for pets



Agricultural pesticides are often more dangerous than household pesticides and should not be used at home.

Other toxic household chemicals

There are other household chemicals that are potentially dangerous to our health. These are:

- bath and kitchen cleaners and disinfectants, detergents, bleach, caustic soda and lamp oil
- drain cleaners, paints, solvents, glues, windshield washer fluid for the car
- beauty care products such as hair and nail products
- medicines

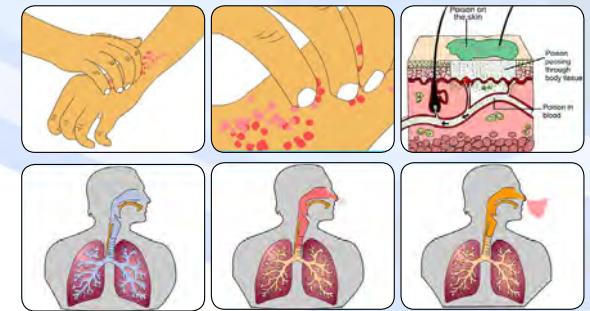
These chemicals should be used according to instructions on the product label.

Objects that contain toxic chemicals such as energy efficient lamps and old thermometers with mercury, may also be found in the home.



3 What is Poisoning?

Poisoning occurs when a substance adversely interferes with normal body functions after it is swallowed, inhaled, injected, or absorbed.



Chemicals that can cause poisoning

There are different types of chemical substances that we can be exposed to in the home and workplace. Products that are not meant to be ingested or inhaled, such as shampoos, paint thinner and pesticides can also make you ill if ingested.

Medicines, medicinal herbs, or alcohol can be ingested in small quantities but are harmful if taken in large amounts. Naturally occurring chemicals include some plants, bacterial toxins that can cause food poisoning such as Salmonella and the venom found in the bites and stings of some animals and insects.



Poisoning disrupts the normal functioning of the body. Different poisons have different effects. Poisons often affect the nervous system, respiratory system, gastro intestinal tract (GIT) and/or liver and kidneys.

Poisoning can cause skin rashes, fatigue, dizziness, muscle weakness, headache, stomach cramps, vomiting, nausea, fainting or coma. These may occur within a short period of time.



4 What is Toxicology?

Paracelsus, a well-known scientist who defined **POISON** said;

- all substances are poison
- the **DOSE** will determine whether it can cause poisoning or not



Toxicology

- A science that studies poisons and their effects.
- It is through toxicology that we know which chemicals are toxic and how they work.



Toxic: Poison

Substances that can make you feel sick or even cause death.



Toxicity: Dose

- Toxicity is the ability of the chemical to cause injury, illness, death.
- Toxicity depends upon the dose which is the amount your body takes in.
- The higher the toxicity, the more harmful or dangerous the chemical is.

<p>VERY TOXIC CHEMICALS Dose: a small amount makes you ill</p> <p>Examples</p> <p>Rat Poison</p> <p>Pesticide & Insecticides</p>	<p>LESS TOXIC CHEMICALS Dose: a large amount makes you ill</p> <p>Examples</p> <p>Mosquito Mat</p> <p>Mosquito Coil</p>	<p>OTHER TOXIC CHEMICALS Dose: an excessive amount makes you ill</p> <p>Examples</p> <p>Vitamin</p> <p>Plant</p>
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Toxicity: Duration

Acute Exposure: Short term exposure



Acute toxicity shows up more quickly and can be fatal. Commonly, children are more sensitive to toxic substances.

For many substances the acute toxic effects observed from a single exposure, (one time contact with it), may be quite different from that of repeated exposures.

An example is alcohol, acute effects are getting drunk or even falling into a coma.

Chronic Exposure: Long term exposure



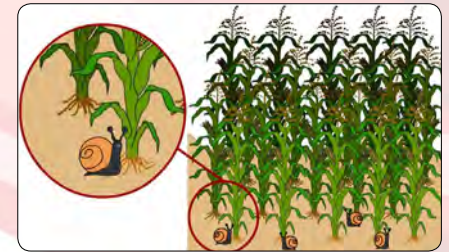
Chronic toxicity shows up after a long period of time. People can appear healthy despite having high levels of poisonous substances such as pesticides in their blood.

Chronic poisoning is much more complex and its signs are difficult to see and can develop after a long time, repeated or continuous exposure to small amounts of a substance.

In our example of alcohol, chronic effects are liver cells dying (cirrhosis) or dementia in old age.

5 What is a Pest?

Pests are organisms that can cause harm to crops, humans and constructions. Snail is an example of a pest. It feeds on crops.



Examples of pests

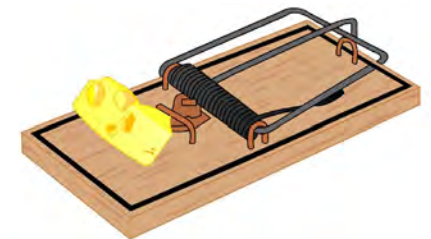


Managing pests

There are several ways of managing pests. Integrated Pest Management (IPM) uses different methods, chemical (pesticides) and non-chemical, to minimise the amounts of chemicals used.

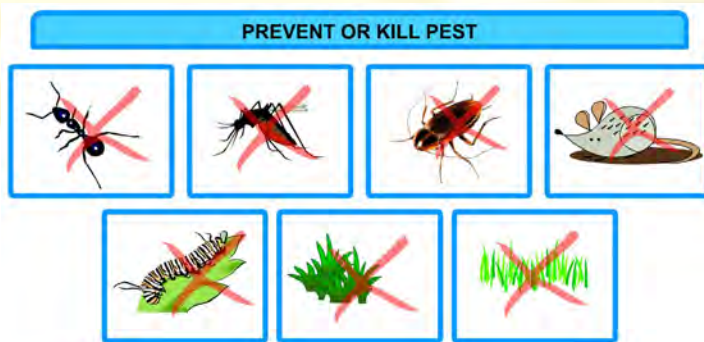
The reason is that chemicals can have harmful effects on people, animals, and the environment. Sometimes pests become resistant to them, thus spraying pesticides does not help any longer.

Examples of non-chemical methods for in and around the house are: prevention by removing breeding places where mosquitoes can breed, filling up cracks in the walls and cleaning up food bits.







6 What is a Pesticide?

Pesticides are chemicals used to PREVENT or KILL PESTS.



Types of pesticides

 <p>Insecticides Kill insects and other arthropods.</p>	 <p>Rodenticides Control mice and other rodents.</p>
TYPES OF PESTICIDES	
 <p>Herbicides Kill weeds.</p>	 <p>Fungicides Kill fungi causing plant diseases.</p>

Which are very toxic pesticides?

The classification used in many countries is the World Health Organization (WHO) recommended classification of pesticides by hazard.

Pesticides are classified by toxicity from Class **Ia** being the extremely hazardous to **U** unlikely to present acute hazard.

Some pesticides are POPs

POPs are Persistent Organic Pollutants. Persistent means that they remain intact in the environment for long periods, they are not easily degraded.

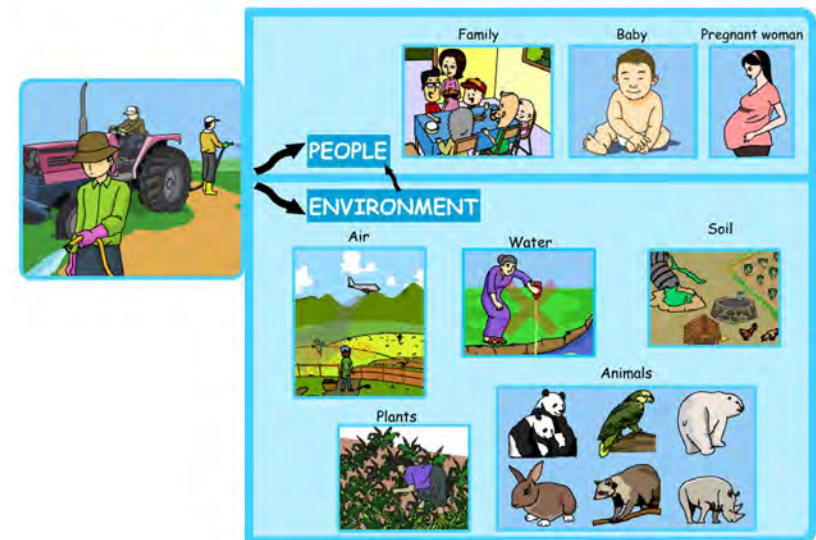
They accumulate in body fat, concentrate through food webs, cause harmful effects on wildlife, and pose a risk for human health.

They travel far from where they have been used. For example, high concentrations have been found in the blood of Inuit peoples in the Arctic, where such chemicals have never been applied.

Examples are insecticides like DDT and dieldrin and several industrial chemical products (some brominated flame retardants) or byproducts (PCDD dioxins).

The Stockholm Convention (SC) is a global treaty that aims at protecting human health and the environment from POPs by reducing or eliminating their release. Most countries have now signed the convention.

DDT was very widely used and caused problems for wildlife, for example eggshell thinning in predatory birds. It is found everywhere, even in human milk. DDT may now only be used exceptionally for disease vector control, under certain conditions, for example indoor residual spraying.



Exposure to pesticides

What to do before using pesticides?

Before buying/using pesticides or toxic chemicals, the following questions should be considered:

- Is it really necessary to buy/use this chemical, or are there other solutions?
- Is there a less toxic product which can be used?
- Is this the right product for the problem?
- What does the label say about protective measures? What is the right amount to apply?
- How much should I buy/ prepare so as not to have leftovers?



7 Use of Pesticides

Use of pesticides in agriculture

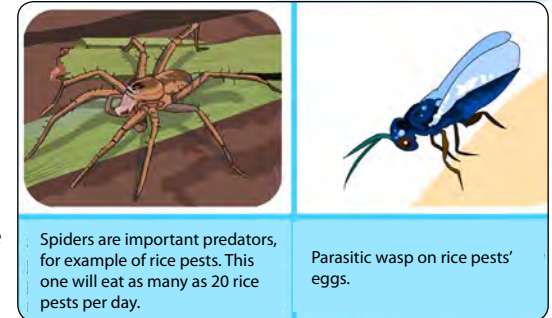
In agriculture, pesticides are often used against weeds, fungi causing plant disease and insects. Rodenticides can be used against mice or rats which eat stored grain.

Pesticides can have adverse effects on health and the environment. They may harm other plants and animals than those they are intended for.

Pesticides also do not always work. For example: insects can become resistant to them, they can survive after being sprayed. Sometimes other insects, which were not a problem before, increase and cause unacceptable damage. This can happen when predators which used to eat them are killed. Predators can be other insects, or spiders for example.

Pesticides are also expensive. They should not cost more than the loss of money caused by the pest.

Because of this, pesticides should be used as part of an Integrated Pest Management Programme.



Spiders are important predators, for example of rice pests. This one will eat as many as 20 rice pests per day.

Parasitic wasp on rice pests' eggs.

Integrated pest management

With Integrated Pest Management farmers try and use less chemicals. They combine different ways to manage pests. Often they make more money that way because they spend less on pesticides.

Examples of ways of using less chemicals are:

- Preventing pests. Keeping plants healthy. Planting at the right time, right distance between plants.
- Using kinds of plants which do not get disease ("resistant/tolerant plant varieties").
- Preventing the development of pests by changing crops from year to year ("crop rotation") or combining different crops on a field ("multiple cropping").



More ways of using less chemicals are:

- Helping/using predators which eat the pest. "The enemies of your enemies are your friends"
- Taking measures to stop rodents from reaching food stores.
- Using chemicals only when there is a forecast that there will be unacceptable damage by the pest.



Use of pesticides in vector control

Vectors of disease are organisms (often insects) transmitting disease. An example is mosquitoes transmitting malaria or dengue fever.

Insecticides are often sprayed against mosquitoes. Care is taken to choose insecticides which are least toxic to people.

Recently there has been much success in combating malaria by using treated bed nets.



It is important to integrate insecticide use with other measures, like eliminating breeding places, for example clean still standing water in which the mosquitoes can multiply. This way of minimising pesticides use is called IVM, Integrated Vector Management.

Use of pesticides in the house

Pesticides should only be used as a last resort. It is better to prevent pests, for example by using screens so that they cannot enter the house. There are other ways of getting rid of them. For example, ants can be killed with boiling water or soap, and fly paper used for flies.

When pesticides are applied:

- Choose the right pesticide for the pest. Not every pesticide is suitable for every pest. Never use agricultural pesticides in the house and garden.
- Choose the least toxic chemical available. It is not the most "powerful" chemical that will do the job best.
- During spraying, people, pets, food and drinks should be removed.
- Do not enter the sprayed rooms before opening the windows.
- Use the amount written on the label. Using more might destroy what you are trying to protect!
- Use less pesticide by using baits.

Restriction or ban of pesticide use

When adverse effects of chemicals/pesticides have been found, governments can restrict and/or ban their use.

Some pesticides can only be used for certain purposes and under certain conditions. For example:

- Some pesticides are allowed for cotton but should not be used for other crops.
- Some can only be handled by persons who have taken a special course on how to apply them.
- Some can only be used by someone wearing protective gear, a respirator etc.



8 Effects of Pesticides on People

Signs and symptoms of poisoning with pesticides

Different pesticides may lead to different symptoms.

Acute poisoning

Some common signs and symptoms of acute poisoning from pesticides are:

- skin rashes
- headaches
- dizziness
- nausea and vomiting
- diarrhoea
- stomach cramps
- muscle weakness and numbness
- tremors
- seizures
- coma



Chronic poisoning

Over time, the following problems may arise:

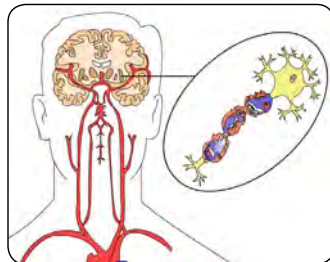
- muscle weakness and numbness
- loss of memory, sight or ability to think clearly
- behavioural problems
- reproductive disorders

These symptoms are often similar to those of other illnesses. It may be hard to relate these with pesticide exposure.

Effects of pesticides

Many pesticides are toxic, some are very hazardous. Pesticides often affect the nervous system, the sending of messages from brain and spinal cord to muscles and organs.

Not all effects are known. It is always better to be careful when using pesticides, and only to use them when absolutely necessary, in the right amount.

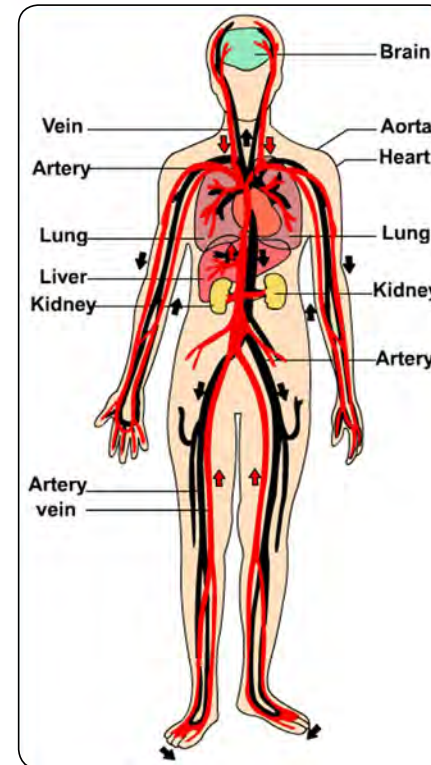


Acute poisoning with delayed effects

Effects from poisoning are not always immediate. Paraquat, a type of pesticide, can cause lung damage a week after exposure, and can kill.

Chronic poisoning

For some (organophosphorous) pesticides, the effect of repeated small doses cannot be seen but continuous exposure can ultimately result in serious effects at a later stage, for example on the nervous system.



They can also affect reproduction, fertility, birth defects and development, the ability to have healthy children with normal growth. Some are similar to hormones, the chemical messengers of the body, and may disrupt the hormonal system by sending messages which are stronger, or at a wrong time.

Some pesticides may cause cancer, the growth of tumours which consist of cells which are not under control. These may take up to 20 years to develop after exposure to a chemical. Some cancers in children have been linked to exposure to pesticides.

9 What to do in Case of Poisoning

All poisoning cases should be seen by a doctor as soon as possible. It is important that the doctor knows which pesticide the person was exposed to. If the container is available, it should be sent with the poisoned person for the doctor to see. At least, the trade and approved names of the pesticide should be copied from the label.

The label might include important notes on the treatment of poisoning, which should be followed.



If pesticide poisoning occurs....

- Refer the patient to a doctor as soon as possible
- It is important for the doctor to know what pesticide the person has been exposed to



If pesticide poisoning occurs....

- Call the Poison Centre for advice

What to do in case of poisoning?

Swallowed poison

Remove anything remaining in the mouth. Unless the victim is unconscious, having a seizure, or cannot swallow, give a small amount of water to drink. Call the poison centre for advice.

Do not try to neutralize a poison by giving milk, raw eggs, salt water, mustard, vinegar or citrus fruit juices as an antidote or to cause vomiting. Never attempt to induce vomiting by sticking your fingers anywhere in the patient's mouth; this procedure can be very dangerous.

Syrup of Ipecac

Syrup of Ipecac is NOT recommended for treatment of poisoning.

Activated charcoal

Activated charcoal is not recommended for home use. It is used to bind drugs and chemicals before they are absorbed. Activated charcoal does not bind all drugs or chemicals and has some risks when given.

Poison in the eye

Remove all foreign materials from the eyes including contact lenses if worn. Gently flush eye for 10 minutes, using slightly warm water. Do not use any eye drops. Call the poison centre.

Poison on the skin

Remove any contaminated clothing. Rinse the affected area thoroughly with large amounts of water. Wash the same area gently with hand soap and warm water to remove all remaining chemicals on the skin. If exposed, remember to wash hair and under fingernails. Call the poison centre.

Inhaled poison

Get the exposed person to fresh air as soon as possible. Avoid breathing fumes. Call the poison centre.

Do NOT Panic!

10 How Poisons can get into your Body?

Route of entry

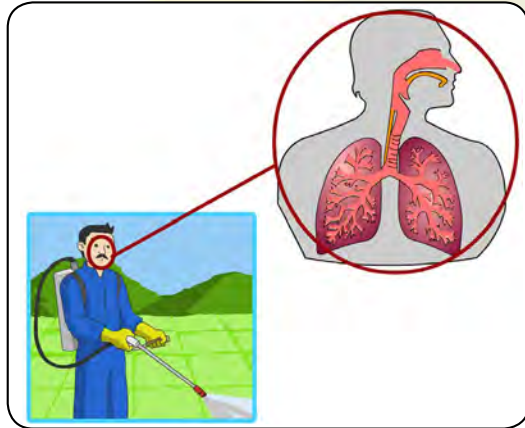
Route 1: Skin

Some pesticides go through the skin or eyes easily and this can lead to poisoning.



Route 2: Inhalation

Inhalation (breathing in) is a common route of exposure for pesticides.



Route 3: Ingestion



Eating with contaminated hands

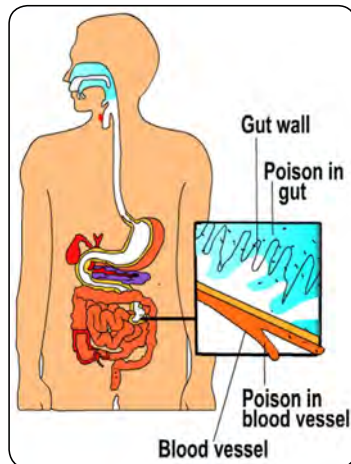


Eating/drinking when spraying



Smoking in contaminated work area

Ingestion is the pathway for entry of substances eaten or drunk. Chemicals may enter the body by absorption from the gastrointestinal tract.

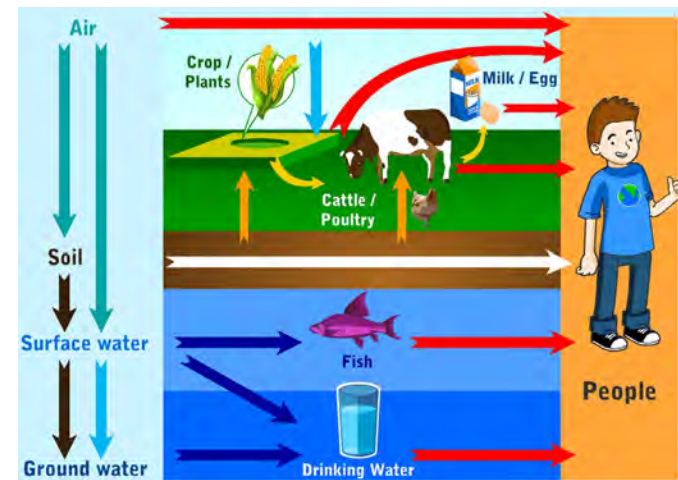


11 Pathways Through the Environment

Life cycle of chemicals



Pathways through the environment





12 How to Identify a Toxic Compound, Product and Understand the Label

The Food and Agriculture Organization of the United Nations (FAO) recommends the following as the essential parts of a label, written in the local language text :

1. Identification of contents

- ◆ product or trade name
- ◆ type of formulation
- ◆ active ingredient name
- ◆ net content of the product

2. Safety information

- ◆ a clear warning on the label regarding safety instructions before opening the pack, handling, transportation and storage warning symbols; and hazard classification and symbol;
- ◆ a safety text covering:
 - product-specific advice,
 - good agricultural practice,
 - relevant protective clothing,
 - precautions when handling the concentrate (if applicable),
 - precautions during and after application,
 - environmental safety during and after application,
 - safe storage,
 - safe disposal of product and used container and
 - how to clean equipment (if a potential risk exists).
- ◆ safety pictograms
- ◆ warning
- ◆ first-aid and medical treatment advice

3. Instructions for use

- ◆ how to mix and apply the product and rate of use;
- ◆ when to use the product, including timing and frequency (including maximum number of applications per use season), or when not to use it, e.g. during flowering of the crop;
- ◆ where to use the product: which crops, targets, areas;
- ◆ any limitations, such as susceptible crops or varieties, weather conditions, harvest interval; compatibility with other products, where appropriate; and
- ◆ how to avoid harming beneficial insects, such as bees and natural predators, or wildlife

13 Risky Situations with Chemicals/ Pesticides

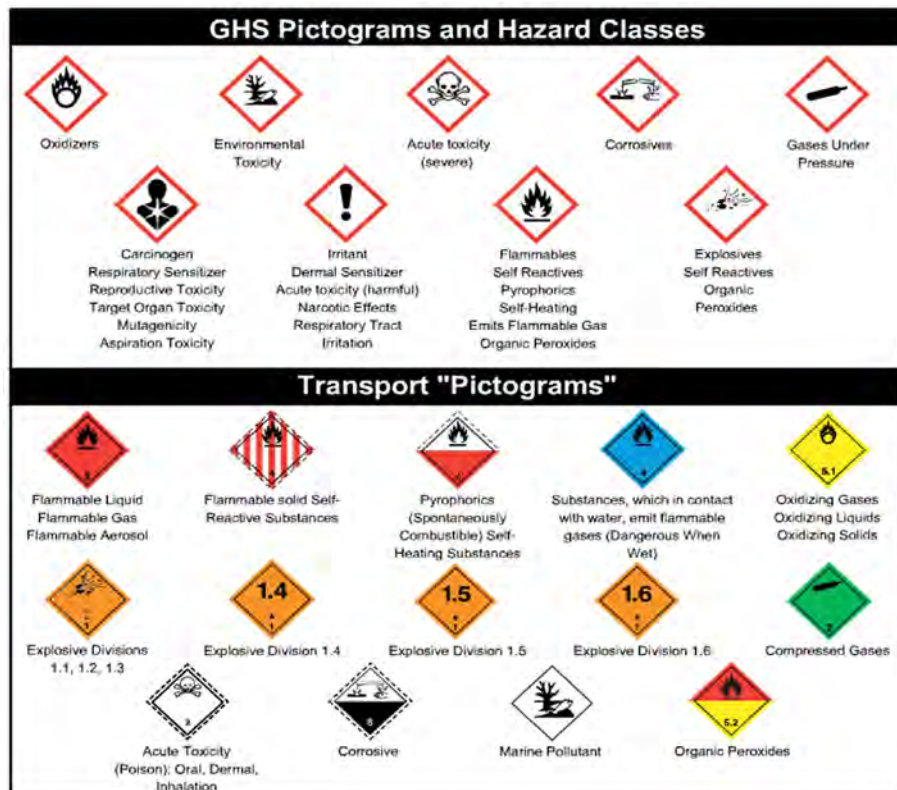
4. Other information

- ◆ name, address and telephone number of local distributor;
- ◆ registration number, if any;
- ◆ manufacturer's name and company logo;
- ◆ trade mark acknowledgment;
- ◆ date of manufacture and formulation and batch number; and
- ◆ shelf life.



Hazard symbols for chemicals (pesticides)

- Hazard is the adverse health effect the chemical is capable of causing.
- Hazards are identified by symbols.



Children and family members may accidentally ingest the pesticides if...



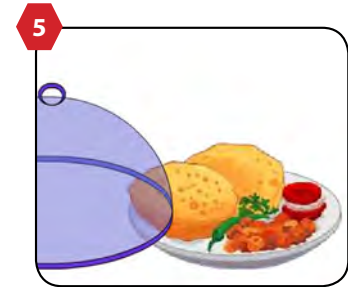
1 pesticides are mistaken for water or drinks



4 empty pesticide containers or bottles are used for other purposes, such as storing milk



2 food is contaminated by a leaking container during transportation or storage



5 food is left uncovered during indoor residual spraying in public health operations



3 used or empty pesticide containers are left around where children might play with them



6 equipment and/or pesticides-ridden clothes are left accessible to children

14 Personal Protection when using Pesticides

Personal protection when using pesticides

- When handling pesticides, contamination should be prevented by wearing overalls or shirts with long sleeves and trousers (not shorts).



- The head and neck must be protected.



- Eyes must be protected when mixing and loading pesticides or when spraying above shoulder level. Visors, goggles or safety spectacles can be used for this purpose.



- A respirator should be worn to avoid inhalation of dusts, vapours and gases.



- Pesticides must not be applied by persons in bare feet or wearing sandals.



- Hands must be protected by gloves during handling of concentrates, while applying hazardous pesticides and when washing or maintaining application equipment.



- At the end of each working day all equipment and work clothing must be washed. Work clothes should never be washed with the clothes of the rest of the family.



- Very hazardous pesticides should only be applied by persons wearing full personal protective equipment. These applicators must have received extra training in this area.



15 Protecting Younger Children, Sisters and Brothers

Children are vulnerable to toxic chemicals

Children and infants are especially vulnerable to pesticides (and other toxic chemicals) because:

- their weight is much less than an adult's but their skin area for exposure is not so much less. They eat and drink more per unit of body weight than an adult.
- their organs are still developing, may be more sensitive to and/or less capable of coping with toxic substances.
- they are more likely to come in contact with pesticides because they tend to put things in their mouth, crawl/play on floors or soils which may be contaminated.



Most childhood poisoning incidents reported by poison centres worldwide occur in children less than three years old. Most frequent causes are:

- medicines
- household cleaning products
- cosmetics (products people use to make themselves more beautiful), like perfume and nail polish, deodorant and soap,
- lamp oil
- pesticides
- poisonous plants and venomous creatures



All chemicals in the house should be kept out of reach of children, preferably in locked cabinets.

Protection of young children in the house

What can be done to protect young children in the house?

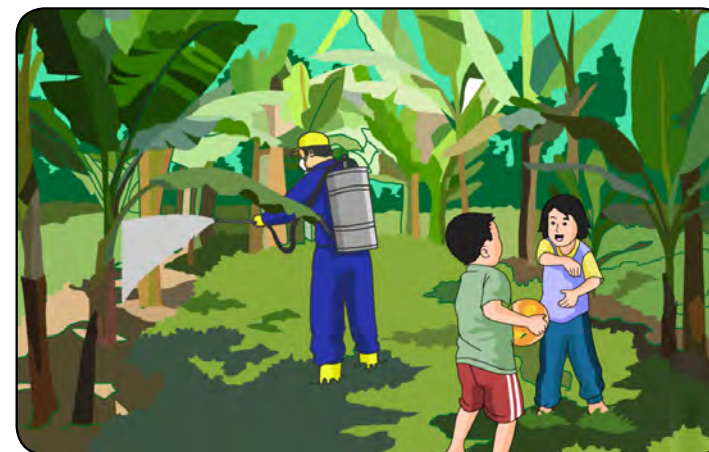
- keep chemicals out of reach of children.
- try using other ways of controlling pests instead of using pesticides.
- use the safest possible chemicals.

- if you are using chemicals and you are interrupted by a phone call or doorbell, remember to put the chemicals out of reach.
- do not put toxic chemicals in empty food or drink containers.
- when applying pesticides make sure no children are present, remove toys, food etc.
- do not let children re-enter sprayed rooms before they have been properly ventilated.
- never use pesticides which are meant for another purpose.



Protection of young children on a farm and other areas

Children living in rural areas, or whose parents are involved with agricultural activities are more likely to come in contact with pesticides.



What can be done to protect young children on a farm?

- use pesticides only as a last resort in an IPM programme
- no children present during mixing and spraying
- keep children out of pesticides spray drift
- clean up spills immediately
- respect waiting times for re-entry of fields and for eating sprayed food
- wash clothes and equipment after spraying and keep work clothes separate from family wash
- store pesticides, leftovers, wastes, containers, equipment or pesticide ridden clothes locked in a shed

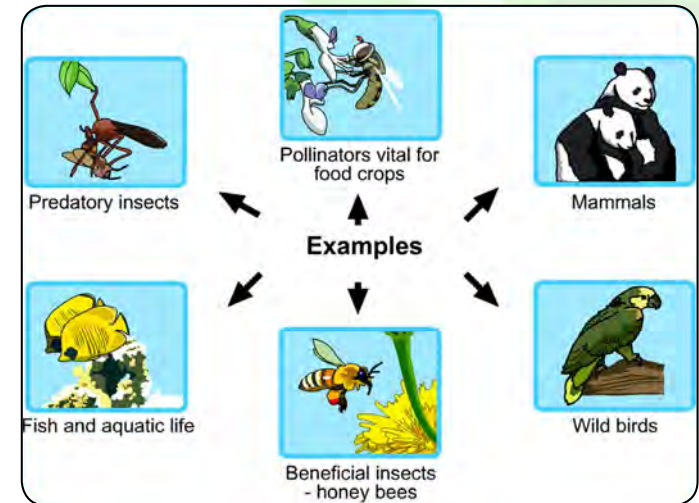


What can be done to protect young children in other playing areas?

Children living in urban areas should not play in areas where toxic wastes have been dumped.

Roles of non-target organisms

Pesticides are toxic and can also adversely affect non-target organisms. Low levels of pesticides in the environment can affect many different kinds of living creatures, including humans. For example, studies on predatory birds, aquatic mammals (e.g. dolphins and whales) and laboratory rodents have shown effects on reproduction, the endocrine and immune systems and development of cancer.



Examples of non-target organisms:

- aquatic organisms (e.g. shrimp), fish
- pollinators (e.g. bees, butterflies)
- predators (e.g. predatory insects, spiders, bats, birds, amphibians eating insects)
- beneficial insects (silkworms and honey-bees)
- micro-organisms/ small organisms living in the soil (e.g. earthworms)
- other wildlife
- domestic animals

All of these organisms can be affected by pesticides.

There are wild species we enjoy watching, like beautiful butterflies or birds.

Some of the organisms listed are useful to people because they supply food (fish, honey etc.) or silk.

Other organisms have an important role in ecosystems. Micro-organisms and earthworms in the soil help break down dead plants and animals into the nutrients that plants need to grow. In turn, plants and trees growing on hills can protect against erosion.



Pollinators are needed for many tree species to produce fruit. An example is the oil palm in Malaysia. When it was first introduced, it did not bear much fruit, till a pollinating insect (a weevil) was imported from Cameroon.



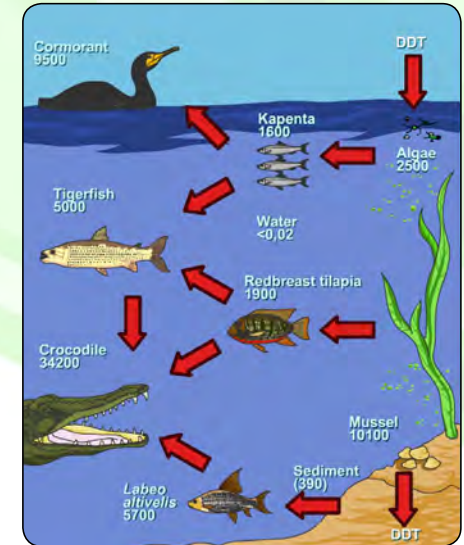
Harmful insects can be kept under control by other insects, for example tiny wasps that grow in their eggs. Predators such as predatory insects and spiders are important for agriculture because they eat the insects that eat the crops. When predators are

affected by pesticides, plant eating insects often increase, leading to damage to the crop.

DDT almost eliminated predatory birds in several regions in the 1970s. These birds help control rodents and other pests, such as quelea weaver birds which eat crops in Africa. Reef-building corals can be affected by pesticides. Corals play an important role in protecting the coast in tropical countries.



Some pesticides such as POPs do not easily break down. Their use has led to their long term presence in the environment. POPs often accumulate in body fat of different organisms. Concentrations increase in food webs. See the example below for DDT.



Places sensitive to pesticides

Protecting the environment when using pesticides

There are some places and resources in particular that are sensitive, and should be protected from pesticides:

- schools, houses
- places where food is stored for people and domestic animals
- water, surface water and groundwater
- national parks/nature reserves/natural areas/wildlife.



Contamination of water should be avoided when:

- mixing, filling the spray
- spraying pesticides
- washing equipment and clothes
- storing and disposing pesticide wastes, containers and wash water

Even a few millilitres of a pesticide can kill fish and other aquatic organisms and contaminate large volumes of drinking or irrigation water.

It is important to clean up spills immediately.

The farmer should take care in choosing the day he will spray: it should not be windy to avoid drift to sensitive areas. Rain or irrigation will increase run-off to water.

17 Disposal of Toxic Wastes

Disposal of toxic wastes

When toxic wastes are dumped without care or not disposed of correctly they can cause severe health problems and death and even contaminate water and land for decades after.

Chemical waste should be separated from other household waste.



Prevention: not buying too much/ if not absolutely necessary.

What is the best way for disposing of chemical wastes?

They should be disposed off only in an approved, constructed and maintained toxic waste disposal sites. The best way is destroying them in a high temperature incinerator facility or cement kiln.

Burning them is not recommended because toxic fumes can be released at lower temperatures. Burying them is also not recommended because they can contaminate soil and/or water.

Store them behind lock and key so that they are out of reach till they can be disposed of.

What is the best way of disposing of chemical containers? Different countries have different regulations. Possibilities are: puncturing them so that they cannot be reused, and/or bringing them to a recycling programme.

Separation of waste as practiced in some developed countries





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