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Second Fogarty Indo US Training Workshop on

Pesticide, Health & Safety

Organised by

Centre for Occupational & Environmental Health (COEH)
Under IVPSS, Govt. of NCT Delhi

in collaboration with

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&

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Venue : Conference Hall, Deptt. Of CME, 3rd Floor, MAMC
Date : 29th & 30th November 2002

CONTENTS

- **Introduction to Pesticides:**
  - What are Pesticides? 1
  - Pesticides Formulation 5
  - Pesticide names 7
  - Pesticide classification 9
  - Are Pesticide necessary? 12
- **Occupational Health aspects of Pesticides:**
  - Handling & Use
  - How can Pesticides enter in the body? 15
  - Toxicity, Hazards & Risk of the Pesticides 27
- **Handling, & Using Pesticides safely:**
  - Preventing Contamination 39
  - Buying, Transporting, Storing, & Disposing of Pesticides 65
- **Dealing with ill effects from Pesticide exposure:**
  - How chemicals effect the body 86
  - Signs & symptoms of overexposure 89
  - Getting information in a suspected poisoning incident cases 91
  - First-aid procedures in a poisoning incidence 93

Second Fogarty Indo-US Training Workshop on Pesticide, Health & Safety

Course Outline

29.Nov.2002 (Day I)

8:30-9:00	:	Registration
9:00-9:30	:	Inaugration and Introduction - Goals and methods of course, handouts
9:30-10:00	:	Pesticides: The big Picture: India ***TK Joshi MD, MPH***
10:00-11:00	:	Pesticides: What they do, how they work: Organochlorines,Anticholinesterases, Paraquat and others: Acute and long-term Toxicological effects, Rx
11:00-11:20		Break - Groups organize for exercises
11:20-13:00	:	Pesticides : What they do, how they work(continued) ***Dr Richter and Dr Aggarwal Case studies***
13:00-14:00	:	Lunch
14:00-14:30	:	Pesticide Residues in Foods : Dr. S.K. Handa
14:30-15:30	:	Simple toxicological and epi tools, : ***Dr. Basu and Richter***
15:30-16:15	:	Surveillance and Preventive strategies Sources of data: Walk through, Economic data preventing contamination, risks from transport and waste
16:15-16:30	:	Tea (Groups meet again)
1640:17:15	:	Review: Medicine and Toxicology: Pesticides in India ***(Dr Kanungo)***
17:15-18:00	:	Walk through: Low tech investigations: Using your feet, eyes, ears, and nose, Identify the hazards, recommend solution

30th Nov. 2002 (Day II)

8:00-8:50	:	Epidemiological exercises: Overnight assignments Epidemic of parathion poisoning in community 25 min DDT and breast milk 25min
8:50 –9:40	:	Malathion in anti-malarial sprayers 25min Chronic arsenic toxicity 25 min
9:40-10:00	:	Break (look over crop yeild/ pesticide use exercise)
10:00-10:20	:	Skin absorption: A brief review 20 min
10:20 –10:50	:	Kids: The high-risk group: Children and child labor—Special populations
10:50-11:20	:	Exercise: More for Less? Cotton yield and pesticide use: Case study and discussion
11:20-11:40	:	Disaster and Emergency response : The lessons of Bhopal
11:40-12:45	:	Round Table and discussion : Think globally, act Locally:Designing interceptive strategies for India: The role of the professional as a catalyst and change agent.Sources help and information. Local programs for hdx, estigation, Rx, management of pesticide use and prevention of Pessticide use: What are the components and how to catalyze them. (See PANNA slides) ***Dr Joshi, Dr Richter and others***
12:45-13:00	:	Concluding remarks

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IP.1. INTRODUCTION TO PESTICIDES

IP.1.1 WHAT ARE PESTICIDES?

A *pest* can be defined as being an organism (plant or animal) in the wrong place at the wrong time, which results in some harm to man or the environment (harm includes economic damage and personal physical harm). This includes insects on crops, insects which spread disease, plants growing in undesirable places (weeds), fungal pathogens (agents which cause disease) on crops, birds or rodents (rats, mice etc.) which attack crops (see Fig. IP.1).

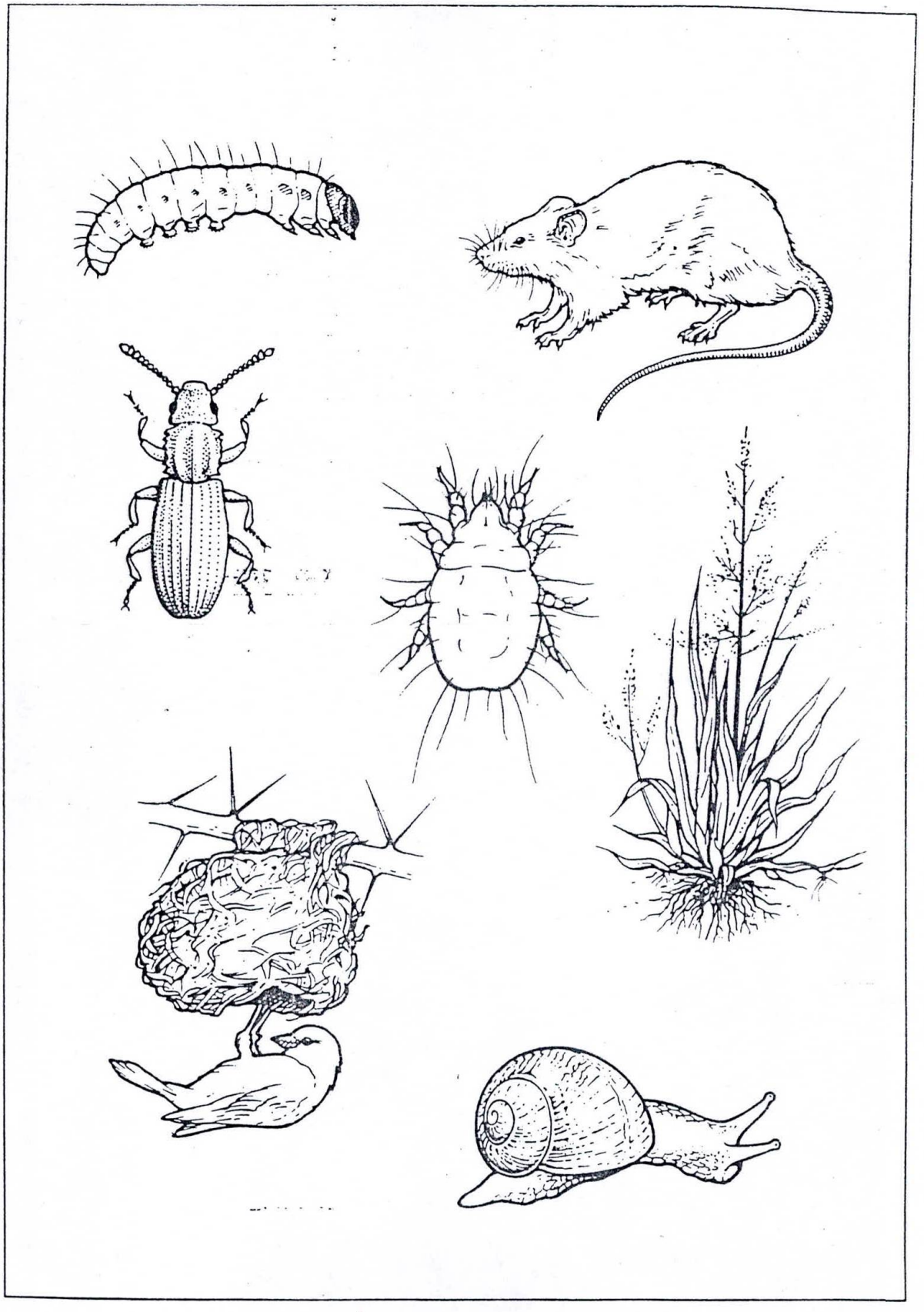
Chemicals which are used to control pests are called *pesticides* or *agrochemicals*. In other words pesticides are used to control organisms which are damaging to crops, to human or animal health, or which may cause nuisance. Pesticides are also used to control organisms which affect humans or animals externally (parasitic animals such as fleas, ticks or mites), as distinct from pharmaceutical or veterinary products which control organisms affecting the victim internally.

A modern pesticide is tested extensively before it is released to the commercial market. This testing aims to answer several questions:

- Is it effective for its intended use, under different conditions (climate, soils etc)?
- Is it acceptable in terms of its human and animal toxicity, even though it may not always be used as recommended?
- Is it acceptable in terms of long term or chronic effects to health such as carcinogenicity (causing cancer), birth and inherited defects, effects on the nervous or immune systems?
- How does it behave in the environment in terms of:
  - persistence of residues (on plants, in soil etc.)?
  - movement in soil, into water etc?
  - effects on non target organisms (bees, soil organisms such as earthworms, water organisms such as daphnia and fish etc.)?
  - the behaviour and effects of any breakdown products of the original chemical?

This programme of testing both in the laboratory and under field conditions typically takes more than 8-10 years to complete before the pesticide is commercially marketed. Even after it has been commercially launched, studies are continued to monitor the use of the product in the field.

Figure IP.1: Pests include a wide variety of plants and animals



This detailed testing means that many chemicals are tested and rejected because they do not fulfil all requirements. For example, each year approximately 12,000 chemicals are tested at ZENECA's research station and from these perhaps only one will pass all the rigorous testing to become a commercially viable product. The exhaustive testing ensures that modern pesticides are very much safer to man and to the environment than many earlier chemicals used as pesticides.

Many countries now have some sort of government controlled *registration* process, under which the company wishing to register a pesticide must submit extensive data based on the tests listed above, before the pesticide is approved for sale in a country. This controls the products available in a particular country, and ensures that any which are unacceptably hazardous to humans, animals or the environment can be prevented from being sold.

KEY MESSAGES - WHAT ARE PESTICIDES

- *Pesticides or agrochemicals are chemicals used to control pests*
- *A pest is any organism (insect, animal, plant, fungal pathogen etc.) in the wrong place*
- *Pesticides undergo very lengthy and expensive testing before marketing which looks at efficacy, toxicity and environmental effects*
- *Most countries have government controlled registration procedures which control the pesticides which can be used in that country*

IP.1.3 PESTICIDE FORMULATIONS

In its raw or technical form, a pesticide cannot be readily applied by a user. It has to be prepared or *formulated* in such a way as to allow the user to apply it easily and evenly to the intended target, and to make it effective on that target. The chemical part of the formulation which is responsible for killing or controlling the pest is known as the *active ingredient*.

In addition to the active ingredient, the formulation may be made up of several other components, e.g.

- Solvent used in liquid formulations.
- Carriers used in solid (powder, granular or bait) formulations.
- Surface Active Agents (*Surfactants*) used to enable the product to mix easily with water or to ensure the product spreads or sticks to the target better.
- Colouring agents prevent pesticide being mistaken for food or drink.
- Emetic to bring about vomiting if a product is accidentally or deliberately swallowed.
- Stenches - an unpleasant smell will help prevent accidental ingestion.
- Bittering agents to give a foul taste to prevent swallowing.

A particular active ingredient may be available in several formulations, which may be different in the composition of other ingredients or in the concentration of active ingredient.

Formulations can broadly be divided into two types depending on how they are to be applied:

- *solids*, e.g. granules, dusts, blocks or baits
- *liquids* e.g. emulsifiable concentrates (E.C.), wettable powders (WP), suspension concentrates (S.C.)

Those which are applied as liquids are most common, and most of these require dilution with water before they can be sprayed. The concentrated formulations which are provided for mixing with water also vary, and may be either:

- *solid*, e.g. wettable powders (WPs), water soluble granules (SGs) etc.
- *liquid* e.g. emulsifiable concentrates (ECs), soluble concentrates (SLs), suspension concentrates (SCs).

Different formulations present different hazards to the user. In general formulations designed to be applied as solids such as granules are less hazardous to the user than formulations designed to be sprayed as liquids such as wettable powders, emulsifiable concentrates or suspension concentrates. Those which must be mixed with water for spraying as a liquid are also generally safer to handle as a solid concentrate rather than a liquid concentrate.

KEY MESSAGES - PESTICIDE FORMULATIONS

- *Formulations are the form in which pesticides are supplied to the user*
- *A pesticide intended for use as a liquid spray may be supplied for dilution as either a liquid or solid*
- *Pesticides may be applied as solids or liquids*
- *Solid formulations are generally safer to handle than liquid ones*

IP.1.2 PESTICIDE NAMES

Any particular pesticide has different types of name. These are discussed below using paraquat as an example.

- *Chemical name* describes the chemical structure of the molecule.
  For example the chemical name for paraquat is:
  1,1'-dimethyl-4,4'-bipyridinium ion

- *Common name* is the internationally agreed name for the chemical, which is used to avoid the use of lengthy chemical names which are difficult to remember. Paraquat is an example of an agreed common name.

- *Trade* or *Brand name* is the commercial name of the formulated product, i.e. it is a particular concentration of the chemical which controls the pest (e.g. paraquat) plus carriers or solvents, surfactant, emetic, stench, colour etc. Any particular chemical may be sold under a variety of trade names depending on the companies involved, the formulation type, the target and the country in which it is sold. For example, formulations containing paraquat are sold under the following ZENECA trade names in various countries, "Gramoxone", "Priglone", "Weedol", "Paracol", "Gramuron", "Totacol", "Gramocil", "Gramonol" and "Terraklene".

The chemical name is not very important, except to research chemists, however the common name is important, since it describes a particular chemical which may be sold under a variety of trade names. Trade names are also important, because they indicate a particular formulation of a chemical. For example "Gramoxone" is a formulation of paraquat which contains blue dye, stench (to give it a powerful smell) and emetic (to cause vomiting if swallowed). These are all additives included to make the product safer to use, yet not all formulations of paraquat contain all three additives.

KEY MESSAGES - PESTICIDE NAMES

- *Pesticide chemical names describe the chemical structure*
- *Pesticide common names indicate the active ingredient*
- *Pesticide Trade names are company specific names for the active ingredient in a specific formulation*

IP.1.4 PESTICIDE CLASSIFICATION

There are many ways of classifying pesticides. Different methods of classification are relevant to different applications. The classification of pesticides by hazard will be dealt with in section OH.1.2.2

IP.1.4.1 TARGET GROUP

One of the simplest methods is by the type of pest which the product will control, for example:

Product	Target Pest
Acaricide	mites, ticks, spiders
Fungicide	fungi
Herbicide	weeds
Insecticide	insects
Molluscicide	slugs, snails
Nematicide	nematodes
Rodenticide	rodents (rats, mice etc.)

It is important to remember that these categories are not necessarily exclusive. For example, an insecticide may also act as an acaricide. In addition there are also terms for groups of chemicals used to control different stages of insects, i.e.

Product	Stage
Ovicide	Eggs
Larvicide	Larvae
Adulticide	Adult

These are most often used when the different stages live in different habitats or show different behaviour, and so require control programmes aimed only at that stage. For example in mosquito control, larvicides are sprayed in water to kill larvae and pupae, while adulticides are sprayed in or around houses to kill the flying adults. These categories are not exclusive, since a larvicide might also act as an adulticide and vice versa.

These groupings may give a very general idea of the hazards involved. For example, many herbicides are less toxic to man than most insecticides. However it should not be assumed that a herbicide is always less toxic than an insecticide, since there are exceptions.

IP.1.4.2 CHEMICAL GROUP

Pesticides can be classified according to their chemical group. For example the principle groups of insecticides are as follows:

- *Organochlorines* - these are some of the earliest man-made (synthetic) insecticides. Many of this group build up in food chains by accumulating in fat tissue, and show long environmental persistence, and this has led to a great reduction in their use. Examples include DDT, aldrin, dieldrin, lindane and endosulfan

- *Organophosphorous* (OP) insecticides are generally less persistent than organochlorines, but many can be more toxic to man. Examples include parathion, monocrotophos, dimethoate, malathion.

- *Carbamates* are similar in biological action to OPs. As a group they show a wide range of mammalian toxicities and biological properties. Examples include carbofuran, bendiocarb, thiodicarb.

- *Pyrethroids* are a relatively new group of insecticides, which generally show relatively low levels of mammalian toxicity when compared with other groups. They are generally toxic to fish. Examples include cypermethrin, deltamethrin, lambda cyhalothrin, fenvalerate.

- *Plant derived chemicals* such as nicotine, pyrethrum, rotenone. This is not strictly a chemical group, since their chemical structures can be very different, but they all have a common origin as they are extracted from plants.

While some generalisations can be made about these chemical groups, they should be used with caution. For example, OPs are often more toxic than pyrethroids, but there are often exceptions, and it cannot be assumed that all OPs are more toxic than all pyrethroids.

KEY MESSAGES - ARE PESTICIDES NECESSARY?

- *Pesticides are accepted as the most effective means of pest control in most cases, and will continue to be widely used for the foreseeable future*

- *Pesticides are likely to become more often used within Integrated Pest Management (IPM) programmes, in combination with other appropriate methods of control*

OH.1 OCCUPATIONAL HEALTH ASPECTS OF PESTICIDE HANDLING AND USE

It is not difficult to use agrochemicals safely. In most cases it is simply a matter of common sense. The key to safe use of pesticides is an understanding of the hazards involved, so we can minimise the risks associated with them.

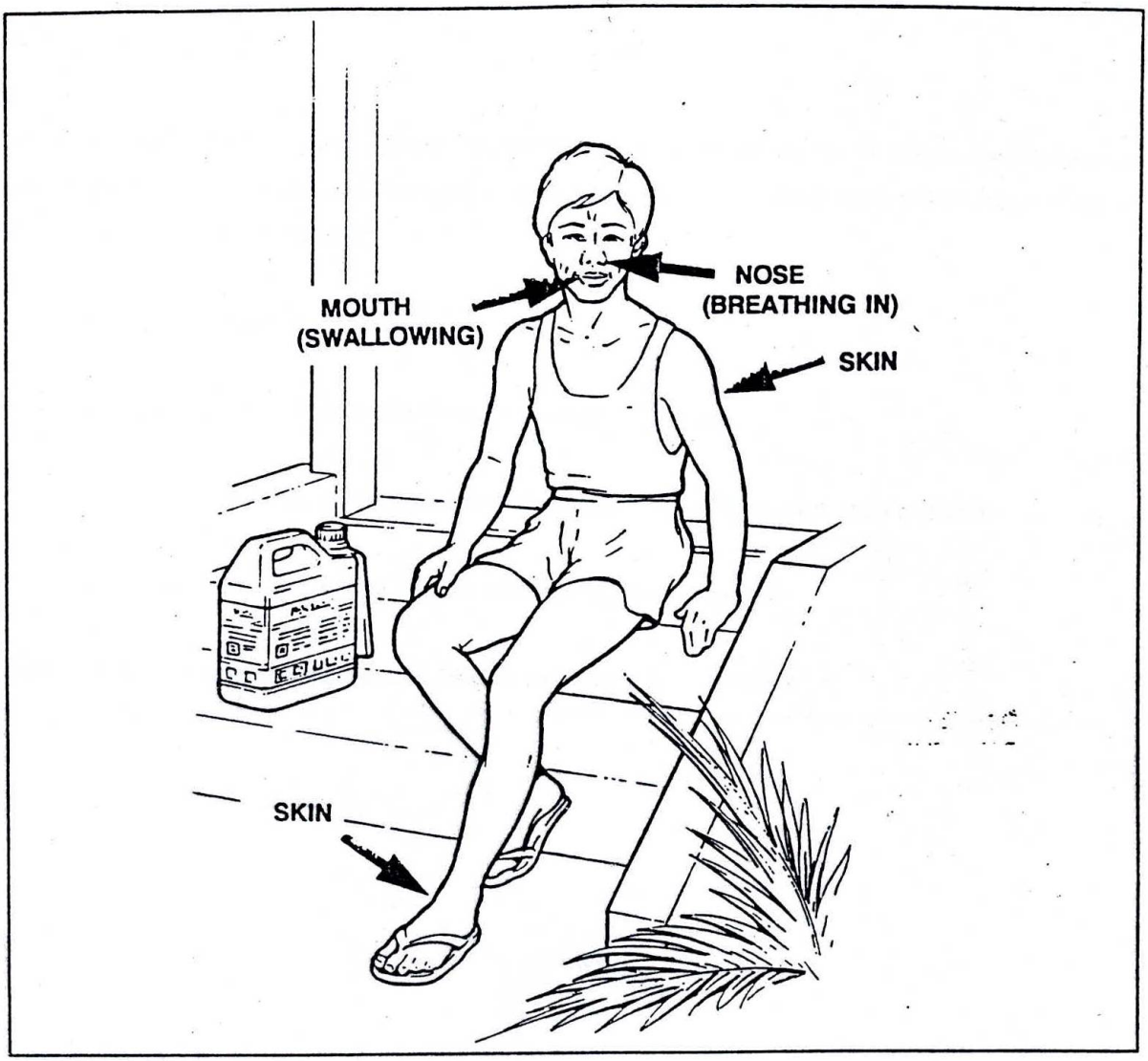
OH.1.1 HOW CAN PESTICIDES ENTER THE BODY?

Pesticides can get into the body in one of three ways:

- By *ingestion* - through the mouth into the gut (oral route)
- By *inhalation* - breathing into the lungs (respiratory route)
- Through the *skin* (dermal route)

The likelihood of pesticides getting into the body by each of these routes varies considerably. This will be considered for each route in the following sections. It is important that people who come into contact with pesticides understand the dangers associated with the three routes, and how they are most likely to be poisoned under different circumstances. Unless users understand the hazards involved and how they might be poisoned, they will not change their practices to safer ones, because they will not understand the need to change.

Figure OH.1: Possible routes of entry into the body



KEY MESSAGES - HOW PESTICIDES GET INTO THE BODY

- *Pesticides can enter the body by breathing in (inhalation), swallowing (ingestion) and through the skin (dermal contact)*
- *Understanding the relative importance of these routes is the key to improving safety practices among pesticide users.*

OH.1.1.2 INHALATION

This is the route which would lead to the quickest poisoning. However, like ingestion, it is unlikely that most users would be poisoned by this route, except in a few particular circumstances (such as using *fumigants* (pesticides formulated to work as gases) without respiratory protection. Pesticides are rarely used as fumigants.

This is because the respiratory system consists of a network of tubes (the trachea and bronchioles) which get narrower and narrower towards the part of the lungs where oxygen exchange takes place (the small sacs known as alveoli). Only pesticide droplets or particles which are less than 1 μm(1 μm= 0.001 mm) in size can get all the way to the alveoli, and only droplets less than 30 μmin size can get beyond the nose and throat.

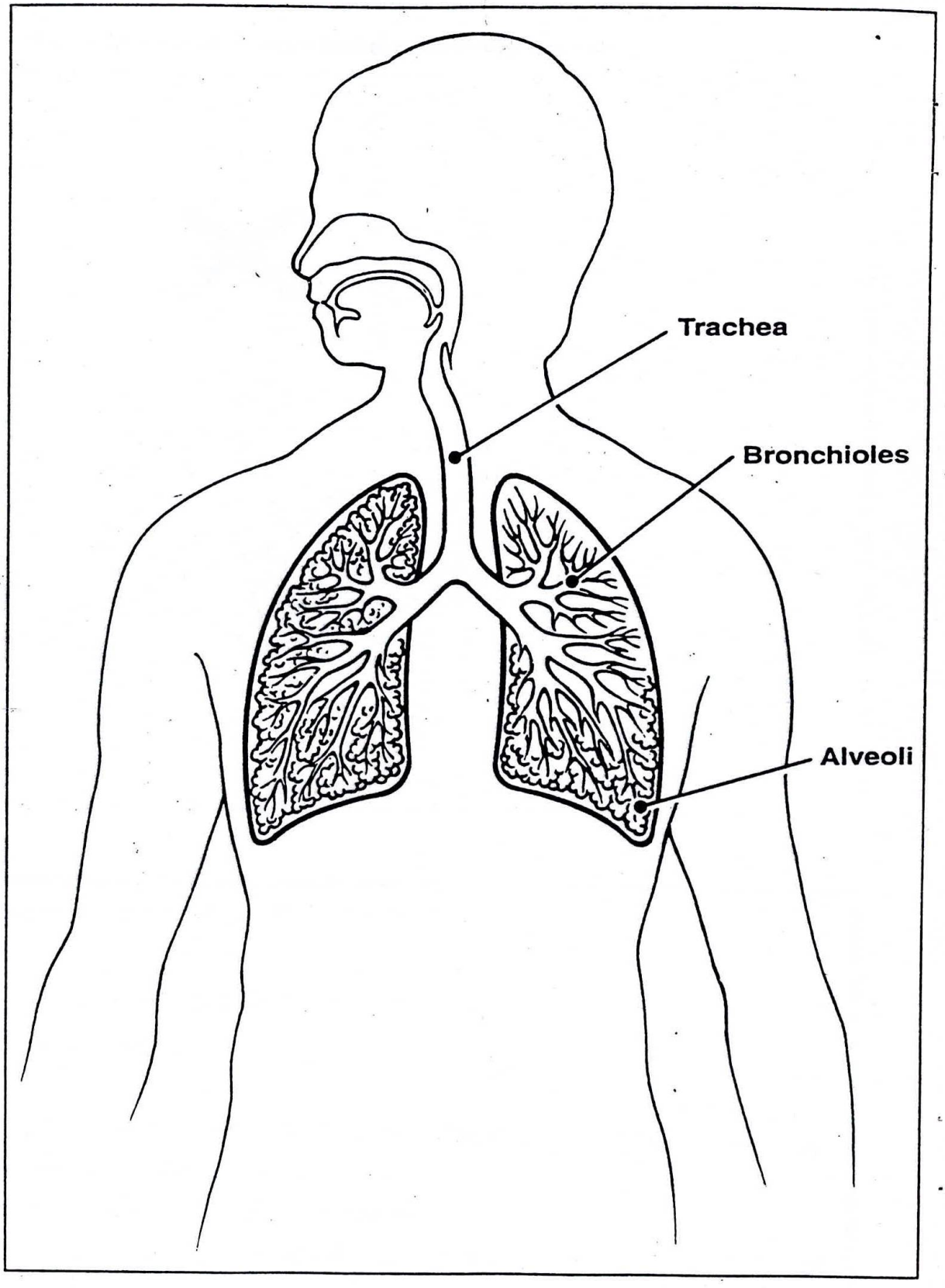
The sprayers used most commonly by farmers do not produce droplets this small, or produce only very few droplets of this size, so the likelihood of inhaling enough to cause a harmful effect is extremely small. Yet it is common for users to perceive this to be the most common route, and to try and protect the airways with masks, scarves etc. while ignoring the more common route of skin entry. In addition wearing an absorbent mask or scarf on the face which becomes contaminated with spray, may be more harmful to the user through continual contact with the facial skin than if no respiratory protection is used.

Some pesticides have a *vapour action* (they give off poisonous fumes) and could poison by this route, but relatively few of these are used, and in the open air would not generally cause problems, as the fumes would be readily dispersed. Remember that a strong smell does not necessarily indicate a pesticide with vapour action - some pesticides have smells added to the formulation to make them safer by alerting people to the fact that they are pesticides, but the smell itself is not poisonous.

In a few special situations, poisoning might happen by this route, for example:

- Mixing powders and allowing them to blow up into the face
- Using a pesticide which gives off a vapour in a confined space such as a building

Figure OH.3: Respiratory system



OH.1.1.3 SKIN CONTACT

Pesticides, like other chemicals, can pass through skin. The factors which affect the level of hazard by this route are:

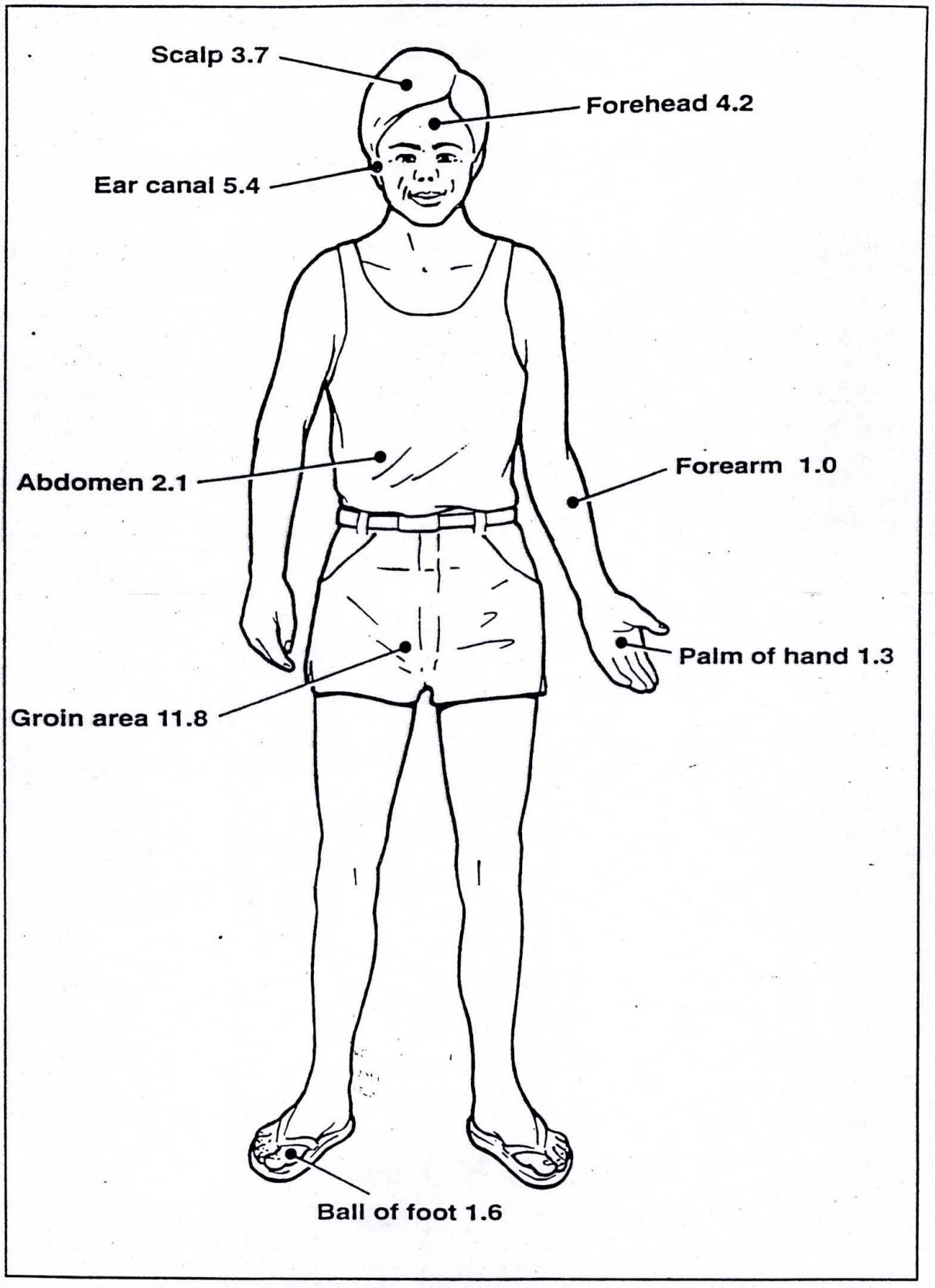
- *The dermal toxicity of the active ingredient*
- *The amount of active ingredient present on the skin*, which is related to concentration of product and volume)
- *The time over which the pesticide is present on the skin*

It can be hazardous to have concentrated pesticides on the skin or to leave even dilute pesticides on the skin for long periods of time. This means that greater care is necessary when handling concentrated products - during measuring and mixing, and that good personal hygiene is very important to prevent pesticides remaining on the skin for long periods of time.

The speed at which pesticides pass through the skin depends on several factors which include:

- *Type of pesticide* - some pesticides pass through skin more quickly than others
- *Formulation* - liquids generally pass through skin more quickly than solids
- *Area of body* - the skin on some parts of the body allows chemicals to pass through much more quickly than others (see Fig. OH.5)
- *Whether skin is intact* - cuts or grazes allow pesticides to pass into the body easily
- *Presence of sweat* - sweaty or damp skin allows chemicals to pass more quickly than dry skin

Figure OH.5: Rates of absorption of chemicals by different parts of the body, relative to absorption rate by forearm (given value of 1)

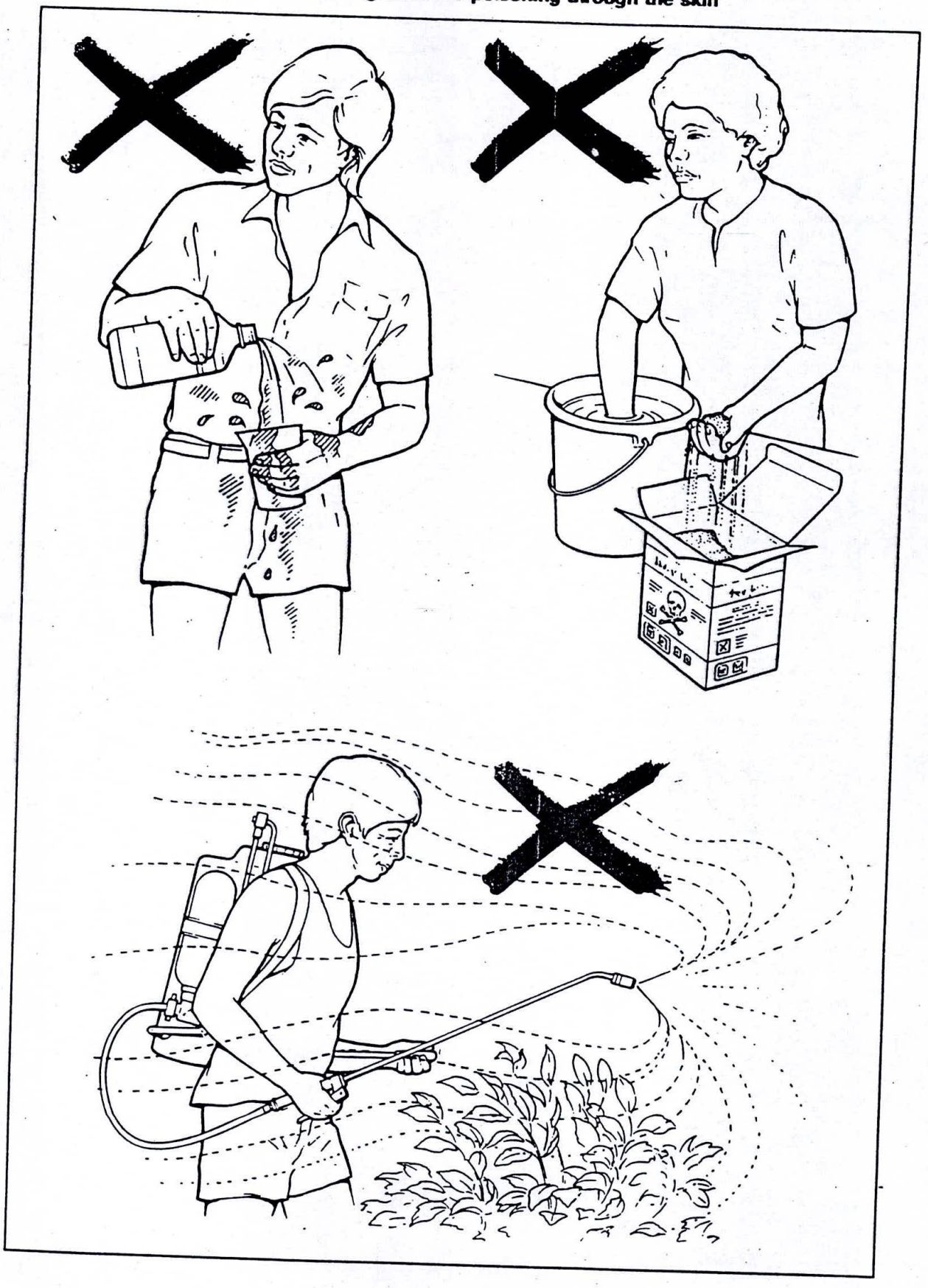


There are many situations which might lead to poisoning through the skin. A few of these are:

- *Careless handling* leading to spills or splashes - especially hazardous with concentrated products
- *Not using appropriate protective clothing* when mixing or spraying pesticides (see section OH.2.1.5)
- *Wearing contaminated clothing* for long periods
- *Contact with sprayed crop* - contaminating the body by brushing against recently sprayed leaves.
- *Spraying against the wind* - allowing droplets to drift onto the body
- *Use of leaking sprayers* which may contaminate the back or hands
- *Poor standards of personal hygiene* - failing to wash exposed or contaminated skin or contaminated clothing

Another part of the body which requires special consideration are the *eyes*. Eyes are particularly vulnerable to chemicals, and care should be taken to protect them, especially when handling concentrated product, since permanent injury can be caused by contamination.

Figure OH.6: Situations which might lead to poisoning through the skin



KEY MESSAGES - POISONING THROUGH THE SKIN

- *Pesticide users may not understand that pesticides go through the skin into the body and that the skin is probably the most common route by which users are poisoned*
- *Concentrated pesticides are more hazardous than diluted ones, and greater care needs to be taken while measuring and mixing*
- *The time during which the pesticide is on the skin is important. Contact over long periods is hazardous.*
- *Take care to cover cuts and abrasions while handling pesticides*

OH.1.2 TOXICITY, HAZARD AND RISK

It is important to be clear about the difference between the terms toxicity, hazard and risk.

- *Toxicity* is the inherent capability of a chemical to cause harm to the body
- *Hazard* is the potential to cause harm, and includes consideration of toxicity, formulation etc.
- *Risk* is the likelihood or probability of harm occurring, and includes hazard, exposure etc.

This means that if we are assessing the dangers faced by pesticide users, considering toxicity alone is not enough, we must also consider:

- whether or not the pesticide is likely to get into the body, in other words how is the user exposed?
- how much is the user exposed to (this depends on concentrations, formulations, amounts on skin etc.)?
- over what time period is the worker exposed?

This involves assessment of a large number of factors before arriving at a conclusion about the risks involved.

It is possible to use a highly toxic product with low risk, because of the other factors are involved, just as it is also possible for a product with low toxicity to cause health problems because it is used in a dangerous way - with high risk. Each of these aspects will be considered separately.

KEY MESSAGES - TOXICITY HAZARD AND RISK

- *The likelihood of harm from a pesticide depends on much more than its toxicity - factors such formulation, risk of exposure, length of exposure etc. must also be considered.*

OH.1.2.1 TOXICITY

"Everything is a poison, nothing is a poison. It is the DOSE which makes the poison"

(Paracles)

This was said by a famous chemist as far back as the 15th century. Chemicals can damage our bodies and even kill us. Yet many chemicals are essential to health. Good example are vitamins - they are vital in small quantities for healthy bodies, yet in large quantities they can be poisonous. Clearly the amount of chemical taken into the body over a certain period of time, known as the *dose*, is very important, and affects whether the chemical is beneficial, has no effect, or is harmful. Pesticides are exactly the same as other chemicals - our bodies can tolerate certain amounts of pesticide in them with no effect, but if too much is taken in it can lead to harm.

Pesticide toxicity is most commonly measured using the LD_{50} or the *50% Lethal Dose*. This is the amount of a test chemical which will kill 50% of the test animals (usually rats), measured in mg (milligrams) of active ingredient per kg (kilogram) body weight. This gives us a measure so that we can compare the toxicity of pesticides. Because it is an amount which causes an effect, a chemical with a LOW LD_{50} is MORE TOXIC than a chemical with a high LD_{50}, since it needs a smaller amount to cause death. The effects of other chemicals can be measured in exactly the same way. Pesticides are often thought of always being extremely poisonous chemicals, yet many pesticides are no more harmful than many of the chemicals we come across in our daily lives (for examples see Table OH.1).

Table OH.1 Toxicity of Pesticides and Other Chemicals

PESTICIDES		OTHER CHEMICALS	
Pesticide	LD_{50} (mg/kg)	Other Chemicals	LD_{50} (mg/kg)
Parathion (insecticide)	13	Nicotine (in cigarettes)	1
Paraquat (herbicide)	150	Caffeine (in tea and coffee)	355
Malathion (insecticide)	2100	Aspirin (painkiller)	1500
Glyphosate (herbicide)	4230	Salt (used in food)	3750

This means that considering toxicity alone will not tell us whether a user is likely to come to harm from a product. It is part of the answer, but many other factors need to be considered to enable the user to handle pesticides with minimum risk. Pesticides as a group are not all extremely

poisonous, neither are they completely safe. We need to take a balanced view and treat pesticides with the caution necessary for the product which is to be used, its toxicity, and a whole range of other factors which will be discussed in the following sections.

KEY MESSAGES - TOXICITY

- *Pesticides, like other chemicals, can be present in the body without causing harm.*
- *It is the DOSE at which ill effects occur which is important in terms of the toxicity of the pesticide. Many pesticides are no more toxic than many other chemicals we come across in our day to day life.*
- *Pesticide toxicity is measured using the LD_{50} - which is the dose which causes 50% of test animals to die, measured in mg/kg body weight.*

OH.1.2.2 HAZARD

Considering hazard takes the process of thinking about possible dangers a step further. Hazard is the potential of the product to cause harm. Toxicity is one part of the hazard, but a product can only be toxic if it gets onto or into the body, so considering hazard includes the other characteristics of the product such as formulation, packaging, likely exposure route etc.

The hazard of a product can be reduced by the use of particular formulations. Solids tend to be safer than liquids of equivalent toxicity, because the rate of uptake is less when the product gets onto the skin, or even when ingested. Liquid formulations also vary in their hazard because of the solvents or surfactants used in the formulation.

Hazard is also affected by the concentration of the pesticide. When bought from the dealer the pesticide is concentrated, and most pesticides require dilution for spraying. This means that the hazard associated with handling concentrated products is higher, for example when measuring and mixing the product, and so greater precautions are necessary (see Fig. OH.7). When diluted the pesticide spray is much less hazardous, because they are usually diluted with water by as much as 100 or 200 times.

The World Health Organisation (WHO) produces a classification of pesticides based on hazard. This recognises that solids are generally safer to handle than liquids, and that the oral route is more toxic than the dermal (skin) route of entry. It puts pesticides into different categories of hazard based on their oral and dermal LD_{50}s and whether they are solid or liquid. This classification is shown in Table OH.2.

Figure OH.7: Handling concentrate is more hazardous and requires more precautions than using dilute spray

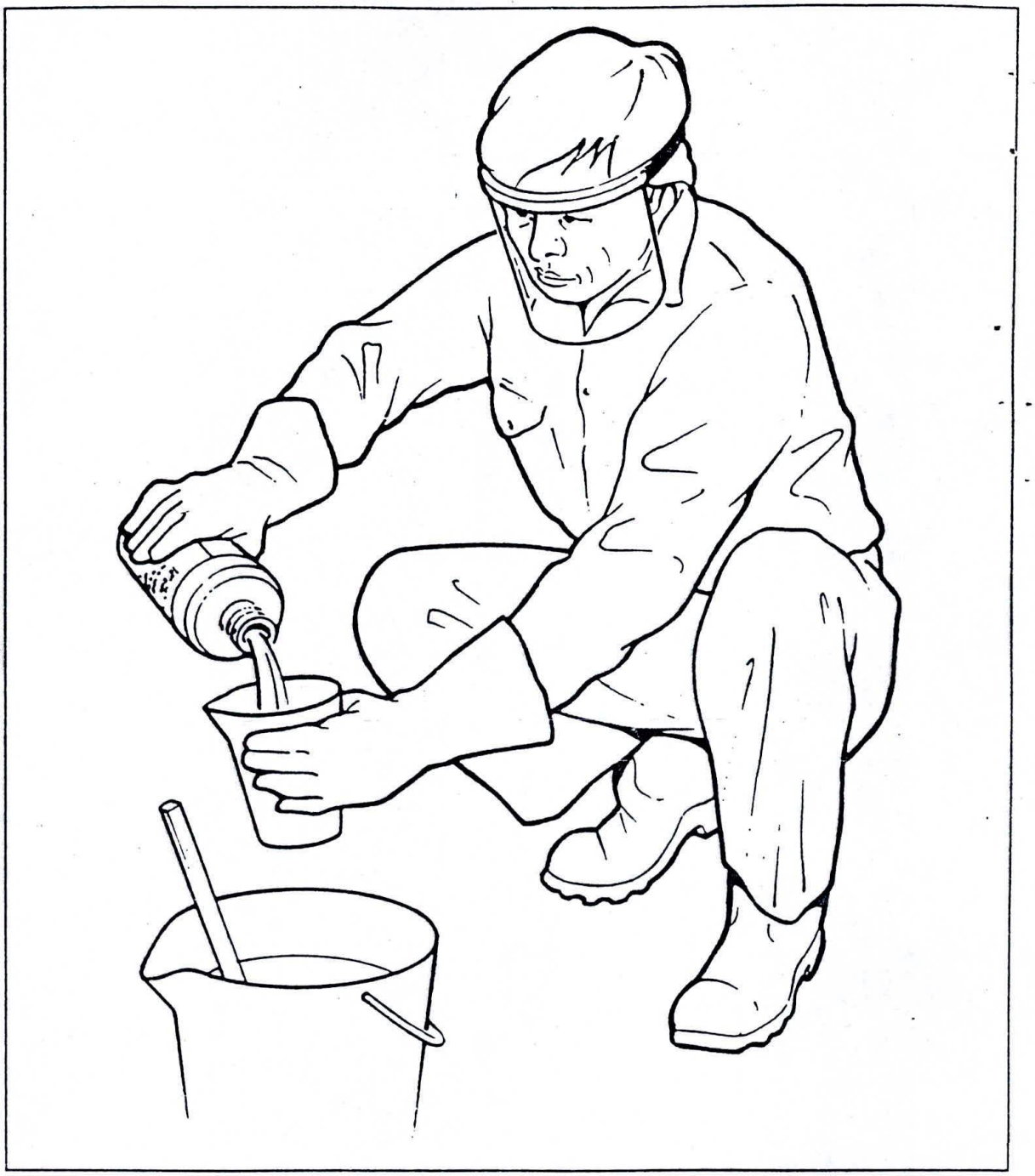


Table OH.2: WHO Classification of Pesticides by Hazard

HAZARD CLASS	LD_{50} FOR THE RAT (mg/kg body weight)			
	ORAL LD_{50}		DERMAL LD_{50}	
	Solids	Liquids	Solids	Liquids
Ia Extremely Hazardous	5 or less	20 or less	10 or less	40 or less
Ib Highly Hazardous	5 - 50	20 - 200	10 - 100	40 - 400
II Moderately Hazardous	50 - 500	200 - 2000	100 - 1000	400 - 4000
III Slightly hazardous	Over 500	Over 2000	Over 1000	Over 4000
Products unlikely to present a hazard in normal use	Over 2000	Over 3000	-	-

This means that a pesticide with an oral LD_{50} of 100 mg a.i. per kg body weight would be classed as a moderately hazardous product if it were a solid but the same pesticide as a liquid would be classed as highly hazardous.

This classification is often used as a basis for legislative controls (e.g pesticides in groups Ia and Ib may be restricted in use or availability) and is also used for labelling. The colour coding systems on labels in many countries are based on this or similar classifications. The colour coding system in Malaysia for example is:

Black - extremely hazardous
Red - highly hazardous
Yellow - moderately hazardous
Blue - slightly hazardous

These are often accompanied by warning signs - the skull and crossbones is usually used to signify a product in Class Ia or Ib (Extremely or Highly hazardous). Farmers and other users must be taught to recognise these colour codes and signs, so that they understand for example that a product with a red or black band must be handled more carefully than one with a yellow band.

KEY MESSAGES - HAZARD

- *Hazard involves more than just toxicity - it includes other factors such as formulation*

- *The WHO classification of pesticides by hazard is a good indicator of pesticides which must be treated with more caution*

OH.1.2.3 RISK

Risk is part of our everyday lives. Travelling by car or by boat is potentially dangerous and we take a risk when we do it. But risk is only part of the story because the risks must be balanced against the benefits such as quick, easy travel, enabling large loads to be carried etc. Using pesticides entails risk, but also gives considerable benefit (a rapid, effective way to control pests and so improve yield or crop quality without the need for large amounts of labour). We must aim to minimise the risks and maximise the benefits of using pesticides.

It is very difficult to give hard and fast rules for safe handling and use of all pesticides. This is because the risk varies with different circumstances. A farmer using a highly hazardous product with no protective clothing, in a very careless fashion and with a poorly maintained leaking knapsack sprayer will be at much greater risk of poisoning than one using a slightly hazardous product, with careful handling in a tractor sprayer. The precautions which should be taken must relate to individual circumstances - for example the recommendations for protective clothing are much more when an extremely or highly hazardous product is being used, and they are also greater when concentrate is being handled (for example when mixing or measuring pesticide) compared with when dilute product is being handled (for example when spraying). It is possible that a product with a potentially high hazard can be used with low risk provided appropriate safety precautions are used.

In general a farmer or other user should try and minimise risk for his own circumstances by assessing the hazard and risk associated with his particular conditions and then taking steps to control the risk. This can be done by asking a series of questions:

Reducing exposure

1. Can I use another method of control not involving pesticides?
2. Can I use another suitable pesticide which is less hazardous (in a lower hazard category)?
3. Is the same pesticide available in a less hazardous form e.g. granules instead of liquids?

Once a suitable product is identified - what are the hazards?

1. How will the pesticide be most likely to get into the body under the conditions I intend to use?
2. Will contact with the skin present any special problems (e.g. irritancy)

What are the risks?

1. Who will be exposed to the pesticides?
2. How long and how often will the exposure be?
3. How is the pesticide handled during storage? during use? during disposal?
4. Will equipment failure (e.g. leaks) cause extra exposure?

Controlling the risks

1. Can I use a pesticide which is packaged in a safer way (e.g. water soluble sachets)
2. Can I adapt my spraying equipment or buy new equipment to make the mixing or spraying process less likely to contaminate (e.g. closed transfer systems - which transfer the product from the pack into the sprayer without the risk of operator exposure)
3. Can I improve my handling practices i.e.
   - use only as label recommends
   - better personal hygiene
   - sprayer maintenance to reduce leaks
   - greater care in handling
4. Can I ensure that anyone using the pesticide is fully aware of the possible hazards and trained to use the pesticide safely
5. What is the most appropriate protective clothing to use? (refer to product label):
   - for mixing?
   - for spraying?

KEY MESSAGES - RISK

- *Risk is the likelihood of harm occurring, and includes a large range of considerations including toxicity, hazard and likelihood of exposure*
- *Assessment of risk for an individual users circumstances is an important way of minimising risk associated with pesticides*

OH.1.2.4 LONG TERM EFFECTS OF PESTICIDES

As well as having immediate (acute) toxic effects, some pesticides may have longer term *chronic* affects. As with acute toxic effects, there is a need to be clear about the risks from these.

As part of the normal development process before a new pesticide is sold, extensive testing is carried out to identify possible long term risks such as whether the chemicals might cause cancer. As with the toxicity testing, it is the *dose* at which this occurs which indicates the level of risk, because it relates to the quantities of chemical to which different people might be exposed (e.g. farmers applying the chemical or people eating small amounts as residues on food). In other words a pesticide would not be sold if it were found to cause cancer at doses at which people might normally be expected to be exposed.

A review of health effects in man from long term exposure to pesticides has been carried out. This looked at studies of people expected to be most exposed to pesticides i.e. those involved with pesticide manufacture and users of pesticides, particularly farmers. These studies showed that there was a general tendency towards lower mortality when all causes were combined. The reason for this is assumed to be the healthier lifestyle of such groups (physical exercise, fresh air, general lifestyle). It does not seem therefore that long term exposure to pesticides increases the risk of death.

When global cancer was studied specifically, no evidence was found to indicate that those who are more exposed (manufacturers and users) had different levels of cancer from the general population. Indeed several studies showed lower overall cancer risk in the more exposed group, which is also assumed to be because of their healthier lifestyles.

In our normal diet we are exposed to many chemicals which could cause cancer (*carcinogens*) as well as naturally occurring chemicals which have pesticidal action. It has been estimated that food plants contain between 5000 and 10000 natural pesticides and breakdown products which are potentially toxic in humans, so that we typically eat 10,000 times more natural pesticides than synthetic ones. The doses at which these occur in fruit and vegetables do not generally give cause for concern, in fact the health benefits from eating plenty of fruit and vegetables far outweigh any possible harmful effects.

This is not to say that there are no long term risks associated with pesticide use. For example, prolonged use of some organophosphorus insecticides has led to problems with the nervous system. It is often farmers who have been using pesticides for many years without any obvious

health problems who are the hardest people to convince that they should use safety precautions when handling pesticides. Stressing the dangers of chronic poisoning can be helpful to overcome this attitude.

KEY MESSAGES - LONG TERM EFFECTS

- *Extensive testing is carried out by manufacturers before a pesticide is sold to ensure that there is no risk from long term effects on human health.*

- *Wide ranging studies show that there is no evidence for increased numbers of deaths due to possible long term effects of pesticide exposure*

HP.1 HANDLING AND USING PESTICIDES SAFELY

It is not difficult to use pesticides safely. Most precautions are simply common sense. The key to teaching about safe use is to teach users to understand about hazard and risk, and then they can make sensible decisions about how to reduce the risk and understand why they need to do it. A farmer who does not recognise the importance of skin as the most common route of entry in cases of poisoning during use will not take the appropriate measures to protect his skin.

Another difficulty is that of motivation - many pesticide users have used pesticides in large quantities for many years without any apparent ill effects - why should they change their practices? It then becomes a problem of changing attitudes, which can be difficult.

As the skin is the most important route of entry under most conditions, preventing contamination of the skin is perhaps one of the most important aspects of safe use of pesticides.

HP.1.1 PREVENTING CONTAMINATION

When most people are asked about how they can prevent skin contamination, the most common response is to use protective clothing. There is no doubt that protective clothing is an important means of controlling exposure, but its limitations (which are discussed in section HP.1.1.5) mean that it must be considered the last line of defence. There are other, better ways to prevent or minimise the effects of contamination. This can be summed up as five golden rules:

1. *ALWAYS READ AND MAKE SURE YOU UNDERSTAND THE LABEL BEFORE STARTING TO USE ANY PESTICIDE*

2. *HANDLE PESTICIDES CAREFULLY AT ALL TIMES TO AVOID CONTACT OR CONTAMINATION*

3. *MAINTAIN SPRAYERS WELL TO AVOID LEAKS OCCURRING DURING USE*

4. *PRACTICE GOOD PERSONAL HYGIENE WHEN USING PESTICIDES*

5. *ALWAYS USE APPROPRIATE PROTECTIVE CLOTHING WHEN USING PESTICIDES*

However general safety guidelines which cover all circumstances of handling and use are difficult to give. A user should always study his or her own set of circumstances carefully to determine the best and safest way to handle and use the pesticide for their own situation.

HP.1.1.1 THE PRODUCT LABEL

The product label is very important. It is the most important piece of information which tells the user everything he needs to know to be able to use the product safely and effectively.
A sample label is shown in Figure HP.1. There is a considerable amount of information on the label covering the effective way to use the product in terms of:

- which pests will it control
- for which crops is it recommended
- what are the recommended amounts to use
- what are the best application methods to use

There is also a large amount of safety information on the label, in particular:

- indication of the hazard associated with the product (often shown by colour bands or warning signs such as skull and crossbones - see section HP.1.2.2)
- general safety advice for handling (e.g. do not smoke, drink or eat while using this product, washing advice) and any particular safety precautions which should be followed
- the protective clothing recommended for mixing and spraying that product
- possible environmental precautions - either general warnings or specific ones such as harmful to fish or harmful to bees
- storage advice
- disposal recommendations
- procedures for first aid in an emergency
- advice for doctors or medical staff on treatment of poisoning

Clearly the pesticide user must make sure he reads and understands all the advice given on the label before he starts to use the product, and this must always be a key message when teaching about safe use of pesticides.

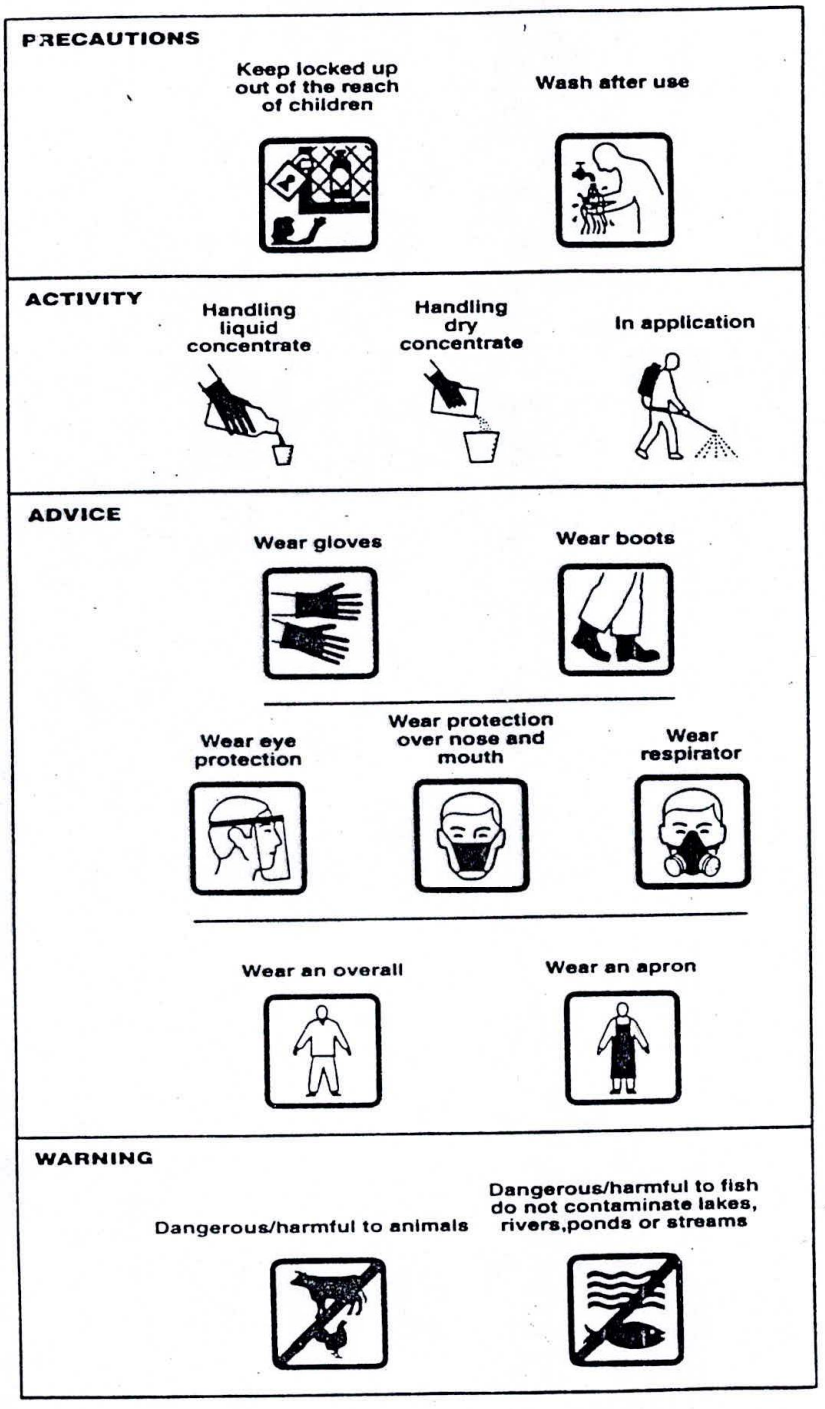
However there is a problem with pesticide labels that people often do not bother to read them, or they are unable to read them because of illiteracy or being unable to read small print, or they may not understand the technical language used.

Those who are unable to read, usually have access to someone, often someone in the family, who can read and these people should be encouraged to ask these people to read the label for them.

In addition, to help those who cannot read, many labels now have internationally recognised

pictograms on them. These are simple pictures designed to give simple safety messages. They are designed to be as self-explanatory as possible, however it cannot be assumed that everyone will understand what they mean, and it is important to teach people to understand them. The pictograms and their meanings are shown in Fig. HP.2.

Figure HP.2: Pictograms to show safe handling recommendations

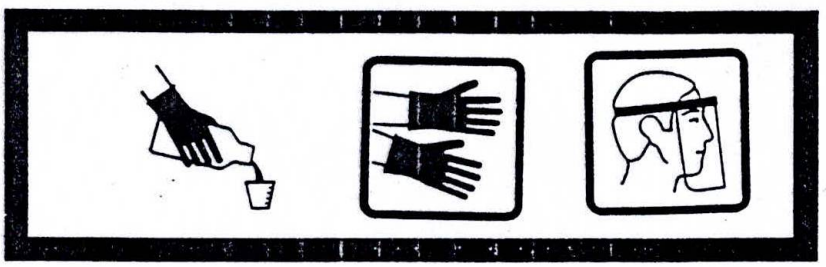


The pictograms showing storage (keep locked up out of reach of children and wash after use should be present on all product labels. The other pictograms present will vary depending on the product involved. The activity pictograms ("handling liquid concentrate", "handling solid (dry) concentrate" or "in application") will always be shown associated with the appropriate protective clothing pictograms usually with a box drawn around them (see Fig. HP.3).

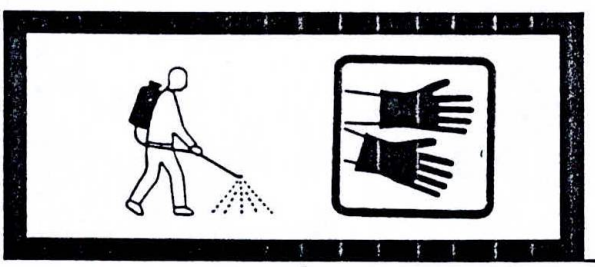
You would always expect to see either the "handling liquid concentrate" or the "handling solid concentrate" pictogram (depending on the formulation involved) with at least the "wear gloves" and "wear eye protection", as this is the minimum recommendation for handling any concentrate. If the "application" pictogram is not shown, this means that no special extra protection is required for spraying, a long sleeved shirt and long trousers with shoes or preferably rubber boots (the minimum protection for any pesticide operation) is all that is required.

The environmental warnings (harmful to animals and harmful to fish - do not contaminate lakes rivers or streams) will only appear on the label if the product is especially hazardous to animals or fish.

Figure HP.3: Pictogram combinations



a. This means: "when mixing liquid concentrate wear rubber gloves and eye protection"



b. This means: "when applying (spraying) wear rubber gloves

KEY MESSAGES - READING THE LABEL

- *The label contains a great deal of important safety information. Users must always be encouraged to read the label before use*

- *Pictograms help to give safety information to those who are unable to read. Pesticide users should be taught to look for and understand these pictograms*

HP.1.1.2 CAREFUL HANDLING OF PESTICIDES

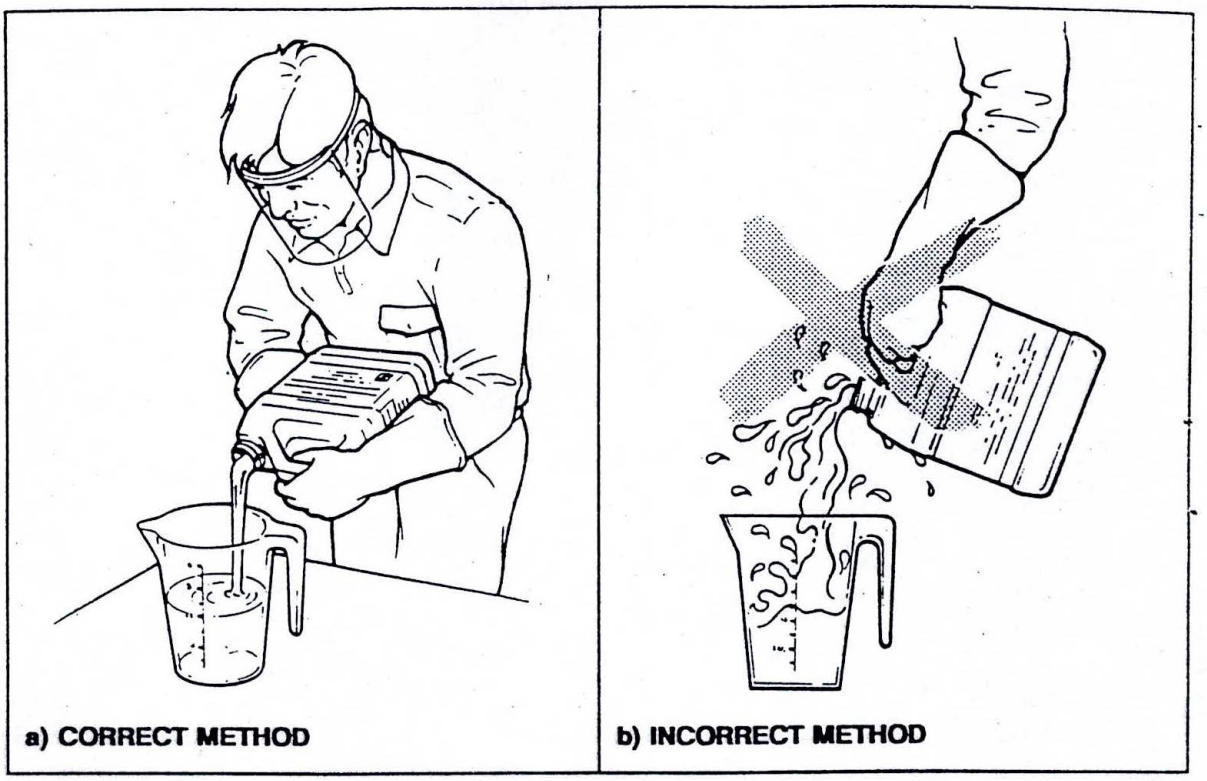
Avoiding contamination by careful handling involves thinking about all aspects of the normal pesticide operation to see if there is potential for contamination, and if so, what can be done to avoid or reduce it.

In general the most common ways to do this are:

During Mixing and Measuring:

- Always open bottles or packs carefully to avoid splashing or spilling
- Always pour products carefully to prevent spilling. Holding the bottle well away from the body reduces the likelihood of splashes hitting the body or eyes.
- When pouring from a large container (e.g. 4 or 5 litres in size), hold the container so that the opening admits air during pouring (see Figure HP.4). This prevents "glugging" of the liquid which can cause dangerous splashing.
- When the product has been measured out, always replace the cap or lid immediately to prevent spilling in the event of the bottle being knocked over.
- Always place bottles, measuring jugs etc. on flat secure surfaces during measuring, to reduce the likelihood of their falling over and spilling the contents
- Always rinse empty pesticide containers and any measuring jugs or other containers at least three times at the time of mixing, adding the rinse water to the spray tank so that it forms part of the spray mixture. This reduces the hazard associated with handling empty containers.
- Do not overfill the sprayer, as even with the lid on, it may spill out when it is picked up and contaminate the user

Figure HP.4: Correct way to pour from a large container to prevent splashing



a) CORRECT METHOD

b) INCORRECT METHOD

During spraying

- Always keep the spray nozzle held downwind of the body to prevent the wind blowing the spray onto the body (see Fig. HP.5)

- Always start spraying at the downwind end of the field, to avoid having to walk through crop which has been contaminated by drifting spray (see Fig. HP.6)

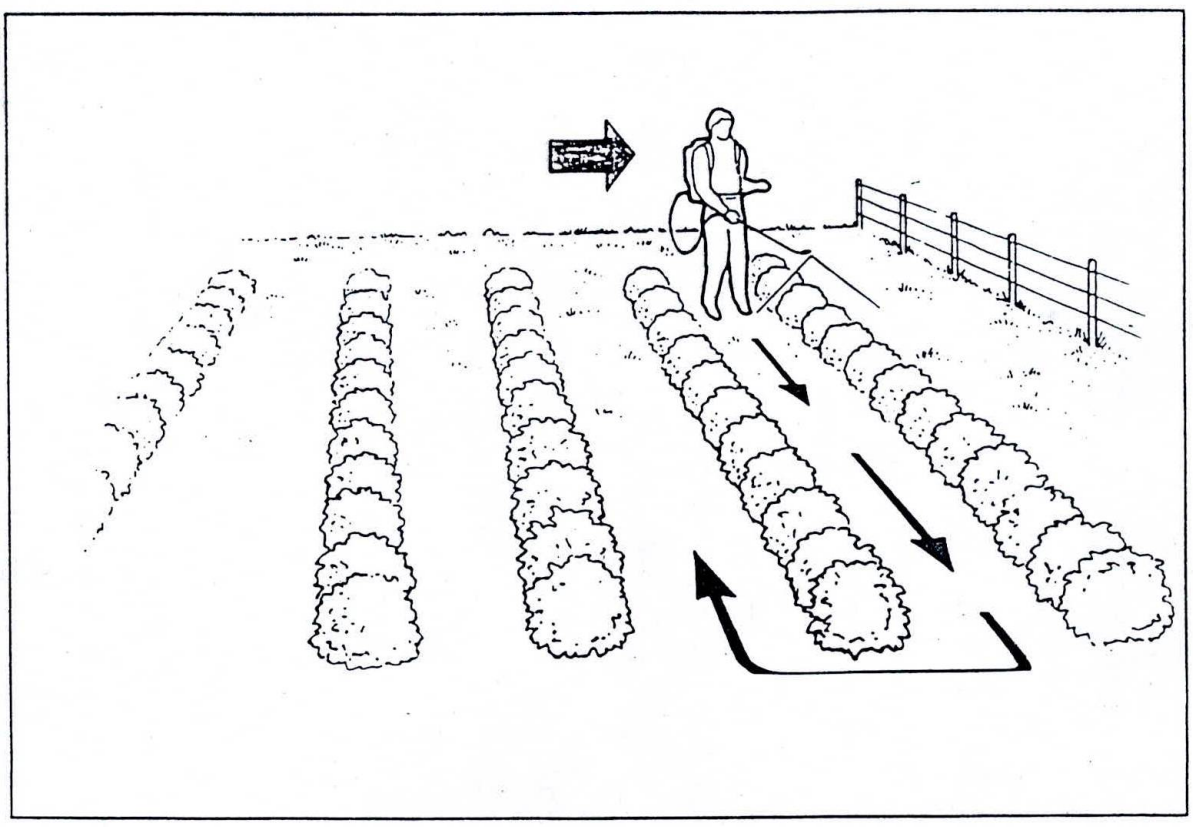
- Do not re-enter treated crop until it is safe to do so (at least until the spray has dried or after the label advises). Keep other people and animals away until it is safe.

KEY MESSAGES - CAREFUL HANDLING PROCEDURES

- *Examine all aspects of the mixing and spraying operations to see if any practice is likely to cause contamination, then think of ways in which this can be avoided or minimised*

Figure HP.5: Always hold the spray nozzle downwind of the body

Figure HP.6: Always start spraying at the downwind end of the field



HP.2.1.3 SPRAYER MAINTENANCE

Leaking sprayers are one of the most common causes of contamination, and can result in very severe contamination. It is important to carry out regular maintenance to avoid leaks occurring during spraying. This means:

- checking a sprayer with water before starting to mix up a pesticide. If leaks are found then the sprayer must be repaired before use

- carrying out a regular (e.g. monthly) check on the sprayer - dismantling the sprayer and checking for any signs of wear (e.g. cracking, abrasion) on the rubber components, and replacing any components which are seen to be worn

Another common cause of contamination is sprayers leaking through the top onto the neck and back because of overfilling. This can be easily prevented by making sure that the sprayer is never filled too full.

HP.1.1.3.1 Dismantling a sprayer to Check for Worn Parts

IT IS VERY IMPORTANT TO CHECK THERE IS NO PRESSURE IN A SPRAYER BEFORE STARTING TO DISMANTLE IT. A SPRAYER CAN CAUSE DANGEROUS CONTAMINATION, ESPECIALLY OF THE EYES, IF IT IS TAKEN APART WHILE STILL PRESSURISED. ENSURE THERE IS NO PRESSURE BY OPERATING THE TRIGGER UNTIL SPRAY NO LONGER COMES OUT OF THE NOZZLE.

Remember too that even cleaned sprayers may contain harmful residues, and it is advisable to wear gloves when dismantling a sprayer.

Even if leaks are not found when checking the sprayer with water, the sprayer should be dismantled to check for signs of wear which could lead to leaks while spraying.

When dismantling the sprayer, the important parts to check are those which are likely to leak (see Figure HP.7). The most common parts of the sprayer which leak are any joints e.g. screw thread connections and connections of the hose, and any rubber parts such as seals or 'O' rings which are liable to wear. The nozzle assembly, trigger valve on the lance, and the pump should all be checked carefully. Screw connections which leak should be tightened, and if necessary plumbers tape (PTFE tape) can be wrapped around the screw thread to correct leaks (see Fig. HP.8). Alternatively any worn seals can be replaced at the join.

Figure HP.7: Parts of the sprayer liable to leaks

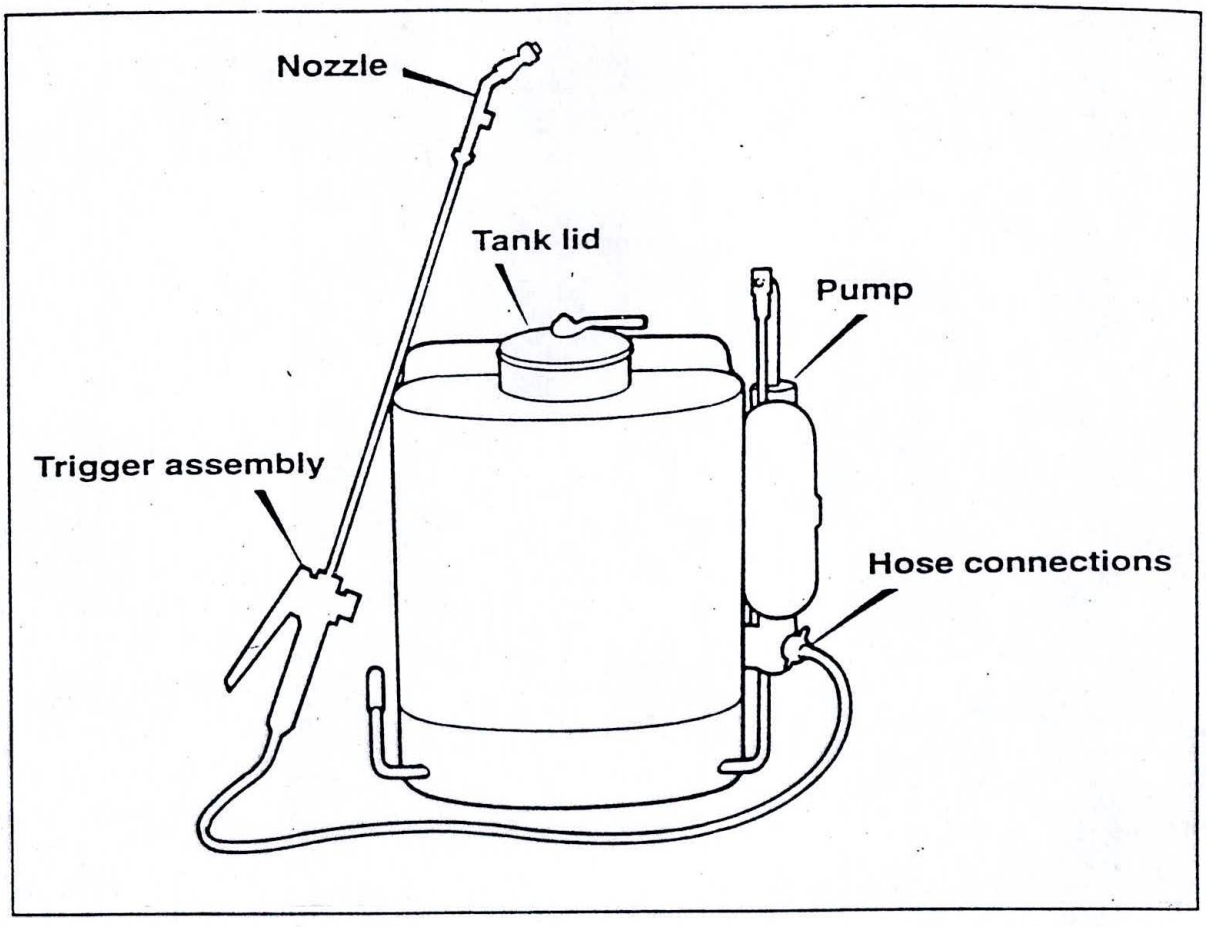
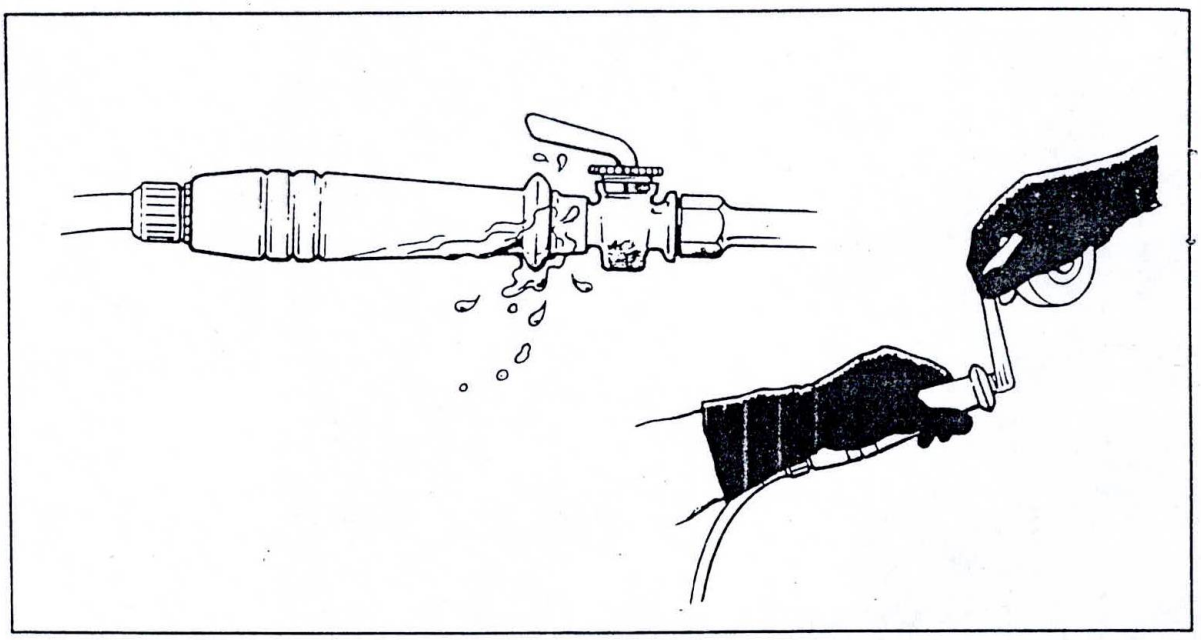


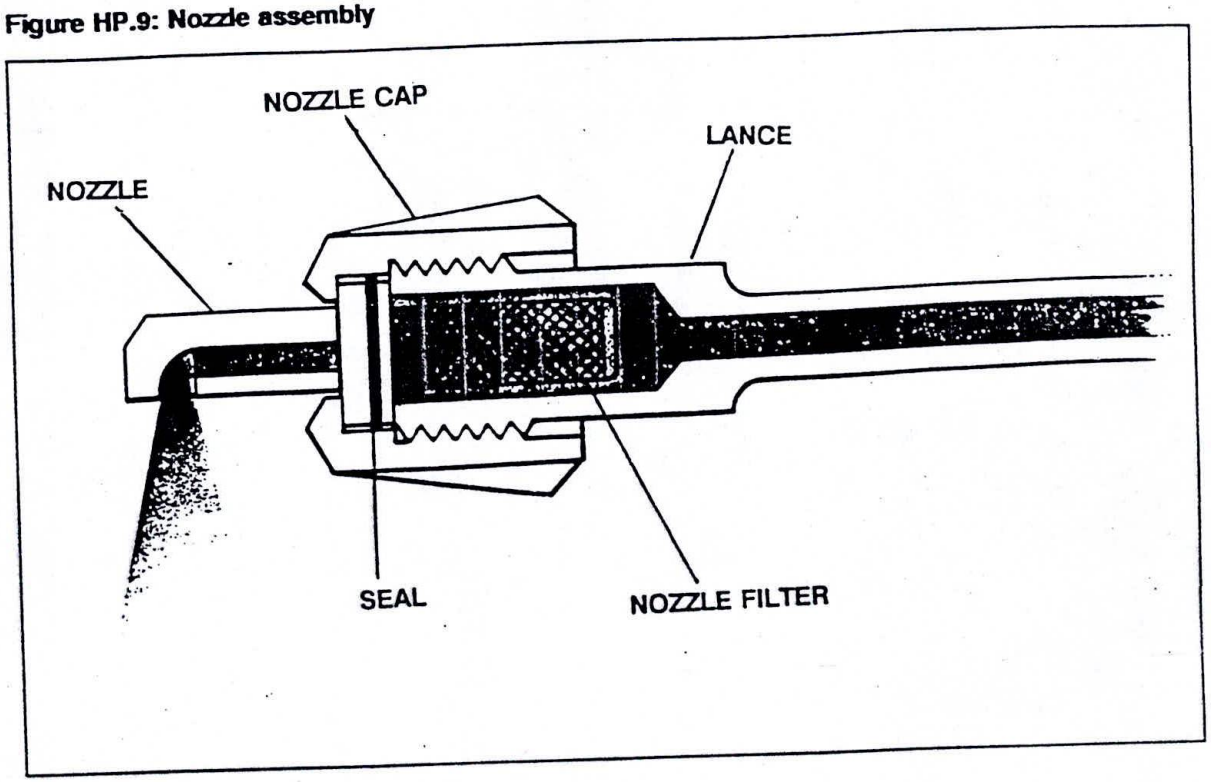
Figure HP.8: Leaks at screw connections can be repaired with plumbers tape



Nozzle Assembly

The nozzle assembly can be unscrewed. Check that the nozzle is clean, and the seal is in good condition (see Fig. HP.9)

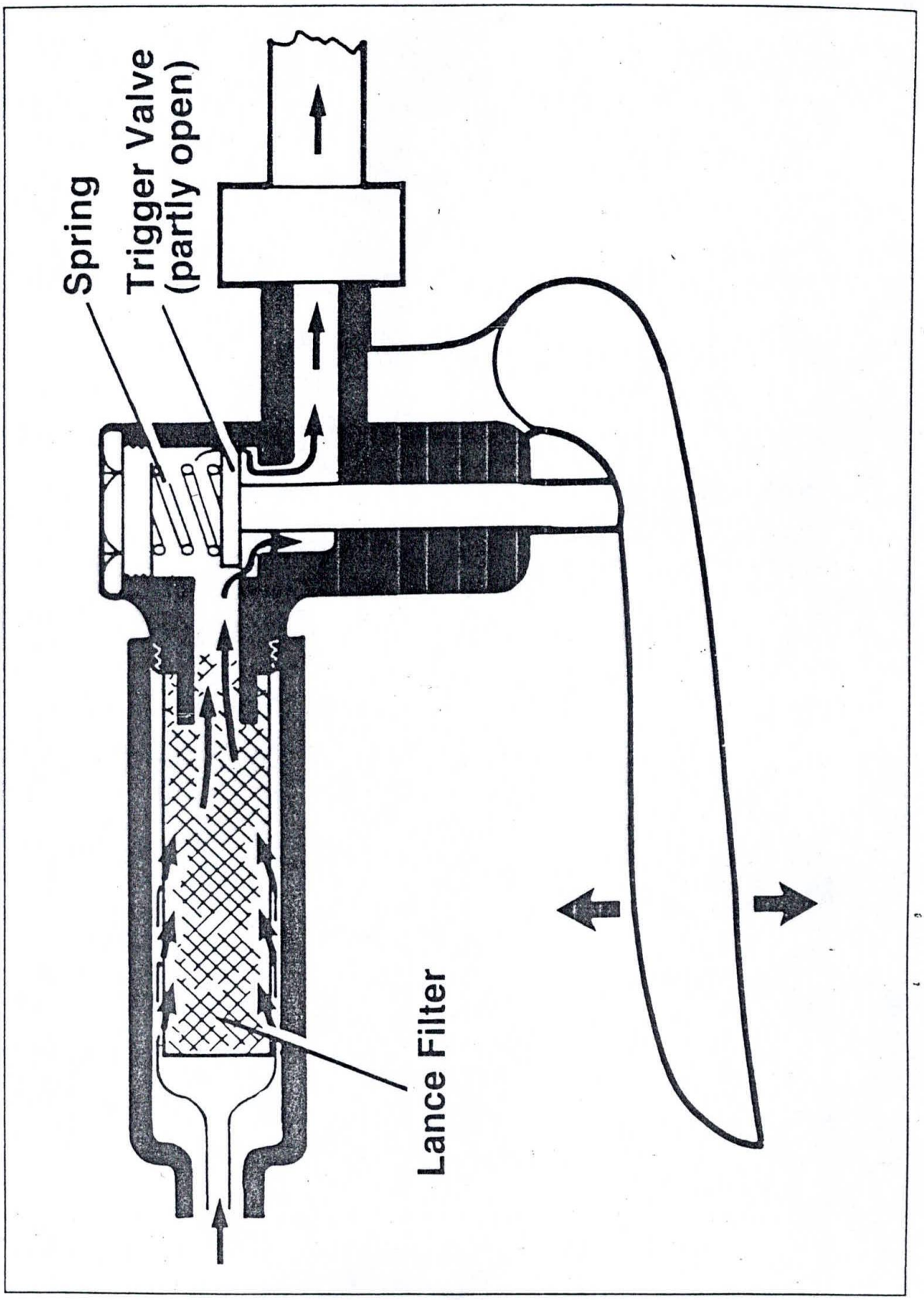
Figure HP.9: Nozzle assembly



Trigger valve

The trigger valve should be taken apart by unscrewing the nut on the top and removing the valve and the spring. Check that the seals around the valve and the valve itself are in good condition (see Fig. HP.10). If there are signs of wear replace them. Check the condition of the seals on any screw threads.

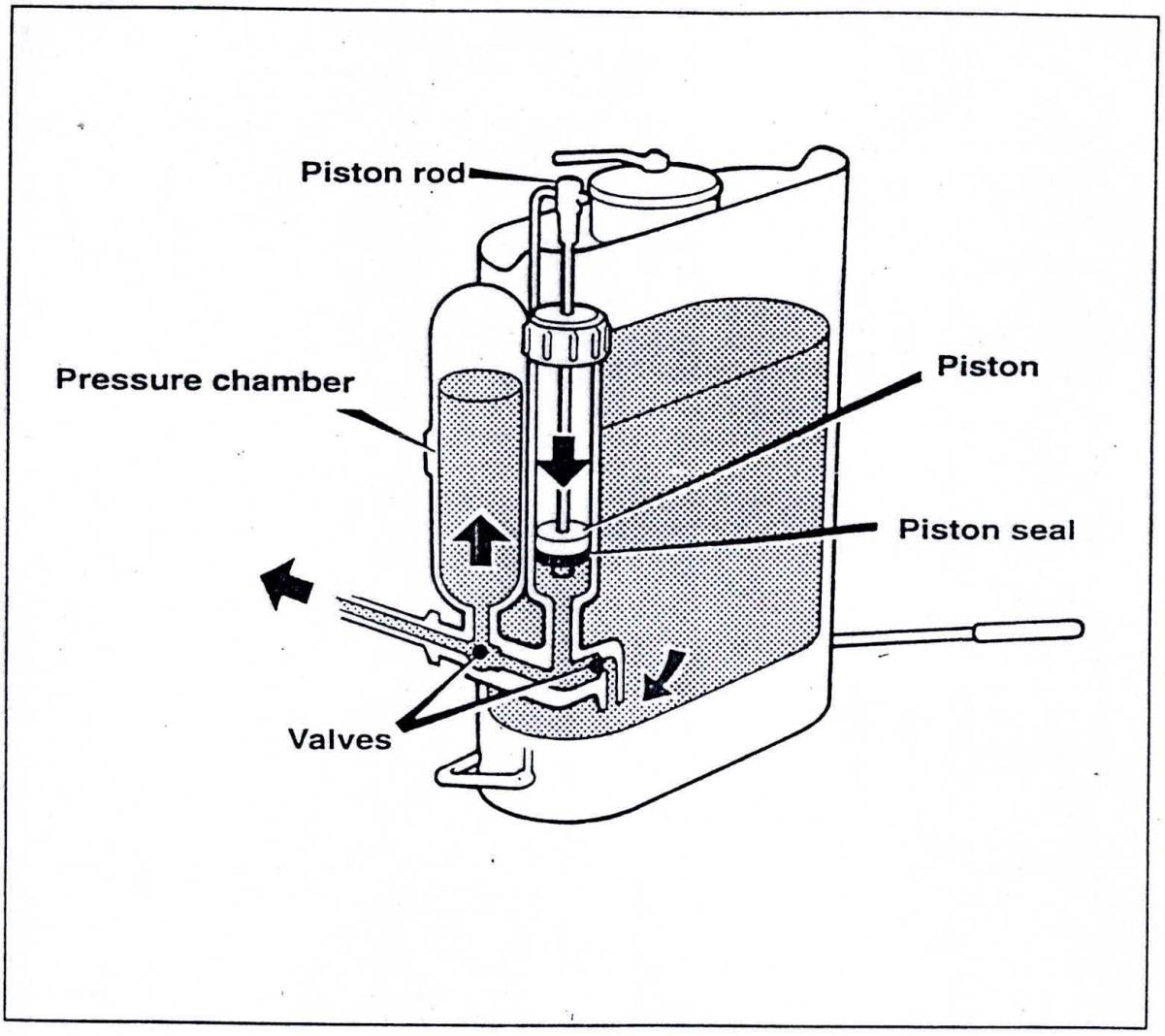
Figure HP.10: Trigger valve assembly



Pump

The pump can be dismantled by removing the pins on the rod which connects the lever to the top of the piston rod. Unscrew the top of the pump chamber and remove the piston. Check the piston seal for signs of wear. The ball valves should also be checked for wear and cleanliness. One is removed from inside the tank by unscrewing the inlet tube assembly and the other is located below the pressure chamber, and can be checked by unscrewing the pressure chamber (see Fig. HP.11).

Figure HP.11: Parts of the pump and pressure chamber



Although time consuming, farmers can be encouraged to maintain their sprayers for economic as well as health reasons - a well maintained sprayer will last longer and will do the job more effectively than a poorly maintained one.

HP.1.3.1.2 Leaks during spraying

There may be times that even well maintained sprayers start to leak while spraying. If this happens it is important to carry out the following procedure:

1. Stop spraying - check to see if there is any contamination of the skin or clothing. If there is then wash affected area thoroughly and change contaminated clothing
2. Put on gloves and repair the leak. This may involve emptying the sprayer. If there will be time to continue spraying afterwards, then store the spray mix securely in another container while carrying out the repair. If there is no time to continue spraying, then dispose of the spray mix carefully (see section HP.1.2.4.2).

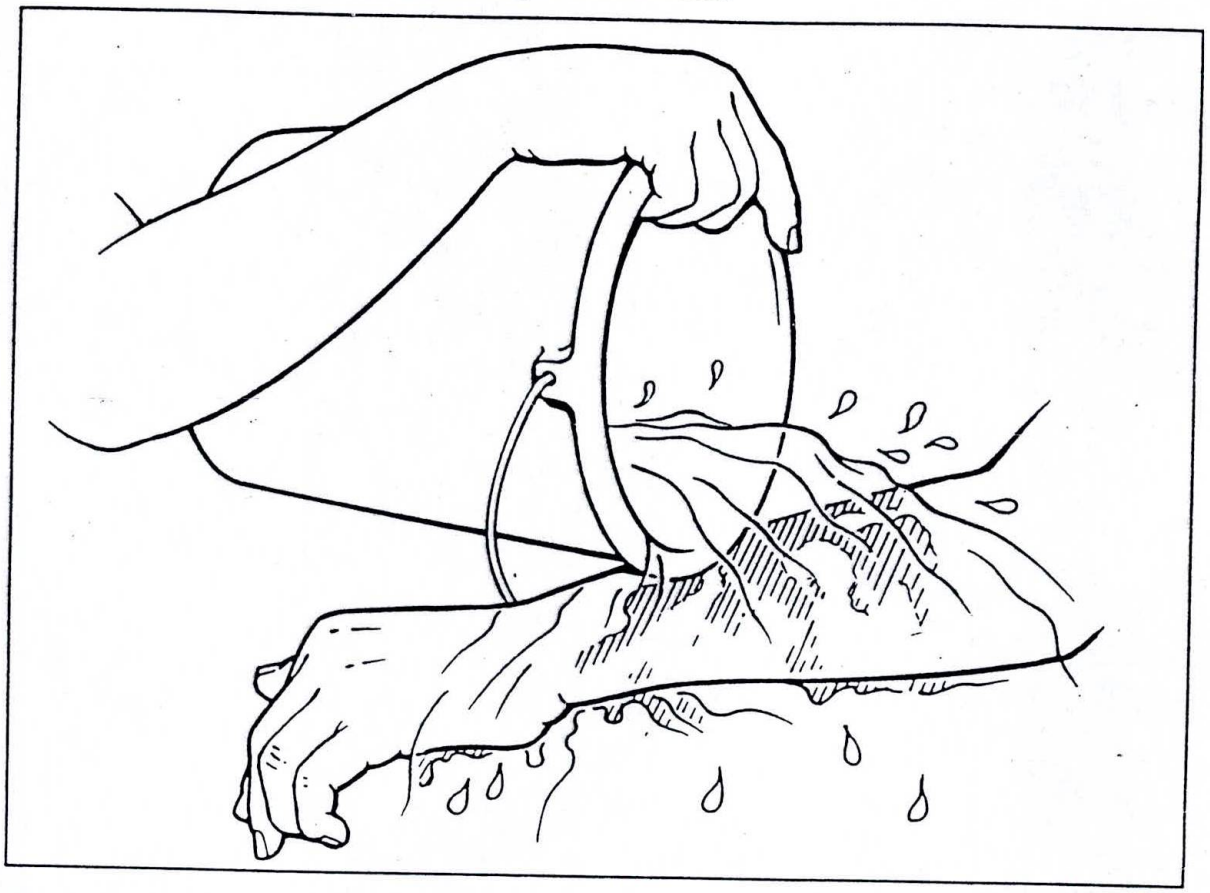
KEY MESSAGES - SPRAYER MAINTENANCE

- *Leaks from sprayers can cause severe contamination, and may lead to severe ill effects*
- *Regular maintenance of sprayers will help to prevent leaks occurring during spraying*
- *If a leak does occur during spraying, always stop immediately, decontaminate the skin and clothes if necessary and repair the leak before continuing*

HP.1.1.4 PERSONAL HYGIENE

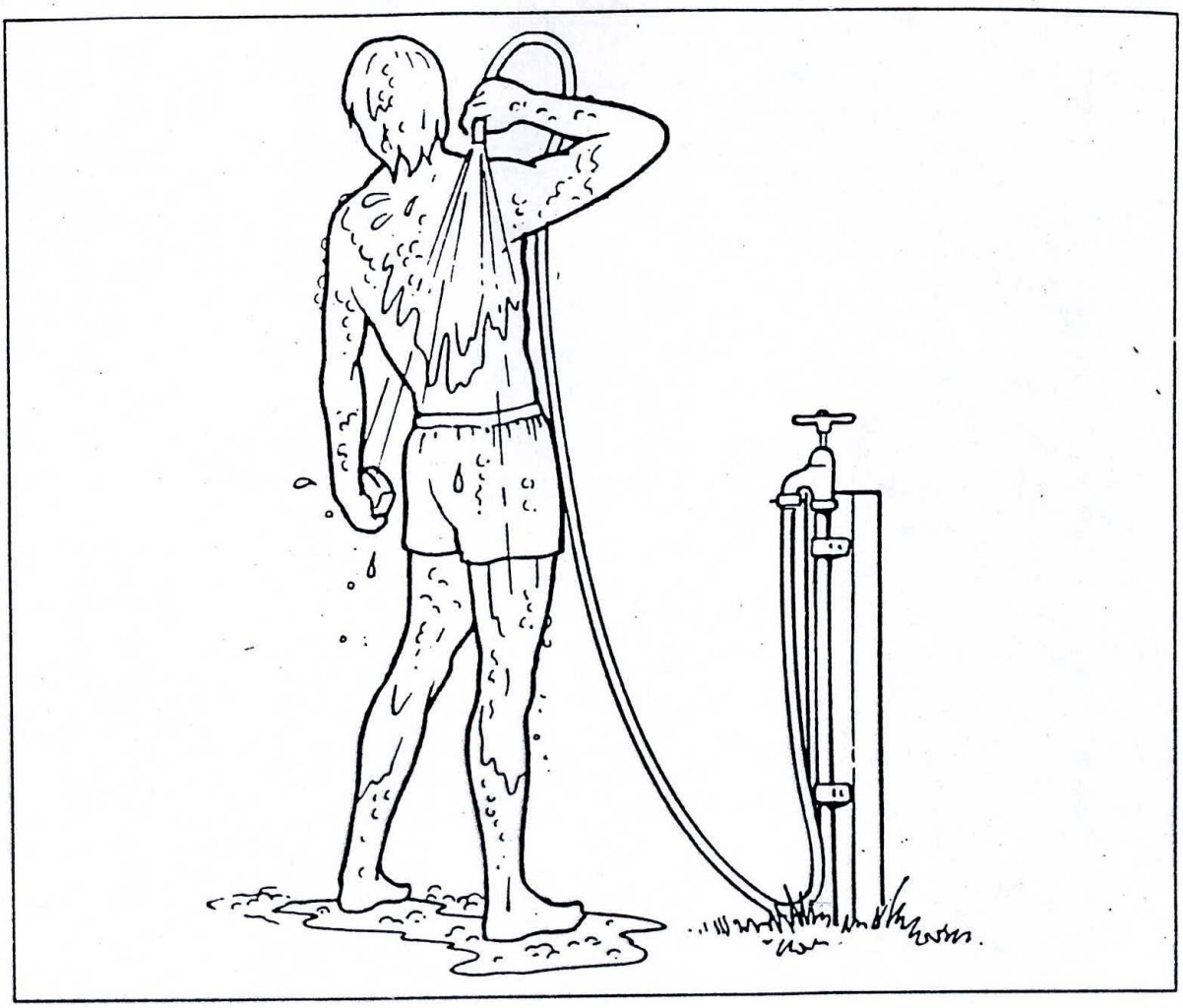
Practising good personal hygiene is a very important way to prevent chemicals passing through the skin into the body. When chemicals get onto the skin, the key factors which affect whether the chemicals cause poisoning by this route are the amount of active ingredient present (related to volume and concentration) and time on skin. Concentrated chemicals on the skin are more dangerous than dilute ones, and so it is very important to wash immediately with plenty of water if the skin is contaminated with concentrated pesticide.

Figure HP.12: Always wash immediately if contaminated



Routine washing, for example when finishing mixing and before spraying, and washing at the end of the spray operation means that any pesticide does not remain on the skin for long periods (see Fig. HP.13). Even dilute pesticide can be harmful if left on the skin for a long time.

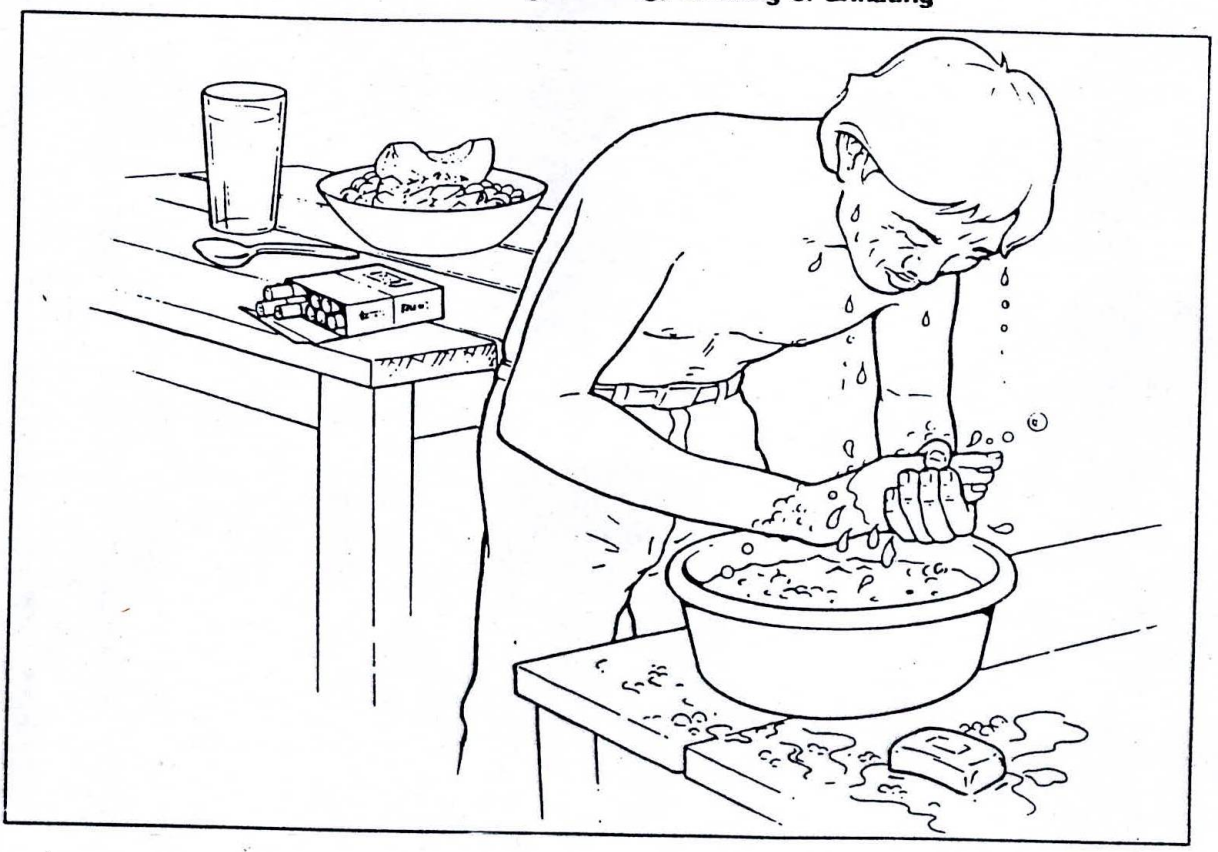
Figure HP.13: Always wash thoroughly after spraying



When working with pesticides, a user may wish to stop for a break to smoke, drink eat or urinate. If smoking eating or drinking is carried out with contaminated hands there is the possibility that pesticide will be transferred to the mouth and swallowed. Urinating with contaminated hands can cause contamination of the skin in the groin area, where uptake is most rapid (see section OH.1.1.3 and Fig. OH.4). It is therefore very important to wash before eating, drinking smoking or urinating.

Pesticide users must be encouraged to practice regular washing as part of their normal routine of work. Keeping clean water and soap available at all times during mixing and spraying is good practice which must always be stressed.

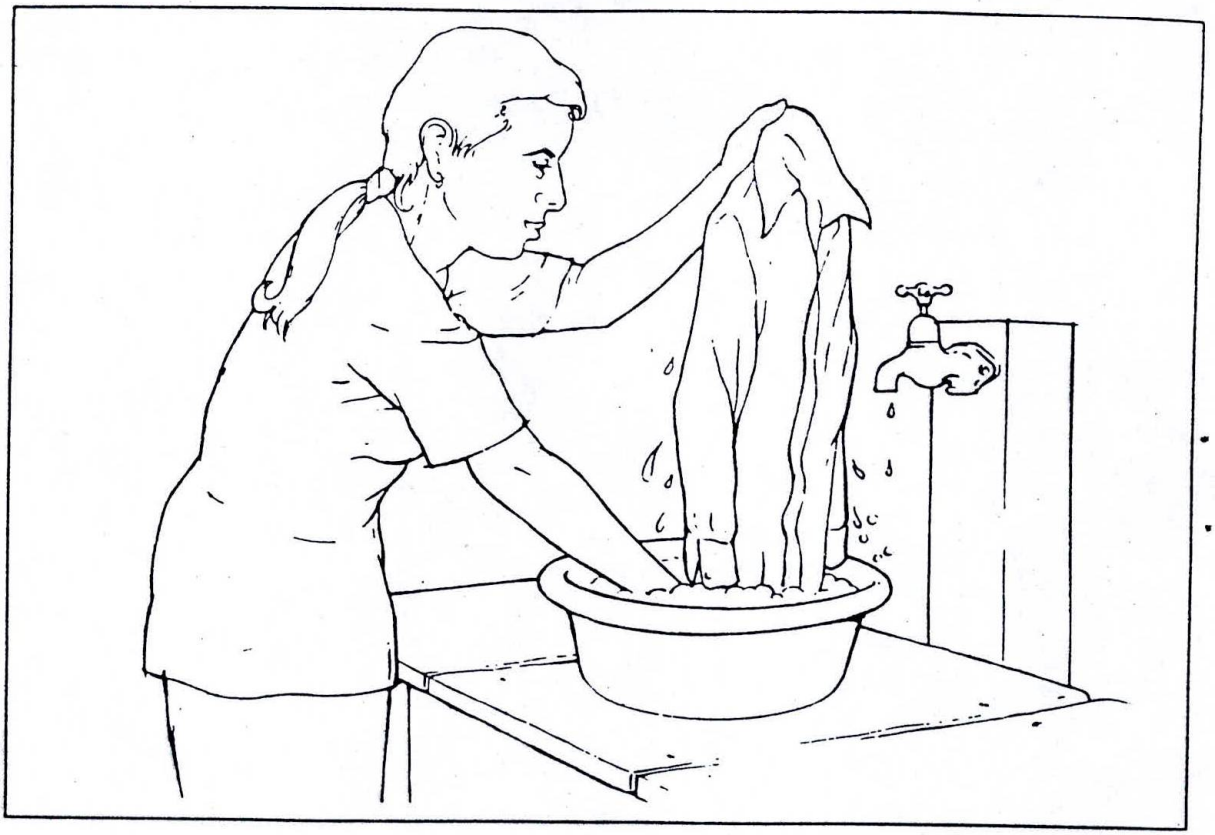
Figure HP.14: Always wash before eating, drinking, smoking or urinating



Contaminated clothing must also be changed at the end of the spray operation, or immediately if it gets severely contaminated, such as when a sprayer springs a leak, or if it becomes significantly contaminated with concentrated pesticide, for example by spilling product when mixing.

Work clothing should always be washed after use or when contaminated. Ensure all work clothing is washed separately from the normal household washing, to prevent cross contamination of other clothes (see Figure HP.15).

Figure HP.15: Always wash work clothing separately from household washing



KEY MESSAGES - PERSONAL HYGIENE

- *Always wash thoroughly after spraying or handling pesticides*
- *Always wash before eating, drinking, smoking or urinating*
- *Always wash immediately if the skin becomes contaminated*
- *Change and wash work clothing after spraying*
- *Change and wash work clothing if it becomes badly contaminated, or contaminated with concentrate during mixing or spraying*

HP. 2.1.5 PROTECTIVE CLOTHING

Protective clothing, also known as *personal protective equipment* or *PPE*, is intended to reduce the likelihood of skin contamination leading to poisoning or to prevent inhalation of pesticide. It is however, very impractical to use PPE which will completely prevent any contamination, since a totally waterproof suit would be very hot and uncomfortable to wear. In a tropical climate, wearing too much PPE could be dangerous, as it may lead to heat stroke, or because it is uncomfortable to wear for long periods, may lead to users cutting corners or becoming careless in an attempt to finish the job quickly. Wearing PPE can also lead to a false sense of security. For example, a user wearing rubber gloves for a long period will sweat inside them; if those gloves become contaminated on the inside due to carelessness, wearing for a long time or from small holes in the gloves, the uptake from the pesticide inside the glove can be very rapid, because of the sweat and the fact that the pesticide is held against the skin of the hand, yet the wearer believes he is well protected and neglect other protection measures such as personal hygiene.

Recommendations for protective equipment are therefore a compromise between items that are easy and relatively comfortable to wear in hot climates, and which offer a reasonable degree of protection. Cotton has been shown to give acceptable protection for spraying, provided good practices are also used, and has the advantage that it is relatively comfortable in hot climates. Because PPE is not totally protective, it is never a substitute for other good practices, such as avoiding contamination, sprayer maintenance and good personal hygiene. PPE should always be considered as the last line of defence.

It is also important to recognise that handling concentrated chemical requires more protection than when spraying dilute product, and recommendations will always reflect this.

Different pesticides require different protective clothing. The recommendations are always given on the product label, and these should also be supported by the use of pictograms (see section HP.2.1.1)

The minimum requirement for any pesticide operation is a long sleeved shirt such as a cotton shirt, long trousers and enclosed shoes, or preferably rubber boots (leather shoes or boots can soak up pesticide. This amount of protection is all that is required for spraying many dilute pesticides. More toxic pesticides will require more protection - check the pesticide label to see what is recommended for that product. If no specific advice is given about protective clothing for spraying on the label, then the minimum protection of long sleeved shirt, long trousers and rubber boots is assumed (see Fig. HP.16).

When spraying upwards, such as into bushes or trees, it is advisable to wear a broad brimmed hat to protect the head and upper face (see Fig. HP.17).

Figure HP.16: Minimum recommended protection for spraying dilute pesticide

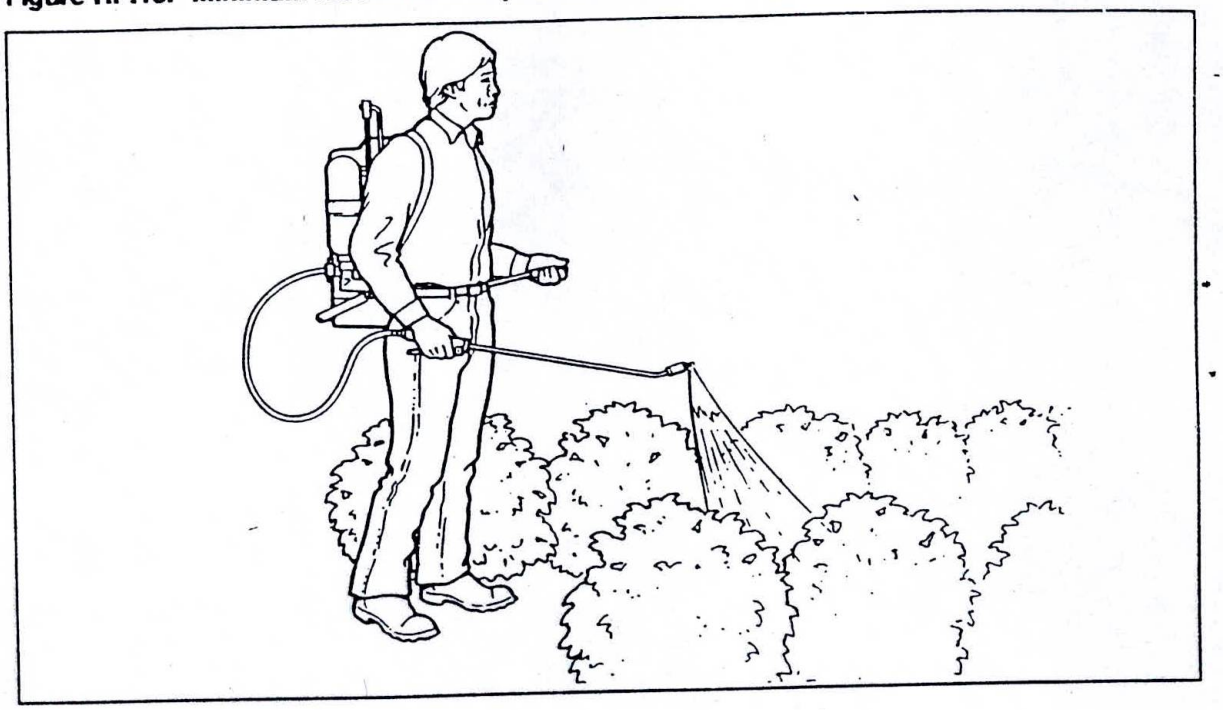
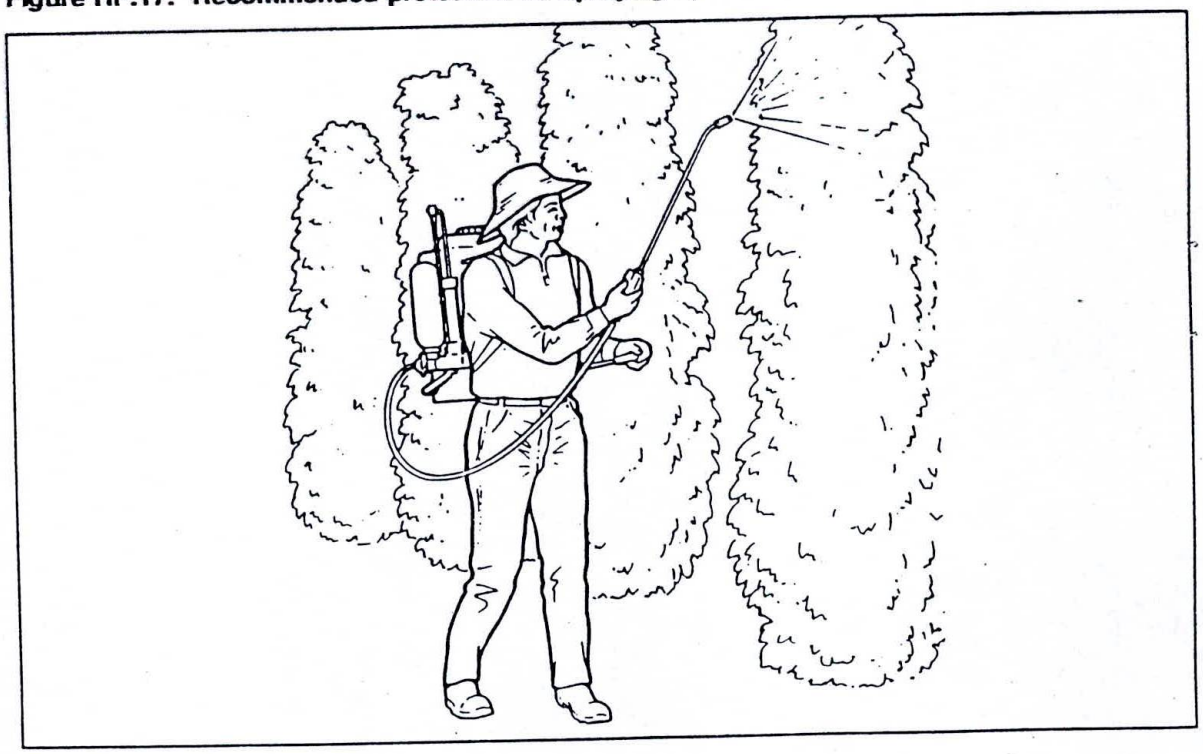


Figure HP.17: Recommended protection for spraying upwards



Handling concentrate, when mixing and measuring, requires more protection. The minimum for handling liquid concentrate would be long sleeved shirt, long trousers, rubber boots, gloves preferably made from nitrile rubber, which is more resistant to most chemicals than natural rubber, and eye protection such as a face shield or goggles (see Figure HP.18). A faceshield is usually preferable to goggles, since it protects the whole face, not just the eyes, and is cooler to wear in hot climates. When measuring and mixing powders, the addition of a dust mask is necessary to prevent any powder being inhaled (see Fig. HP.19). Some more toxic pesticides require more protection, such as an apron, and the label should always be consulted for the recommended protection for the product.

Figure HP.18: Minimum recommended protection for handling liquid concentrate

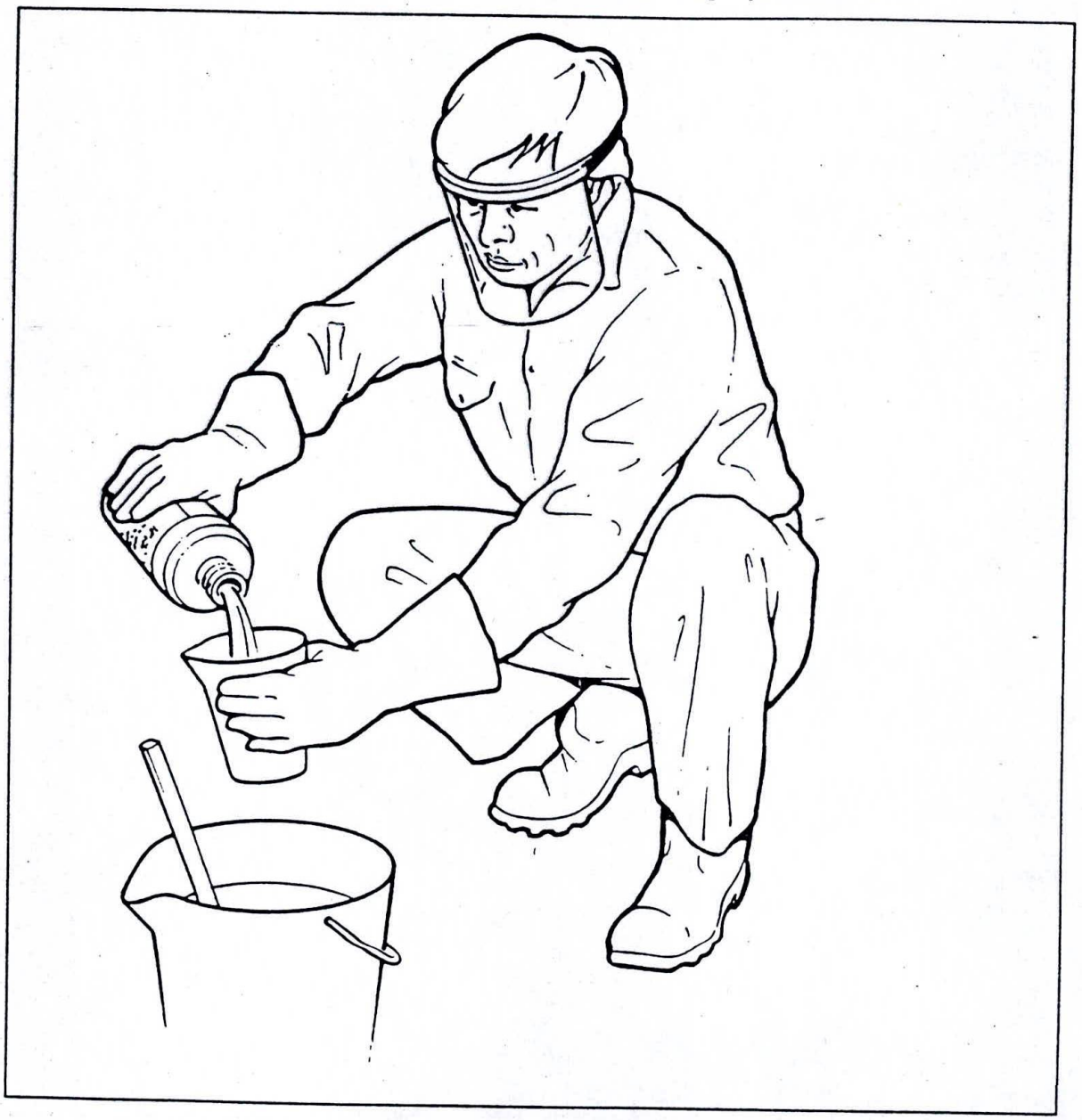
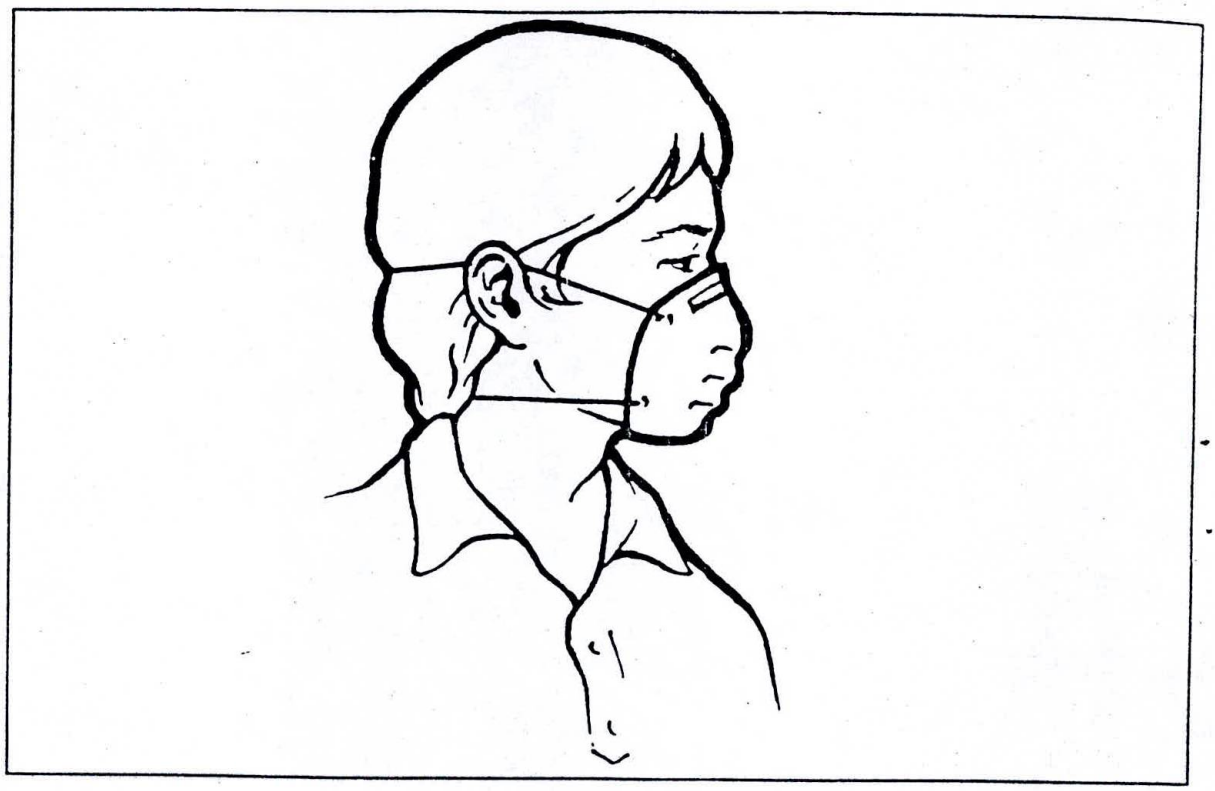


Figure HP.19: A dust mask to prevent inhalation of powders



Protective clothing is not always readily available, especially in rural areas. If it is unavailable, then other items could be used.

Eye protection

A pair of sunglasses could be used as eye protection when handling concentrate. Alternatively a simple face shield to protect the eyes can be made from a plastic soft drinks bottle (2 litre size), as shown in Fig. HP.20.

Hand protection

Plastic bags could be used to cover the hands instead of gloves, but because chemicals will pass quite quickly through the plastic bag, they should only be used once and then destroyed, and it is always better to get proper rubber gloves if possible.

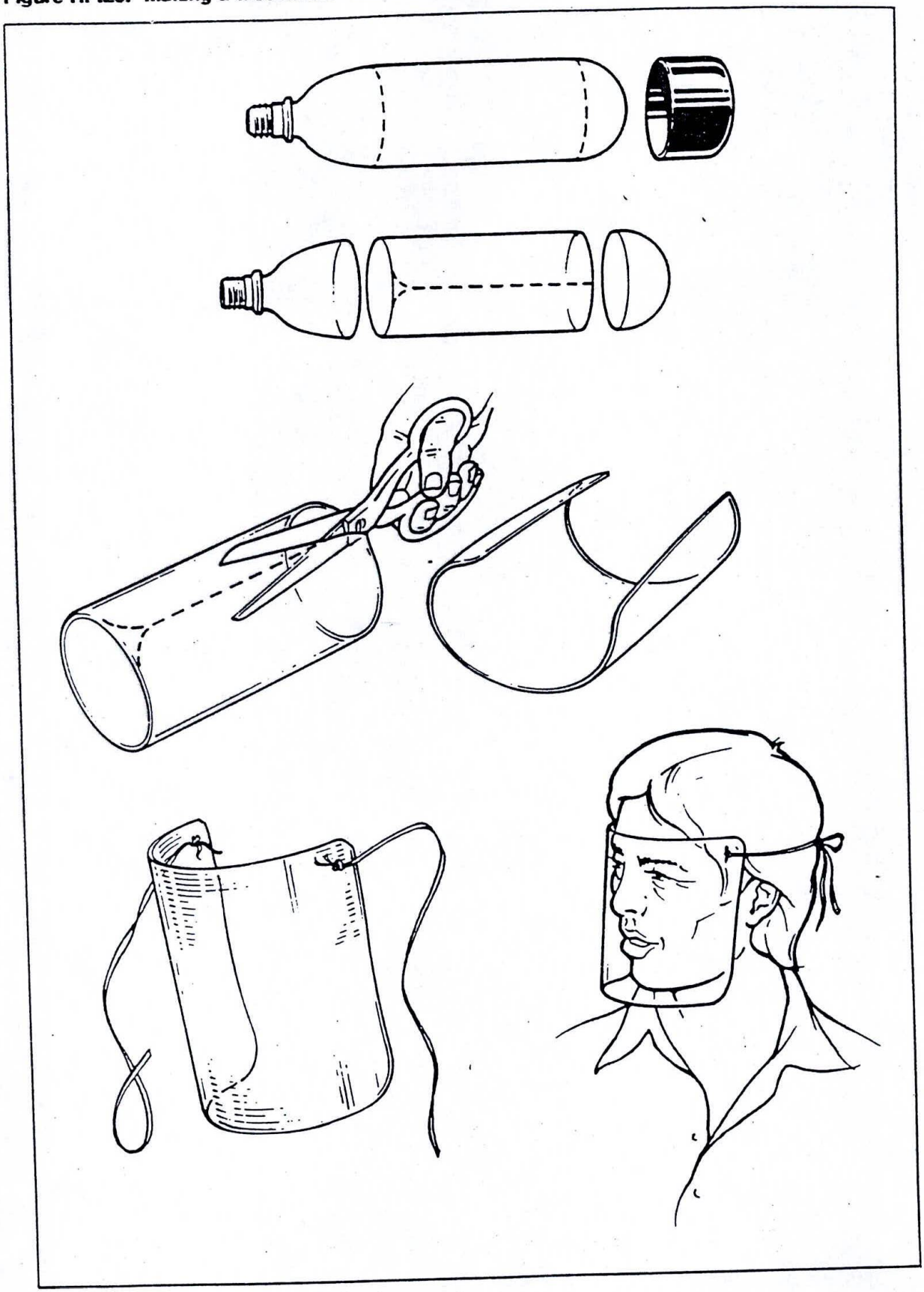
Respiratory protection

A cotton scarf or handkerchief could be used instead of a dust mask when mixing powders.

Body protection

An apron could be made from a large plastic sack such as a fertiliser bag, tied with string.

Figure HP.20: Making a face shield from a soft drinks bottle

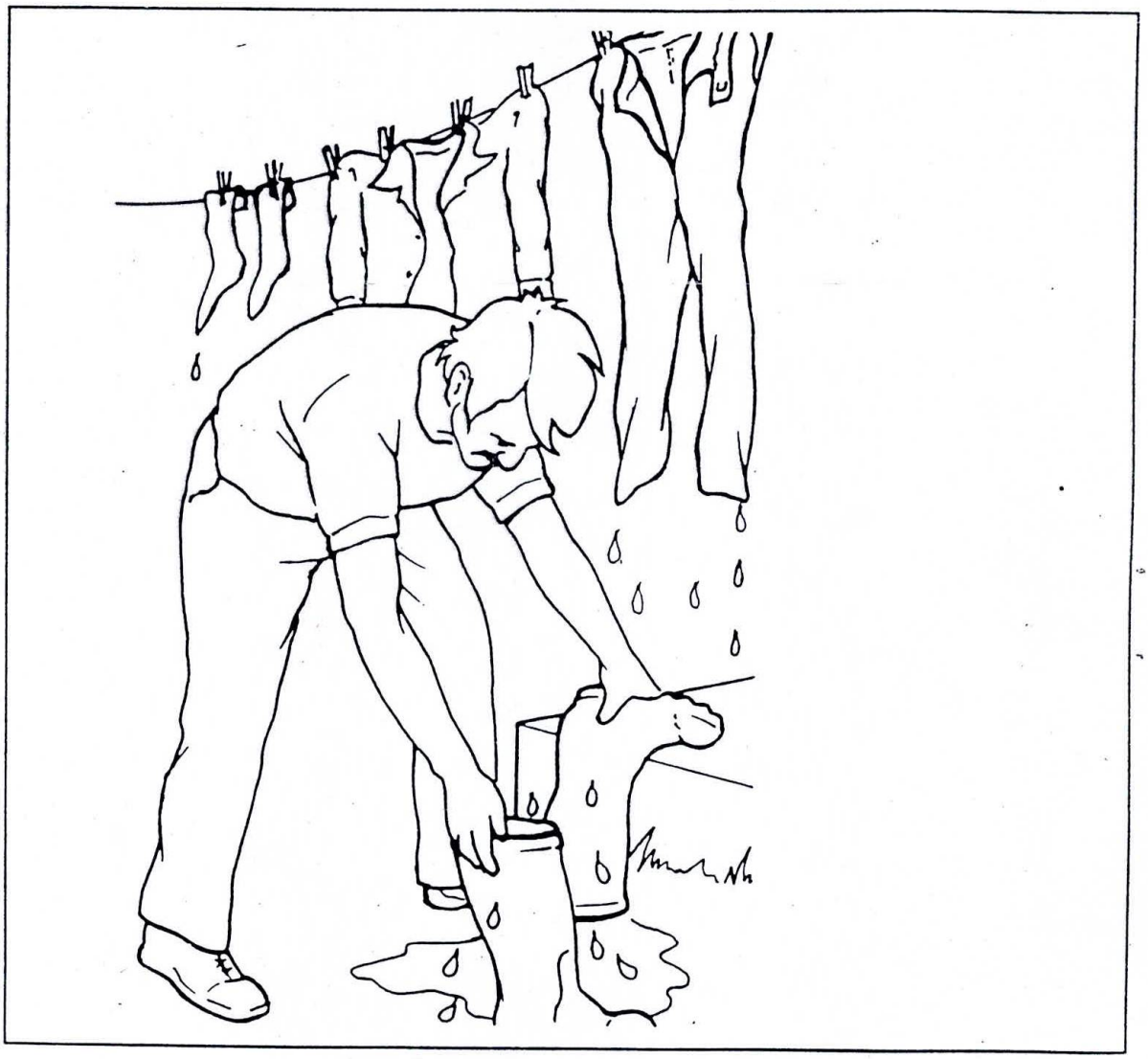


Foot protection

As an alternative to boots, large plastic bags could be worn over the shoes tied, around the ankles to keep them in place. They should only be used once, however and disposed of carefully after use.

It is important to clean and look after protective clothing. The long sleeved shirt and long trousers, should preferably be kept only for use with pesticides, and all clothing and protective equipment should be washed carefully after each use. Gloves and boots should be washed inside as well as outside (see Figure HP.21), in case there is any contamination on the inside. Repair any tears in clothing before re-use. If there are holes in rubber gloves, they should be thrown away and a new pair used. All work clothing should be washed separately from the household washing.

Figure HP.21: Clean boots and gloves both inside and out



KEY MESSAGES - PROTECTIVE CLOTHING

- *Protective clothing is never a substitute for other good practices - it is the last line of defence*
- *Handling concentrate requires more protection than spraying dilute product*
- *The minimum protection is always a long sleeved shirt, long trousers and rubber boots. Gloves and eye protection will also be needed when handling concentrated chemical*
- *Always read the label to see what is recommended for that product when mixing and when spraying*

HP.1.2 BUYING, TRANSPORTING, STORING AND DISPOSING OF PESTICIDES

The hazards of pesticides are not only associated with their use. Careless handling of pesticides at other times can not only cause harm to the user, but also endanger anyone else who comes across them, especially those who may not understand the dangers, such as children. There are various precautions which should be followed when buying pesticides from the dealer, when transporting and storing pesticides and when disposing of waste pesticide and empty containers. Each of these situations will be considered separately.

HP.1.2.1 BUYING PESTICIDES FROM THE DEALER

When buying pesticides, the buyer should be encouraged to question the dealer about the products he needs. Dealing with a particular pest, disease or weed problem requires that the product is effective for that problem. However it may be possible to buy a product which is just as effective but is less hazardous. The dealer should be able to recommend products which are equally effective for a particular problem, and the relative hazards of each can be checked by looking to see whether one is in a lower hazard category, by examining colour bands on the label. Looking at the recommended protective clothing on the label is also helpful, since it is better to select a product which does not require a large amount of protective clothing to ensure its safe use. The buyer should also read the label carefully to make sure that the product is suitable for his needs in terms of recommended crops etc.

When buying pesticide packs, the buyer should also examine the condition of the pack carefully. Leaking packs are a serious hazard to anyone transporting, storing or handling the pack, and could cause major problems, for example by contaminating other things such as food. The buyer must always refuse to accept packs that are visibly leaking or are damaged such that they may leak in the future. The buyer should also ensure that the pack label is firmly attached and in good condition so that it is easily legible.

Figure HP.22: Always read the label before buying pesticide

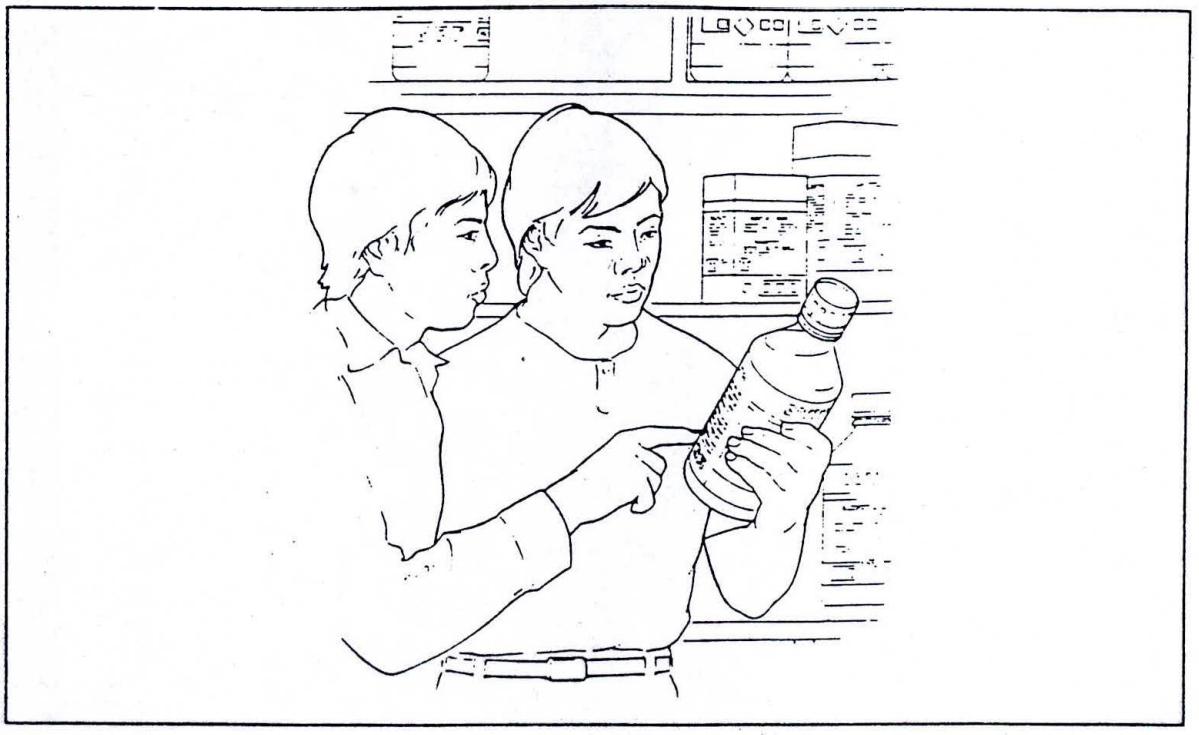


Figure HP.23: Never accept leaking or damaged packs

A pesticide pack is carefully designed to be strong and reduce hazards associated with its use (easy to pour, easy to clean etc.). It also has the product label which helps the user to handle it safely. Pesticides should never be decanted into other containers, because of the risks associated with this (for example the danger of someone mistaking the contents of an unlabelled bottle of pesticide for a drink). The dealer must never be asked to decant or transfer his stock to another container because a smaller quantity than the pack for sale is required.

Figure HP.24: Never ask a dealer to decant or transfer pesticide into another container

KEY MESSAGES - BUYING PESTICIDES

- *Always read the label before buying pesticides from the dealer*
- *Never accept damaged or leaking packs from the dealer*
- *Never ask the dealer to decant or transfer pesticide into another container*

HP.1.2.2 TRANSPORTING PESTICIDE

Transporting pesticide needs careful consideration, because of the potential for serious harm if accidents occur. It is difficult to give detailed recommendations for all cases, because of the range of different transport methods used, from carrying while walking to carrying in a truck.

The main dangers during transport are that:

- Someone unfamiliar with the hazard, especially a child, might come across the pesticide and harm themselves through ignorance

- The pesticide pack might become damaged during transport and leak, causing contamination of surfaces later touched by people or contamination of food being transported at the same time

This means that consideration must be given to the security of the transport system, to ensure pesticides are never left unattended, and to ways of segregating the transported pesticide from passengers and food items. Ideally pesticides and food must never be transported at the same time, however constraints on transport often mean that this is unavoidable, and so some means must be found to keep the pesticide and food apart to prevent any possibility of contamination.

Figure HP.25: Never leave pesticides unattended during transport

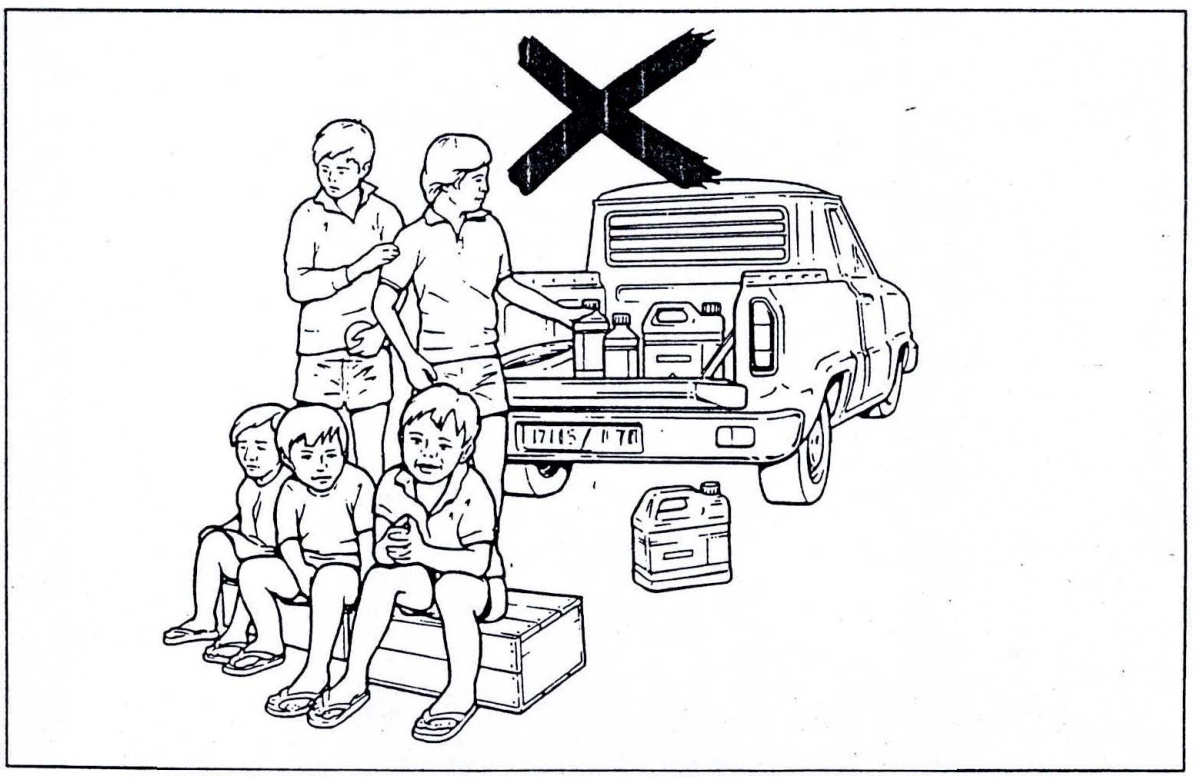
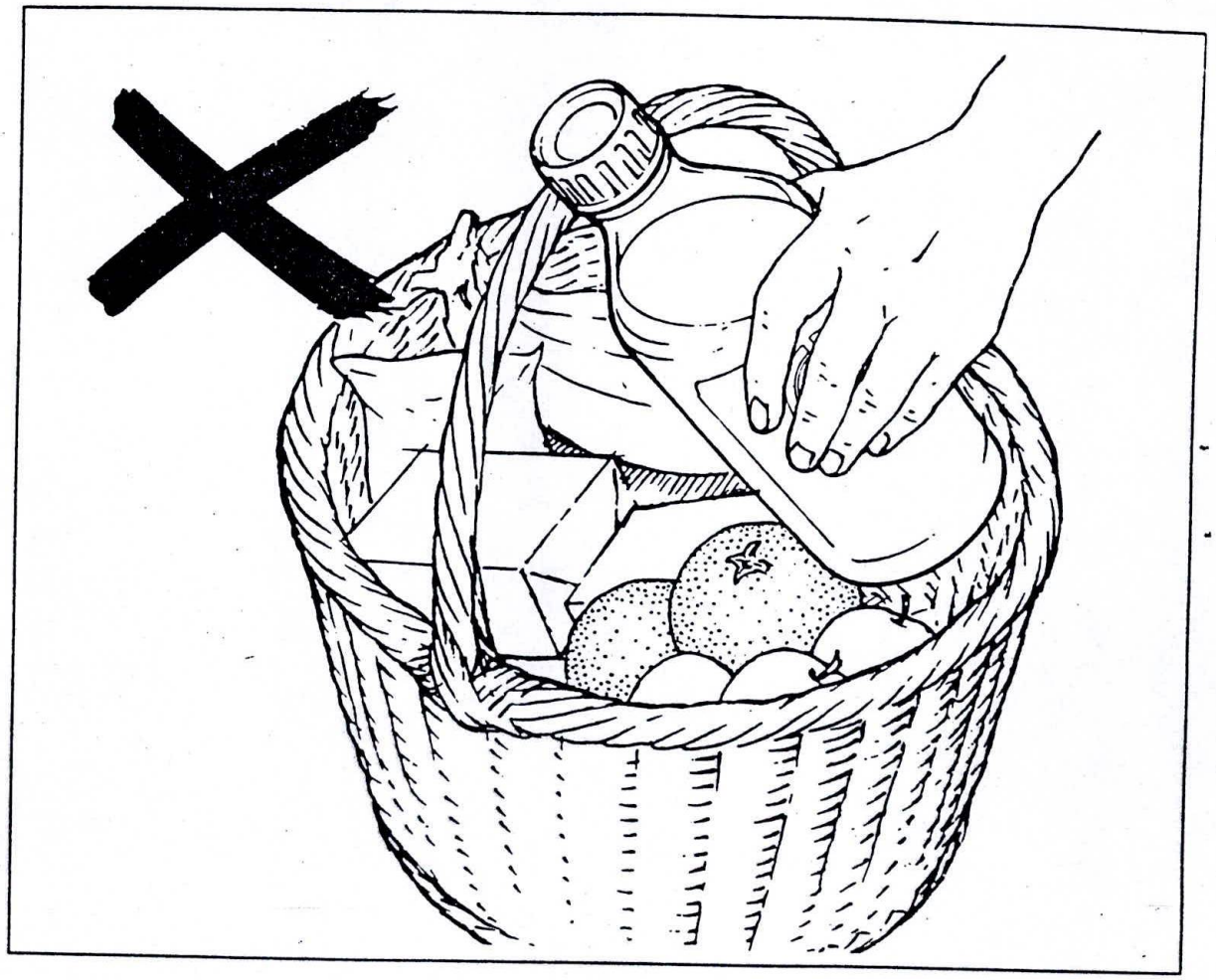


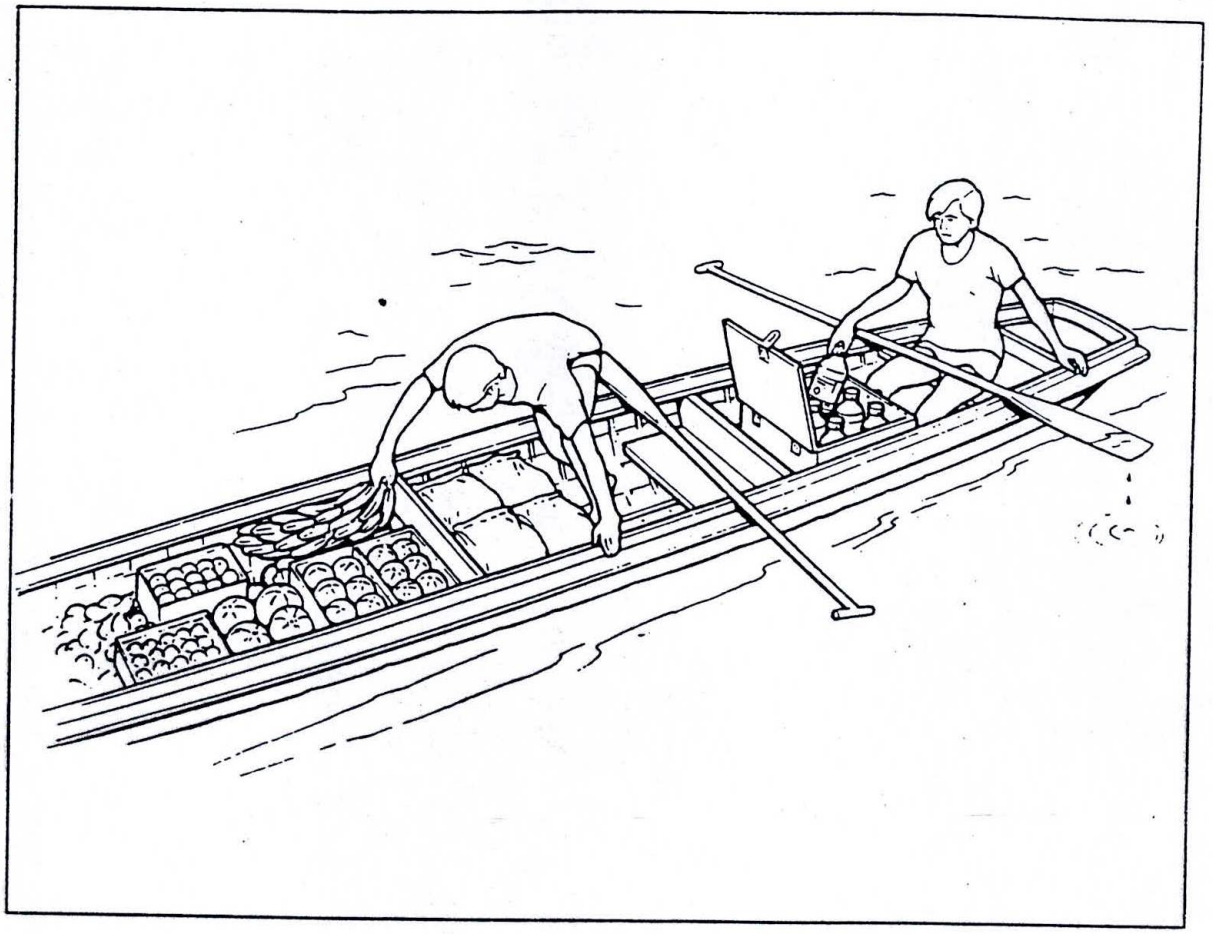
Figure HP.26: Never carry pesticides together with food



The easiest way to achieve both these things is to transport pesticides in a lockable box. This can be easily constructed to the size necessary to hold the quantity of pesticide usually purchased. this could be strapped to the back of a bicycle or motorbike if this is the normal transport method used, or carried in the back of a car, truck or boat. The box enables security through locking, but also helps to protect the pesticide pack from damage during transport and will help to confine the effects of a spill if leakage should occur.

Where it is unavoidable that food is carried at the same time as pesticide, the box will help to segregate them, but it is also important to make sure they are kept as far away from each other as possible (see Figure HP.27)

Figure HP.27: Ensuring segregation of pesticides during transport



KEY MESSAGES - TRANSPORTING PESTICIDES

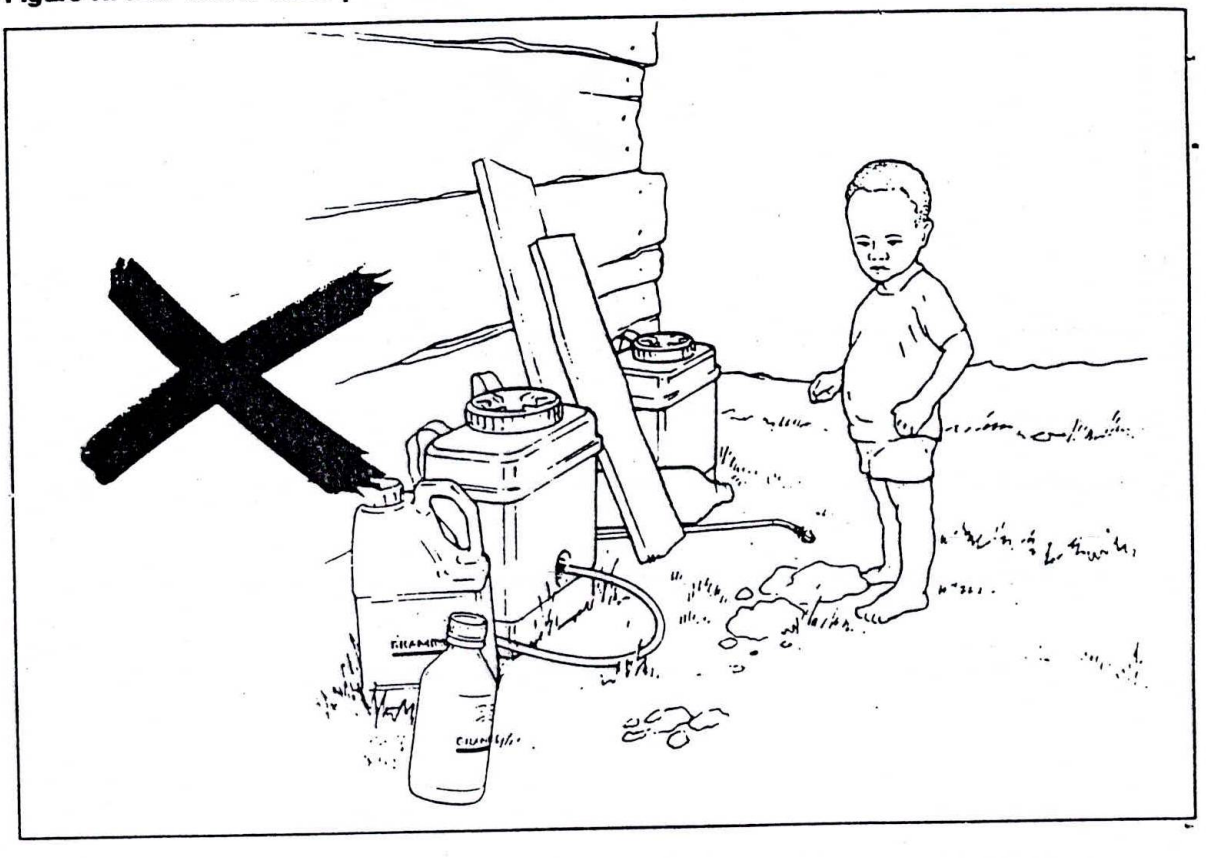
- *Never leave pesticides unattended during transport*
- *Segregate pesticides from passengers and other items, especially food*
- *A lockable box will help to transport pesticides securely and safely*

HP.1.2.3 STORING PESTICIDE

Safe storage of pesticide is very important, because the consequences of careless storage can be very serious and may affect people other than the user, especially children.

Pesticides should NEVER be left unattended, even for a short time. This means that pesticides must be securely stored away after mixing, before the farmer starts to carry out his spraying.

Figure HP.28: Never leave pesticides unattended

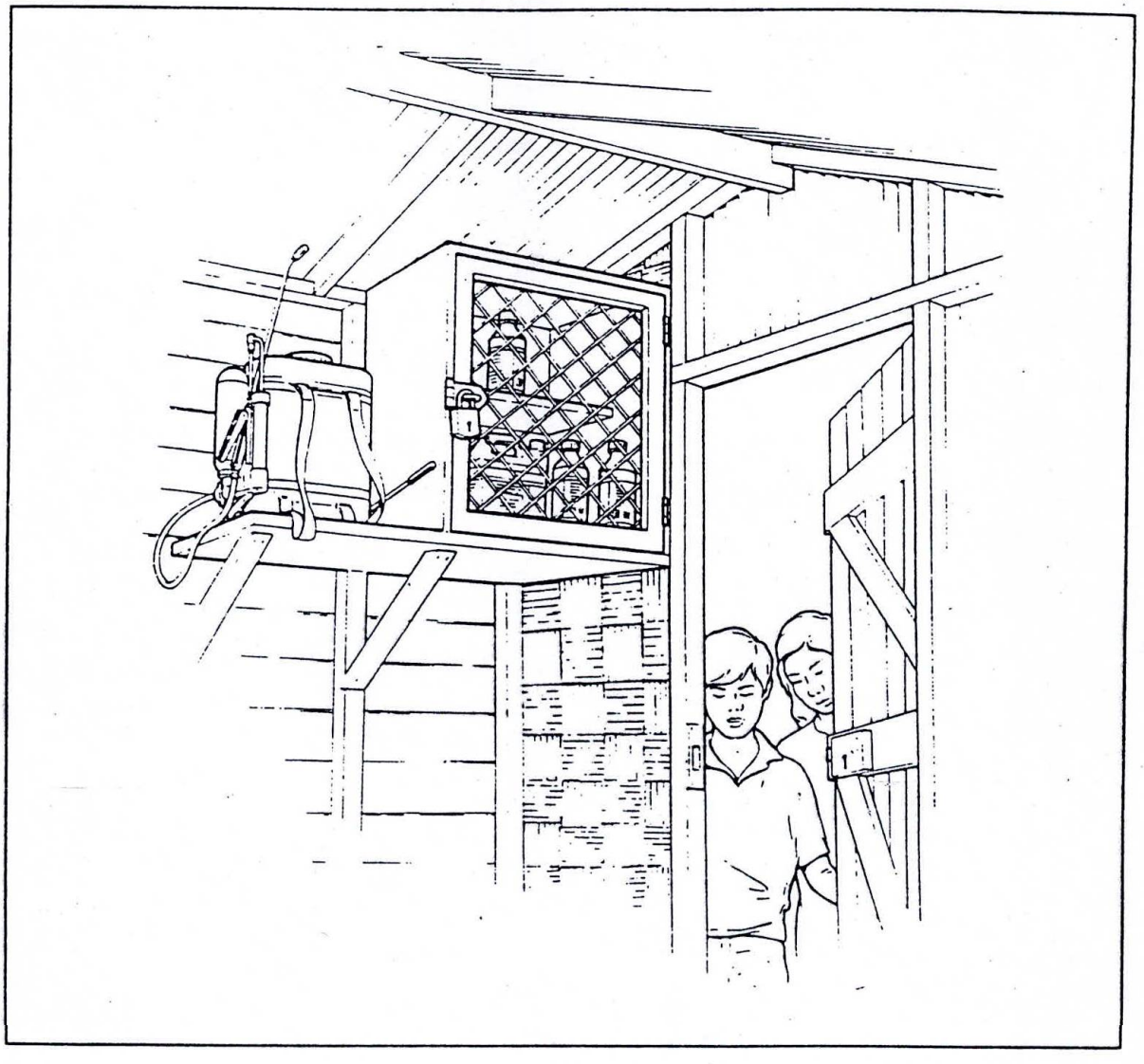


The general guidelines for building a pesticide store are that it should be:

- away from the home
- secure, preferably lockable
- out of the reach of children and animals

A farm shed is ideal for the purpose, provided it can be made secure. Remember that there are other potentially hazardous items, such as sprayers, buckets, jugs etc. used for mixing pesticide, protective equipment (gloves etc.) which should also be stored securely away from children and animals.

Figure HP.29: A well designed farm pesticide store



The rules for managing pesticides in store are that:

- Pesticides must always be kept in their original containers. They should never be decanted or transferred into other containers. This is because pesticide containers are strong, designed for the purpose of holding pesticides and have a complete label which relates to that product (see Figure HP.30)

- Do not buy large quantities of pesticide and store it for long periods. It is not only hazardous to keep large quantities, but the product may expire and this then presents a major disposal problem, as it is very difficult to dispose of concentrated chemicals safely.

HP.1.2.4 DISPOSING OF PESTICIDE WASTE

Pesticide waste arises in several ways. The most common form of waste is empty pesticide containers. Other possible types of waste include contaminated water (e.g. sprayer washings), excess spray mix, expired product, torn or damaged protective clothing or other equipment, leaking packs or absorbent material used to clean up a spill.

Disposing of waste is never easy. It is always better to avoid having waste or to minimise the quantity produced or reduce the hazard associated with it. This can be done in several ways depending on the type of waste involved.

HP.1.2.4.1 Avoiding, Minimising or Reducing Hazard Associated with Waste

To avoid or reduce waste pesticide, or pesticide contaminated water (e.g. sprayer washings) or minimise hazard associated with disposal

- Only buy enough pesticide for short term needs, to avoid products going out of date, resulting in the need to dispose of concentrate
- Consider the area to be sprayed and only mix up just enough to do the job, to avoid having to dispose of excess spray mix
- When mixing pesticide, if the container is emptied, rinse it at least three times at the time of mixing and add the rinse water to the sprayer as part of the spray mix
- Before disposing of liquid pesticide waste, dilute it further with water to reduce the hazard

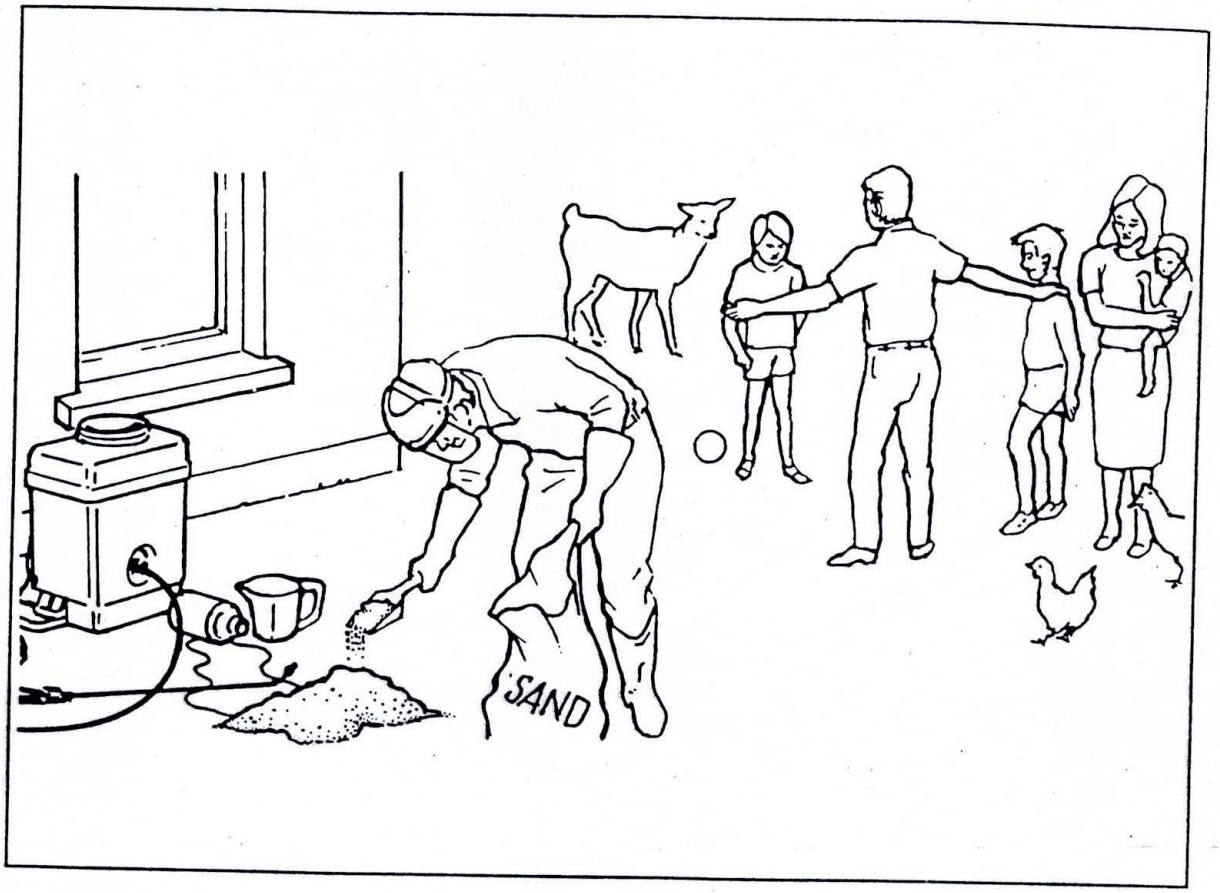
To reduce the hazard associated with empty pesticide containers

- Always triple rinse empty containers before disposal. This should be done during mixing. This substantially reduces the hazard associated with empty containers.

To avoid leaking packs and contaminated absorbent material

- Never accept leaking or damaged packs from the retailer
- Transport and handle packs carefully to avoid damage

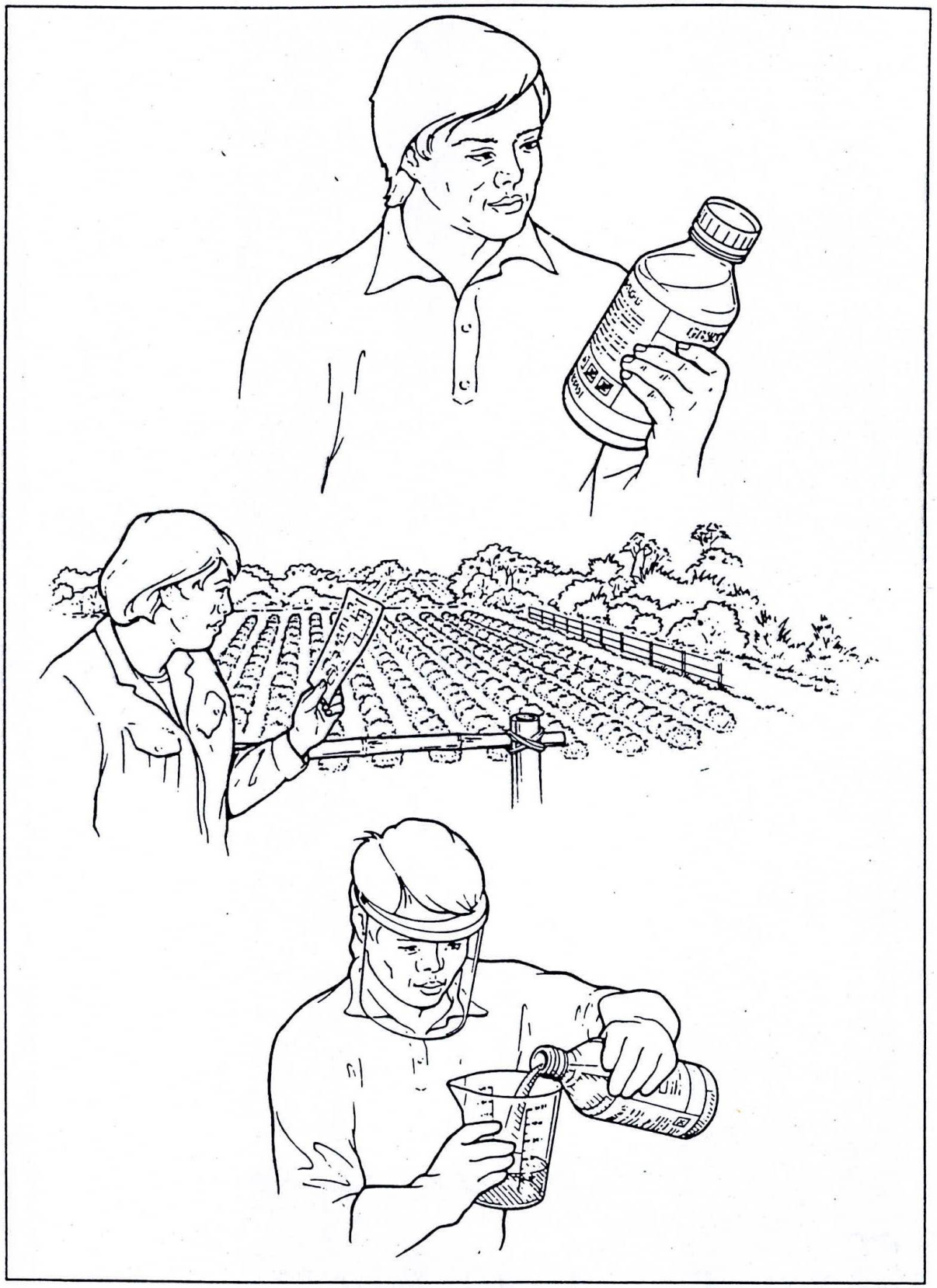
Figure HP.31: Cleaning up a pesticide spill



KEY MESSAGES - PESTICIDE STORAGE

- *Never leave pesticides unattended at any time*
- *Always keep pesticides and other hazardous items locked up, out of the reach of children and animals*
- *Always keep pesticides in their original containers*
- *Only buy and store enough pesticide for immediate or short term needs*

Figure HP.32: Consider the area to be sprayed and only mix up just enough for the job to avoid waste



Where waste is unavoidable there are various recommendations for disposal, relating to the type of waste involved. Waste disposal might be covered by local legislation, and it is important to comply with this where relevant.

HP.1.2.4.2 Recommendations for Disposal of Liquid Waste

PESTICIDE CONCENTRATE (e.g. expired product, pesticide in a leaking container)
Disposing of concentrated product is never easy, because of the hazard it presents. All efforts should be made to avoid the need for disposing of concentrate (see previous section). If it is unavoidable, waste concentrated product should be disposed of by:

- Using the product by spraying it in the normal way onto a recommended crop
- Returning it to the dealer if he will accept it
- Arranging for collection and disposal by professional waste contractors

SURPLUS PESTICIDE SPRAY MIX
Dilute the spray mix with further water, and overspray onto the crop, provided that by doing so the maximum permitted dosage is not exceeded. Higher than recommended dosages can lead to residue problems on food crops.

If it is not possible to spray an appropriate crop, the diluted spray mix should be sprayed onto a piece of waste ground, well away from buildings, water bodies such as streams, rivers, ponds or lakes, animals and areas where children are likely to play.

If it is not possible to spray safely onto a crop or onto a piece of waste ground, then dig a hole and tip the diluted spray mix into it. As before, ensure the site selected for the hole is well away from buildings and water bodies

Figure HP.33: Disposing of diluted excess spray mix by spraying onto waste ground

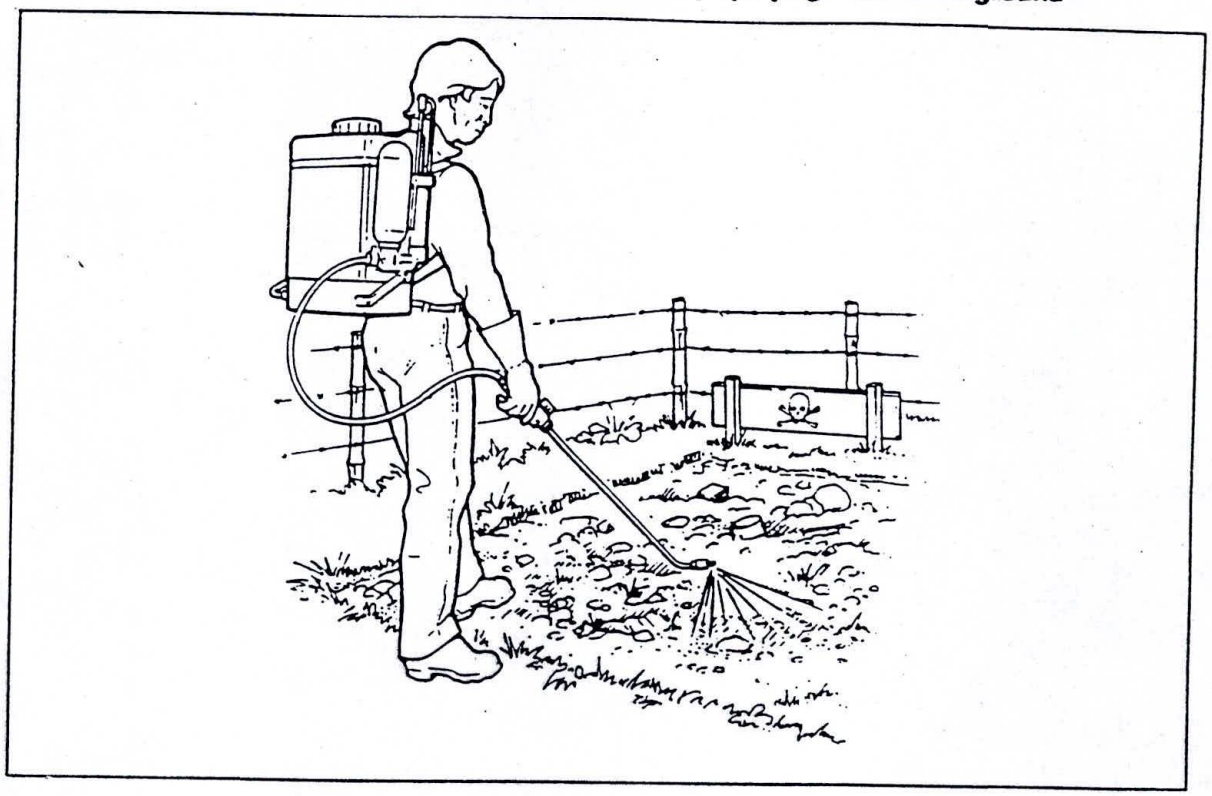
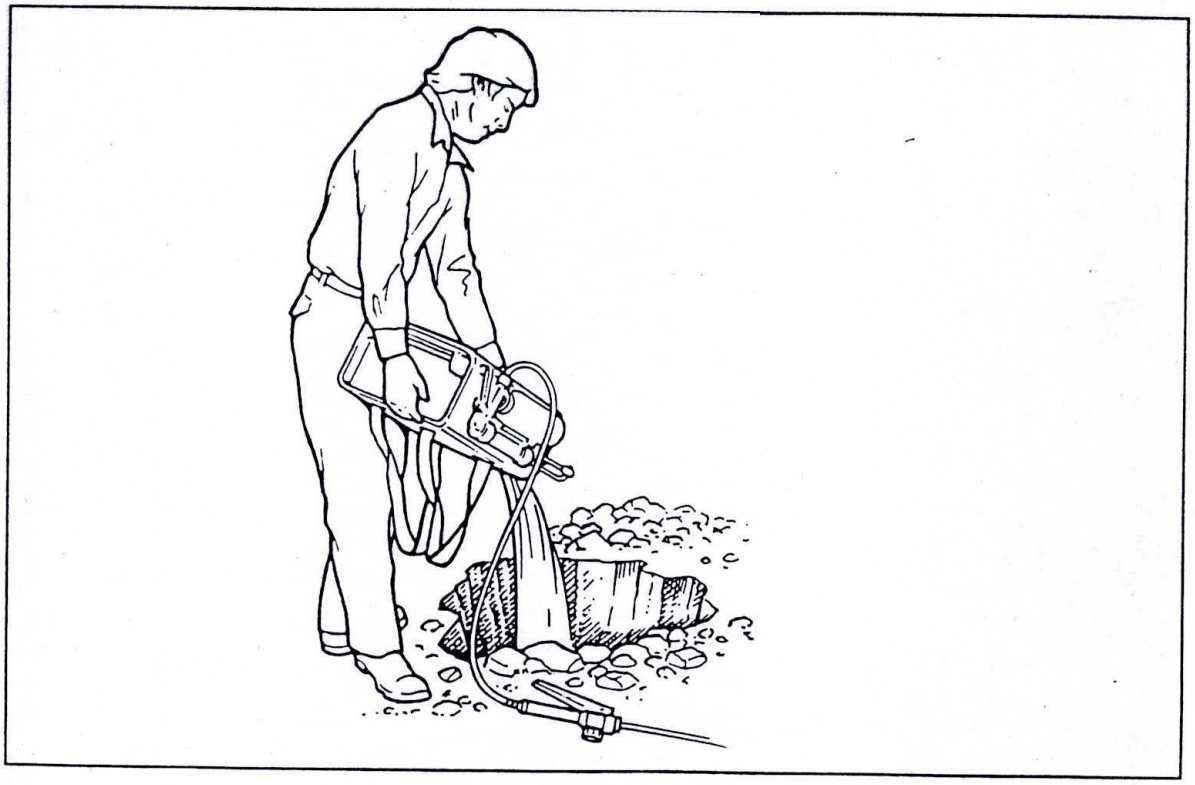


Figure HP.34: Disposing of waste spray mix into a hole

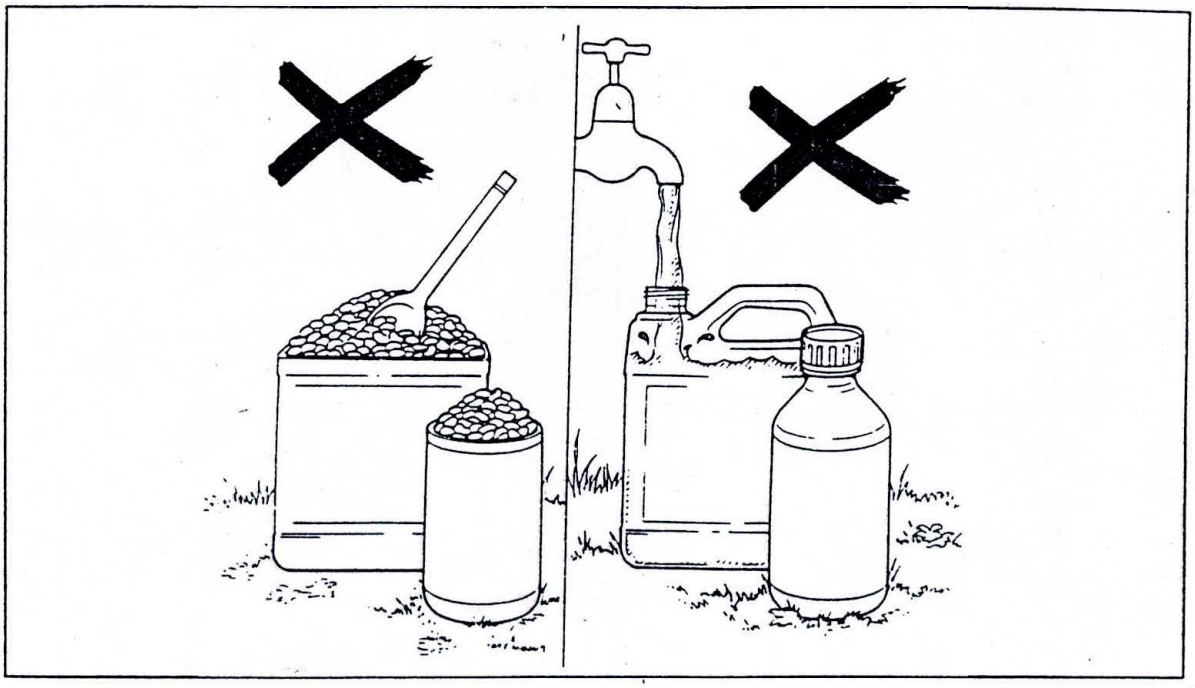


79

HP.1.2.4.3. Disposal of empty containers and other solid waste

Empty containers should NEVER be re-used, because it is possible that harmful residues remain in them, even after rinsing well. Their re-use for storing food or water must always be actively discouraged because of the possible harm that could arise.

Figure HP.35: NEVER re-use empty pesticide containers as they may contain harmful residues



It is important to reduce the hazard of empty pesticide containers before disposal. This should be done whenever a container is emptied during mixing, and is known as *triple rinsing* (see Figure HP.36). The procedure to follow for triple rinsing is:

1. Drain the remaining pesticide from the container for at least 30 seconds into the sprayer tank.

2. Add clean water to the empty container until it is approximately one quarter full.

3. Replace the container cap securely, then shake the container for about 30 seconds, making sure that all the inner surfaces of the container are well rinsed. Large containers may need to be rotated or rolled.

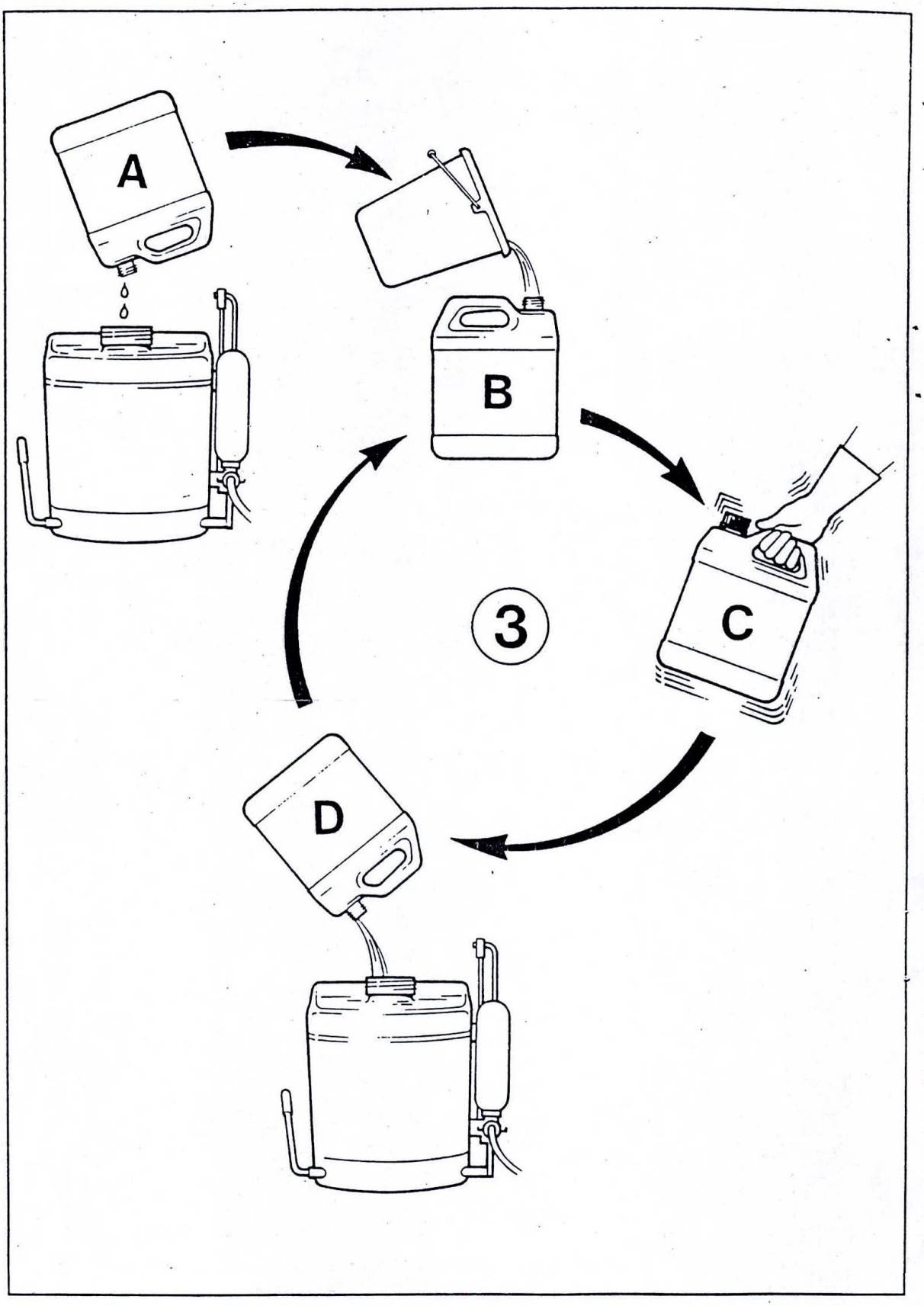
4. Remove the cap and empty the rinsings into the sprayer tank, so that it forms part of the spray mix. Allow it to drain for at least 30 seconds.

5. Repeat steps 2-4 twice more. If the rinse water is still coloured or milky after three rinses, then repeat the rinsing process until the rinse water is clear.

The decontaminated containers should be stored carefully until the spraying is over for the day. It is preferable to dispose of them as quickly as possible, i.e. the same day, to prevent large amounts of waste building up. However, if this is not possible, store the containers securely until they can be disposed of safely.

If there is a container collection or recycling scheme, this is the preferred disposal option, and every effort should be made to comply with the scheme. If there is no such scheme, empty containers, or other solid waste such as contaminated absorbent material from a spill, could be burnt or buried (if local legislation permits).

Figure HP.36: Containers should be triple rinsed at the time of mixing



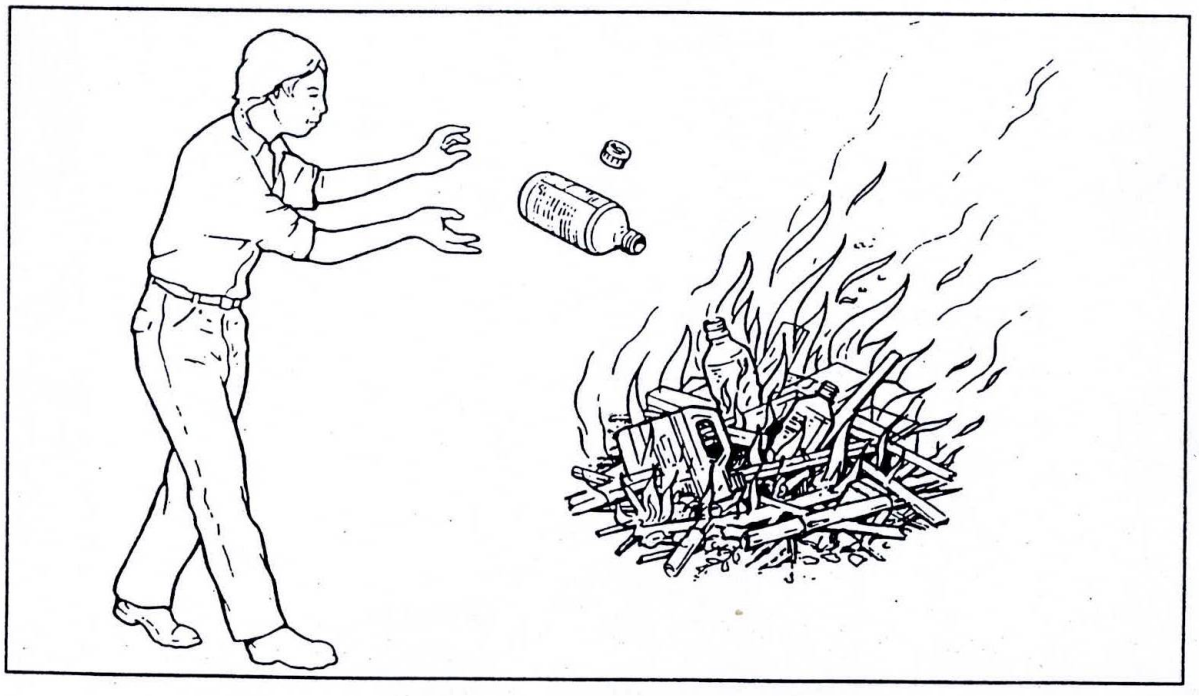
Burning waste

Waste which can be burnt includes triple rinsed plastic containers, paper or cardboard packs. Never try to burn aerosols, which can explode and cause injury, or containers which have held products classed as highly flammable.

Important guidelines to follow are:

- Site the fire well away from schools, hospitals and residential areas, and at least 20 metres downwind of other buildings, water bodies, animals, sports facilities etc.
- Make sure the fire is hot and burning well before any waste is added
- Avoid breathing the smoke from the fire, stand upwind, and keep other people away from the fire and the smoke
- Remove the caps from the containers and throw them onto the fire one at a time to make sure they burn completely at a high temperature
- Keep the fire under control, and supervise it continuously until all waste is completely destroyed
- When the ashes are cool, bury them.

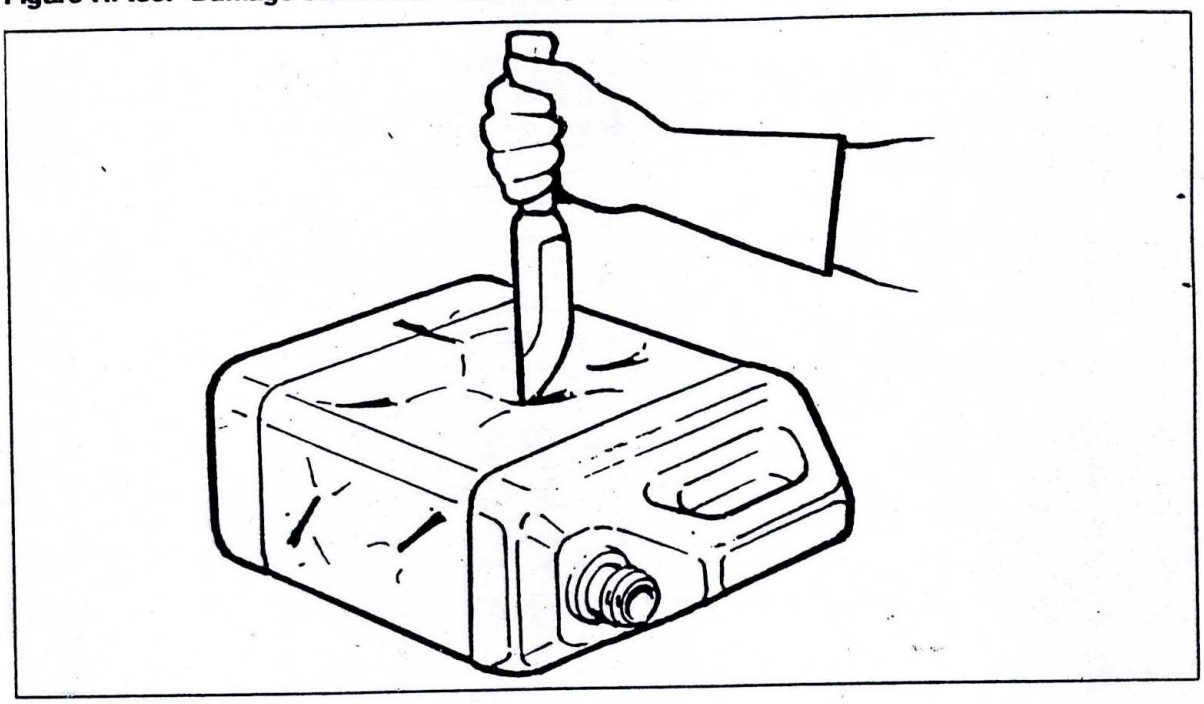
Figure HP.37: Disposal of waste by burning



Burying waste

Before disposal, remove the caps and damage the containers to prevent their re-use for example by cutting or puncturing plastic or by crushing metal or glass. Glass should be crushed inside a sack to prevent injury.

Figure HP.38: Damage containers before disposal to prevent re-use



It is important to choose a safe site for burying waste. The site chosen should be:

- On an isolated area of waste land at least 50 metres from water bodies (streams, rivers, ponds, lakes etc), buildings or animals.

- Preferably not on sandy soils, where contaminants can easily leach out of the pit to contaminate ground water. Avoid areas where the ground water table is within 2 metres of the bottom of the pit. if there is any doubt about the soil or water table, line the pit with an impervious material such as clay, butyl rubber or heavy duty plastic (polyethylene) sheeting.

The guidelines for digging and filling the pit are:

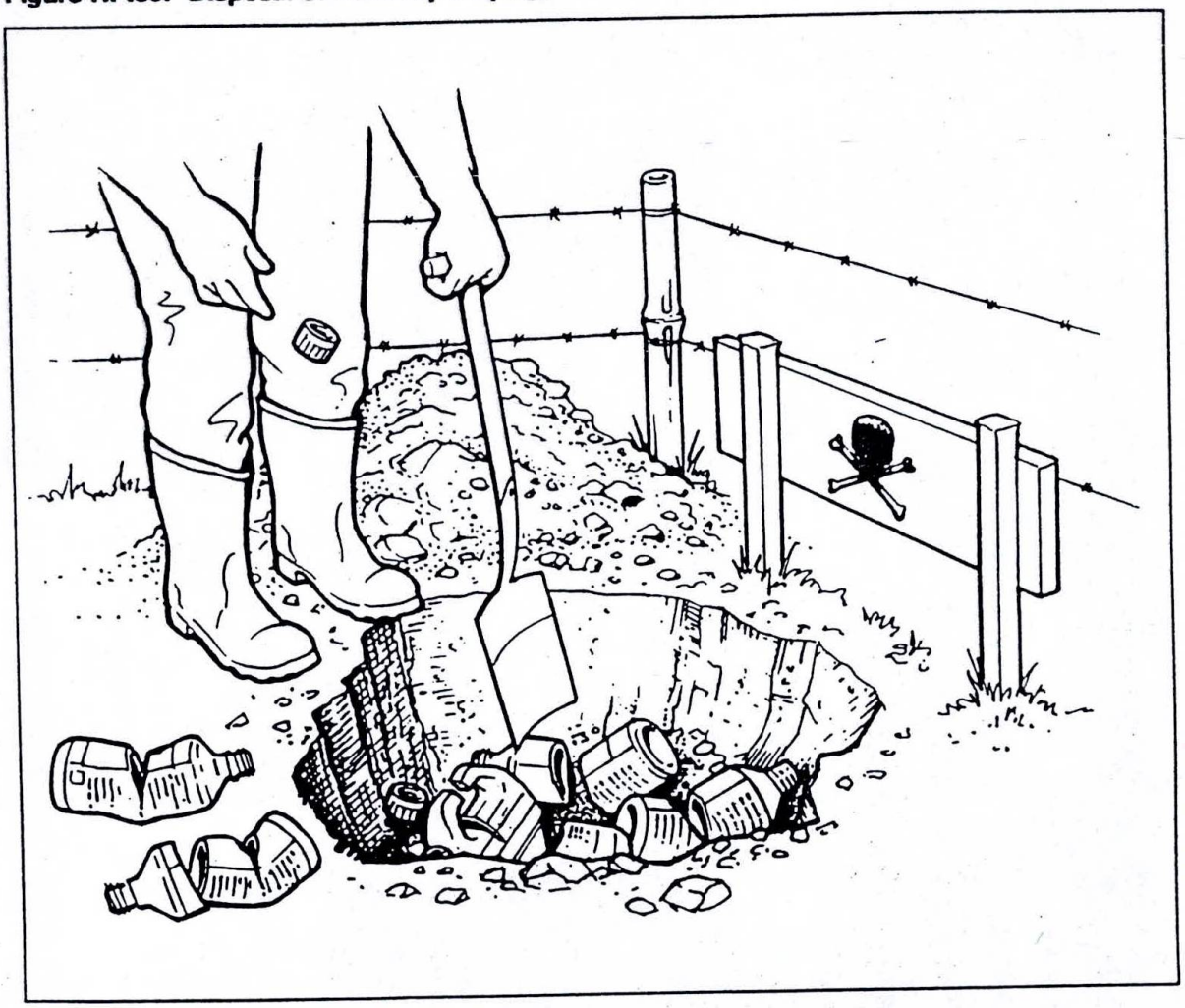
- Dig the pit deep enough that the top of the waste level is at least 1 metre below the normal soil surface.

- Fill the hole with 10-15 cm layers of contaminated waste alternated with layers of organic household or farm waste to help the breakdown process. Addition of lime, chalk or wood ash will also speed up the breakdown process.

- When the hole is filled to a point 1 metre below the normal soil surface, complete the filling of the hole with the original soil

- Keep a record of what is buried, as well as when and where it was done. Mark the burial site with a warning sign and prevent access by children and animals.

Figure HP.39: Disposal of waste by burying



KEY MESSAGES - WASTE DISPOSAL

- *Always try to avoid or reduce waste, or minimise its hazard before disposal*
- *Dispose of liquid waste carefully to avoid hazard to other people, animals or the environment*
- *Empty containers must never be re-used for other purposes*
- *Empty containers must always be triple rinsed to reduce hazard*
- *Empty containers should be disposed of carefully and safely, in accordance with recommended guidelines for their disposal*

IE.1 DEALING WITH ILL EFFECTS FROM PESTICIDE EXPOSURE

When using pesticides, the message that *PREVENTION IS BETTER THAN A CURE* cannot be emphasised enough. However there may be circumstances when someone is called upon to deal with a serious poisoning incident. This section is not intended to be a guide to treatment of poisoning, as that is a subject for medical doctors - it will look at emergency and first aid procedures to be carried out in the event of someone becoming ill from pesticide exposure.

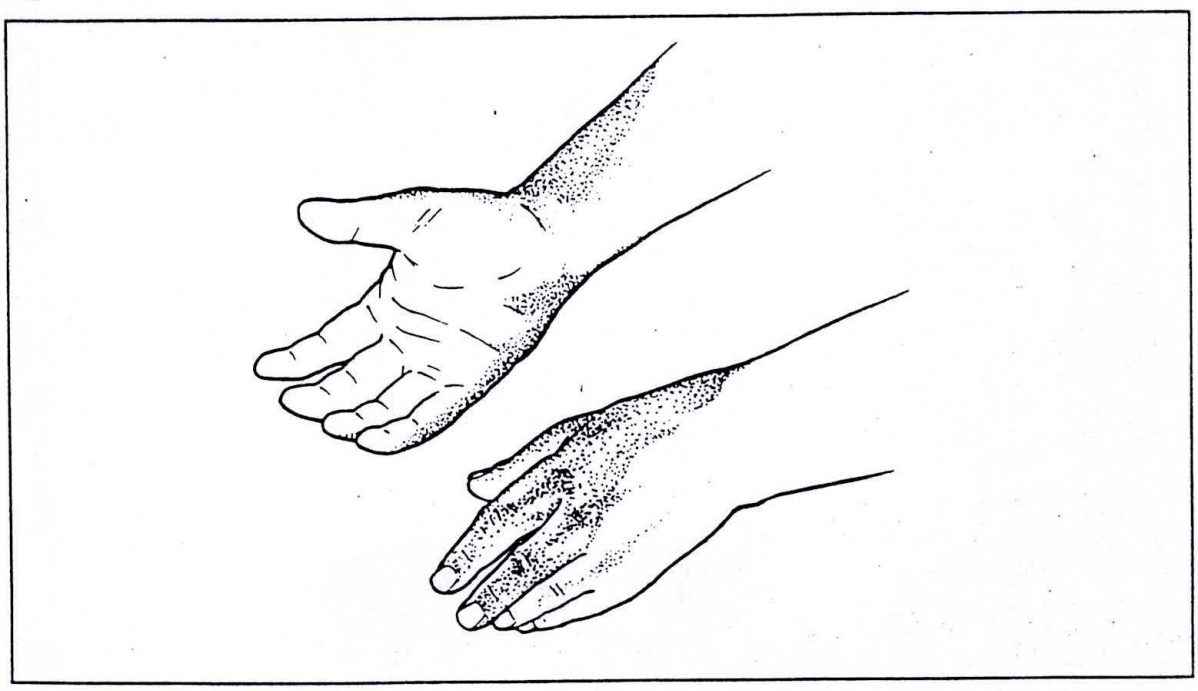
IE.1.1 HOW CHEMICALS AFFECT THE BODY

Different pesticides act in different ways on the body. This means that there are a whole range of different signs and symptoms which may be associated with over exposure or ultimately poisoning.

The range of effects associated with over exposure to pesticides depends on the severity and duration of exposure.

There may be only surface effects, such as skin irritation or rashes, which are often reversible, i.e. they disappear when the pesticide is no longer used. They do not necessarily indicate that the person has been poisoned, but can be a useful sign of over-exposure which indicate poor use practices such as insufficient attention to personal hygiene.

Figure IE.1: Surface effects such as skin irritation



Other surface effects may be more serious. For example eye damage can occur from contact with some pesticides, especially concentrated products, if not treated quickly.

Pesticides can enter the body through the skin, by swallowing and by inhalation (see section OH.1.1). The human body does have mechanisms to detoxify or get rid of unusual chemicals. The main organs responsible for this are the liver and the kidneys. This means that when a pesticide enters the body, the effect it might have on the body varies with the different pesticides, the amount taken in and the body's ability to detoxify or get rid of the pesticide through excretion in the urine.

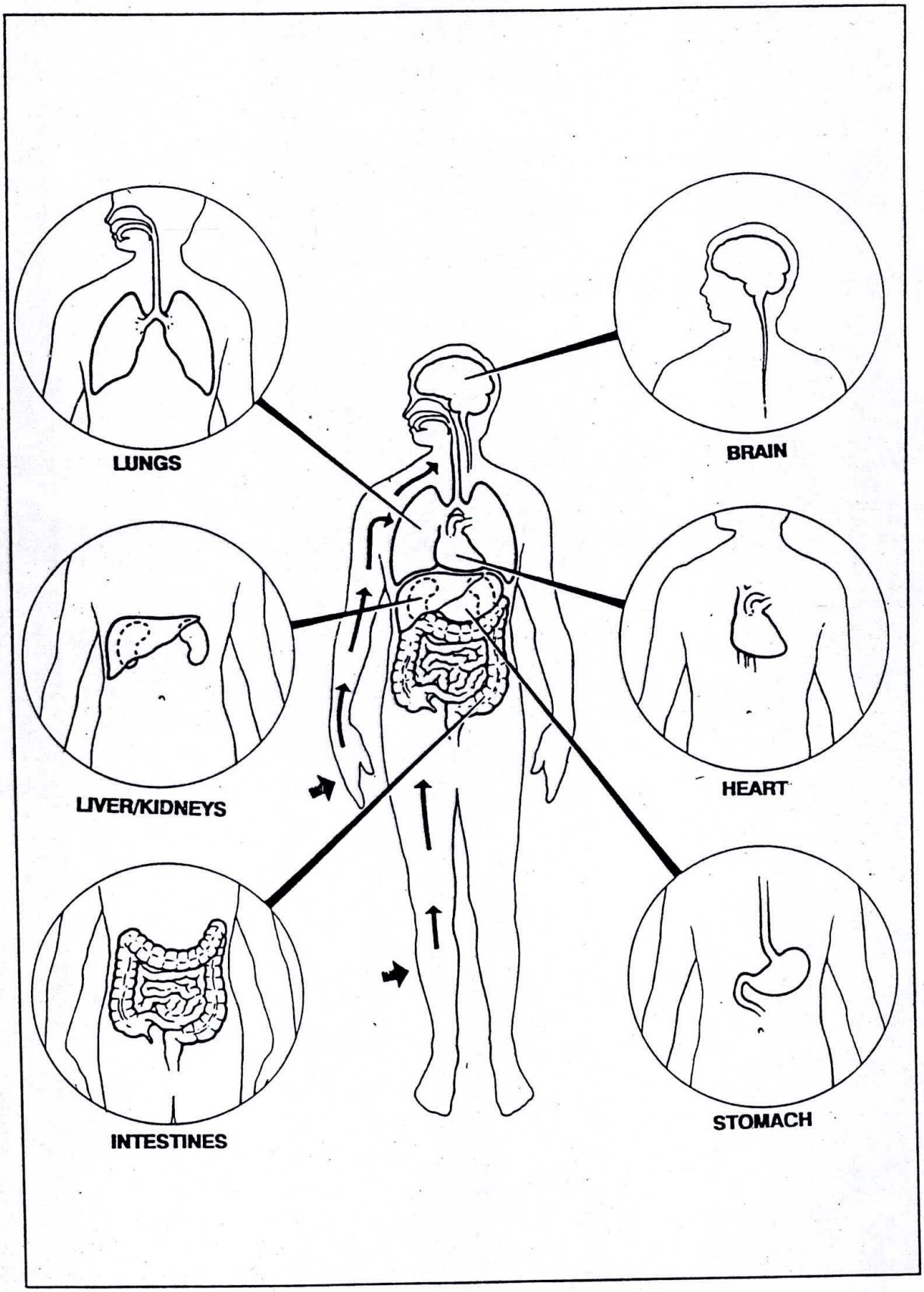
Pesticides can affect all the main organs of the body. A pesticide entering through the skin can move in the body to affect the brain and nervous system, the lungs, the stomach and digestive system, the liver and kidneys etc. (see Fig. IE 2). Users need to understand that sysmptoms such as headache or vomiting may be caused by exposure through the skin.

A person exposed through inhalation will suffer the fastest poisoning compared with skin or stomach exposure, because it is absorbed into the blood stream very quickly. Similarly, swallowing pesticide is likely to lead to faster poisoning than skin exposure. However it should be remembered that skin contamination is the most common route of exposure (see section OH.1.1.3).

KEY MESSAGES - CHEMICAL EFFECTS ON THE BODY

- *Pesticides may cause only surface effects (on skin or eyes) or enter the body to cause poisoning*
- *The body has natural defence mechanisms to get rid of small amounts of chemicals or make them harmless*
- *Inhalation leads to the fastest poisoning by pesticides but skin contamination is the commonest route of entry in normal use*

Figure IE.2: Pesticides can pass through the skin and affect the major organs of the body



IE.1.2 SIGNS AND SYMPTOMS OF OVER EXPOSURE

Signs and symptoms of possible poisoning or over exposure can be linked to different parts of the body, not necessarily near the site of exposure. A person exposed to pesticides from skin contamination, swallowing or inhaling, cause the pesticide to be absorbed through the skin, through the gut walls or through the walls of the respiratory surfaces in the lungs respectively. The pesticide can then be carried from these sites to all parts of the body in the bloodstream.

Possible signs and symptoms are given for the different parts of the body which might be affected.

HEAD	Headache
EYES	Itching, burning, watering, blurred vision, unusually narrow or widened pupils
MOUTH	Burning, nausea, excessive salivation, vomiting
SKIN	Irritation, burning, heavy sweating, rashes
LUNGS	Coughing, wheezing, difficulty in breathing, stopping breathing
HEART	Slow or rapid pulse, chest pain, weak or absent pulse
DIGESTIVE SYSTEM	Nausea, stomach pain, vomiting, diarrhoea
NERVOUS SYSTEM	Restlessness, dizziness, muscle twitching, staggering, convulsions
PHYSICAL CONDITION	Weakness, tiredness, low temperature, high temperature

Most of these symptoms can also be caused by other common ailments, for example high temperature, sweating, rapid pulse may also be caused by fever. Other common ailments which may cause some of these symptoms include heat stroke, alcohol or drug abuse, diabetes, allergic reactions or epilepsy.

It is therefore extremely difficult for someone who is not medically qualified to diagnose pesticide poisoning. This must be left to the medical staff.

Even if it appears likely that pesticide poisoning has occurred, because a clear exposure can be established, no automatic assumptions should be made, and no judgements should be made about the seriousness of the possible poisoning. Apparently mild symptoms of poisoning do not necessarily indicate that poisoning is not serious, since the poisoning may only be in its early stages, and could become more severe with time.

Figure IE.3: Headache or vomiting may be a symptom of pesticide poisoning, or may be due to other problems

It is important that anyone who has to deal with a person showing some of these signs or symptoms and who may have been exposed to pesticides, should gather as much information about the situation as possible. This information should be passed on to medical staff when the victim is taken to the doctor. This will help the doctor to decide the best course of action for treatment. They should also give appropriate first aid to the victim (see section IE 1.4), and get them to a doctor as quickly as possible.

KEY MESSAGES - SIGNS AND SYMPTOMS OF POISONING

- *It is very difficult to diagnose pesticide poisoning since many of the symptoms are similar to other problems*
- *If you suspect someone has been poisoned gather as much information about the circumstances as possible and get the patient to a doctor as quickly as possible*

IE.1.3 GETTING INFORMATION IN A SUSPECTED POISONING INCIDENT

If you suspect someone has been poisoned by pesticides, prompt, effective action may help to save their life. In this situation it is important to:

GIVE FIRST AID IMMEDIATELY AND GET MEDICAL HELP AS QUICKLY AS POSSIBLE - SEE SECTION IE.1.4

The doctor who treats the patient will need as much information as possible about the suspected poisoning incident. The way that you gather information will vary depending on the circumstances, for example ask the patient if possible, but ask others (workmates, friends, family etc.) as well, especially if the patient is unconscious or unable to answer. Use a variety of senses - - key things are to ASK, LOOK and SMELL.

ASK

- the patient or workmates whether work with any chemical has taken place and whether contamination has occurred
- what product has been handled and how much has been used
- how long ago and for how long handling took place
- what PPE had been worn
- what type of ill effects have been noticed or experienced
- whether the patient suffers from a known medical condition (e.g. diabetes, epilepsy, asthma, allergic reactions, heart condition etc.)
- whether alcohol, drugs or medicines have been taken

LOOK

- for evidence of pesticide containers, labels or spray equipment. Collect all labels or containers to give to the doctor

- for evidence of exposure, e.g. spillage onto ground or clothing, contamination on skin etc.

- for defective or faulty equipment, e.g. leaking sprayer

- at the patient's condition

SMELL

- any characteristic chemical smells - some pesticides have distinct smells which will be apparent if the patient is contaminated

- any evidence of alcohol

Whether or not the patient has been poisoned, or is suffering from another condition, the action should be the same - give immediate first aid and get medical assistance as quickly as possible. Make sure the doctor is given all the information you have obtained, including the pesticide label, which helps to identify the product and contains treatment advice for doctors.

KEY MESSAGES - GATHERING INFORMATION ABOUT SUSPECTED POISONING

- *Gather as much information as possible at the scene of the suspected poisoning incident for giving to doctor*

- *Use different approaches to get the full picture: ask, look and smell*

IE.1.4 FIRST AID PROCEDURES IN A POISONING INCIDENT

Planning for emergencies will help to give appropriate assistance should a poisoning incident occur. In particular:

1. Determine the quickest and easiest way to get medical assistance or to transport the patient to a medical centre

2. Keep emergency equipment available at all times, including:

   - Plenty of clean water and soap for decontamination, or a supply of dry cloths or paper for wiping pesticide from skin where no water is available
   - Blanket for cover in case of shock
   - Plastic container or sack for storage of contaminated clothing
   - Activated charcoal for use in cases of swallowed pesticide

The immediate help given to a victim of pesticide poisoning can be vital.
The most important things to remember are:

- *Speed is essential*, but act calmly and methodically
- *Take care not to contaminate yourself* during treatment
- *Act according to the priorities of the patient.* The highest priority is adequate breathing
- *Assess the situation* and act according to the circumstances

The decision tree in Figure IE.19 will help you to decide on appropriate action in different circumstances. Follow it carefully.

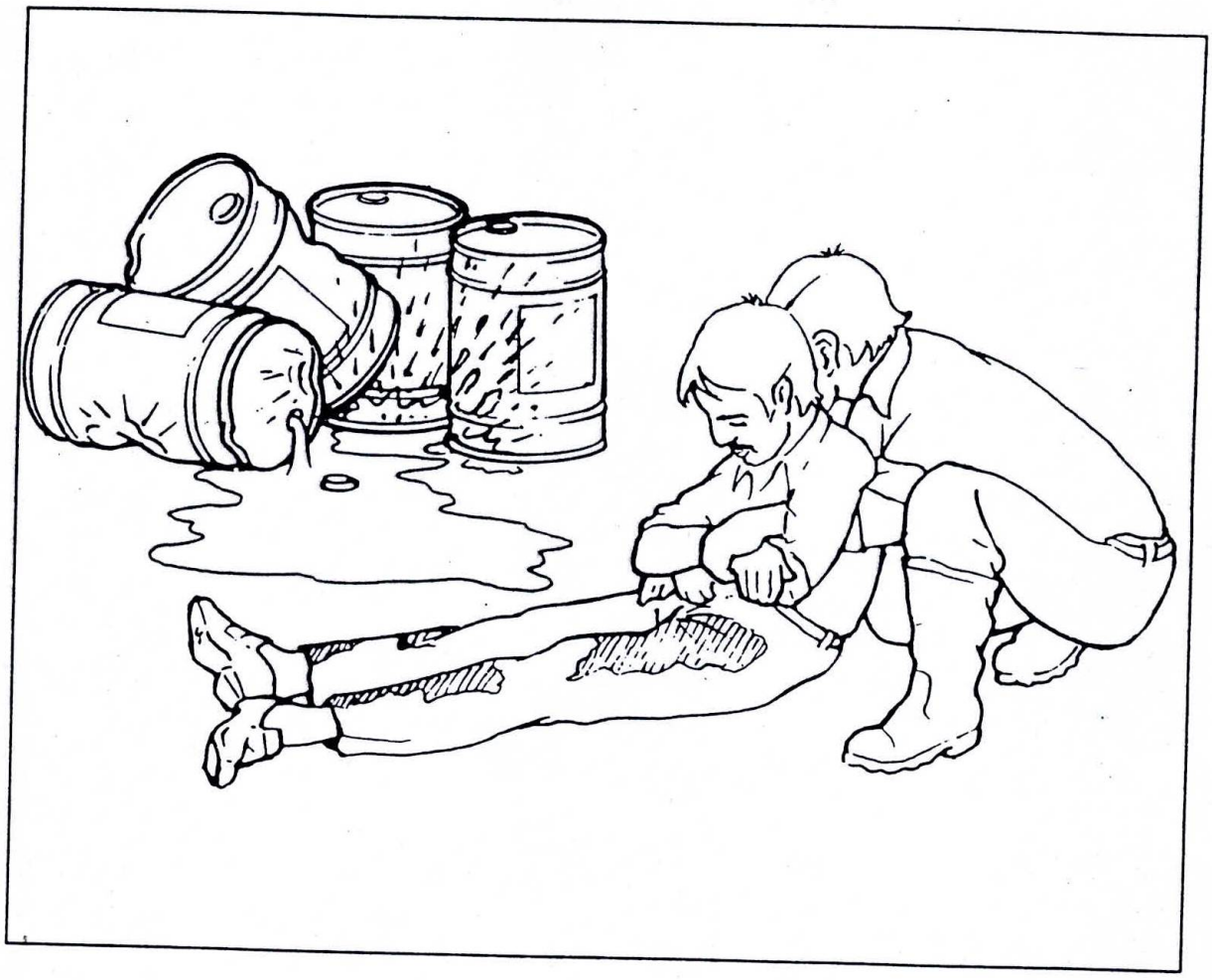
It is important to get medical help as quickly as possible, preferably by sending someone else to call for help, while you deal with the First Aid measures. If you are alone, then call for medical assistance as soon as it is safe to leave the patient, in particular when he is breathing.

IE.1.4.1 DECONTAMINATION

Pesticide which has contaminated the body, on clothing or skin, will continue to be taken up as long as it remains in contact with the skin. It is therefore important to decontaminate the person as quickly as possible, taking care not to contaminate yourself in the process.

The first priority is to remove the victim away from the source of contamination, if he is still in contact with it. Drag him or her quickly away.

Figure IE.4: Remove the victim from the source of contamination



Action next will depend on the circumstances. If someone has pesticide in the eyes, it is important to treat this before dealing with other skin contamination, as permanent eye injuries can occur unless prompt action is taken to wash them out.

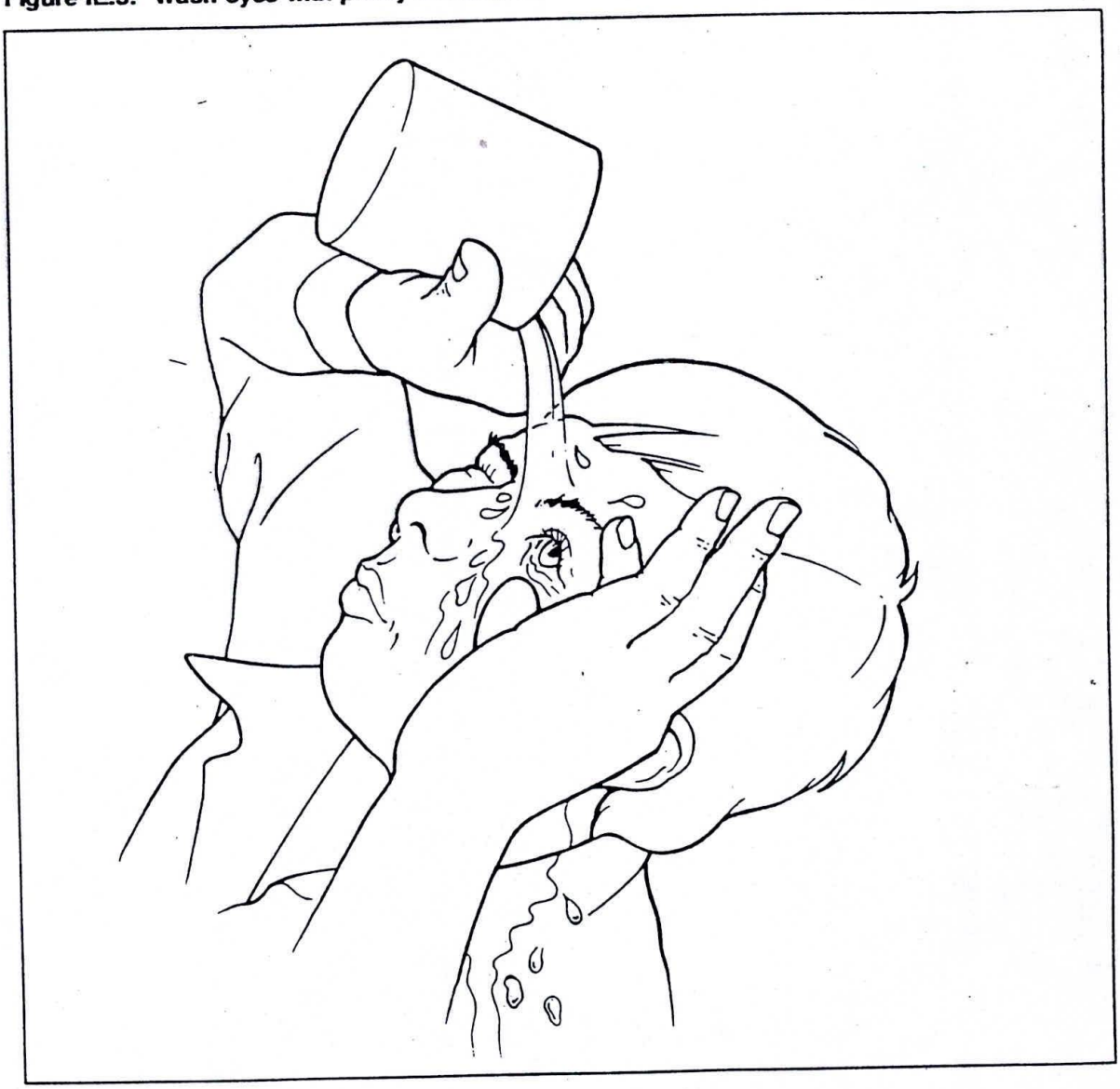
IE.1.4.1.1 REMOVING PESTICIDE FROM EYES

Washing of eyes should be carried out by holding the eyelids apart and rinsing thoroughly with plenty of clean water (see Figure IE.5). Hold the head under a gently running tap if available.

If only one eye is contaminated, take care not to contaminate the other eye during this washing process, by tilting the head towards the side of the contaminated eye, so that the uncontaminated eye is uppermost.

Continue the rinsing process for at least 10 minutes to ensure that all traces of pesticide are removed. Then ensure the patient receives medical assistance, because of the potential seriousness of eye injuries.

Figure IE.5: Wash eyes with plenty of clean water for at least 10 minutes



IE.1.4.1.2 DECONTAMINATING SKIN

Once any eye contamination has been attended to, other areas of contamination should be dealt with. Quickly remove all contaminated clothing and wash the patient well in plenty of water, using soap if available. If no water is available, gently wipe the skin with cloths or paper. Avoid harsh rubbing or scrubbing of the skin.

Figure IE.6: Remove contaminated clothing and wash skin with plenty of water

IE.1.4.2 FIRST AID PROCEDURES

Giving first aid to a poisoning victim uses many of the basic first aid techniques applicable in many other situations. The following procedures are intended as a reminder for someone who has received basic first aid training. The product label is an important source of First Aid advice for that product, and should always be checked to determine actions to take. The decision chart in Fig. IE.21 will help you to decide the sequence of actions to take for different circumstances.

General points to follow are:

- *Keep reassuring the patient throughout* - he or she may be very frightened and can become agitated.
- *Keep the patient at rest*, some poisoning can be made worse by movement
- *Observe breathing and consciousness closely.* Prompt action is essential if breathing stops, as brain damage and then death can occur within minutes, unless action is taken.

The basic first steps in treating a patient involve the checking the A B C of first aid, airway, breathing and circulation:

A Airway

B Breathing

C Circulation

The following sections tell you how to do this.

IE.1.4.2.1 CHECKING AIRWAYS, BREATHING AND CIRCULATION

A. CLEAR AND OPEN *AIRWAYS*

1. Examine patient's mouth/throat for obstructions (objects, vomit etc) and remove if present.

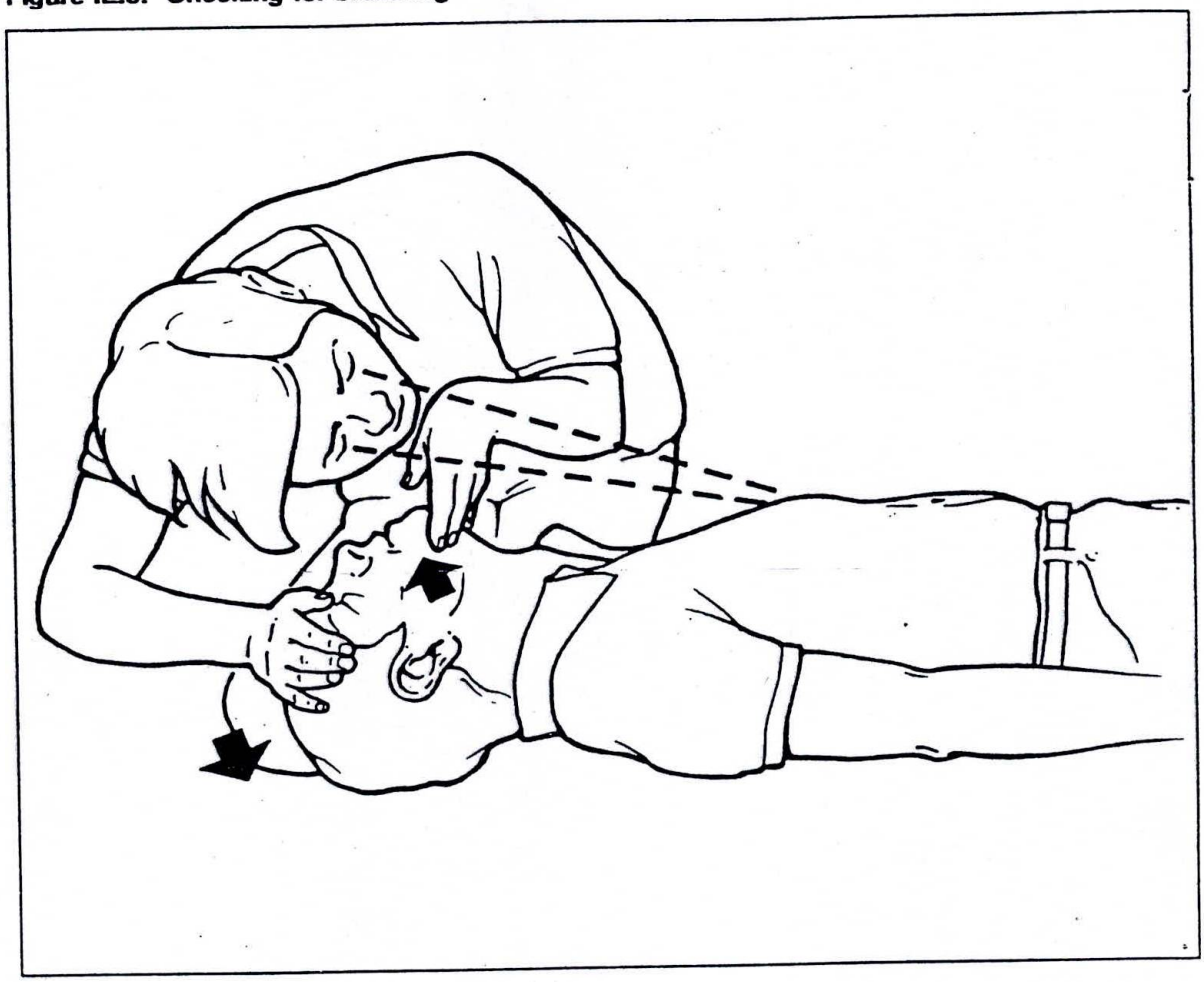
2. Open the airway by gently pulling the chin forwards while pressing the forehead backwards (see Fig. IE.7)

Figure IE.7: Opening the airway

B. CHECK IF PATIENT IS *BREATHING*

Place your ear above patient's mouth and look along chest and abdomen (see Fig. IE.8). If patient is breathing you will hear and feel breath and see movement of the chest and/or abdomen. If not CHECK HEART BEAT (C)

Figure IE.8: Checking for breathing



C. *CIRCULATION* - CHECK IF HEART IS BEATING

1. Feel for the pulse in the neck by gently placing the fingertips against the voice box (Adam's apple) and sliding them down into the groove between at the side of the neck nearest you. If checking pulse of an infant find it on the inside of the upper arm (between shoulder and elbow).

2a. If no pulse is present start CARDIO-PULMONARY RESUSCITATION (CPR - see later section)

2b. If pulse is present but patient is not breathing, start MOUTH TO MOUTH/ NOSE VENTILATION

Figure IE.9: Checking the pulse in an adult

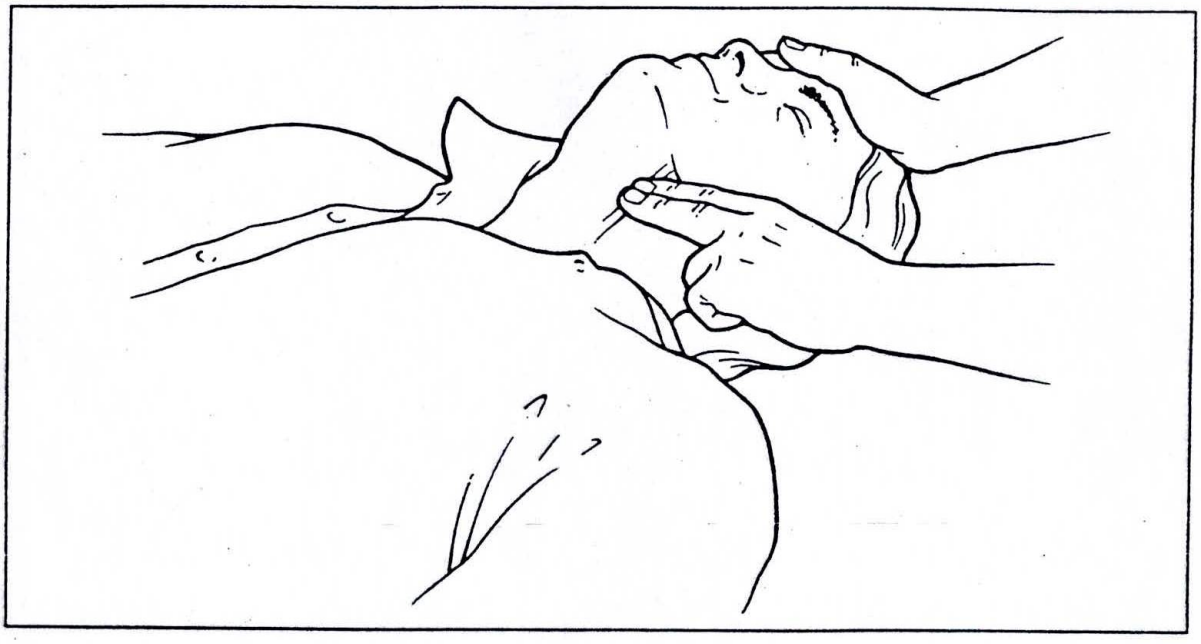
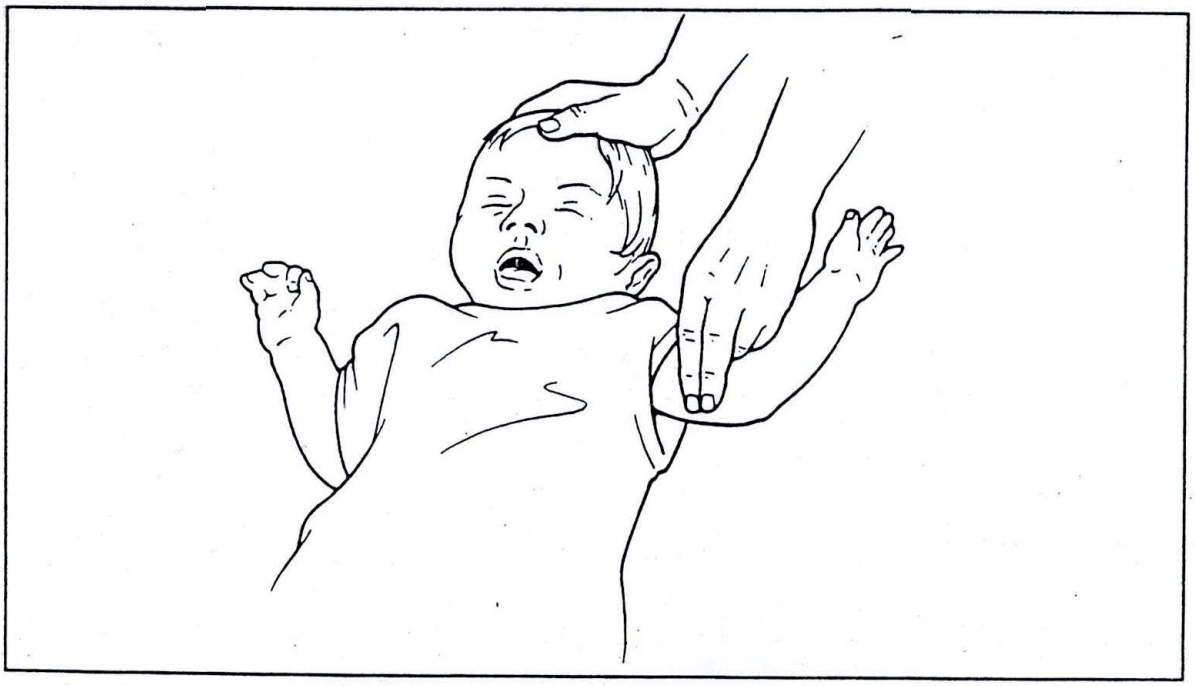


Figure IE.10: Checking for a pulse in an infant



IE.1.4.2.2 MOUTH-TO-MOUTH/MOUTH-TO-NOSE VENTILATION

101

1. Turn patient on back. CLEAR AND OPEN THE AIRWAY (see previous section)

2. Pinch the nostrils together and place your lips around the open mouth. If there is pesticide contamination around the mouth then use mouth-to-nose ventilation by closing the mouth with your thumb and sealing your lips around the nose.

3. Blow into patient looking along chest to see chest rise.(Blow more gently into a child or infant). Remove your mouth and watch chest fall.

4. Continue ventilations at rate of one every 5 seconds until natural breathing starts (If being done on a child give one ventilation every 3 seconds). Check pulse after every 10 ventilations.

Figure IE.11: Giving mouth-to-mouth ventilation

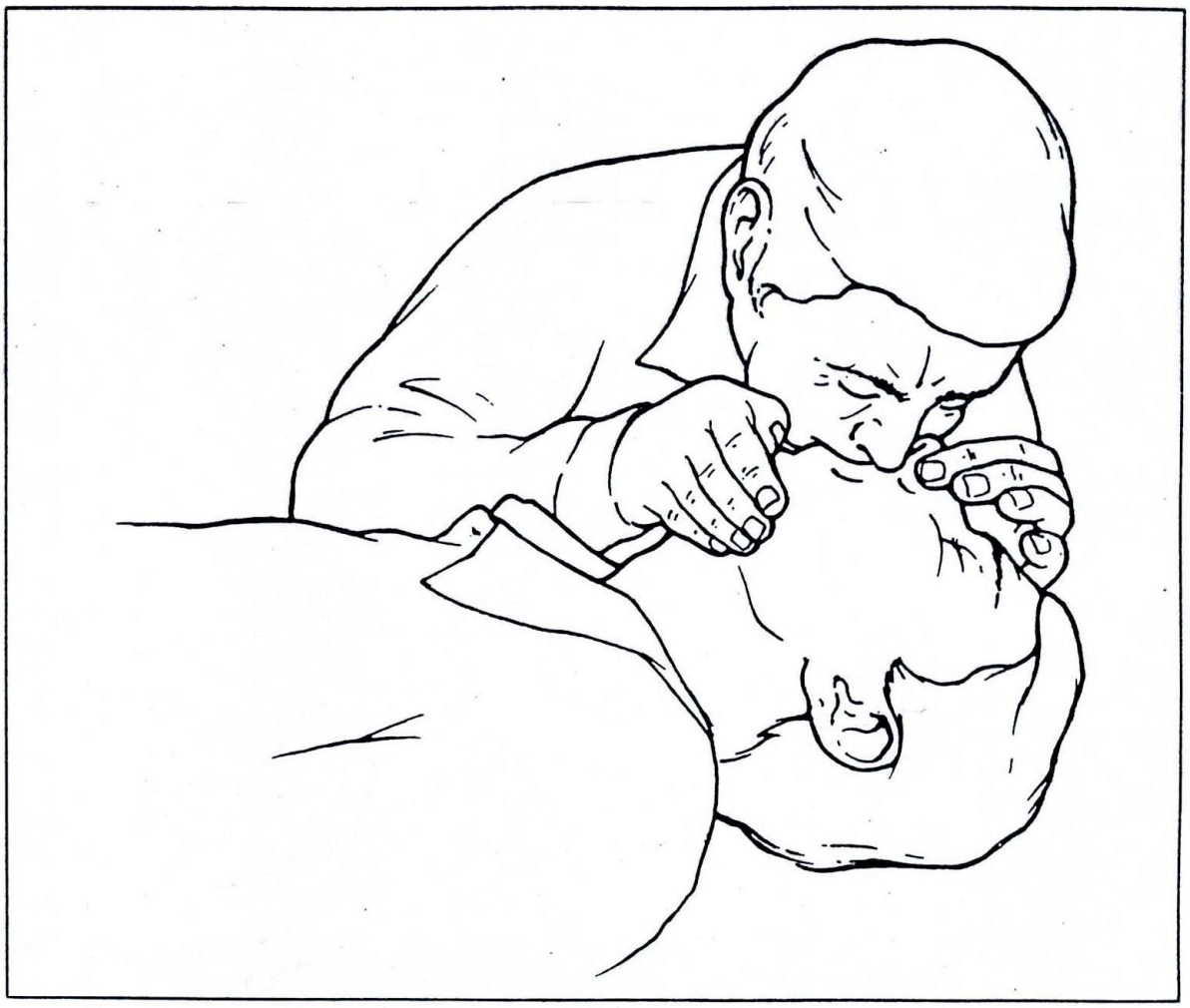
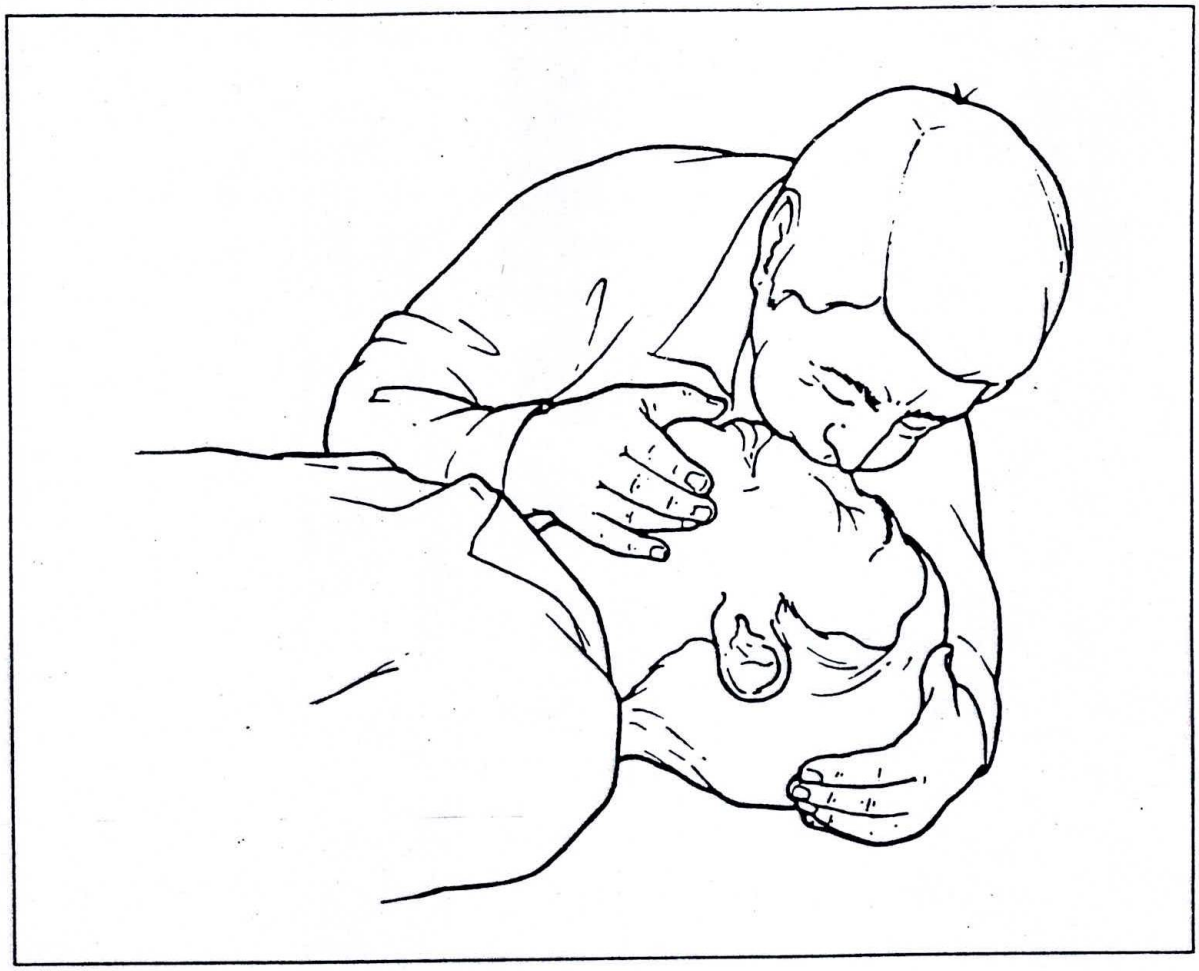


Figure IE.12: Giving mouth-to-nose ventilation



IE.1.4.2.3 CARDIOPULMONARY RESUSCITATION (CPR) FOR ADULTS (OVER 9 YEARS) 103

This is carried out if the heart has stopped and combines artificial ventilation with chest compression. *It should only be attempted by somebody who has been trained in its use, since it is possible to cause injury if not done correctly.* If this is being carried out on a child or infant go to the next section.

1. Put patient onto back and CLEAR AND OPEN AIRWAY

2. Give two VENTILATIONS (see previous section on mouth-to-mouth/nose ventilation)

3. Feel with your fingers for junction where bottom of ribs meet breastbone.

4. Place heel of hand at a position two fingers width above this junction.

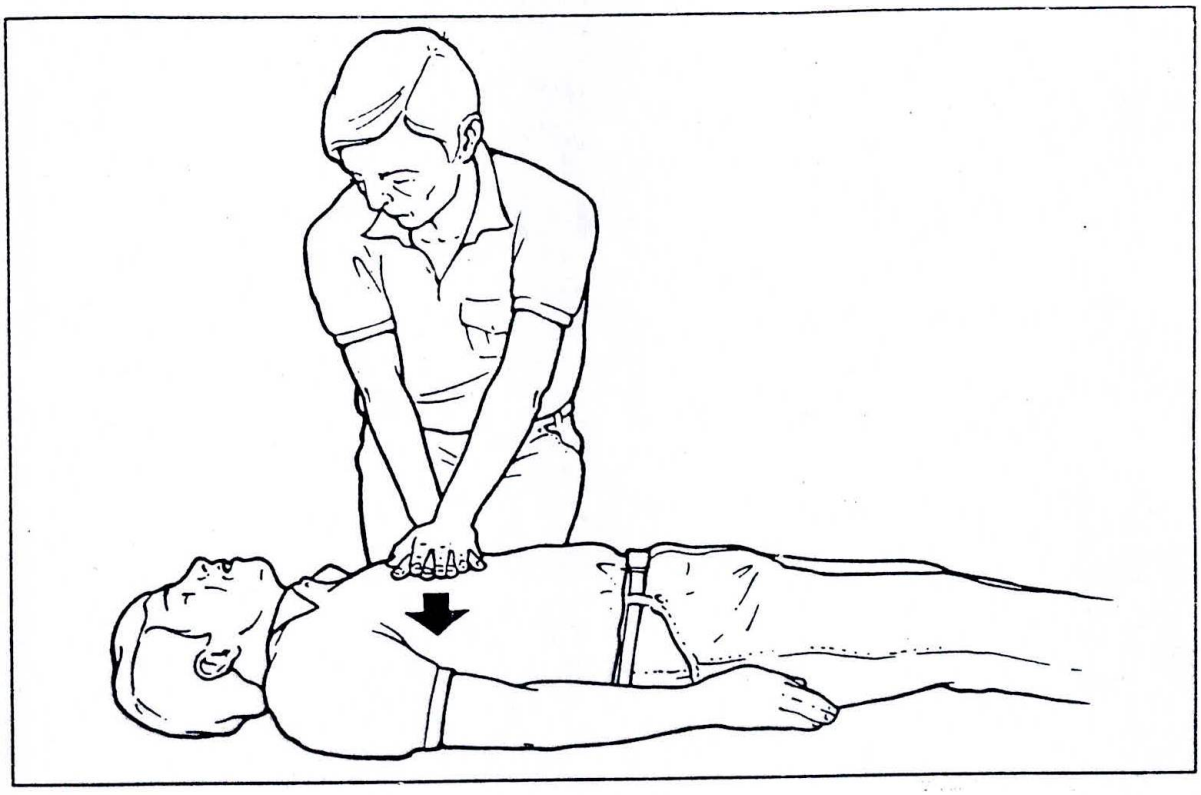
5. Cover this hand with your other hand and interlock fingers (see Fig. IE.13)

6. Keeping your shoulders directly above hands and your arms straight, press down vertically on the breastbone moving it 4-5 cm (1½-2 inches). Immediately release pressure. Continue smoothly at a rate of 80 per minute.

7. Give 15 compressions (count out loud) followed by two VENTILATIONS

8. If two first aiders are present, one can give compressions and the other give VENTILATIONS but instead give 5 compressions followed by 1 ventilation.

Figure IE.13: Carrying out cardiopulmonary resuscitation (CPR) on an adult



I.E.1.4.2.4 CARDIOPULMONARY RESUSCITATION (CPR) FOR CHILDREN AND INFANTS (UNDER 9 YEARS)

This is carried out if the heart has stopped and combines artificial ventilation with chest compression. For adult CPR see previous section. Only do this if you have been trained in its use, since it is possible to injure a patient if not done properly.

1. Put patient onto back and CLEAR AND OPEN AIRWAY

2. Give two VENTILATIONS

3. Feel with your fingers for junction where bottom of ribs meet breastbone.

4. Place heel of hand at a position two fingers width above this junction. *Do not use two hands for pressure*, as more gentle pressure is required than for an adult. (see fig. IE.14). If being done on infant (under 1 year) use two fingers instead of heel of hand (see Fig. IE.15). Keeping your shoulder directly above hand and your arm straight, press down vertically on the breastbone with light pressure moving it only 3-4 cm (1-1½ inches) - even

less if being done on an infant. Immediately release pressure. Continue smoothly at a rate of 100 per minute. 105

7. Give 15 compressions (count out loud) followed by two VENTILATIONS

8. If two first aiders are present, one can give compressions and the other give VENTILATIONS but use instead 5 compressions followed by 1 ventilation.

Figure IE.14: Carrying out cardiopulmonary resuscitation (CPR) on a child

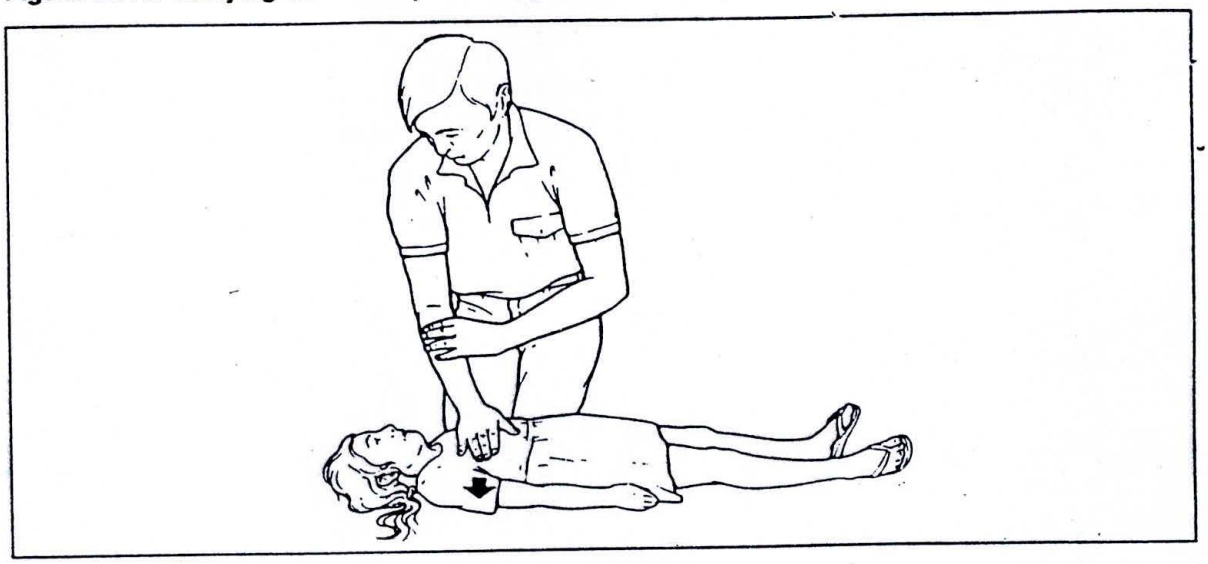
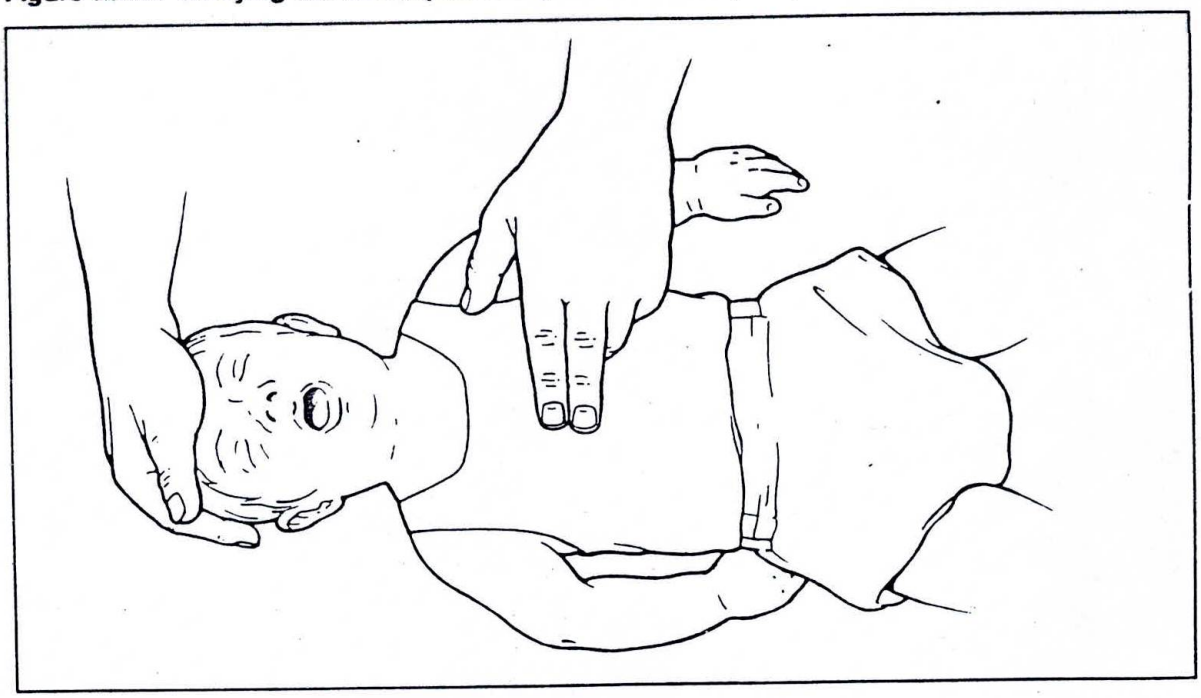


Figure IE.15: Carrying out Cardiopulmonary resuscitation (CPR) on an infant



IE.1.4.2.5 THE RECOVERY POSITION

Once you have checked the airway, breathing and circulation and the person is breathing and has a pulse, it is important to put the person into a position which ensures the airway remains clear, even if the patient should vomit. This is known as the *RECOVERY POSITION*. If you have to leave a patient, for example to get medical help, this is the safest position to leave them in, since the airways are clear, and the patient cannot easily roll onto his or her back. This can be done in the following way:

1. Carry out A,B,C: CHECK AIRWAY IS CLEAR , CHECK PATIENT IS BREATHING and HEART IS BEATING

2. Kneel beside the patient and remove spectacles if present.

3. Straighten his legs and place his nearest arm at right angles to his body, elbow bent and palm upwards.

4. Bring his far arm across his chest. Hold his hand palm outwards against his nearest cheek.

5. With your other hand grasp his far thigh. Pull his knee up keeping his foot on the ground (see Figure IE.16a).

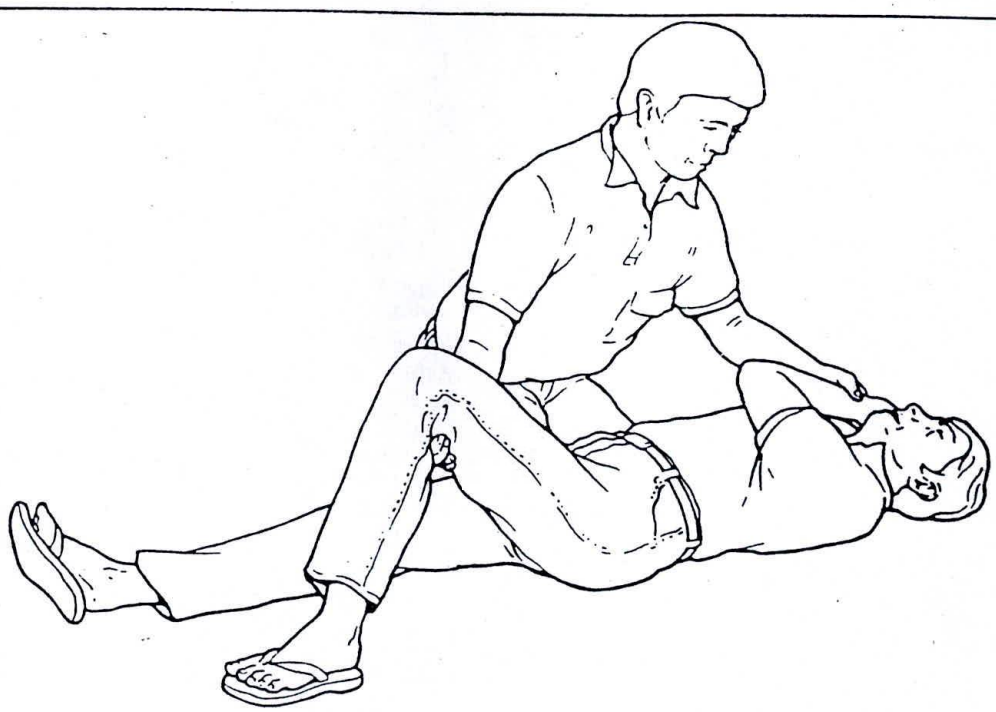
6. Holding the hand against the cheek, pull knee towards you to roll patient onto side.

7. Tilt head back to maintain open airway and adjust hand under cheek if necessary to maintain head position (see Figure IE.16b).

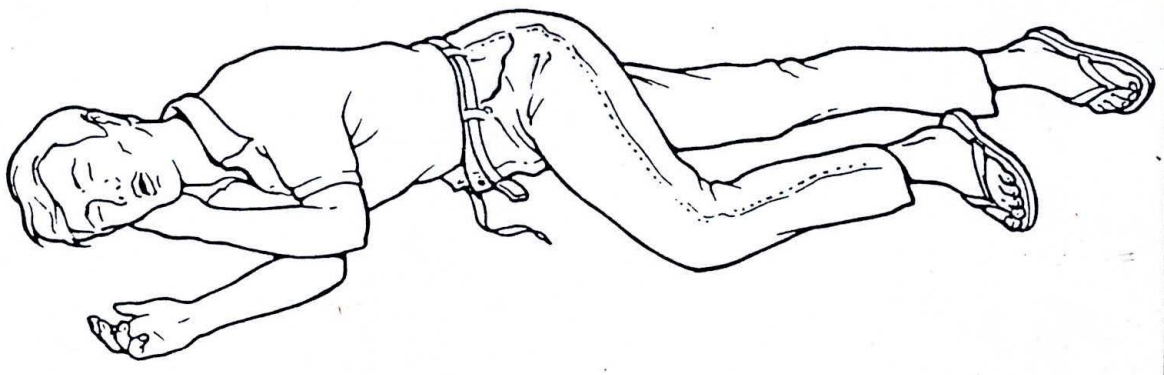
8. Adjust upper leg so that hip and knee are bent at right angles.

9. CHECK BREATHING and PULSE at frequent intervals.

Figure IE.16: Putting a patient into the recovery position



a. Pull the knee up, keeping the foot on the ground



b. Roll patient onto side, holding the hand against the cheek. Tilt head back to ensure open airway.

IE.1.4.2.6 INDUCING VOMITING

If pesticide is swallowed, vomiting should only be induced under the following circumstances:

WHEN PATIENT IS CONSCIOUS *AND* PESTICIDE LABEL RECOMMENDS IT *AND* MEDICAL HELP IS MORE THAN 1 HOUR AWAY

Unless *all three* conditions are met, DO NOT INDUCE VOMITING, simply get medical help as quickly as possible, as this is a technique which is better carried out by a qualified medical person.

If the medical help is a long way away, the pesticide label advises induction of vomiting and the patient is conscious, then vomiting can be induced in the following way:

1. Give the patient some clean water to drink.

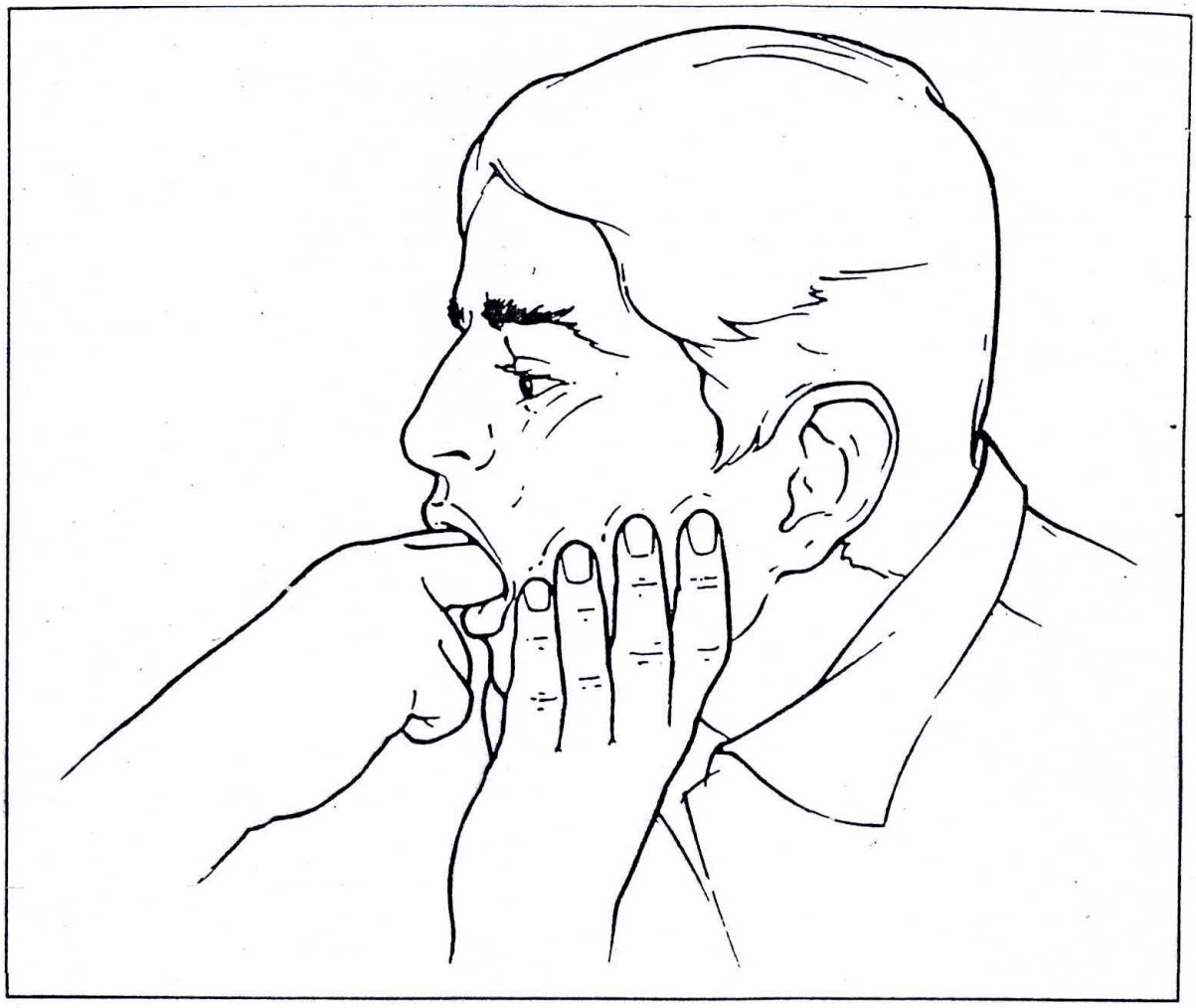
2. With the patient in a sitting or standing position pinch his cheeks between his teeth with one of your hands, to prevent him biting your fingers.

3. Standing to one side of the patient (not directly in front as you may get contaminated when vomiting occurs), tickle the back of his throat with two fingers, until vomiting occurs (see Fig. IE.17).

4. After vomiting has occurred or if induction of vomiting is unsuccessful, give 3 tablespoons of activated charcoal in half a glass of water to drink. Repeat as often as possible until medical help is obtained

5. Put patient into recovery position and get medical help as quickly as possible.

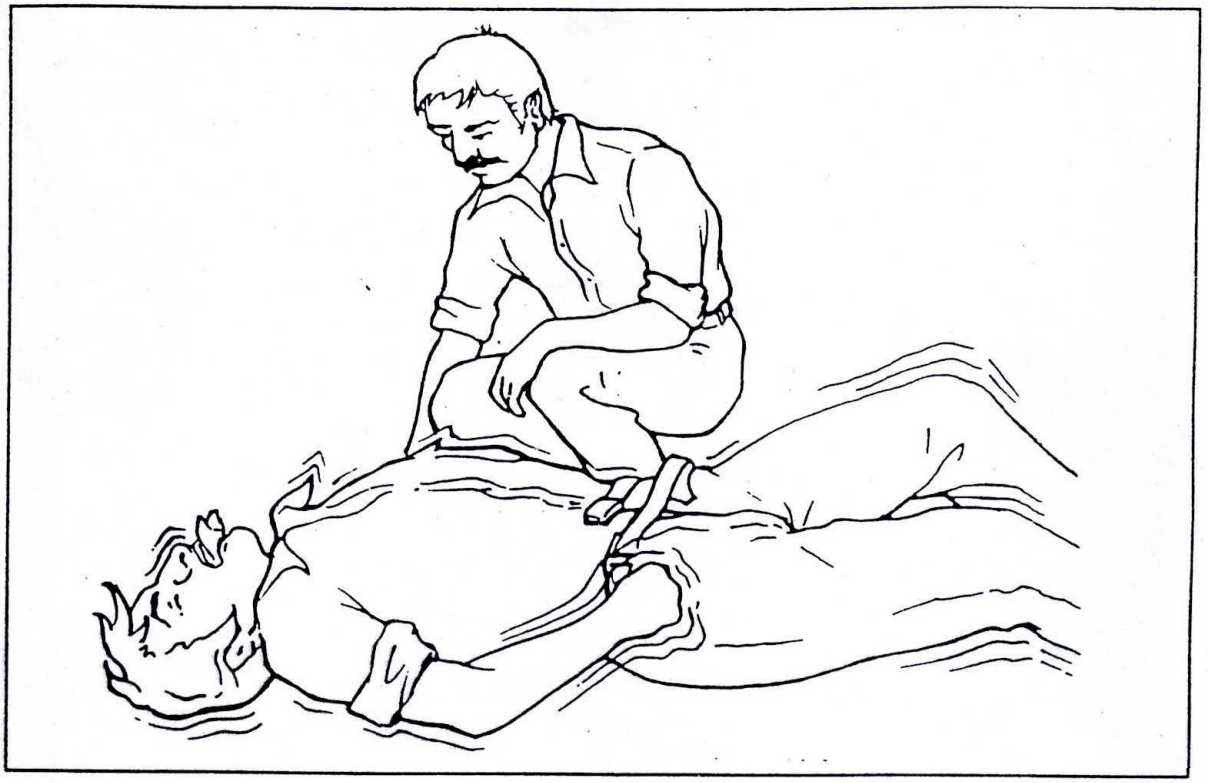
Figure IE.17: Inducing vomiting in a patient



IE.1.4.2.7 MANAGING CONVULSIONS

Occasionally some pesticides cause convulsions or fits. If this happens, do not try to restrain the patient. Simply move away from any objects which might cause injury, and then check airway breathing and circulation when the fit is over.

Figure IE.18: Dealing with convulsions



IE.1.4.2.8 OTHER POINTS

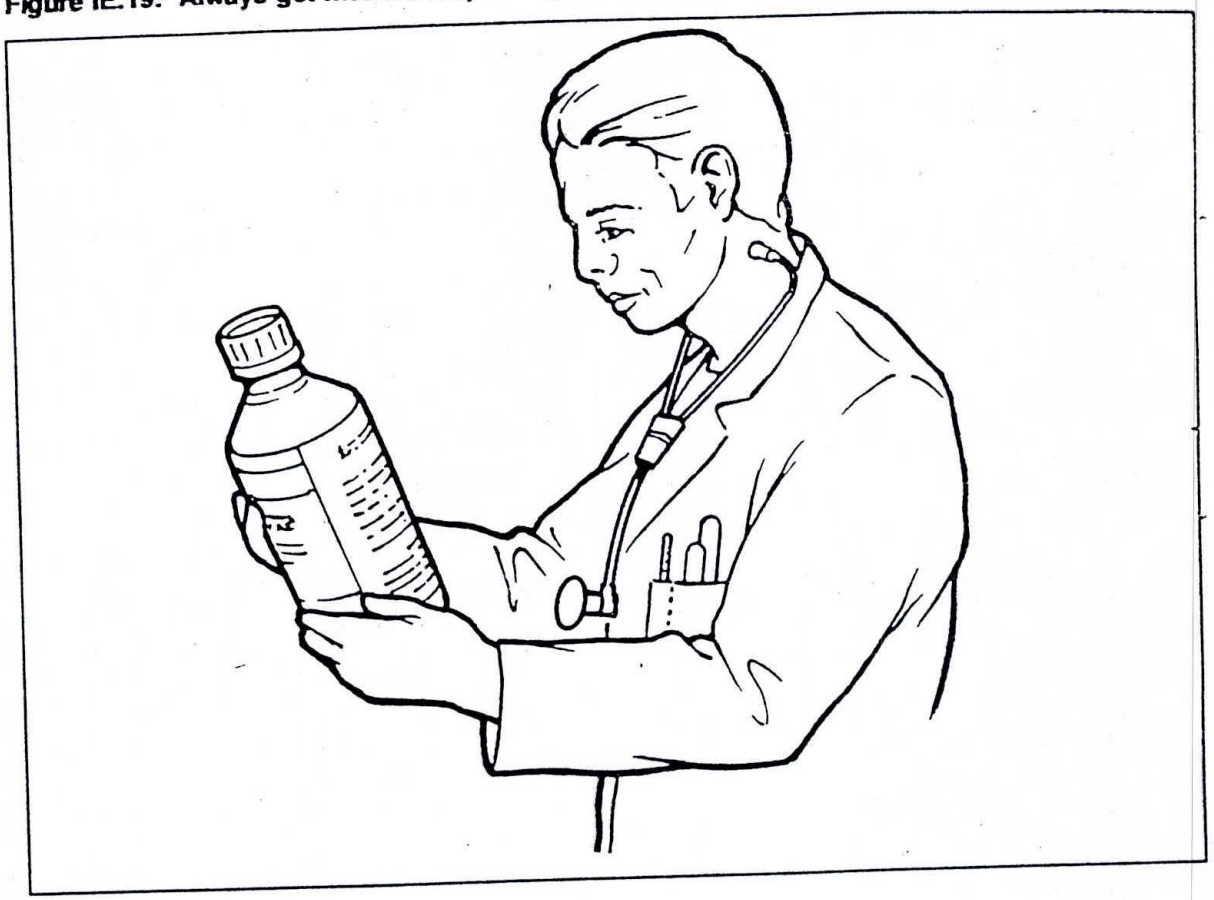
WHEN DEALING WITH A SUSPECTED POISONING DO NOT:

- Allow patient to smoke
- Give alcohol or milk, as it may speed the uptake of pesticides

WHEN OBTAINING MEDICAL HELP, MAKE SURE:

- The doctor is given all the information about the case and any first aid treatment given
- The doctor is given the product pack with the label attached (or the label alone if it is not possible to bring the pack)

Figure IE.19: Always get medical help and give the doctor the product label.



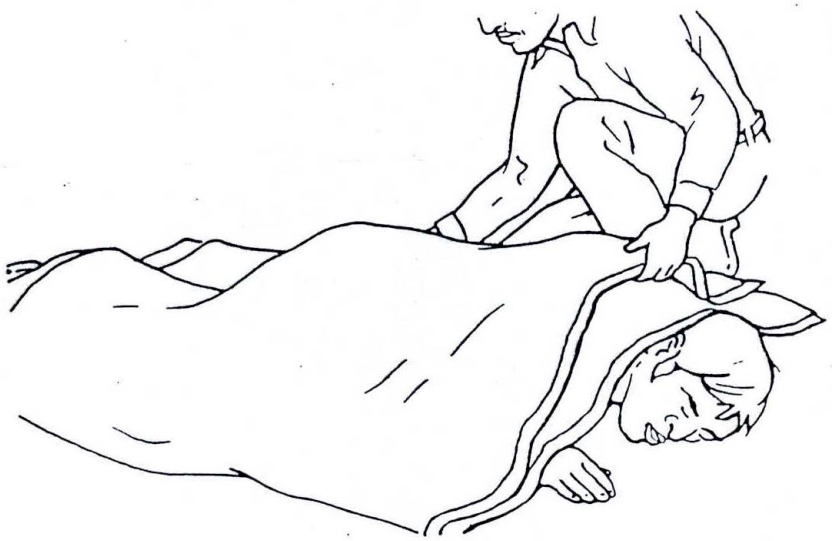
MANAGING TEMPERATURE

Some pesticides lead to unusually high or low body temperatures

- If body temperature is too high, try to lower it by sponging patient with cold water
- If body temperature is too low, keep patient warm by covering with a blanket or coat

Figure IE.20: Managing patient temperature

a. If too hot, sponge with water

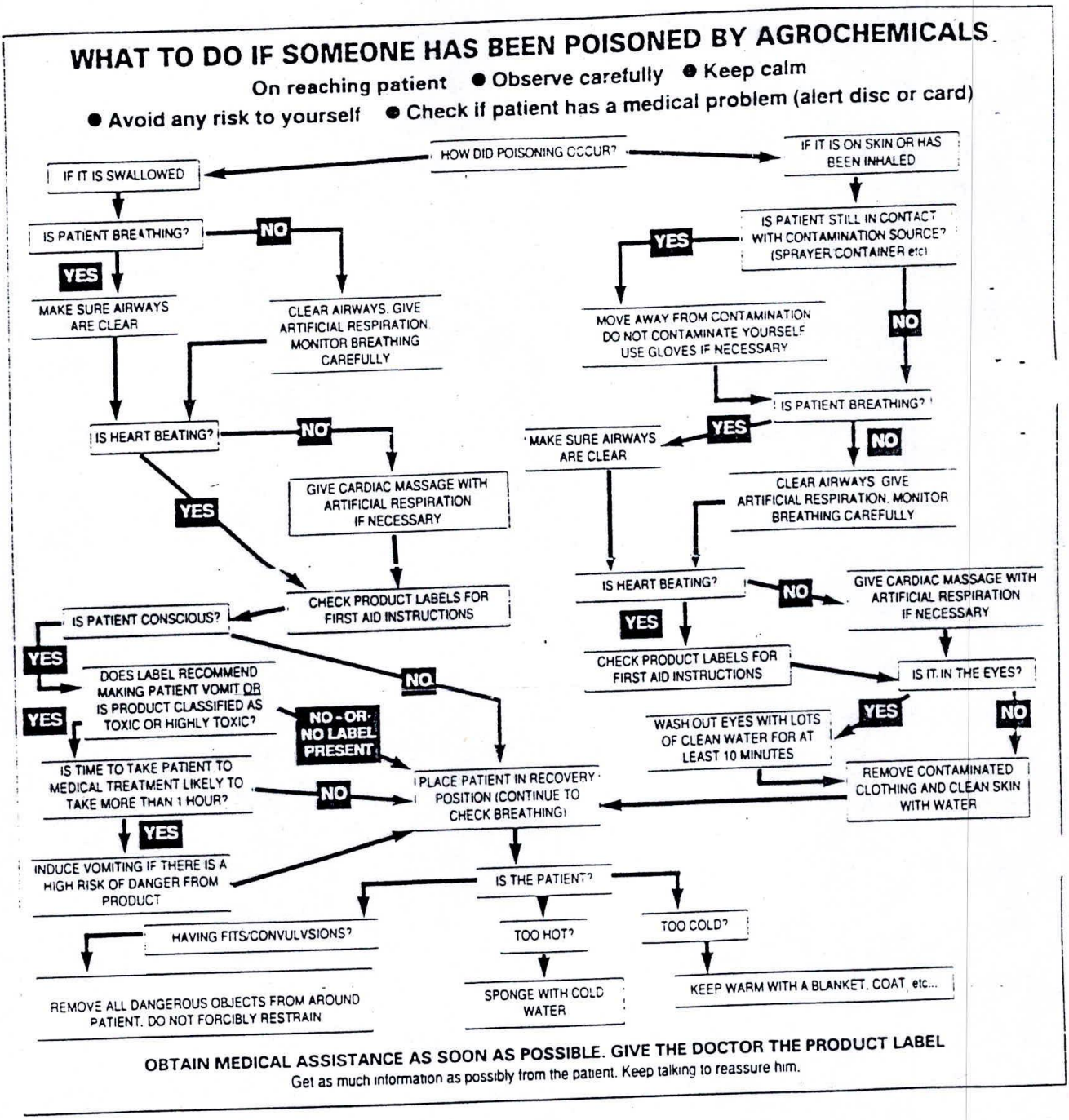


b. If too cold, cover with blanket, coat etc.

AFTER A CASE OF POISONING HAS OCCURRED:

- **Record the poisoning and its circumstances**
- **Evaluate the circumstances and identify the cause of the poisoning**
- **Take action to prevent the poisoning incident happening again**

Figure IE.21: What to do if someone has been poisoned



KEY MESSAGES - FIRST AID IN A POISONING INCIDENT

- *Act calmly and methodically - highest priority is BREATHING*
- *Always seek medical help as soon as possible*
- *Always take the product label or the whole container with label attached to the doctor*
- *Evaluate a poisoning incident to ensure it does not happen again*