
IPCS

INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

MULTILEVEL COURSE ON THE SAFE USE OF PESTICIDES AND ON THE DIAGNOSIS AND TREATMENT OF PESTICIDE POISONING

FEBRUARY 1994



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Programme des Nations Unies
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International Labour Office
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World Health Organization
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CONTENTS

INTRODUCTION:		Page
1.	Background	4
2.	Objectives of the Multilevel Course	5
3.	Arrangement of the Manual	5
4.	Extension of the Manual	5
5.	Language of the Manual	6
 PART I:		
1.	Presentation of the Multilevel Course	7
2.	Levels of modules	8
3.	Timing within the course	8
4.	Use of visual aids	8
5.	Photography of visual aids	9
	Table I/1: Explanatory module	10
	Table I/2: List of equipment needed for the photography of most photographic modules . . .	11
 PART II:		
Organization of training programmes:		
A.	For leaders of courses to train the trainers (TTT courses)	12
	Table II/1: Suggested outline of a two week TTT course	14
	Table II/2: Suggested checklist for a TTT course	15
B.	For trainers	16
	Table II/3: Suggested checklist for a course	18

	Page
PART III:	
1. List of Sections, Subjects, and Modules	19
Section I: General	20
Section II: Absorption and effects of pesticides	21
Section III: Personal protection	22
Section IV: Protection of others	23
Section V: Chemical types and modes of action of pesticides	24
Section VI: First aid treatment of pesticide poisoning	25
Section VII: Medical treatment of pesticide poisoning	26
Section VIII: Other related subjects	27
Section IX: Evaluation	28
Note on Educational objectives	28
2. Specimen module selection for specified groups	29
Table III/1: Specimen module selection	29
3. Terminology used	30
4. Short bibliography	34
5. Index to modules	39

THE MODULES (on separate sheets):

Section I	- General
Section II	- Absorption and effects of pesticides
Section III	- Personal protection
Section IV	- Protection of others
Section V	- Chemical types and modes of action of pesticides
Section VI	- First aid treatment of pesticide poisoning
Section VII	- Medical treatment of pesticide poisoning
Section VIII	- Other related subjects
Section IX	- Evaluation

INTRODUCTION

1. BACKGROUND

It is already a half-century since modern pesticides began to be introduced. They replaced older plant-derived pesticides, such as nicotine, and other chemical pesticides, including the salts of arsenic. Many of the older compounds were highly toxic, and their use by the public was restricted in many countries. The advent of DDT, with its wide spectrum of activity and low human health hazard seemed to be full of promise for the control of agricultural and public health pests.

As the organochlorine pesticides were followed by organophosphorus compound and the carbamates, so the benefits of their use became apparent; rises occurred in both the quantity and quality of crops, and animal health improved. It cannot be disputed that the world could not have sustained the nutrition of its increasing population without the use of modern pesticides. They have also contributed significantly to improvements in human health through the control of vector-borne diseases.

After a few years it became apparent that these benefits were bought at a price. Target pest species began to develop resistance to the most widely used pesticides. To combat this, new compounds were introduced, some of which were of higher acute toxicity and hazard to humans and other non-target species. Unexpected adverse effects on the environment began to appear in both animals and plants. The use of pesticides had become so widespread globally that it was clear that control was needed. Never before had the public access to such a range of powerful and hazardous chemicals.

In recent years, strict regulation and training in the safe and effective use of pesticides have been introduced in many countries, but these are by no means universal. Detrimental effects on the environment still occur, particularly due to the misuse of pesticides. Many people are affected in various ways by pesticides. The number of these is difficult to estimate but it is considerable.

Ways of counteracting adverse environmental effects have been devised. Some of these include sophisticated application techniques to reduce the quantities of pesticides applied. Others are based on integrated pest control. The benefits of the proper use of pesticides remain, and the resilience shown by target species indicates that if pesticide use in good agricultural practice and in public health was discontinued, the results would be disastrous.

Over the years, the public has been faced with conflicting views on the use of pesticides, to the extent that many people are now confused or hold opinions that have little scientific validity. There is therefore a growing need for presentation of simple scientific facts to enable people to come to informed judgements. This can be done in schools, universities, or in public interest groups. Education in the use of pesticides cannot be confined to users, and the content of any course on the subject must contain material that can be adapted to a wider audience.

Many adverse effects of pesticides can be prevented if correct and appropriate techniques are used by trained personnel. Registration of pesticides is essential to set minimum standards for their safe and effective use, and to limit public access to the more hazardous compounds. This does not replace the need for the education of pesticide users. Training must be flexible so that it can be readily updated to include new compounds and techniques, and needs to be repeated at all levels as changes occur in personnel or application techniques.

This course is presented to try to meet the need for widescale training in the safe and effective use of pesticides.

2. OBJECTIVES OF THE MULTILEVEL COURSE.

This course is intended:

1. to prevent adverse effects of chemical pesticides by training in safe practices all those handling them after manufacture and formulation, in order to protect themselves, others, and the environment,
 - by outlining how such adverse effects may be produced, and
 - by describing techniques by which they may be prevented.
2. to train doctors and those giving first-aid in special aspects of the diagnosis and treatment of cases, should poisoning occur.
3. to provide insight into the safety aspects of the use of pesticides for those engaged in pesticide registration procedures, and for public interest groups.
4. to provide a structure which may be integrated into training in other aspects of the use of pesticides, at all levels, adapted to the needs of specific groups.

3. ARRANGEMENT OF THE MANUAL

PART I opens by outlining the structure of the course. It discusses the techniques that can be used in the conduct of courses, and contains an example of the basic module.

PART II gives suggestions for the training of trainers in a two-week course, and the organisation of training programmes lasting from one hour up to one week full-time or part-time equivalent, for various groups.

PART III opens with a list of modules, arranged in sections and subjects. This is followed by the modules, numbered according to the list. Each section is preceded by the educational objectives suggested for various levels.

4. EXTENSION OF THE MANUAL.

Training is not only required in the safe use of pesticides. Although this must be a persistent theme, related subjects are the correct choice of pesticides, application methods including correct dosage, the choice, care and maintenance of equipment, and environmental monitoring. Any course on safe use should be so structured that these subjects can be integrated into the presentation, and emphasized according to the needs of the groups undergoing training.

It will probably be found that the modules of the course as issued do not completely meet the needs of some groups. This is especially true when new topics are introduced such as those mentioned above. There is no limit to the number of modules that can be included in the course and most of these will have to be written locally. To be consistent with the rest of the course, these should be in the same format (See Table I/1, page 10).

Information on the numbering of new modules is given in the text at the beginning of Part III, 1. List of Sections, Subjects and Modules, page 19.

5. LANGUAGE OF THE COURSE.

All or part of this course may need to be translated into local language. If resources are limited, priority should be given to the modules, or at the very least to modules at the basic level.

PART I

1. PRESENTATION OF THE MULTILEVEL COURSE

This course is intended for those handling pesticides in any way, for those concerned with the control and registration of pesticides, and to provide basic information for others concerned with the safe and effective use of pesticides. The course material is designed so that each course may be presented at the appropriate educational level of the group being trained. Therefore, the subject matter has been broken down into a large number of succinct points, giving both information and/or specific advice or instructions. It is the task of the trainer to select the points most needed to achieve the educational objective of the group, and present these in the most relevant form. Other subjects concerned with the efficient use of pesticides can be introduced into any course, as necessary.

The course consists of modules, each concerning a learning point. The modules are grouped in sections, and subjects, and each is individually numbered within its subject. Educational objectives are outlined at the beginning of each section. An explanatory module is shown on page 10 and the list of modules is at the beginning of Part III, pages 19-28.

The advantage of the modular system is the ease with which a trainer can select for each course the modules most suited to the particular group, taking into account the educational level of the participants. To facilitate this, modules are drafted at three levels of detail and terminology. The system also allows the inclusion of material of national relevance, either where this is indicated or by the insertion of new modules dealing with other aspects of pesticide use.

The emphasis throughout the use of the course must be its relevance to the groups being trained. The participants should have some characteristics in common, such as occupation or interest, and educational level. It is difficult to foresee any circumstances in which all the modules in this course would be used in the preparation of a course for any particular group, except for training trainers in the use of this course.

The sections and subjects are arranged in a sequence that might be followed on a training course, but this should be flexible. The modules are intended to guide the trainer, and to act as lecture notes.

THE TRAINER SHOULD NEVER READ THE MODULE TO THE PARTICIPANTS. THE MODULES ARE WRITTEN IN A CONDENSED FORM, AND THE TRAINER MUST INTERPRET THEM TO THE PARTICIPANTS, AND MUST DRAW ON PERSONAL EXPERIENCE OR ON NATIONAL PRACTICES TO ENSURE THAT THE POINT MADE IN THE MODULE IS SEEN BY THE PARTICIPANTS AS APPLICABLE TO THEIR SITUATION AND EXPERIENCE.

2. LEVELS OF MODULES

The level of each module is shown below the module number, as follows:

- | | |
|---------------------|---|
| BASIC | ● A simple point for participants in any course. |
| INTERMEDIATE | ● A more detailed point for participants with operational responsibilities or who work with compounds of high hazard, and need more understanding of preventive measures. |
| ADVANCED | ● Point for participants with a scientific background, or who are trained in first-aid to a high level. |

Modules at the advanced level may be further qualified as follows:

- | | |
|--------------------|--|
| /TECHNICAL | ● A technical point for those groups engaged in specified occupations. |
| /MEDICAL | ● A point made specifically for health workers or first aiders. |
| /REGULATORY | ● A point made for those engaged in pesticide regulatory activities or other aspects of pesticide control. |

Literature references may be inserted into modules at the advanced level, if desired.

A suggested plan of the modules that may be used for the training of specific groups is shown in Table III/1 (page 29).

3. TIMING WITHIN THE COURSE

Only general guidance can be given as to how much of the course can be covered in a session (45-50 minutes), as this will depend very much on the participants. Some modules suggest discussion points, and these will take more time than a module which is only descriptive. In a comprehensive course lasting one or more days, it is probably not practicable to cover more than one section in a session. This is true regardless of the levels of the modules, as it is to be anticipated that the explanation of modules to a basic level course will take as long as a greater number of modules, some of which contain greater detail, to an intermediate or advanced level course.

Thus, considering that sections VI and VII are mutually exclusive, the fastest that a comprehensive course can be given is seven sessions. If courses are to be shorter than this, a very strict selection must be made. Modules are not all of the same length, but probably no more than 10 should be attempted in a session, if they are to be properly presented, and if participation of the trainees or the audience is to be encouraged.

4. USE OF VISUAL AIDS

Most modules suggest the type of visual aid by which it should be supported. These are in the forms of text, diagrams with or without words and photographs. The presentation of visual aids will depend on the facilities available. For all literate groups, text and diagrams can be written on blackboards, on turn-over sheets (flip-charts) of paper or card, or on transparent plastic film for overhead projection. All text must be written in the national language.

Photographs can be used as prints on a flip-chart, but are better made into slides for projection. They can be used for all groups. There are a few modules for which a slide will be suitable for all ethnic or national groups, but for most modules it is necessary to use photographs taken in the country or community in which the course is being given. This enables the trainees to identify with the situations pictured. All photographs showing a wrong practice must be clearly identified as such by a mark on the picture itself. This can be added to a slide with a felt pen.

It has been suggested that video tapes might be used. These require expensive facilities for both photography and projection, and familiarity with the use of the camera. Although a commentary can be added, such tapes should only be used as a last resort. Flexibility in the construction of each course is sacrificed, and the participants are unable to interact with the person presenting the course.

5. PHOTOGRAPHY OF VISUAL AIDS

Locally taken photographs have the greatest impact as visual aids. The photographs are best reproduced as 35 mm colour slides. A good quality camera is essential.

Although it is possible to photograph operations in progress, experience has shown that it is better to simulate operations, paying attention to fine details, especially those which concern safety but are not the subject of the photo being taken. Each shot should be taken several times from different angles, and the best chosen for inclusion in the course. The point made by a module may sometimes be illustrated by more than one photograph. The workers being photographed should be actually carrying out the operation, rather than posing in a static manner. A team of 7-8 workers should be used so that the same workers do not appear too frequently.

Since photographs should be taken in the field, it is important that the equipment needed should be available in the field when it is needed for photography. A list of equipment needed for most of the photographic modules is shown in table I/2 (page 11). Special arrangements have to be made for those modules dealing with agricultural aviation, or large scale mechanical spraying or fogging.

Table I/1. EXPLANATORY MODULE

Module No.: Example
Level: See Page 5

Section: Roman numeral, main subdivision of course.
Subject: Capital letter, topic within the section.
Number: Number, of this module within the topic.

Main points:

THE POINT(S) TO BE UNDERSTOOD BY THE PARTICIPANTS.

Words in capital letters provide emphasis, or indicate words or sentences that might be used in textual visual aids.

Example(s): of the main point, where applicable.

Subsidiary point(s):

Level: (if different from above.)

These add to the main point. Subsidiary points may be at a different level from the main point, and should only be mentioned to the participants if they are relevant to the group.

For discussion:

A question arising from the main or subsidiary points, sometimes to introduce national relevance. No answers are given as the group should arrive at its own answer. If the conclusion is incorrect, the trainer should make a note to return to the question later in the course when the participants have more knowledge.

Other information:

1. This section is to provide additional information to the trainer to enable him to answer possible questions, to indicate emphasis, or to cross-reference another module.
2. The headings of paragraphs on examples, subsidiary points, for discussion, and other information only appear in modules if there is an entry beneath them.
3. If the trainer considers that additional main points are needed, new modules can be drafted, using this format. See the text at the beginning of Part III, 1 (page 20).

Suggested visual aid: type of aid, plus a note on content or subject.

Table I/2. LIST OF EQUIPMENT NEEDED FOR THE PHOTOGRAPHY OF MOST PHOTOGRAPHIC MODULES

Pressurized and mechanical hand sprayers
ULV equipment (if relevant)
Overalls or coveralls, or other suitable protective clothing
Plastic boots (2 pairs)
Canvas shoes
Neoprene gloves (2 pairs)
Plastic apron
Brimmed hats (2)
Plastic visors attached to headband (2)
Plastic visor attached to safety helmet
Scarves
Disposable dust masks
Tins with lids for food, cigarettes, etc.
Bowls for washing hands and face, and clothing and equipment
Water and soap
Mixing paddle and buckets
Scales, scoop, plastic bags
Spade or mattock
Empty combustible pesticide containers
Empty plastic pesticide liners for burying
Empty large drums (1-2)
Empty cartons and bags
Food sacks (several)
Animal feed sacks
Teapot

Note: This list is not complete, and other items may need to be added according to local circumstances. For example, chemical safety goggles may be recommended for some tasks outside the tropics.

PART II

ORGANIZATION OF TRAINING PROGRAMMES

A. FOR LEADERS OF COURSES TO TRAIN THE TRAINERS (TTT COURSES).

1. ORGANIZATION OF TTT COURSES. Courses are best arranged by institutes where experts and course facilities are readily available. The number of participants should not exceed 10, and the courses should last at least two weeks full-time. A typical programme is shown in Table II/1 (page 14).

2. THE LEADER'S PREPARATION. The leader of a TTT course must be familiar with both parts of the Manual, and must emphasize to the trainees the need to make the course relevant at all times to those whom they will be training. For this reason, flexibility has been built into the course, and success in training will depend considerably on how this flexibility is used.

3. SELECTION OF PARTICIPANTS. Before any courses can be started, it is important that the total number of people to be trained should be estimated. This number, and the geographical distribution of the courses will determine how many trainers should be trained. The educational standard of the trainers will vary with the groups, but it is essential that they should have background in the use of pesticides, and a general interest in both prevention, and in training techniques. Sanitarians and agricultural extension officers are the type of staff who make good trainers, provided that they are given adequate time to develop their knowledge and techniques.

4. BEFORE A TTT COURSE. The leader should allow at least three months lead time before a TTT course. During this time, various arrangements have to be made as set out below, and the success of the course will reflect the thoroughness with which this is done. Decisions should already have been made on whether the whole or parts of the course manual should be translated into local language.

- a) Select the participants, and arrange for their travel and accommodation for the duration of the course.
- b) Arrange suitable study accommodation for the course itself. A classroom with tables and chairs, a blackboard with chalk or a whiteboard with felt pens, newsprint flip charts with felt pens, a slide projector, an overhead projector, and a screen are all likely to be needed.
- c) Arrange that a copy of the course manual will be available for each participant to keep.
- d) Arrange for a supply of materials for the preparation of visual aids, and for any demonstration equipment for each participant. Blank newsprint, clear plastic sheets or rolls for overhead projection, and a set of felt pens for each participant will be needed. If photographs are available, a set for each participant should be reproduced. If they are not available, the provision of a set of templates for diagrams or drawings should be considered.

- e) Arrange for any guest lecturers needed and brief them on how their contributions will fit into the course. Lecturers other than the leader should take a number of sessions, at least one on each day. This maintains the interest of the participants, and lessens the load on the trainer. The lecturers should be asked to follow strictly the plan of the course, and will need a copy of the manual well beforehand for this purpose.
- f) Arrange for a field visit during the first week. Pay a preliminary visit to the site, and see if it is suitable for any more photographic visual aids. If so, these could be taken during the visit of the participants to illustrate the care needed to ensure the accuracy of the photograph in the context of the course. Arrange transport to and from the visit.
- g) Arrange 3-5 groups of 10-15 participants to be trained during three mornings in the second week. Arrange a field demonstration for each of these groups.

Table II/2 (page 15) suggests a check list for the organization of a TTT course.

Table II/1. SUGGESTED OUTLINE OF A TWO-WEEK TTT COURSE**Sessions: 45 - 50 minutes. Breaks: 10 - 15 minutes.****Morning: 4 sessions. Afternoon: 2 sessions.**

WEEK	DAY	MORNING SESSIONS				AFTERNOON SESSIONS	
		1	2	3	4	5	6
1.	1.	Objectives and planning		Arrangement of courses		Arrangement of manual	Teaching techniques
	2.	Section I, A, B		Section V, A		Section V, B, C, D	
	3.	Section II, A		Section II, B, C		Section III, A, B	
	4.	Section III, C		Section IV, A, B		FIELD VISIT	
	5.	Section VI, A,B,C				Section VII, A, B (optional)	Section VIII, A, B
2.	1.	Section IX				Preparation of visual aids	
	2.	Training by TTT course participants in groups to other selected courses				Evaluation of training experience each day	
	3.						
	4.						
5.	Evaluation and conclusion of the TTT course						

NOTES

- In the table above, the Sections are those listed on pages 19-28 in Part III of this manual. The letters refer to the subjects in each section, except for Section IX which covers the whole course.
- This timetable is intended to be flexible. During the sessions devoted to part B, participants should be advised to note the amount of time spent on each module, so that they can get an idea of timing in arranging their own courses. See also the section on timing of courses in Part II.
- The first session on Objectives and Planning should include the opening of the course, and time for each participant to introduce him or herself, briefly stating details of work and past experience. This tends to overcome shyness, and indicates to the leader those participants who are likely to be able to contribute useful experience during the course.

Table II/2. SUGGESTED CHECK LIST FOR A TTT COURSE

NAME OF COURSE:	DATES:			
PLACE:	No. of participants:	ARRANGEMENTS		
		Starting	Target	Date
		Date	Date	Completed

SELECTION OF PARTICIPANTS:
 Procedure:
 Accommodation:
 Travel:

PREPARATION OF PROGRAMME
 (See Table II/3):

ARRANGEMENT OF GUEST LECTURERS:

ARRANGEMENT OF FIELD VISIT BY WHOLE COURSE:
 Place:
 Preliminary visit:

ARRANGEMENT OF TRAINING COURSES:
 Places:
 Preliminary visits:
 Allocation of trainees:

REQUIREMENTS FOR WHOLE COURSE:
 Manuals:
 Photographic visual aids:
 Notebooks, pens:

REQUIREMENTS FOR MEETING ROOM:
 Tables and chairs:
 Black or white board:
 Flipcharts:
 Blank newsprint:
 Slide projector:
 Overhead projector:
 Screen:
 Sheets or rolls of transparent plastic film:
 Felt pens:
 Demonstration equipment: gloves, visors,
 dust masks:
 Templates for preparation of visual aids?

OTHER NOTES:

B. FOR TRAINERS

1. THE TRAINER'S PREPARATION. The trainer of a course on the safe use of pesticides must be familiar with the whole of this Manual, must understand the characteristics of each group taking the course, and how the course can be adapted to make it relevant to each group. If it appears that there are gaps in the course, the trainer must know how to prepare and test new modules to cover specific circumstances or new subjects.

2. SELECTION OF PARTICIPANTS. There is no limitation on who may participate in a course. However, a course will be more likely to be successful if the participants share some characteristics, such as work itself, the types of pesticides being used, or scientific or educational background. Public interest groups are likely to be less homogenous than occupational groups, and therefore the approach has to be more general.

Participants are frequently nominated or selected by an organization sponsoring the course. In the early part of the first session of any course, the trainer should ask each participant to introduce him- or herself briefly to the group. This enables the trainer to estimate the level(s) of the participants, and also identifies those who are likely to play a more active participatory role in the course.

3. ORGANIZATION OF A COURSE. The **NUMBER** of participants should exceed 10 (to make it cost-effective to arrange the course), but should not be more than 20, as communication within the group suffers after this point.

The **LENGTH** of the course will depend on the group. The course should be split into sessions of no more than 45-50 minutes each, followed by breaks of 10-15 minutes. For occupational groups, a minimum of eight sessions should be planned, but 12-16 sessions would be better. Such courses could be spread over three mornings of four sessions each, or over three days, including a two session field visit, preferably on the second day. In courses lasting one day or more, the last session should include an evaluation of the course.

For a public interest group, only two sessions may be feasible, and therefore only a few aspects can be dealt with adequately.

4. BEFORE A COURSE. The trainer should allow at least six weeks lead time to make the preparations for the course.

- a) If the trainer has not selected the participants, obtain information on the characteristics of those selected.
- b) Either arrange suitable accommodation for the course, or visit the accommodation to be provided. A room in a quiet place is needed, furnished with tables and chairs. The availability of a black or white board, or a blank flip-chart should be checked. Slide and/or overhead projectors will probably be needed for the course. If these are not available, the equipment should be arranged, and an adequate power source should be ensured.
- c) Select the modules appropriate to the group, and make out the course programme for the number of sessions to be provided. See the notes on timing of sections, subjects, and modules in Part I.

- d) Select the visual aids for the modules chosen, and list any demonstration equipment that should be taken to the course.
- e) Decide if any handouts are to be given out during the course. Provide notebooks and pens or pencils, so that participants can make their own notes during the course.
- f) In longer courses, decide whether any guest lecturer will be included to take one or more sessions. This stimulates the participants and takes some load off the trainer, but guests must be briefed and asked to follow the modules selected.
- g) If a field visit is to be included in the course, arrange this or get details about it. In any case, make a preliminary visit to decide on the points to be covered during the visit.

Table II/3 suggests a check list for the organization of a course.

Table II/3. SUGGESTED CHECK LIST FOR A COURSE.

NAME OF COURSE:

Dates:

PLACE:

Number of sessions:

Number of participants:

Characteristics of participants:

PROGRAMME: (Enter module numbers. Draw a line under last session each day)

Session	Section	Subject(s)	No.s
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			

Guest lecturer?

Sessions:

Arranged?

FIELD VISIT? Sessions:

Place:

Preliminary visit (date):

Points to be covered:

MEETING ROOM:

Preliminary visit (date):

Tables

Chairs

Board B/W

Flip-chart

Power point

Slide projector

Overhead projector

Screen

Chalk

Felt pens

Notebooks

Pens/pencils

TO TAKE TO COURSE:

Handouts

Items missing above

Visual aids

Demo, equipment:

Gloves

Visor

Labels

Dust Mask

OTHER NOTES:

PART III

1. LIST OF SECTIONS, SUBJECTS, AND MODULES

Modules are arranged in Sections according to main topics. The Sections are numbered with Roman numerals I - IX. Each Section is subdivided into Subjects, which deal with aspects of the section topic. Subjects are denoted by letters A to D. Finally each Subject is subdivided into modules, each dealing with a single learning point. Modules are numbered 1,2,3, etc. within each Subject. The total number of the module therefore has three components, viz II B 4 (Section II, Subject B, module 4).

The detail of the modular number is given on the top of each module, and the number and level are repeated in the upper right hand corner to facilitate sorting and filing of modules.

The general arrangement is designed to give a logical development of each section topic, but this does not mean that modules should necessarily be presented in a course in numerical order. The various levels of the modules have not contributed to the arrangement as set out in this list, and therefore the trainer always has to make a choice of modules appropriate to the level of each group of trainees.

For this reason, and so that new modules can be interleaved, the modules are supplied in loose-leaf form. Nevertheless, the trainer is advised to file modules after use in the order in which they are numbered, to avoid future difficulty in finding specific modules.

An explanatory module is shown in Table I/1, page 10.

If new modules are written (see Introduction, 4. Extension of the Manual, page 5) this format should be used. Depending on whether new sections, subjects, or modules are introduced, they should be numbered as shown in the following examples:

Note: The new topics below are used only for the purpose of these examples.

Examples

1. New section to be inserted after existing Section: II(a) Application methods, followed by Subjects A, B, C, etc., and Modules 1, 2, 3, etc.
2. New Subject to be inserted into existing Section: Section I, General, Subject A(a) or C. Choice of pesticides, followed by Modules 1,2, 3, etc., depending on how the new subject fits logically in the sequence of subjects within the Section.
3. New module to be inserted into existing Section and Subject: Section I, Subject A, Module 6(a) Definition of concentration.

Titles of any new modules should be inserted into the list below.

Key to abbreviations in the list:

Suggested visual aids: T Text
 D Diagram with or without words
 P Photograph
 E Example or sample
 * indicates that national material should be included
 () Visual aid optional

Key to levels: B Basic
 I Intermediate
 A Advanced
 /T Technical
 /M Medical
 /R Regulatory
 - Indicates two levels in the same module

SECTION I: GENERAL

		Level	Visual Aid
Subject A:	Definitions:		
No. 1	'Pest' and 'pesticide'	B-A	T
No. 2	Pesticide names according to target species	I	T
No. 3	Pesticide actions on target species	I	T
No. 4	Systemic pesticides	I	T
No. 5	Active ingredient, Formulations (a)	B	T
No. 6	Formulations (b)	I	T
No. 7	Household pesticide	B	T
No. 8	Definition of 'toxicity'	B-A	T
No. 9	Definition of 'hazard' and 'risk'	B	T
Subject B:	Classification and labelling		
No. 1	Hazard classes	I	T
No. 2	Classification by formulation	I	T
No. 3	Importance of label	B	E*
No. 4	Contents of a label	A/R	E*

SECTION II: ABSORPTION AND EFFECTS OF PESTICIDES

		Level	Visual Aid
Subject A: Absorption			
No. 1	Routes of entry: through the skin	B	D
No. 2	Routes of entry: through the mouth	B	D
No. 3	Routes of entry: through the lungs	B	D
No. 4	Routes of entry: through broken skin	B	D
Subject B: Adverse effects of pesticides			
No. 1	Acute and long term effects	I	T
No. 2	Storage: accumulation of dose or effect	I	(T)
No. 3	Relationship of dose to exposure or effect	A	(T)
No. 4	Pesticides and cancer	I	(T)
Subject C: Control of pesticides			
No. 1	Registration of pesticides	B	(T)
No. 2	The Code of Conduct on the Distribution and Use of Pesticides	B-I	(T)
No. 3	Distribution of pesticides	I-A/R	(T)

SECTION III: PERSONAL PROTECTION

		Level	Visual Aid
Subject A:	Protection by hygiene		
No. 1	Objective of protection	B	T
No. 2	Washing	B	P
No. 3	Eating and drinking at work	B	P
No. 4	Smoking at work	B	P
No. 5	Chewing	B	P
No. 6	Household pesticides	B	P
Subject B:	Protection of the body		
No. 1.	The main part of the body	B	P
No. 2	The head and neck	B-I	P
No. 3	Lower legs and feet	B	P
No. 4	The hands	B	P
No. 5	The eyes	B	P
No. 6	The lungs	B-I	P
No. 7	Washing of clothing and equipment	B	P
Subject C:	Protection according to task		
No. 1	Responsibility of controllers and supervisors	I	T
No. 2	Knapsack spraying	B	P
No. 3	Pressurized hand spraying	B	P
No. 4	Mechanised spraying	I	P
No. 5	Dusting	B	P
No. 6	Mixing pesticides	B	P
No. 7	Bagging pesticides	B	P
No. 8	Supervising the field	I	P
No. 9	Maintaining the equipment	I	P
No. 10	Acting as a flagman	I	P
No. 11	Controlling pests commercially	A/T	P
No. 12	Loading pesticides	I	P
No. 13	Piloting an aircraft applying pesticides	A/T	T

SECTION IV: PROTECTION OF OTHERS.

		Level	Visual Aid
Subject A: Other people			
No. 1	Introduction	B	T
No. 2	Transport by truck	B	P
No. 3	Transport by boat	B	P
No. 4	Storage of pesticides	I	P
No. 5	Locking up	I	P
No. 6	Storing and using household pesticides	B	P
No. 7	Exclusion from sprayed crops	B	P
Subject B: Other organisms: the environment			
No. 1	Results of pesticide contamination	I	P
No. 2	Disposal of wash water in a pit	B	P
No. 3	Disposal of wash water as a diluent	B	P
No. 4	Disposal of containers by burying	B	P
No. 5	Disposal of containers by burning	B	P
No. 6	Decontamination of containers	I	P
No. 7	Disposal of large quantities of unwanted pesticides	I	-

SECTION V: CHEMICAL TYPES AND MODES OF ACTION OF PESTICIDES

		Level	Visual Aid
Subject A: General points			
No. 1	Names of pesticides	B	E*
No. 2	Modes of action of pesticides	I	-
No. 3	Mixtures of pesticides in the field	I	-
No. 4	Manufactured mixtures of pesticides	A	-
Subject B: Insecticides			
No. 1	Organophosphorous compounds	I/A	T*
No. 2	Carbamate compounds	I/A	T*
No. 3	Organochlorine compounds	I/A	T*
No. 4	Pyrethroid compounds	I/A	T*
Subject C: Rodenticides			
No. 1	Warfarin	I	T*
No. 2	Warfarin derivatives	I	T*
No. 3	Other rodenticides	I	T*
Subject D: Other pesticides			
No. 1	Paraquat and diquat	I	T*
No. 2	Pentachlorophenol and related compounds	I	T*
No. 3	Metals	I	T*

SECTION VI: FIRST AID TREATMENT OF PESTICIDE POISONING

		Level	Visual Aid
Subject A:	Symptoms and signs (1-4)		
	Symptoms and signs, treatment (5-8)		
No. 1	General	B	T
No. 2	Organophosphorous poisoning	I	T
No. 3	Carbamate poisoning	I	T
No. 4	Organochlorine poisoning	I	T
No. 5	Pyrethroid insecticides	I	T
No. 6	Poisoning by rodenticides	I	T
No. 7	Poisoning by paraquat and diquat	I	T
No. 8	Pentachlorophenol and related compounds	I	T
Subject B:	Treatment		
No. 1	General principles	B	T
No. 2	Poisoning by organophosphorous compounds	I	T
No. 3	Poisoning by carbamate compounds	I	T
No. 4	Poisoning by organochlorine compounds	I	T
Subject C:	Local treatment of splashes of pesticides		
No. 1	In the eye	B	P
No. 2	On the skin	B	P

SECTION VII: MEDICAL TREATMENT OF PESTICIDE POISONING

		Level	Visual Aid
Subject A: History, signs and symptoms			
(and treatment for (No. 8))			
No. 1	History	A/M	T
No. 2	Organophosphorous poisoning	A/M	T
No. 3	Carbamate poisoning	A/M	T
No. 4	Organochlorine poisoning	A/M	T
No. 5	Pyrethroid insecticides	A/M	T
No. 6	Rodenticides	A/M	T*
No. 7	Paraquat and diquat poisoning	A/M	T
No. 8	Pentachlorophenol and related compounds	A/M	-
Subject B: Treatment			
No. 1	General principles	A/M	(T)
No. 2	Poisoning by organophosphorous compounds	A/M	(T)
No. 3	Poisoning by carbamate compounds	A/M	(T)
No. 4	Poisoning by organochlorine compounds	A/M	T
No. 5	Pyrethroid insecticides	A/M	(T)
No. 6	Poisoning by rodenticides	A/M	T
No. 7	Paraquat and diquat poisoning	A/M	T

SECTION VIII: OTHER RELATED SUBJECTS

		Level	Visual Aid
Subject A:	Administrative subjects		
No. 1	Selection of staff	A	-
No. 2	Records of exposure to pesticides	I	D*
no. 3	Reporting of cases of poisoning	T	T*
Subject B:	Scientific subjects		
No. 1	Field testing of cholinesterase activity	A	P
No. 2	Interpretation of cholinesterase results	A	T

SECTION IX: EVALUATION

Method that may be used for evaluation of courses.

NOTE ON EDUCATIONAL OBJECTIVES

Educational objectives are set out at the beginning of each Section. These and table III/1, Specimen Module Selection for Specified Groups below are given for guidance only. Trainers must be free to choose only those modules relevant to the groups actually being trained, and each group should finish their course feeling that it has been entirely relevant to their work. To include too much in a course is as likely to affect its usefulness as including too little.

2. SPECIMEN MODULE SELECTION FOR SPECIFIED GROUPS

The table below is indicative only, and should not be followed exactly. The choice of modules for any group will depend on the educational level of the participants, their contact with pesticides in their work or in their homes, and the pesticides to which they may be exposed.

Public interest groups will vary greatly in their background, and the reasons why they are attending a course. For this reason, no educational objectives are given for these groups but suggestions will be found in the table III/1.

Table III/1. SPECIMEN MODULE SELECTION

GROUP:	L	M	N	P ¹	R	S	
L	Spraymen in a malaria control campaign.						
M	Supervisors of agricultural spraymen.						
N	Health workers in agricultural area.						
P ¹	Agricultural aviation personnel.						
R	Pesticide registration personnel.						
S	Public interest group.						
Sec.	Subj.	L	M	N	P ¹	R	S
I	A	1,5,8,9	1-6,9	1-9		1-9	1,5,7,8,9
	B	3	1-3	1-3		1-4	1,3
II	A	1-3	1-4	1-4		1-3	1-3
	B		1,4	1-4		1-4	1
	C		1	1,3		1-3	1,2
III	A	1-5	1-5	1-6		1-6	1,6
	B	1-7	1-7	1-7		1-7	
	C	1,3,6,7	1,2 4-9 ²		9,10 12,13	11	
IV	A	1-3	1-5,7	1		1,7	1,6,7
	B	2-5	1-6	1,6		1-7	1
V	A	1	1-3	1-4		1,2,4	1,3
	B		1-4 ³	1-4 ³		1-4	
	C		1-3 ³	1-3 ³		1-3	
	D		1-4 ³	1-4 ³		1-3	
VI	A	1	1-8 ³	1-8		1	1
	B	1	1-4 ³	1-4		1	1
	C	1-2	1-2	1-2		1-2	1-2
VII	A	This section is for medical officers.					
	B						
VIII	A		2,3	1,3		3	
IX	This section is for the trainer.						

¹ As appropriate modules for group M, with the additional modules shown.

² As relevant to the work undertaken.

³ As relevant to the compounds used.

3. TERMINOLOGY USED

The module number is given for words defined in a course module to increase familiarity with the modules. Medical terms used in Section VII have not been included in the glossary.

ABSORPTION	The process by which a chemical is taken into the tissues of plants and animals.
ACARICIDE	A chemical which controls mites and ticks.
ACCUMULATION OR CUMULATION	Of a chemical: Increase in the amount of a chemical in the body when absorption exceeds excretion. Of an effect: An effect produced by repeated doses which singly do not produce any effect.
AEROSOL	A fine mist of solid or liquid particles suspended in air.
AVICIDE	Module I A 2.
ACTIVE INGREDIENT	The biologically active part of the pesticide present in a formulation.
ANTIDOTE	A chemical or drug intended to counteract the effects of a poison.
BIOACTIVE	Affecting the structure or function of living organisms.
BIOLOGICAL CONTROL AGENTS	Module I A 1.
CARCINOGENIC	Causing cancer.
CHOLINESTERASE	An enzyme present in animals and essential for proper nerve function.
CONCENTRATE	A pesticide which requires dilution before application.
CLASSIFICATION	A distribution (of pesticides and their formulations) into classes according to their hazard, etc. Module I B 1.
DETOXIFICATION	Processes in the body whereby a toxic substance is rendered less harmful.
DILUENT	Inert material used to dilute a concentrate.
DOSE	The amount of a chemical administered to an organism.
DUSTABLE POWDER	Module I A 6.

EFFECT	The result on an organism of more than a threshold or higher dose of a chemical.
EMETIC	A chemical which will cause vomiting.
EMULSIFIABLE CONCENTRATE	Module I A 6.
ENZYME	A highly selective protein which enables reactions to take place in living cells or body fluids under physiological conditions.
EXPOSURE (to a chemical)	The situation in which the contact between the chemical and an organism might result in absorption of the chemical by the organism.
FIRST AID	Emergency treatment given to a sick or injured person before medical aid is available.
FOGGING CONCENTRATE	Module I A 6.
FORMULATION	Module I A 5.
FORMULATOR	An industrial concern which adds one or more pesticidal active ingredients to other chemicals to make a mixture suitable for application.
FUNGICIDE	Module I A 2.
GRANULES	Module I A 6.
HAZARD	Module I A 9.
HERBICIDE	Module I A 2.
HOUSEHOLD PESTICIDE	Module I A 7.
INGEST	Eat or swallow, take in through the mouth.
INHALE	Breathe into the lungs.
INSECTICIDE	Module I A 2.
LARVICIDE	Module I A 2.
LD₅₀	Module I A 8.
MICRO-ORGANISM	Virus, bacterium or fungus, or a unicellular plant or animal.
MITICIDE	Module I A 2.
MOLLUSCICIDE	Module I A. 2.

OIL MISCIBLE LIQUID	Module I A 6.
ORGANISM	Any living thing, plant, animal, or micro-organism.
PASTE	Module I A 6.
PELLET	Module I A 6.
PEST	Module I A 1.
PESTICIDE	Module I A 1.
POTENTIATION	The result when one chemical enhances the toxicity of another so that their combined effect is greater than the addition of the effects of each.
POUR-ON FORMULATION	Module I A 6.
PRE-HARVEST INTERVAL	The time that must elapse between the latest application of a pesticide to a crop, and the harvest of the crop.
RISK	Module I A 9.
RODENTICIDE	Module I A 2.
SOLUBLE POWDERS	Module I A 6.
STORAGE (of a chemical in the body)	Deposition of a chemical in an organ or tissue of the body in which it is apparently inactive as long as it stays there.
SPECIFICITY	The capacity of a chemical to affect only the target organism, without affecting other organisms in the same environment.
SYNERGIST	As applied to pesticides, a chemical without pesticidal action which enhances the action of a pesticide. As applied generally, synergism is sometimes synonymous with potentiation.
SYSTEMIC PESTICIDE	Module I A 4.
TABLET	Module I A 6.
TARGET AREA	The area to be treated with a pesticide.
TARGET SPECIES	The species that a pesticide is designed to control.
TECHNICAL PRODUCT	Module I A 5.
THRESHOLD	The minimum dose or concentration of a chemical at which an effect is first induced.

TOXICITY	Module I A 8.
WATER IN OIL EMULSION	Module I A 6.
ULV LIQUID (UL)	A pesticide formulation designed to be applied at ultra low volume (less than five litres per hectare).
ULTRA LOW VOLUME (ULV)	A volume of pesticide spray applied at a very low rate per unit area.

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No.	9	DDT and its derivatives
	15	Tin and organotin compounds
	29	2,4-Dichlorophenoxyacetic acid (2,4-D)
	34	Chlordane
	38	Heptachlor
	39	Paraquat and diquat
	40	Endosulfan
	41	Quintozene
	42	Tecnazine
	43	Chlordecone
	44	Mirex
	45	Canphechlor
	62	1,2 Dichlorethane
	*63	Organophosphorous insecticides - a general introduction
	*64	Carbamate Pesticides - a general introduction
	66	Kelevan
	67	Tetradifon
	71	Pentachlorophenol
	73	Phosphine and selected metal phosphides
	76	Thiocarbamate pesticides - a general introduction
	78	Dithiocarbamate pesticides, ethylenethiourea, propylenethiourea - a general introduction
	79	Dichlorvos
	82	Cypermethrin
	83	DDT and its derivatives - environmental aspects
	84	2,4-Dichlorophenoxyacetic acid - environmental aspects
	87	Allethrins
	89	Formaldehyde
	90	Dimethoate
	91	Aldrin and dieldrin
	92	Resmethrins
	93	Chlorophenols
	94	Permethrin
	95	Fenvalerate
	96	d-Phenothrin
	97	Deltamethrin
	98	Tetramethrin

99	Cyhalothrin
101	Methyl mercury
104	Principles for the toxicological assessment of pesticide residues in food
121	Aldicarb
124	Lindane
130	Endrin
132	Trichlorfon
133	Fenitrothion
145	Methyl parathion
148	Benomyl
149	Carbendazim
153	Carbaryl (in press)
158	Amitrole (in press)

3. HEALTH AND SAFETY GUIDES:

2	Kelevan	39	Mirex
5	2,4-Dichlorophenoxyacetic acid (2,4-D)	40	Camphechlor
11	Tetradifon	41	Chlordecone
12	Tecnazine	47	Atrazine
13	Chlordane	49	Captafol
14	Heptachlor	50	Captan
17	Endosulfan	51	Paraquat
18	Dichlorvos	52	Diquat
19	Pentachlorophenol	54	Lindane (gamma-HCH)
20	Dimethoate	57	Formaldehyde
21	Aldrin and dieldrin	60	Endrin
22	Cypermethrin	64	Aldicarb
23	Quintozene	65	Fenitrothion
24	Allethrins	66	Trichlorfon
25	Resmethrins	72	Folpet
28	Phosphine and selected metal phosphides	73	Rotenone
30	Deltamethrin	74	Parathion
31	Tetramethrin	75	Methyl parathion
32	d-Phenothrin	77	Propachlor
33	Permethrin	79	Methamidophos
34	Fenvalerate	80	Monocrotophos
38	Cyhalothrin and lambda-cyhalothrin	81	Benomyl
		82	Carbendazim

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IRPTC produces data profiles on pesticides which can be used to provide information on human health and environmental effects and which could therefore usefully provide advice on the safe handling of pesticides. Requests for data profiles should be addressed to the Director, IRPTC/UNEP, Palais des Nations, 1211 Geneva 10, Switzerland.

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PART III

5. INDEX TO MODULES

A

Absorption, and exposure	II B 3	
through lungs	II A 3	
through mouth	II A 2	
through rashes	II A 4	
through skin	II A 1	
through wounds	II A 4	
Active ingredient	I A 5	
Accumulation, of dose	II B 2	
of effect	II B 2	
Arsenic	II B 4	V D 3
Atropine, as antidote		
in carbamate poisoning	VI B 3	VII B 3
in organophosphate poisoning	VI B 2	VII B 2
Avicide	I A 2	

B

Bagging pesticides	III C 7	
Bathing	III A 2	
Biological control	I A 1	
Body protection	III B 1	
Boots	III B 3	

C

Calciferol related compounds	V C 3	
poisoning, first aid	VI A 6	
poisoning, medical	VII B 6	
Cancer	II B 4	
Carbamate pesticides,		
mode of action	V B 2	
poisoning, first aid, symptoms	VI A 3	
first aid, treatment	VI B 3	
medical symptoms	VII A 3	
medical treatment	VII B 3	
Chewing at work	III A 5	
Cholinesterase	V B 1	V B 2
field testing	VIII B 1	
interpretation of results	VIII B 2	
Classification	I B 1	I B 2
Clothing, as protection	III B 1	
washing of	III B 7	
Code of conduct	II C 2	
Containers	I B 3	
decontamination of	IV B 6	
disposal of	IV B 4	IV B 5

Contamination, environmental of skin	IV B 1 III B 1	
Controllers, duties of	III C 1	
Copper salts	V D 3	
Coveralls, see Overalls		
Cumulation, see Accumulation		
D		
DDT	II B 2	
Decontamination of containers	IV B 6	
Disposal, of containers of unwanted pesticide of wash water	IV B 4 IV B 7 IV B 2	IV B 5 IV B 3
Diquat medical, symptoms medical, treatment poisoning, first aid	V D 1 VII A 7 VII B 7 VI A 7	
Dose, accumulation of	II B 2	
Drinking at work	III A 3	
Dusting	III C 5	
Dusts, protection against	III B 6	
E		
Eating at work	III A 3	
Effect, accumulation of acute long term	II B 3 II B 1 II B 1	
Environment, contamination of	IV B 1	
Equipment, maintenance of washing of	III C 9 III B 7	
Exclusion from sprayed crops	IV A 7	
Evaluation of course	IX	
Exposure, and absorption and protection records	II B 3 III B 1 VIII A 2	
Eye, protection splashes in	III B 5 VI C 1	
F		
First aid for poisoning, symptoms, general	VI A 1	
carbamate compounds	VI A 3	
organochlorine compounds	VI A 4	
organophosphorous compounds	VI A 2	
paraquat and diquat	VI A 7	
pentachlorophenol	VI A 8	
pyrethroids	VI A 5	
rodenticides	VI A 6	

treatment, general	VI B 1	
carbamate compounds	VI B 3	
organochlorine compounds	VI B 4	
organophosphorous compounds	VI B 2	
paraquat and diquat	VI A 7	
pentachlorophenol	VI A 8	
rodenticides	VI A 6	
splashes in eye	VI C 1	
splashes on skin	VI C 2	
Flagman, protection of	III C 10	
Fluoroacetates	V C 3	VII B 6
Food, carriage in field	III A 3	
Foot protection	III B 3	
Formulation, definition	I A 5	
distribution	II C 5	
liquid	I A 6	
mixtures of in field	V A 3	
solid	I A 6	
Fungicide	I A 2	
Fumigant	I A 3	
G		
Gases, protection against	III B 6	
Gloves	III B 4	
Goggles	III B 5	
H		
Hand protection	III B 4	
Hazard, classes	I B 1	
definition	I A 9	
and exposure	II B 3	
Head and neck protection	III B 2	
Herbicide	I A 2	
Household pesticides	III A 6	
storage of	IV A 6	
I		
Insecticide	I A 2	
L		
Label	I B 3	I B 4
Larvicide	I A 2	
Leg protection	III B 3	
Loading pesticides	III C 12	
Locking up pesticides	IV A 5	
Lungs, absorption by	II A 3	
protection	III B 6	

M

Maintaining equipment	III C 9
Masks	III B 6
Medical, poisoning, symptoms, and history	VII A 1
carbamate compounds	VII A 3
organochlorine compounds	VII A 4
organophosphorous compounds	VII A 2
pyrethroid compounds	VII A 5
rodenticides	VII A 6
paraquat and diquat	VII A 7
pentachlorophenol	VII A 8
Medical, poisoning, treatment	
general	VII B 1
carbamate compounds	VII B 3
organochlorine compounds	VII B 4
organophosphorous compounds	VII B 2
pyrethroid compounds	VII B 5
rodenticides	VII B 6
paraquat and diquat	VII B 7
Mercury	V D 3
Miticide	I A 2
Mixing pesticides	III C 6
Mixtures of pesticides, in field	V A 3
manufactured	V A 4
Modes of action	V A 2
Molluscicide	I A 2
Mouth, absorption by	II A 2

N

Names of pesticides	V A 1
Nematocides	I A 2

O

Obidoxime, as antidote	VII B 2
Organochlorine pesticides,	
accumulation of	II B 2
mode of action	V B 3
poisoning,	
first aid, symptoms	VI A 4
first aid treatment	VI B 4
medical symptoms	VII A 4
medical treatment	VII B 4

Organophosphorous pesticides,		
accumulation of	II B 2	
mode of action	V B 1	
poisoning,		
first aid, symptoms	VI A 2	
first aid, treatment	VI B 2	
medical symptoms	VII A 2	
medical treatment	VII B 2	
Overalls	III B 1	
P		
Paraquat	V D 1	
medical, symptoms	VII A 7	
medical, treatment	VII B 7	
poisoning, first aid	VI A 7	
Pentachlorophenol	V D 2	
poisoning, first aid	VI A 8	
Pest, definition	I A 1	
Pest control operations	III C 11	
Pesticide, classification	I B 1	
definition	I A 1	
disposal of	IV B 7	
distribution	II C 3	
household	I A 7	III A 6
modes of action	V A 2	
names	V A 1	
systemic	I A 4	
see also Effect		
People, protection of	IV A 1	
Pilots	III C 13	
Poison, contact	I A 3	
stomach	I A 3	
Poisoning,		
reporting of cases	VIII A 3	
see First aid, and Medical		
Pralidoxime, as antidote	VII B 2	
Protection, of body	III B 1	
of eyes	III B 5	
of hands	III B 4	
of head and neck	III B 2	
of legs and feet	III B 3	
of lungs	III B 6	
of other people	IV A 1	
personal	III A 1	
Pyrethroid pesticides,		
mode of action	V B 4	
medical, symptoms	VII A 5	
medical, treatment	VII B 5	
poisoning, first aid	VI A 5	

R

Registration of pesticides	II C 1
Respirators	III B 6
Risk	I A 9
Rodenticide	I A 2
calciferol	V C 3
chloralose	V C 3
fluoroacetates	V C 3
poisoning, first aid	VI A 6
thallium	V C 3
warfarin	V C 1
warfarin derivatives	V C 2
zinc phosphide	V C 3

S

Shoes	III B 3
Showering	III B 2
Skin, absorption by	II A 1
splashes on	VI C 2
Smoking at work	III A 4
Spraying, and wind	III B 3
knapsack	III C 2
mechanized	III C 4
pressurized hand	III C 3
Staff selection	VIII A 1
Storage of pesticides	IV A 4
see also Accumulation	
Supervising, in field	III C 8
Supervisors, duties of	III C 1

T

Technical product	I A 5
Thallium	V C 3
poisoning, first aid	VI A 6
Tin	V D 3
Toxicity, chronic	II B 1
definition	I A 8
and hazard	II B 3
Transportation of pesticides	
by boat	IV A 3
by truck	IV A 2

V

Vapours, protection against	III B 6
Visor	III B 5

W

Warfarin	V C 1
Warfarin derivatives	V C 2
poisoning, first aid	VI A 6
poisoning, medical	VII B 6
Washing, of skin	III A 2

Z

Zinc phosphide	V C 3
poisoning, first aid	VI A 6
poisoning, medical	VII B 6



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

Main points:

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

NEVER USE A PESTICIDE FROM AN UNLABELLED CONTAINER

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

Subsidiary point:

Labels should always be printed in a locally understood language.

For discussion:

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

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

Other information:

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

Suggested visual aid: Examples of pesticide labels used nationally.

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

Main point:

A LABEL CONTAINS BOTH INFORMATION AND ADVICE

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

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

Other information:

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

Suggested visual aid: Examples of pesticide labels used nationally.

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

Main points:

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

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

Subsidiary points:

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

Other information:

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

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

GENERAL

A. APPLICATORS

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

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

B. ALL OTHER GROUPS:

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

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

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

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

Main points:

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

A PESTICIDE USUALLY REFERS TO ANY CHEMICAL WHICH KILLS A PEST

Level: ADVANCED

Subsidiary points:

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

For discussion:

How is 'pesticide' defined in this country?

Other information:

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

Pesticide means any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or which may be administered to animals for the control of insects, arachnids, or other pests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

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

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

Main point:

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

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

For discussion:

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

Other information:

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

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

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

Main point:

Pesticides may act on target species in several ways,

Examples: A pesticide which kills the pest by first passing into it through the skin, cuticle, or exoskeleton, is a **CONTACT POISON**;
A pesticide which kills the pest by first passing into the stomach is a **STOMACH POISON**;
A pesticide which is distributed in the air is a **FUMIGANT**. It may act as a contact poison or be inhaled, according to target species.

Subsidiary point:

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

Other information:

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

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

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

Main points:

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

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

Subsidiary points:

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

Other information:

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

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

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

Main points:

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

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

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

Subsidiary points:

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

For discussion:

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

Other information:

Examples of formulations are given in module I A 6.

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

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

Main point:

FORMULATIONS ARE COMPLEX CHEMICAL MIXTURES.

Only a selection of those in use are shown below.

Examples:

SOLIDS:

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

GRANULES (GR), DUSTS or DUSTABLE POWDERS (DP), often applied as such; PELLETS or PASTE (PA) used for baits (RB);

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

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

LIQUIDS:

EMULSIFIABLE CONCENTRATES (EC) to be added to water;

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

LIQUIDS (UL) for use in ULV application equipment;

AEROSOL GENERATORS (AE);

FOGGING CONCENTRATES (HN or KN);

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

SHAMPOOS for humans.

Subsidiary points:

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

For discussion:

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

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

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

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

Main point:

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

Subsidiary point:

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

For discussion:

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

Other information:

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

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

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

Main point:

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

Subsidiary points:

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

Level: ADVANCED

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

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

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

LOEL the Lowest Observed Effect Level.

Other information:

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

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

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

Main points:

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

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

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

Subsidiary point:

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

For discussion:

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

Other information:

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

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

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

Main points:

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

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

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

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

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

Subsidiary points:

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

For discussion:

What system of classification is in use in this country?

Other information:

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

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

ABSORPTION AND EFFECTS OF PESTICIDES

A. APPLICATORS:

- Subject A: Should know the routes of entry of pesticides into the body.
- Subject B: May need to know the difference between acute and long term effects.
- Subject C: May need to know that pesticides are registered.

B. SUPERVISORS:

- Subject A: Should know the routes of entry of pesticides into the body.
- Subject B: Should know what is an acute effect, and may need to know about accumulation of dose or effect. Should understand relationship between exposure to pesticides and cancer.
- Subject C: May need to know that pesticides are registered.

C. SANITARIANS, AGRICULTURAL EXTENSION OFFICERS AND REGISTRATION PERSONNEL

- Subject A: Should know the routes of entry of pesticides into the body.
- Subject B: Should know what is an acute and long term effect, about accumulation of dose or effect, and the facts concerning pesticides and cancer.
- Subject C: Should know about registration, the Code of Conduct, and distribution of pesticides.

D. OTHER HEALTH AND MEDICAL PERSONNEL

- Subject A: Should know the routes of entry of pesticides into the body.
- Subject B: Should know what is an acute and long term effect, about accumulation of dose or effect, and the facts concerning pesticides and cancer.
- Subject C: Should know that pesticides are registered.

Section: II **Absorption and effects of pesticides**
Subject: A **Absorption: Routes of entry**
Number: 1 **Through the skin**

Main points:

**PESTICIDES MUST BE ABSORBED INTO THE BODY
BEFORE THEY CAN CAUSE ANY DANGER TO HEALTH.**

THERE ARE FOUR ROUTES OF ENTRY OF PESTICIDES INTO THE BODY.

**MANY PESTICIDE FORMULATIONS CAN BE ABSORBED
THOUGH THE INTACT SKIN.
FOR THOSE WHO HANDLE OR APPLY PESTICIDES,
THIS IS THE COMMONEST ROUTE OF ABSORPTION.**

Subsidiary points:

1. The absorption of most pesticides does not leave any mark on the skin to show that it has taken place.
2. Formulations of most pesticides can be absorbed through intact skin as long as they are in contact with the skin. Contact occurs when dust clings to the skin, when liquid splashes on to the skin, when the skin is immersed in liquid, or when spray mist or rebound spray lands on the skin and dries on it.
3. The pesticide is absorbed more rapidly if:
 - the formulation is a liquid or is oily,
 - the formulation is concentrated,
 - the skin is warm or sweaty.
4. Absorption slows or stops as soon as the pesticide is washed off the skin, depending on how well the washing is carried out. Solvents should not be used for washing. Only water should be used, and this is more efficient if used with soap.

For discussion:

If you apply pesticides, how can your skin become contaminated?

Other information:

1. A few pesticides or their solvents are not absorbed through intact skin but are irritant to the skin or corrosive to the nails.
2. See also Module II A 4.

Suggested visual aid: A diagram of the body outline with arrows pointing to the face and forearm (and legs if relevant).

Section: II Absorption and effects of pesticides
Subject: A Absorption: Routes of entry
Number: 2 Through the mouth

Main points:

**PESTICIDES TAKEN THROUGH THE MOUTH ARE ABSORBED IN THE STOMACH
AND IN THE GUT**

Those who handle pesticides can absorb them if they eat, drink,
or smoke at work without first washing their hands.

Workers and members of any families may take pesticides through the mouth if:

- they drink from any unlabelled container or bottle into which pesticide has been decanted. The pesticide is drunk in mistake for water or other drinks, and the amount swallowed can be dangerous, even if the mistake is soon realised from the taste.
- used or 'empty' pesticide containers are left around where children might play with them.

For discussion:

Are there any other ways in which family members might take in pesticides by mouth?
Which of these are likely to cause absorption of high doses of pesticides?

Other information:

1. Uncovered food can sometimes be contaminated during indoor residual spraying in public health operations, but the dosage will be relatively low.
2. If food is contaminated by a leaking container during transportation or storage, dosage may be high.
3. The group should be reminded that the dosage absorbed is what determines the effect.

Suggested visual aid: A diagram of the body outline with an arrow pointing to the mouth.

Section: II Absorption and effects of pesticides
Subject: A Absorption: Routes of entry
Number: 3 Through the lungs

Main point:

**PESTICIDE GETS INTO THE LUNGS IF GAS OR VAPOUR IS INHALED.
ONCE TAKEN INTO THE LUNGS IT MAY BE RAPIDLY ABSORBED.**

Light dust and aerosols can also enter the lungs,
but only the smallest particles reach the alveoli.

Subsidiary points:

1. Absorption from the lung when mists are inhaled is negligible, since the droplets of moisture are too large to pass directly into the lungs. Instead, they are trapped on the moist lining of the nose and throat, and may be absorbed from these as if through the skin, or swallowed.
2. As with the other routes of entry, how much pesticide is absorbed (the dose) depends on its concentration in the fog, vapour, or dust.
3. Some pesticides have a strong smell (e.g. malathion), but in most formulations, any smell comes from the solvents. In either case, smell is not a reliable indication of the concentration of any pesticide in a gas, vapour, or mist.

Other information:

Only particles of diameter 1-8 micrometers (thousandths of a millimetre) can pass into the lungs without being trapped in the nose or mouth, throat, or trachea. Non-reflecting particles of this size are too small to be seen.

Suggested visual aid: A diagram of the body outline with an arrow pointing to the chest area and to the nose.

Section: II Absorption and effects of pesticides
Subject: A Absorption: Routes of entry
Number: 4 Through broken skin

Main point:

THE ABSORPTION OF PESTICIDE THROUGH WOUNDS, CRACKED SKIN AND RASHES ON EXPOSED SKIN IS GREATER THAN THAT THROUGH THE SAME AREA OF INTACT SKIN.

Wounds and rashes should be covered with waterproof dressing as long as the worker continues to be exposed to a pesticide.

Subsidiary point:

A waterproof dressing should be removed or changed for a permeable dressing after work each day, and reapplied if work continues on the next day.

Other information:

This route of absorption is sometimes referred to as 'inoculation'.

Suggested visual aid: A diagram of the body outline with an arrow pointing to a shaded area on a forearm.

Section: II Absorption and effects of pesticides
Subject: B General effects of pesticides
Number: 1 Acute and long term effects.

Main points:

The routes of absorption are not equally efficient in determining how much of the amount entering the body is absorbed. Absorption in the lungs is the most efficient. Absorption through the skin may be the most important, but some pesticides (such as DDT and the pyrethroids) are hardly absorbed through the skin at all, except in oily formulations. In occupational exposure, intake through the mouth is less important, but once it occurs, absorption is difficult to prevent or slow. The effects of the absorbed dose are independent of the route of absorption. By any route, the amount of the chemical absorbed is the DOSE, and once it is absorbed, its effect is independent of the route of absorption.

**AS SOON AS ANY TOXIC CHEMICAL IS ABSORBED, THE BODY OFTEN BEGINS TO
BREAK IT DOWN BY ONE OR SEVERAL AVAILABLE MECHANISMS,
IN ORDER TO RENDER IT HARMLESS.**

**AN ACUTE EFFECT OCCURS WHEN THE LEVEL OF A TOXIC CHEMICAL IN THE
BODY REACHES A CERTAIN THRESHOLD,
AND IT CONTINUES UNTIL THE LEVEL FALLS.**

THE EFFECT OCCURS SOON AFTER THE THRESHOLD HAS BEEN PASSED.

**A LONG TERM EFFECT ONLY APPEARS SOME TIME AFTER ABSORPTION
OF A SINGLE OR MULTIPLE DOSES OF A CHEMICAL WITH CHRONIC TOXICITY.**

Subsidiary points:

1. Many pesticides are acutely toxic, and have no chronic toxicity in humans. These are rapidly excreted or are rapidly broken down after absorption into less toxic compounds. Acute effects can be persistent as long as exposure continues, and the level remains above the threshold.
2. A few pesticides, which are little used, produce long term effects from a single dose. These include thallium, which is a rodenticide, and the organic mercurials which are sometimes used as fungicides for the treatment of seeds for planting. The latter causes permanent paralysis and brain damage if the treated seeds are eaten.
3. The threshold dose for a long term effect may be lower than that for an acute effect.

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

Section: II Absorption and effects of pesticides
Subject: B General effects of pesticides
Number: 2 Storage: accumulation of dose and effect

Main points:

SOME PESTICIDES ARE STORED IN BODY TISSUES.

Example: A few organochlorines are stored in fat.

STORAGE IS NOT CUMULATIVE: IT IS RELATED TO ABSORPTION.

IF THIS DIMINISHES, SO DOES THE LEVEL OF STORAGE.

WHILE STORED, THE CHEMICAL DOES NOT CIRCULATE, AND THEREFORE DOES NOT CONTRIBUTE TO THE LEVEL AT WHICH AN EFFECT OCCURS.

WHEN THE RATE OF EXCRETION OR INACTIVATION OF ANY CHEMICAL IS LESS THAN THE RATE OF ABSORPTION, ACCUMULATION OF THE CHEMICAL IN THE CIRCULATION CAN OCCUR, AND THE THRESHOLD DOSE TO CAUSE AN EFFECT MAY BE EXCEEDED AFTER REPEATED DOSES.

ACCUMULATION OF EFFECT CAN OCCUR WHEN THE EFFECT CAUSED LASTS LONGER THAN THE EXCRETION OF THE CHEMICAL. REPEATED DOSES AT A LEVEL WHICH CAUSES A SMALL EFFECT WITHOUT SYMPTOMS CAN PRODUCE A SYMPTOMATIC EFFECT AS THE EFFECTS OF EACH DOSE ACCUMULATE TO PASS THE THRESHOLD AT WHICH SYMPTOMS APPEAR.

ACCUMULATION OF EFFECT IS MORE IMPORTANT THAN ACCUMULATION OF DOSE, ESPECIALLY WITH ORGANOPHOSPHORUS PESTICIDES.

Subsidiary point:

Storage in fat of DDT and related compounds has caused some concern, and was one of the factors that led to restriction or banning of the compound. It was certainly of significance in some animal species, especially birds, but there is no evidence that any adverse effects have appeared in humans during the 50 years that DDT has been used.

Suggested visual aid: Text, if required.

Section: II Absorption and effects of pesticides
Subject: B General effects of pesticides
Number: 3 Relationship of dose to exposure and effect

Main points:

**FOR ANY TOXIC CHEMICAL, EXPOSURE IS RELATED TO DOSE,
AND DOSE TO EFFECT, AND THEREFORE EXPOSURE IS RELATED TO EFFECT,
THROUGH THE DOSE.**

IF THERE IS NO EXPOSURE, THERE CAN BE NO EFFECT.

**IF EXPOSURE IS HIGH, BUT ABSORPTION IS LOW, THERE WILL BE NO EFFECT IF
THE THRESHOLD DOSE IS NOT REACHED.**

**IF EXPOSURE IS VERY LOW, ABSORPTION WILL ALSO BE LOW,
AND THE DOSE WILL ONLY REACH THE THRESHOLD LEVEL
IF THE THRESHOLD IS LOW.**

**THESE SIMPLE PRINCIPLES ARE THE BASIS OF PREVENTION
OF ANY ADVERSE EFFECTS FROM EXPOSURE TO TOXIC CHEMICALS.**

**IF THEY ARE APPLIED, ANY CHEMICAL, HOWEVER TOXIC, CAN BE HANDLED
SAFELY.**

Subsidiary points:

1. Those who are most likely to be exposed to pesticides are those who manufacture them, those who transport them, and those who apply them as part of their work. Most of this course is about how the exposure of the latter group can be diminished by various protective measures to avoid or lower absorption.
2. In ordinary circumstances, exposure of the public will be slight. They should have no access to hazardous pesticides, and experience has shown that occasional exposure to drift or other minor accidental exposures do not result in significant absorption. Massive pesticide contamination of food has caused serious poisoning among the public. The handling and storage of all pesticide formulations need great care, particularly in transportation.

Suggested visual aid: Text, if indicated.

Section: II Absorption and effects of pesticides
Subject: B General effects of pesticides
Number: 4 Pesticides and cancer

Main points:

AUTHORITIES REGISTERING PESTICIDES REQUIRE TESTS ON ANIMALS TO BE CARRIED OUT TO ASSESS THE POTENTIAL OF EACH PESTICIDE TO CAUSE CANCER. THEY REGULARLY REVIEW RESULTS, AIDED BY THE ADVICE OF INTERNATIONAL EXPERTS.

THE ONLY PESTICIDES THAT HAVE BEEN SHOWN DEFINITELY TO PRODUCE CANCERS IN HUMANS ARE THE INORGANIC SALTS OF ARSENIC.

Subsidiary points:

1. Carcinogenicity tests are usually carried out on rodents which are exposed to a pesticide for a lifetime.
2. Humans do not always react to chemicals in the same way as rodents, and the tests do not exclude the possibility that some compounds which do not produce cancers in animals might do so in man, and vice versa.
3. It may take up to 20 years after exposure to a chemical before cancers appear in humans. Most pesticides have been in use for longer than this period. Exposed human populations have been studied closely, especially in manufacturing and formulating plants. These studies have not produced evidence that pesticides at present in use have caused cancers in humans.

Suggested visual aid: Text, if indicated.

Section: II Absorption and effects of pesticides
Subject: C Control of pesticides
Number: 1 Registration of pesticides

Main points:

PESTS DESTROY UP TO ONE THIRD OF THE WORLD'S FOOD CROPS DURING GROWTH, HARVESTING AND STORAGE, AND CAUSE MILLIONS OF CASES OF HUMAN AND ANIMAL DISEASE EVERY YEAR. PESTICIDES ARE STILL NECESSARY TO REDUCE THESE UNDESIRABLE EFFECTS.

PESTICIDES VARY IN TOXICITY, AND THIS INFLUENCES THE HAZARD THAT THEY PRESENT TO NON-TARGET ORGANISMS, INCLUDING HUMANS. THE SPECIFICITY OF PESTICIDES ALSO VARIES, BUT IN GENERAL IS LOW. THEREFORE, THE USE OF PESTICIDES MUST BE CONTROLLED TO PROTECT THE WHOLE ENVIRONMENT.

MOST COUNTRIES HAVE FOUND THAT THE ONLY WAY TO DO THIS IS TO REGISTER PESTICIDES TO CONTROL THEIR USE.

THE GOAL IS TO PROVIDE SOCIETY WITH ADEQUATE PROTECTION FROM ADVERSE EFFECTS WHILE NOT DENYING IT ACCESS TO BENEFITS FROM THE USE OF PESTICIDES.

THIS INVOLVES DECIDING HOW EACH PESTICIDE FORMULATION SHALL BE DISTRIBUTED, LABELLED AND USED WITH MAXIMUM EFFICIENCY AND MINIMUM HAZARD TO MAN AND THE ENVIRONMENT.

Subsidiary point:

Pesticide registration authorities may be independent or attached to a government ministry, usually agriculture. Regardless of how they are organized, it is essential that other ministries, including health, environmental protection, fisheries, forestry, and others should be closely associated in the registration process.

For discussion:

How are pesticides controlled in this country?

Suggested visual aid: Text, if indicated.

Section: II Absorption and effects of pesticides
Subject: C Control of pesticides
Number: 2 The Code of Conduct

Main points:

NOT ALL ASPECTS OF THE SAFE AND EFFICIENT USE OF PESTICIDES CAN BE COVERED BY THE REGULATIONS MADE AS THE RESULT OF REGISTRATION OF PESTICIDES.

IN 1985, AFTER CONSULTATION WITH OTHER INTERNATIONAL AGENCIES, THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO) ISSUED THE INTERNATIONAL CODE OF CONDUCT ON THE DISTRIBUTION AND USE OF PESTICIDES

Level: INTERMEDIATE

Subsidiary points:

1. The Code of Conduct is addressed to international organizations, governments of exporting and importing countries, industry (including manufacturers, trade associations, formulators, and distributors), users, and public sector organizations such as environmental groups, consumer groups, and trade unions.
2. It deals with:
 - pesticide management
 - testing of pesticides
 - reducing health hazards
 - regulatory and technical requirements
 - availability and use
 - distribution and trade
 - information exchange
 - labelling, packaging, storage and disposal, and
 - advertising
3. Apart from the articles in the Code many of these subjects have been amplified in more detail in Guidelines issued by FAO under the Code.
4. The Code was up-dated in 1989, to include Information Exchange and Prior Informed Consent (PIC).

Other information:

Copies of the Code and the Guidelines can be obtained from FAO.

Suggested visual aid: Text, if indicated.

Section: II Absorption and effects of pesticides
Subject: C Control of pesticides
Number: 3 Distribution of pesticides

Main points:

AN EFFECTIVE WAY OF PROTECTING WORKERS AND THE GENERAL PUBLIC FROM ADVERSE EFFECTS IN THE HANDLING OF PESTICIDES IS REGULATION OF THE DISTRIBUTION OF HAZARDOUS FORMULATIONS

NATIONAL CIRCUMSTANCES MAY DETERMINE HOW THIS IS DONE. MANY COUNTRIES USE THE WHO RECOMMENDED CLASSIFICATION OF PESTICIDES BY HAZARD AS THE BASIS FOR CONTROL.

Level: ADVANCED/REGULATORY

Subsidiary points:

1. A suggested plan is as follows according to the hazard class of the formulation:

Class Ia (Extremely hazardous): permitted to be sold only to approved pest control organizations for specified operations. The applicators must be fully trained, and must use full protective equipment. Some countries require licensing of applicators to ensure that training has been thorough.

Class Ib (Highly hazardous): permitted to be sold only to approved pest control organizations for permitted uses. Applicators must be trained as above.

Class II (Moderately hazardous): permitted to be sold only through certain retailers to those who require to use the pesticides in the course of their work. For example, farmers can buy these pesticides from suppliers of agricultural chemicals in bulk. The retailer should remind the purchasers of the precaution to be taken, and each sale should be recorded in a special register.

Class III (Slightly hazardous), and those formulations in Table 5 of the Guidelines to Classification, unlikely to present acute hazard in normal use: permitted to be sold to the general public in small packs or as ready-for-use packages.

2. The class should be clearly visible from the colour of the label, and the presence of warning symbols on containers of formulations of moderate or higher hazard.

For discussion:

What are the regulations for distribution and labelling in this country?

Suggested visual aid: Text, if indicated.

PERSONAL PROTECTION

A. APPLICATORS, SUPERVISORS, SANITARIANS, AND AGRICULTURAL EXTENSION OFFICERS

Subject A: Should know the rules for protection by hygiene.

Subject B: Should know how to protect the parts of the body.

Subject C: Should know how the methods set out in subjects A and B are applied to specific tasks, and the use of certain types of equipment.

B. OTHER HEALTH AND MEDICAL PERSONNEL

Subject A: Should know the rules for protection by hygiene.

Subject B: Should know how to protect the parts of the body.

Subject C: May be omitted.

C. REGISTRATION PERSONNEL:

Subject A: Should know the rules for protection by hygiene.

Subject B: May need to know how to protect the parts of the body.

Subject C: May need to know how the methods set out in subjects A and B are applied to specific occupations involving special hazards.

Section: III Personal protection
Subject: A Protection by hygiene
Number: 1 Objective of protection

Main points:

**PERSONAL PROTECTION HAS ONLY ONE OBJECTIVE:
TO KEEP THE EXPOSURE OF WORKERS HANDLING A PESTICIDE
AS LOW AS POSSIBLE.**

**PERSONAL PROTECTION DOES NOT BENEFIT
ANYONE EXCEPT THE PERSON WHO USES IT.**

Personal protection is used in many industries,
and is an important part of the control of many environmental hazards.

-In handling pesticides, it is important to avoid absorption through the skin, the eyes and by the mouth. With some formulations, protection of the lungs is necessary.

-Whenever any pesticide formulation is used, good hygiene is essential.
Some type of protective clothing is always needed. It may be only working clothing; the use of other items will depend on the hazards of the formulation being handled.

These are often listed on the label.

Subsidiary points:

1. All workers should know the hazard of the work that they are required to carry out.
2. It is the responsibility of the employer to provide correct information to workers, and if special protective equipment is needed, the employer should provide this, instruct the workers in its proper use, and see that it is maintained and replaced if faulty.

For discussion:

What sort of protection is provided in other industries?

Do local climatic conditions influence the use of protective equipment?

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

Section: III Personal protection
Subject: A Protection by hygiene
Number: 2 Washing

Main points:

**MUCH OF THE PESTICIDE ON THE SKIN WILL BE REMOVED BY WASHING,
AND THE ABSORPTION IS REDUCED.
USING SOAP WILL REMOVE MORE, ESPECIALLY IF THE FORMULATION IS OILY.
ANY PESTICIDE ON THE SKIN SHOULD BE WASHED OFF IMMEDIATELY.**

ALWAYS WASH HANDS, ARMS AND FACE

- BEFORE EATING
- BEFORE DRINKING
- BEFORE SMOKING
- BEFORE TRAVELLING BACK TO BASE
- BEFORE URINATING.

AT THE END OF THE DAY TAKE A BATH OR SHOWER

Hand sprayers can sometimes wash their hands and arms
each time the pump is refilled.

Subsidiary points:

1. Use clean water for washing, but do not wash in streams. If there is little or no water at the application site, it should be taken to the field in a clean drum, preferably fitted with a tap.
2. If practicable, collect the water used for hand and arm washing and dispose of it in the same manner as the water used for washing equipment or use it for mixing.

For discussion:

Are there any local difficulties in arranging for the supply and disposal of water for washing?

Other information:

Disposal of water contaminated with pesticide is the subject of module IV B 2.

Suggested visual aid: Photograph of worker washing hands or face in field or other workplace.

Section: III Personal protection
Subject: A Protection by hygiene
Number: 3 Eating and drinking at work

Main points:

**NO ONE SHOULD EAT OR DRINK WHILE HANDLING PESTICIDES
WITHOUT FIRST WASHING HANDS, ARMS AND FACE IN CLEAN WATER,
PREFERABLY WITH SOAP.**

**IF FOOD IS CARRIED TO THE FIELD,
IT SHOULD BE CARRIED IN A TIN WITH A TIGHT FITTING LID.**

For discussion:

If a worker eats or drinks during work without washing, by which route is the pesticide likely to be absorbed?

Suggested visual aid: Photograph of a man eating in the workplace, clearly marked as a wrong practice with an X.

Section: III Personal protection
Subject: A Protection by hygiene
Number: 4 Smoking at work

Main points:

**WORKERS HANDLING ANY PESTICIDE
SHOULD NOT SMOKE AT ALL WHILE AT WORK**

**IF THEY ARE ALLOWED TO SMOKE DURING A WORK PAUSE,
THEY SHOULD FIRST WASH THEIR HANDS, ARMS AND FACE IN CLEAN WATER.**

Subsidiary point:

If workers carry cigarettes or other smoking material in the pockets of their working clothing, the materials should be kept in a tin with a tight fitting lid.

For discussion:

If a worker smokes during work without washing, by which route is the pesticide likely to be absorbed?

What other (non-pesticide) hazards are associated with smoking?

Other information:

When a cigarette contaminated with pesticide is smoked, apart from the pesticide absorbed through the skin of the lips and mouth, there may be unknown hazards from compounds formed when the pesticide is partly burnt at the tip of the cigarette, and inhaled.

Suggested visual aid: Photograph of a man smoking in workplace, clearly marked as a wrong practice with an X.

Section: III Personal protection
Subject: A Protection by hygiene
Number: 5 Chewing at work

Main points:

**WORKERS HANDLING PESTICIDES SHOULD NOT CHEW
ANYTHING WHILE AT WORK.**

**IF THEY ARE ALLOWED TO CHEW DURING A WORK PAUSE,
THEY SHOULD FIRST WASH THEIR HANDS, ARMS AND FACE IN CLEAN WATER.**

Subsidiary points:

1. The point above includes preparing anything for chewing.
2. If workers carry materials for chewing in the pockets of their working clothing, these should be kept in a tin with a tight closing lid.

Other information:

This module is intended for use in those countries where betel and other materials are chewed. The hazard from chewing gum in commercial packings is probably very low since it is well wrapped, and the tin is not necessary. The other parts of the module still apply.

Suggested visual aid: Photograph of a man putting chewing materials in his mouth, clearly marked as a wrong practice with an X.

Section: III Personal protection
Subject: A Protection by hygiene
Number: 6 Household pesticides

Main points:

ONLY USE PESTICIDES APPROVED FOR USE IN HOUSEHOLDS.

This means pesticides sold in shops in properly labelled containers,
to members of the general public.

Never use pesticides offered by someone else
who might be using them professionally to control
other pests or the same pests in other places.

FOLLOW THESE SIMPLE RULES:

- READ AND FOLLOW THE DIRECTIONS FOR USE ON THE LABEL.
- COVER ALL FOOD BEFORE USING SPRAYS.
- VAPORIZERS AND MOSQUITO COILS SHOULD ONLY BE USED IN WELL-VENTILATED ROOMS.
- ALWAYS WASH HANDS WITH WATER AND SOAP AFTER USING PESTICIDES.

Subsidiary points:

1. The description 'household pesticide' sometimes covers pesticides sold for use in gardens. These may be in the form of concentrated formulations which need to be diluted before use. Do not use these pesticides on any crop or for any pest which is not mentioned on the label, and use only the concentrations recommended.
2. The concentrates may be hazardous, and the precautions on the label should be carefully studied.
3. Be careful not to spray any food crops during the time before harvesting which is specified on the label.

For discussion:

By which routes may pesticides be absorbed if these rules are not followed?

Suggested visual aid: Text using words in capital letters.

Section: III Personal protection
Subject: B Protection of the body
Number: 1 The main part of the body

Main points:

FOR THE PROTECTION OF THE MAIN PART OF THE BODY, THE AIM IS TO COVER AS MUCH SKIN AS POSSIBLE WITH SUITABLE MATERIAL, TO PREVENT THE SKIN BEING CONTAMINATED BY PESTICIDE.

Overalls or a shirt and trousers with long arms and legs are the best ways of protecting the body. They cover about 85% of the skin.

The clothing should be made of cotton, washable, without holes, and it should be worn with the front zipped or buttoned up to the neck while working.

CLOTHING WHICH BECOMES SOAKED WITH A PESTICIDE IS NO PROTECTION AND CAN INCREASE ABSORPTION. IT SHOULD BE CHANGED IMMEDIATELY.

Subsidiary points:

1. Pockets are not essential.
2. Cigarettes, chewing materials, or any type of food should not be carried in the pockets of overalls, except in tins with tight fitting lids.
3. National dress may provide the same protection as an overall if it meets the following conditions:
 - it is made of washable cotton;
 - it covers the body without openings;
 - it has long sleeves;
 - it is long enough to cover the top of boots, if worn;
 - it is repaired or replaced if it wears into holes.

For discussion:

What clothing is worn in this country?

What are the advantages and disadvantages of each type, and which is the best?

Other information: Overalls are known as coveralls in some countries.

Suggested visual aid: Picture of a sprayman or other applicator wearing an overall (or national dress, if appropriate).

Section: III Personal Protection
Subject: B Protection of the body
Number: 2 The head and neck

Main point:

**PROTECTION OF THE HEAD AND NECK IS NEEDED
WHEN USING PESTICIDE FORMULATIONS
OF SLIGHT, MODERATE OR HIGH HAZARD.**

When spray is being applied above waist level to crops, weeds, walls or eaves, a wide-brimmed cotton hat should be worn.

A washable scarf is desirable when pesticide formulations of slight hazard are being used and necessary when the formulations present moderate hazard.

Level: INTERMEDIATE

Subsidiary points:

1. Pest control operators using highly hazardous liquid formulations should wear a full head covering of impermeable material, incorporating a transparent panel. This should be worn loose over the shoulders and not tucked into the clothing. An independent air supply is needed for fumigation.
2. Hard hats may be needed for some tasks.

Other information:

Later modules in this subject cover eye, nose and mouth protection.

Suggested visual aid: Photograph of a sprayman with hat, using wand above waist level.

Section: III Personal protection
Subject: B Protection of the body
Number: 3 Lower legs and feet

Main points:

THE SKIN OF THE LOWER LEGS AND FEET CAN BE CONTAMINATED:

- DURING PESTICIDE APPLICATION, ESPECIALLY BY SPRAY, OR
- BY WALKING THROUGH VEGETATION THAT HAS RECENTLY BEEN SPRAYED.

**NEVER APPLY PESTICIDES IN BARE FEET OR WEARING OPEN SANDALS.
IF POSSIBLE, DO NOT WALK THROUGH RECENTLY SPRAYED AREAS.**

ALWAYS SPRAY AWAY FROM THE WIND.

The best protection is canvas or PVC boots.

Trouser or overall legs should be worn **OUTSIDE** the boots.

This prevents any splashes of pesticide entering the boots.

Subsidiary points:

1. If boots are not available, canvas or leather shoes can be worn, provided that:
 - they are in good condition;
 - the legs of the overall or trousers are over the top of the shoes.
2. For some tasks, especially in forestry, safety boots with a steel toe inset may need to be used.
3. After work, wash the boots outside with water. If the boots or shoes are canvas or have been splashed, wash the inside as well; stand boots upside down to dry.
4. To prevent foot infections, rubber boots should not be used. If possible, each man should have his own footwear.

For discussion:

Why are the trousers not tucked into boots?

Suggested visual aid: Photograph of the feet of a worker with canvas or PVC boots and trousers worn over the boots.

Section: III Personal protection
Subject: B Protection of the body
Number: 4 Hands

Main point:

HANDS MUST BE PROTECTED BY GLOVES.

- WHENEVER HANDLING CONCENTRATE,
- WHENEVER APPLYING FORMULATIONS OF HIGHER HAZARD,
- WHENEVER WASHING OR MAINTAINING PESTICIDE APPLICATION EQUIPMENT.

Gloves should be in good condition, without holes,
made of neoprene, not rubber,
and long enough to reach the sleeves.

IT IS MORE DANGEROUS TO WEAR GLOVES WITH HOLES THAT ALLOW FLUID
TO ENTER THE GLOVE, THAN NOT TO WEAR GLOVES AT ALL.

Subsidiary points:

1. Gloves with holes should be changed as soon as possible.
2. Gloves should be washed at least daily, or whenever removed, inside and out.
3. The wearing of gloves in no way reduces the need to wash the hands before eating, drinking, (chewing) or smoking. The skin of the hands may become lightly contaminated when gloves are put on or taken off.
4. Disposable gloves wear very quickly, and are not suitable unless more than 0.4 mm thick. If used they must be disposed of safely, in the same way as plastic bags that have contained pesticides.

Other information:

Ideally, sleeves should be worn outside the tops of gloves, in the same way as trousers should be worn over boots, and for the same reasons. However, this is often impracticable as the ends of sleeves are too narrow. If there is a danger of splashes with hazardous formulations, this can be minimized by wearing gauntlet gloves.

Suggested visual aid: Photograph of worker wearing suitable gloves.

Section: III Personal protection
Subject: B Protection of the body
Number: 5 The eyes

Main points:

**EYES SHOULD BE PROTECTED FROM SPLASHES.
WHENEVER MIXING OR LOADING PESTICIDES,
OR WHEN SPRAYING AT HIGH LEVELS.**

There are three ways of protecting the eyes:

THE BEST IS A VISOR,

a curved sheet of transparent plastic, which is attached to a hat
or a headband and stands in front of the whole face.

It is comfortable to wear.

Goggles fit tightly around or over the eyes. They are efficient, but
are uncomfortable to wear in hot climates.

If neither of these are available, safety spectacles are better than
nothing.

Subsidiary points:

1. All eye protection equipment must be kept clear, and the outside should be washed and wiped with a soft rag if vision becomes blurred.
2. The equipment and the rag should be carefully washed each day at the end of work.
3. Plastic visors and goggles should not be placed on rough surfaces as the plastic can be easily scratched.
4. Badly scratched or damaged equipment must be replaced before it starts to produce eye strain.

Suggested visual aid: Photograph of a worker wearing a visor.

Section: III Personal protection
Subject: B Protection of the body
Number: 6 The lungs

Main points:

**PROTECTION BY WEARING A RESPIRATOR TO AVOID INHALATION OF DUSTS,
VAPOURS AND GASES
IS ONLY NEEDED IN SPECIALIZED OPERATIONS
WITH FORMULATIONS OF MODERATE OR GREATER HAZARD.**

**OTHERWISE, AND FOR DUSTY FORMULATIONS OF SLIGHT HAZARD,
A CLOTH AROUND THE FACE,
OR A LIGHT WEIGHT DISPOSABLE FACE MASK COVERING
THE MOUTH AND NOSE IS ADEQUATE.**

**THE CLOTH OR MASK MUST BE REPLACED AS OFTEN AS IT BECOMES WET
WITH SWEAT.**

**THE CLOTH MUST BE WASHED AND THE MASK DISPOSED OF
WHENEVER SOILED AND AT THE END OF EACH WORKING DAY.**

Subsidiary points:

1. A respirator must:
 - be fitted with the proper type of canister, and this must be regularly replaced, in accordance with the instructions on the canister;
 - fit closely around the mouth and nose;
 - be washed daily after removal of the canister, and dried;
 - be kept in a clean plastic bag when not in use;
 - be regularly inspected;
 - be worn only by those trained in its use.

2. Respirators can only be worn for short periods in hot climates.

Suggested visual aid: Photograph of a worker wearing a cloth around face or a lightweight dust mask.

Section: III Personal protection
Subject: B Protection of the body
Number: 7 Washing of clothing and equipment

Main points:

**PERSONAL PROTECTION IS NOT COMPLETE UNLESS
ALL WORKING CLOTHING AND EQUIPMENT IS WASHED
AT THE END OF EACH WORKING DAY.**

**AFTER WASHING THE CLOTHES OR EQUIPMENT, RINSE THEM IN CLEAN WATER
AND SPREAD OR HANG THEM OUT TO DRY.**

Subsidiary points:

1. Working clothing should never be washed with domestic clothing.
2. The water used for washing will probably be contaminated with the pesticide and must therefore be disposed of in a safe manner. If the washing has been done properly, rinsing water can be disposed of as any other waste water.
3. Clothing and equipment should never be washed in running water, as the stream or river may be used lower down for drinking or swimming. Fish can also be killed or affected close to the washing point.

For discussion:

If clothes are not washed, what is the danger?

For information:

For disposal of wash water, see module IV B 2.

Suggested visual aid: Photograph of a worker washing clothing or gloves.

Section: III Personal protection
Subject: C Protection by task
Number: 1 Responsibility of controllers and supervisors

Main points:

**IN ANY PESTICIDE APPLICATION, ALL THOSE RESPONSIBLE
FOR THE OPERATION MUST KNOW:**

- THE HAZARD CLASSIFICATION OF THE FORMULATION BEING USED;
- THE PRECAUTIONS THAT MUST BE FOLLOWED BY THE APPLICATORS,
- WHETHER ANY SPECIAL PROTECTIVE CLOTHING AND EQUIPMENT SHOULD BE PROVIDED;
- THE FACILITIES REQUIRED FOR THE HYGIENIC PROTECTION OF THE APPLICATORS, AND THE CARE AND MAINTENANCE OF THE EQUIPMENT.

Subsidiary points:

1. Pesticide application is always an operation that must be planned with care, even if the pesticide presents very low hazard.
2. A group of applicators who have been working with a pesticide of very low hazard for long periods without any problems can become very careless in taking precautions. If a pesticide with a higher hazard is later substituted without informing and warning all those handling it, their poor technique can lead to serious absorption.
3. There are a minimum number of precautions that must be taken in the application of any pesticide, and there must be a minimum standard of maintenance for the application equipment.

For discussion:

What are the minimum precautions to be followed?

Other information:

Minimum precautions will be found in subject A and modules B 1 and B 3 of this section.

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

Section: III Personal protection
Subject: C Protection by task
Number: 2 Knapsack spraying

Main points:

Motorized or hand-pumped knapsack sprayers are usually used for low level spraying. ULV sprayers may be battery operated.

ORDINARY PROTECTION MUST BE WORN FOR THE BODY AND FEET.

**A BLOCKED NOZZLE SHOULD NEVER BE CLEARED BY
BLOWING THROUGH IT.**

USE THE PRESSURE RELEASE VALVE OR A WIRE.

FOR ULV SPRAYING, A CLOTH OVER THE MOUTH AND NOSE MAY BE USEFUL.

Subsidiary points:

1. A common fault is for spraymen to spray in front of themselves, and then to walk through the wet vegetation. The wand must always be held so that the spray is applied at the side of the sprayman, with the wind blowing away from him.
2. It is important that hose connections should be regularly checked to prevent a leak wetting the back of the clothing. If this happens, wet clothing must be changed immediately, and the sprayman should shower or bathe as soon as possible.

For discussion:

In case of motorized sprayers, there is another chemical hazard which is not related to the pesticide. What is it, and how can it be prevented?

Other information:

1. Details of body and feet protection will be found in Subject B of this Section.
2. The protection to be provided will need modification if a formulation of more than slight hazard is to be applied.

Suggested visual aid: Photograph of a worker wearing a knapsack sprayer, correctly dressed.

Section: III Personal protection
Subject: C Protection by task
Number: 3 Pressurized hand spraying

Main points:

The pressurized hand sprayer is usually used for spraying residual pesticides in and around houses for the control of pests of public health importance, and for the application of larvicides to water.

ORDINARY PROTECTION MUST BE WORN FOR THE BODY AND FEET.

**AS SPRAYING IS SOMETIMES HIGH, UNDER THE EAVES OF A HOUSE,
A WIDE BRIMMED HAT IS ALSO NEEDED.**

**A BLOCKED NOZZLE SHOULD NEVER BE CLEARED BY BLOWING
THROUGH IT.**

Subsidiary points:

1. A residual pesticide is a formulation sprayed on a surface, and intended to retain its activity for a period of weeks or months.
2. Before spraying a house, it is important to check that all food, cooking utensils and bedding is covered or moved outside.

For discussion:

What parts of a pressurized sprayer need regular checking and maintenance?

Other information:

Details of body and feet protection will be found in Subject B of this Section.

Suggested visual aid: Photograph of a public health worker with a pressurized sprayer, correctly dressed.

Section: III Personal protection
Subject: C Protection by task
Number: 4 Mechanized spraying

Main points:

Mechanized sprayers are mainly used for applying pesticides through wide booms over ground crops, for applying pesticides at a high level to trees, and for the generation of fogs and mists in cities for the control of pest insects.

**BOTH DRIVING AND LOADING A MECHANIZED SPRAYER CAN BE HAZARDOUS,
DEPENDING ON THE FORMULATION USED.**

**ALL WORKERS MUST WEAR BODY AND FEET PROTECTION
AND LOADERS MUST WEAR VISORS, PLASTIC GLOVES, AND PLASTIC APRONS.**

**FOR HIGH LEVEL APPLICATION, FULL WATERPROOF PROTECTION,
INCLUDING HAT, AND A VISOR MAY BE NEEDED,
IF THE OPERATOR IS NOT IN A FULLY ENCLOSED CAB.**

Subsidiary point:

During fogging or misting, workers may feel more comfortable with a clean cloth over the mouth and nose. For formulations of moderate or higher hazard as applied, a respirator may be needed.

Other information:

Some points made in the modules in this Section on loading aircraft (C 12) are also relevant to loaders of mechanized sprayers, and on piloting agricultural aircraft (C 13) to operators working in a cab.

Suggested visual aid: Photograph of a mechanized sprayer at work, with driver correctly protected.

Section: III Personal protection
Subject: C Protection by task
Number: 5 Dusting

Main points:

Dusting is the application of a pesticide in a powder formulation.
It can be applied by a distributor operated by hand or motorized.

DUST CLINGS TO THE CLOTHING AND TO SWEATY SKIN.

ORDINARY PROTECTION MUST BE WORN FOR THE BODY AND FEET.

A LIGHT DISPOSABLE DUST MASK SHOULD BE WORN.

**A CLEAN CLOTH OVER THE MOUTH AND NOSE IS ONLY SUFFICIENT IF THE
FORMULATION IS OF VERY SLIGHT HAZARD.**

Subsidiary points:

1. The worker should apply the dust so that he is never walking in the dust cloud.
2. Make sure that the application line is so chosen that the wind blows away from the applicator.
3. Formulation of dusts as granules reduces hazard, but friction between the granules during transportation results in some dust always being present. Precautions should be taken accordingly.

Other information:

This module presumes that the dust formulation presents no more than a slight hazard. Otherwise, more comprehensive protection will be needed, for head, hands, eyes and lungs.

Suggested visual aid: Photograph of a worker hand dusting a crop, wearing correct protection.

Section: III Personal protection
Subject: C Protection by task
Number: 6 Mixing pesticides

Main points:

The mixing of pesticides is the dilution of a concentrated formulation to prepare a solution for application.

It does NOT mean the mixture of two separate pesticide formulations. This is a highly undesirable practice unless it is clearly stated on the label that the two formulations are compatible.

THE HAZARD TO THE MIXER IS GREATER THAN THAT TO ANY OF THE APPLICATORS.

THEREFORE THE MIXER NEEDS MORE PROTECTION OF THE BODY, FEET, HANDS AND EYES.

A PLASTIC APRON IS ADVISABLE WHEN POURING THE MIXTURE INTO APPLICATION EQUIPMENT

ALWAYS USE A PADDLE OR STIRRER WHEN MIXING.

NEVER MIX WITH BARE HANDS AT ANY TIME.

Subsidiary points:

1. Make sure that water for washing splashes off the skin is close at hand.
2. The mixer must also wear protection when disposing of empty concentrate containers.

For discussion:

What are the characteristics of a good mixer?

Suggested visual aid: Photograph of a worker mixing pesticide, wearing correct protection.

Section: III Personal Protection
Subject: C Protection by task
Number: 7 Bagging pesticides

Main points:

Bagging is the weighing of a solid formulation into quantities to take to the field for dilution at the point of application. Each amount weighed is sufficient for one pump charge. This procedure has to be carried out under supervision.

**BAGGING MUST BE CARRIED OUT IN WELL-LIT AND WELL-VENTILATED
CONDITIONS.**

**PROTECTION IS NEEDED FOR BODY, FEET AND HANDS,
AND A LIGHT DUST MASK SHOULD BE WORN.**

Subsidiary points:

1. It is important that the bagging area should be kept clean. Damp the floor before sweeping up spilled pesticide. No dry sweeping should be allowed at any time.
2. Avoid touching the outside of bags with contaminated gloves.
3. Each bag must be securely closed with a tie to prevent any spillage.
4. Because the bags are unlabelled, a careful count must be made of the number of bags taken each day to the field. At the end of the day, all bags should be accounted for, and the empty bags should be taken back to the base for disposal.

For information:

The disposal of contaminated soil, unwanted pesticide and empty bags is described in modules in Section IV, Subject B.

Suggested visual aid: Photograph of a mixer at work, wearing correct protection.

Section: III Personal protection
Subject: C Protection by task
Number: 8 Supervising in the field

Main points:

**THE FIELD SUPERVISOR MUST SET AN EXAMPLE TO WORKERS
AND CAN THEN INSIST THAT THE WORKERS FOLLOW SAFE PRACTICES.**

**WHEN TRAINING WORKERS, THE SUPERVISOR MUST TAKE CARE
THAT WORKERS WEAR ALL THE PROTECTION NEEDED FOR THE ACTUAL
OPERATION,
EVEN IF NO PESTICIDE IS BEING APPLIED DURING THE TRAINING SESSION.**

**IN THE FIELD, THE SUPERVISOR MUST ALWAYS WEAR APPROPRIATE
PROTECTION.**

THE SUPERVISOR IS RESPONSIBLE FOR SEEING:

- THAT WASHING WATER IS AVAILABLE,
- THAT THE WORKERS WASH BEFORE EATING, (CHEWING) OR SMOKING,
- THAT CLOTHING AND PROTECTIVE EQUIPMENT IS WASHED AT THE END OF EACH DAY.

**THE SUPERVISOR SHOULD CHECK APPLICATION EQUIPMENT FREQUENTLY
TO SEE THAT IT IS OPERATING EFFICIENTLY AND IS NOT LEAKING.**

Subsidiary point:

The supervisor should also follow all the rules of hygiene for his/her own protection, especially washing before eating, etc.

Suggested visual aid: Photograph of a supervisor talking to a worker, both wearing correct protection.

Section: III Personal protection
Subject: C Protection by task
Number: 9 Maintaining the equipment

Main points:

The maintenance engineer will service not only the pesticide application equipment itself, but also the vehicle, or other machinery associated with the equipment. Parts of these may be heavily contaminated with pesticide. The engineer is often the forgotten worker, who may be more at hazard than some applicators.

THE MAIN HAZARDS FOR A MAINTENANCE ENGINEER ARE TANKS AND HOSES CONTAINING RESIDUES OF PESTICIDE FORMULATIONS, AND PARTS COATED WITH DRIED PESTICIDE RESIDUES.

THE DRIED RESIDUES MAY PRESENT A HIGHER HAZARD THAN THE ORIGINAL FORMULATION, PARTICULARLY IF THEY ARE HANDLED, MACHINED, OR HEATED.

THE SUPERVISOR SHOULD INFORM THE ENGINEER IF THE TECHNICAL PRODUCT OF THE PESTICIDE USED IN THE EQUIPMENT WAS OF MORE THAN SLIGHT HAZARD.

THE ENGINEER SHOULD HANDLE HIGHLY CONTAMINATED PARTS WITH GLOVES, UNTIL THEY CAN BE DECONTAMINATED.

Subsidiary points:

1. The engineer should wash working clothing daily when working on pesticide application equipment, and should follow the other rules of hygiene.
2. Liquid residues and washings should be collected and given to the pesticide applicator for safe disposal, or disposed of in waste oil that is NOT to be recycled. They should not be put down drains.

Suggested visual aid: Photograph of maintenance engineer at work on application equipment, with gloves in view.

Section: III Personal protection
Subject: C Protection by task
Number: 10 Acting as a flagman

Main points:

A flagman is usually only used in aerial pesticide operations. He does not apply any pesticides himself, but holds a flag at the point where the aircraft should begin its next spraying run. In this position, the flagman is at serious risk of being sprayed by the aircraft as it begins its run. If this happens a number of times during a day, exposure can be substantial.

WOMEN AND CHILDREN SHOULD NEVER BE EMPLOYED ON THIS TASK.

**A FLAGMAN MAY BE A CASUAL WORKER,
BUT HE MUST STILL HAVE BODY AND FOOT PROTECTION.
HE SHOULD ALSO WEAR A WIDE-BRIMMED HAT.**

**THE FLAGMAN SHOULD NOT STAND IN THE MIDDLE OF THE RUN,
BUT TO THE WINDWARD SIDE.**

Subsidiary points:

1. If the formulation being applied presents more than a slight hazard, lung protection will also be required.
2. There are alternatives to the use of flagmen, such as the positioning of balloons or flags on poles between aircraft runs. These diminish the risk of exposure, but all workers on the ground during aerial applications need basic body, feet, and head protection.

Suggested visual aid: Photograph of flagman at work wearing correct protection.

Section: III Personal protection
Subject: C Protection by task
Number: 11 Controlling pests commercially

Main points:

Pest control officers work for commercial concerns (or public bodies) engaged in the control of pests in warehouses, food premises, homes, and other places where a particular pest problem might arise. In this capacity, they are usually allowed to use pesticides of much higher hazard than are allowed to be distributed to other sections of the community.

PEST CONTROL COMPANIES MUST TRAIN THEIR OFFICERS CAREFULLY.

**PEST CONTROL OFFICERS MUST BE AWARE
OF THE HAZARD CLASSIFICATION OF THE PESTICIDES THAT THEY HANDLE,
AND USE PROTECTIVE EQUIPMENT ACCORDINGLY.**

**MANUFACTURER'S INSTRUCTIONS MUST BE FOLLOWED WITHOUT ANY SHORT
CUTS.**

**THE LABEL WILL INDICATE THE TYPE OF PROTECTION NEEDED,
AND THIS SHOULD ALWAYS BE FOLLOWED.**

**WHEN PESTICIDES OF HIGH HAZARD HAVE BEEN USED,
WORKING CLOTHING SHOULD NOT BE WASHED WITH DOMESTIC CLOTHING.
PROTECTIVE EQUIPMENT SHOULD BE WASHED AT THE WORK BASE.**

Subsidiary points:

1. Pest control officers have a particular responsibility to dispose of unwanted pesticide and used containers in a safe manner.
2. Pest control officers must not give to friends or any other persons any samples of the pesticides that they use in the course of their work.

For discussion:

In this country, do pest control officers have to take a course in techniques and protection before being allowed to work? If not, would this be useful?

Suggested visual aid: Photograph of a pest control officer at work, wearing correct protection.

Section: III Personal protection
Subject: C Protection by task
Number: 12 Loading pesticides

Main points:

Loading pesticides from a drum, or other container in which pesticide has been mixed, into the hopper of an aircraft or a mechanized applicator can be hazardous. Major exposure can take place if a hose is punctured or bursts during loading or if it leaks at its joints at either end. Lesser but more frequent and substantial exposure may occur on each occasion that the hose is disconnected from the inlet to the hopper.

A LOADER NEEDS A HIGH STANDARD OF PROTECTION AT ALL TIMES.

THE WORKER NEEDS BODY, FEET, AND HAND PROTECTION, AND A PLASTIC APRON.

EYE PROTECTION USING A VISOR IS NEEDED AT ALL TIMES.

HEAD PROTECTION MAY BE NEEDED IF THE LOADING POINT IS HIGH.

Subsidiary points:

1. Water in quantity for washing should be provided in the loading area.
2. Clothing that becomes soaked must be removed immediately, and the worker should wash contaminated skin or shower as soon as possible.
3. Care must be taken not to overfill a hopper, causing spillage.
4. Those loading aircraft must clearly understand their task in order to avoid overloading. Loading sites must be selected with care to avoid exposure of humans and animals, or of watercourses to pesticides spilled at the time of loading or later.

Other information:

The risk of massive exposure of a loader is such that full protection as outlined above should be used when loading any pesticide formulation, diluted or not. Non-pesticidal components of a formulation may be hazardous or locally irritating if massive exposure occurs.

Suggested visual aid: Photograph of a loader at work wearing correct protection.

Section: III Personal protection
Subject: C Protection by task
Number: 13 Piloting an aircraft applying pesticides

Main points:

**THE PILOT OF AN AIRCRAFT APPLYING PESTICIDES MUST KNOW
THE TYPE OF PESTICIDE AND THE HAZARD CLASSIFICATION OF THE
FORMULATION.**

HE MUST AVOID ALL CONTACT WITH PESTICIDE AS FAR AS POSSIBLE BY:

- WEARING USUAL BODY AND FEET PROTECTION;
- NOT GETTING CONTAMINATED TRAMP DUST INTO HIS COCKPIT

by not walking in the mixing area and over places where pesticide might have been spilt;

- KEEPING VENTILATORS IN THE DECK AREA OF THE COCKPIT
CLOSED WHILE FLYING THE AIRCRAFT

to avoid suspending tramp dust in the air inside the cockpit;

- TAKING CARE NOT TO FLY BACK THROUGH THE SWATHE,
OR TO THE LEE OF RECENTLY SPRAYED AREAS.

TURN INTO WIND WHENEVER POSSIBLE

Subsidiary points:

1. Pilots should also follow the rules for protection by hygiene.
2. Pilots must take particular care when working with organophosphorous compounds, as many of these have a local effect on the eye, even when exposure may be so low as to produce no other adverse effects. Impairment of visual accommodation may result in blurred vision, and inability to judge distance correctly. If this occurs, the pilot must land as soon as possible, and not fly again for at least a day. The eyes should be washed out with clean water.
3. Maintenance engineers should be warned that the aircraft has been used for applying pesticides and advised to take precautions in handling contaminated parts. The outside of the aircraft may be contaminated if it has not been washed since operating.
4. A pilot should not normally load his own plane, but if there is no alternative, he must take care to use on every occasion all the protective measures required for loaders while actually loading.

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

PROTECTION OF OTHERS

**A. APPLICATORS, SUPERVISORS, SANITARIANS, AND
AGRICULTURAL EXTENSION OFFICERS:**

Subject A: Should know the importance of protecting other people, and methods for the transportation and storage of pesticides. May need to understand the need for exclusion areas in crops.

Subject B: Should know the importance of protection of the environment, methods of safe disposal of wash water, used containers, and unwanted pesticide. May need to understand ways of decontaminating containers.

B. OTHER HEALTH AND MEDICAL PERSONNEL:

Subject A: Should know that other people in the community need protection from mishandling of pesticides.

Subject B: Should know the importance of environmental protection.

C. REGISTRATION PERSONNEL:

Both subjects: As in B above. May need to understand the methods used.

NOTE TO TRAINER:

New modules on national requirements for the transportation and the storage of pesticides, and for the protection of water sources may need to be introduced into this section.

Section: IV Protection of others
Subject: A Other people
Number: 1 Introduction

Main point:

People and animals may be poisoned, and plants damaged by misuse of pesticides and by failure to take proper precautions for their handling and custody. More people who do not handle pesticides in their work are poisoned through avoidable mishaps than workers handling the pesticides.

EVERYONE WHO HANDLES PESTICIDES HAS A DUTY TO ENSURE THAT NO OTHER PERSON OR ANIMAL IS AFFECTED BY THE PESTICIDES, AND THAT ADVERSE ENVIRONMENTAL EFFECTS ARE AVOIDED AS FAR AS POSSIBLE.

Examples: large outbreaks of poisoning have been caused by the accidental contamination of food with pesticides, usually during transportation. The foods concerned are usually flour, rice, and sugar, as these are carried in sacks.

Children have been affected when they have played with discarded containers, and others have been poisoned using pesticide from unlabelled containers, thinking that it was another product.

Subsidiary point:

It has to be remembered that while workers with pesticides are adults, and are usually healthy, the community consists also of the very young, the very old, and the sick. All these groups are more likely to be affected by doses of pesticide that would have no effect on the healthy adult worker. It is also important that exposure of pregnant women to any toxic chemical should be avoided as far as possible.

For discussion:

Have pesticides adversely affected animals or the environment here?

Other information:

If the above discussion takes place, it has to be borne in mind that pesticides are sometimes blamed for causing effects which are coincident with pesticide application but are not otherwise connected with it. Some mishap leading to **SIGNIFICANT** exposure should be established before a causative relationship can be accepted.

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

Section: IV Protection of others
Subject: A Other people
Number: 2 Transport by truck

Main points:

**CONTAINERS OF PESTICIDE SHOULD NEVER BE CARRIED
IN THE SAME TRUCK AS FOOD OR ANIMAL FEED.**

**IF THE CONTAINER SHOULD LEAK, THE FOOD CAN BE CONTAMINATED
BY THE PESTICIDE.**

**LIQUID FORMULATIONS ARE MORE HAZARDOUS IF THEY LEAK
AS FOODSTUFFS MAY ABSORB THE LIQUID,
AND THE PESTICIDE MAY PASS DEEPLY INTO THE FOODSTUFF.**

THE FOOD MAY NOT SHOW THAT IT HAS BEEN CONTAMINATED.

Subsidiary points:

1. Trucks may carry different goods on different days. Even if pesticide has been carried correctly without any food in the truck on one day, the vehicle may carry food on the following day. Whenever pesticides are carried, the deck of the truck should always be examined after unloading for any evidence of leakage. If a container might have leaked, the deck must be decontaminated immediately.
2. Decontamination is carried out by scrubbing the deck with water. Use sawdust, newspapers or old cloth to absorb the water, and dispose of these in the same way as empty containers, by burning or burying. Feet and hand protection must be used during decontamination.

Other information:

For disposal methods, see modules IV B 4 and 5.

Suggested visual aid: Photograph of truck with drums of pesticide on back.

Section: IV Protection of others
Subject: A Other people
Number: 3 Transport by boat

Main points:

**CONTAINERS OF PESTICIDE SHOULD NEVER BE CARRIED
IN THE SAME BOAT OR COMPARTMENT OF A BOAT AS FOOD OR ANIMAL FEED.**

**IF THE CONTAINER SHOULD LEAK, THE FOOD CAN BE CONTAMINATED
BY THE PESTICIDE.**

**LIQUID FORMULATIONS ARE MORE HAZARDOUS IF THEY LEAK
AS FOODSTUFFS MAY ABSORB THE LIQUID,
AND THE PESTICIDE MAY PASS DEEPLY INTO THE FOODSTUFF.**

THE FOOD MAY NOT SHOW THAT IT HAS BEEN CONTAMINATED.

Subsidiary points:

1. Boats or compartments of boats may be loaded with different goods on different days. Even if pesticide has been carried correctly without any food in a compartment, food may be loaded into that compartment on the following day. Whenever pesticides are carried, the deck beneath it should always be examined after unloading for any evidence of leakage. If a container might have leaked, the deck must be decontaminated immediately.
2. If the boat has more than one deck, pesticide should never be carried in a compartment above another containing food. If leakage occurs, all compartments below should also be examined for contamination.
3. Decontamination is carried out by scrubbing the deck with water. Use sawdust, newspapers or old cloth to absorb the water, and dispose of these in the same way as empty containers, by burning or burying. Feet and hand protection must be used during decontamination.

Other information:

For disposal methods, see modules IV B 4 and 5.

Suggested visual aid: Photograph of drums of pesticide being loaded on to a boat.

Section: IV Protection of others
Subject: A Other people
Number: 4 Storage of pesticides

Main points:

LARGE QUANTITIES OF PESTICIDES MUST BE STORED IN A SECURE WAREHOUSE, IN THEIR OWN WELL-VENTILATED ROOM OR COMPARTMENT.

THE AREA IN WHICH THEY ARE STORED SHOULD BE MARKED WITH 'DANGER', 'NO ENTRY', AND 'NO SMOKING' SIGNS. DRUMS SHOULD BE PLACED SO THAT THEIR LABELS ARE CLEARLY VISIBLE, BUT SHOULD NOT BE STACKED MORE THAN TWO HIGH IF BEING HANDLED MANUALLY.

LEAKING DRUMS MUST BE PUT INTO A SEPARATE AREA ON A BED OF SAWDUST OR OTHER ABSORBENT MATERIAL UNTIL THEIR CONTENTS CAN BE USED OR TRANSFERRED TO A SOUND EMPTY DRUM WHICH HAS HELD THE SAME PESTICIDE.

ALL DRUMS OR PACKAGES SHOULD BE CLEARLY MARKED WITH THE DATE RECEIVED INTO STORE SO THAT THEY CAN BE USED IN STRICT ROTATION.

DRUMS IN STORE MORE THAN TWO YEARS SHOULD NOT BE USED UNTIL THEIR CONTENTS HAVE BEEN TESTED FOR QUALITY.

Subsidiary points:

1. Contaminated sawdust or other absorbent material should be disposed of in the same way as empty containers.
2. Floors of pesticide warehouses should never be dry swept. Damp sawdust or industrial vacuum cleaners should be used.
3. Clean water should be available for those working in the warehouse to wash. All workers should wear correct personal protection.

For discussion:

What is correct personal protection for a warehouseman?

Other information:

1. The minimum protection is for body, feet, and hands.
2. For disposal of empty containers, see subject B of this section.

Suggested visual aid: Photograph of a well-ordered pesticide storage area.

Section: IV Protection of others
Subject: A Other people
Number: 5 Locking up

Main points:

**ALL PESTICIDE STORAGE AREAS MUST BE SECURELY FENCED
TO PREVENT UNAUTHORIZED ACCESS.**

ALL DOORS AND GATES SHOULD BE EFFICIENTLY LOCKED OR PADLOCKED.

**IN CASE OF FIRE, THE ADDRESS OF THE PERSON(S) HOLDING THE KEYS
SHOULD BE FIXED TO THE GATE OR DOOR.**

Subsidiary points:

1. The person(s) holding the keys should be aware of the types of pesticides held in the store, in order to assist firemen or police in the event of fire or break-in. The best way in which this might be achieved is for the same person(s) to be responsible also for keeping the register of pesticides currently in the storage area.
2. On farms, pesticide stocks should be locked up away from any living quarters and livestock housing or food supplies. Buildings where pesticides are stored should also be well away from any water sources that might be contaminated by spillage.

For discussion:

In the event of fire or break-in, what authorities should be informed, and who should do this?

Suggested visual aid: Photograph of padlocked gate or door.

Section: IV Protection of others
Subject: A Other people
Number: 6 Storing and using household pesticides

Main points:

HOUSEHOLD PESTICIDES SHOULD ONLY BE BOUGHT AS NEEDED.

**UNUSED PESTICIDES SHOULD BE KEPT IN A LOCKED CUPBOARD,
BUT NOT IN THE SAME CUPBOARD AS DRUGS OR MEDICINES.**

**DO NOT USE PESTICIDES IN ANY WAY OTHER THAN
AS DESCRIBED ON THE LABEL.**

TAKE CARE NOT TO CONTAMINATE FOOD IN PREPARATION OR STORED.

**PESTICIDE CONTAINERS IN USE SHOULD BE KEPT
OUT OF THE REACH OF CHILDREN.**

CHILDREN SHOULD NEVER BE ALLOWED TO PLAY WITH EMPTY CONTAINERS.

Subsidiary points:

1. It is especially important to lock up all pesticide concentrates which need dilution before use. These are usually intended to be used for garden pests.
2. No pesticides should be stored except in properly labelled containers. Original packings should be used whenever possible.
3. If a child or adult eats or drinks a pesticide, the person responsible for treatment will need to know the name of the pesticide. Do not destroy the package, but give it to the person concerned.

Suggested visual aid: Photograph of insecticide spray on a high shelf.

Section: IV Protection of others
Subject: A Other people
Number: 7 Exclusion from sprayed crops

Main points:

**AFTER APPLICATION OF PESTICIDES IN AGRICULTURE,
NO UNPROTECTED PERSON SHOULD ENTER A SPRAYED AREA
UNTIL THERE IS NO RISK THAT THEY MIGHT ABSORB PESTICIDE.**

**FOR AREAS DUSTED OR SPRAYED WITH A LIQUID FORMULATION
OF SLIGHT HAZARD, THIS IS UNTIL THE PESTICIDE HAS DRIED ON THE CROP.**

**FOR PESTICIDE FORMULATIONS OF HIGHER HAZARD,
CONSULT THE PRODUCT LABEL,
TO FIND OUT IF THIS PERIOD NEEDS TO BE LENGTHENED.**

FOR DUSTED AREAS CONSULT THE LABEL.

**ALL TREATED AREAS MUST BE CLEARLY MARKED WITH
FLAGS OR OTHER MARKING UNDERSTOOD BY THE LOCAL POPULATION
TO MEAN AN EXCLUSION AREA.**

**ALL SUCH MARKINGS SHOULD BE REMOVED
AS SOON AS THE EXCLUSION PERIOD HAS ENDED.**

Suggested visual aid: Photograph of a sprayed crop with markings understood locally to mean an exclusion area.

Section: IV Protection of others
Subject: B Other organisms: the environment
Number: 1 Results of pesticide contamination

Main points:

**IN THE ENVIRONMENT, PESTICIDES CAN CONTAMINATE
SOIL AND ANIMAL FEED ON THE GROUND, WATER, AND - more rarely - AIR.
THIS CAN RESULT IN THE LOSS OF DOMESTIC ANIMALS AND BIRDS,
FISH, AND BENEFICIAL INSECTS AND THEIR LARVAE.**

**EVERY EFFORT MUST BE MADE TO APPLY PESTICIDES SO THAT
THE LOCAL ENVIRONMENT IS NOT HARMED.**

Examples of practices to be followed:

- clean up major spillages on the ground by digging out the contaminated soil and putting it in bags. Dispose these in the same way as used containers.
- put all the water used for washing protective clothing and equipment in drums, and dispose of it as contaminated wash water. Never wash these items in a river or stream.
- dispose of unwanted pesticide and empty containers in such a way that ground water or run-off into streams will not be contaminated. The methods of doing this will depend on the district.

Subsidiary points:

1. Serious environmental contamination is most likely to occur during mixing, and at the end of the days work. It is important that supervisors should allow sufficient time at the end of the day to allow the mixing site to be cleaned up and for the workers to wash before finishing work. If equipment is taken back to the base for cleaning, it should be treated as a pesticide container during transportation.
2. Adequate disposal facilities for empty containers and unwanted pesticide must be available at the operational base or at some other site approved for the disposal of chemical wastes.

For discussion:

In what other ways may the environment be polluted by pesticides?

Suggested visual aid: Photograph of a worker washing out equipment close to a pit.

Section: IV Protection of others
Subject: B Other organisms: the environment
Number: 2 Disposal of wash water in a pit

Main points:

**IN AREAS WHERE THE GROUND WATER IS NOT HIGH,
WASH WATER CAN BE ALLOWED TO SOAK AWAY IN A PIT
WHICH IS SUBSEQUENTLY REFILLED WITH EARTH.**

**MOST PESTICIDES WILL EITHER BE INACTIVATED AS THEY SOAK AWAY
THROUGH THE SUBSOIL OR BE ADSORBED ON TO SOIL PARTICLES,
SO THAT THEY WILL NOT TRAVEL FAR FROM THE VICINITY OF THE PIT.**

**THE PIT SHOULD BE $\frac{1}{2}$ - 1 METRE DEEP,
AND THE BASE SHOULD BE DRY BEFORE USE**

Examples of waters that can be disposed of in a pit:

- small quantities of unwanted liquid pesticide in diluted condition, and further diluted at least ten times;
- water used for washing out equipment;
- water used for washing hands and protective clothing;
- water used for drum decontamination.

Subsidiary points:

1. The pit should be dug more than 100 metres away from streams, wells, or houses.
2. The water should be allowed to soak away slowly, and the pit should be refilled slowly so that no water overflows the pit.
3. Disposal of unwanted pesticide is wasteful, and can be avoided by care in calculating the amount of pesticide needed.

Suggested visual aid: Photograph of man pouring water into a dry pit.

Section: IV Protection of others
Subject: B Other organisms: the environment
Number: 3 Disposal of wash water as a diluent

Main points:

Normally wash water should be disposed of in a soak pit. However, when the ground water level is high, a dry pit cannot be dug. In this case, an alternative has to be found.

**WASH WATER CAN BE USED
TO MAKE UP A DILUTION OF THE SAME PESTICIDE
ON THE NEXT DAY THAT THE PESTICIDE WILL BE USED.**

**THE WASH WATER SHOULD BE COLLECTED
IN A CLEARLY MARKED DRUM WITH A TIGHT LID.**

**IF THE DRUM IS TRANSPORTED, IT SHOULD BE TREATED IN ALL RESPECTS
AS A CONTAINER OF PESTICIDE.
BUT WHEN THE WATER IS USED FOR DILUTION,
IT SHOULD BE MEASURED AS IF IT WAS WATER.**

Subsidiary points:

1. If sprayers have contained a formulation which has tended to be lumpy, problems can arise if the lumps are present in the wash water and subsequently in the water used for dilution. These can be avoided if either the wash water drum is allowed to stand for some hours before the water is used, and the drum is emptied slowly, or if the wash water is passed through a sieve as it enters the wash water storage drum.
2. This method of disposal can also be used in cases where water for dilution is short at the site of application and has to be carried from the base. This often means that no water is available for washing at the application site. The situation need not arise if the water is first used for washing and then used for the final dilution of the day, leaving only a small quantity for the final wash after work.

Suggested visual aid: Photograph of wash water being poured into a marked drum.

Section: IV Protection of others
Subject: B Other organisms: the environment
Number: 4 Disposal of containers by burying

Main points:

Large pesticide containers are usually steel or cardboard drums, and smaller ones are aluminium bottles, and plastic bags and liners. All contain residues of concentrated pesticide, and present the same hazard to the workers handling them as if the workers were mixing the pesticide. If containers cannot be returned to suppliers, there are three ways of disposing of them, the first is by burying.

**A HOLE SUITABLE FOR BURYING CONTAINERS MUST MEET THE SAME
STANDARD**

OF DRYNESS AS THE HOLES FOR DISPOSING OF WASH WATER.

**THE HOLE MUST BE DEEPER, SO THAT WHEN FILLED, THE HIGHEST POINT
OF THE BURIED CONTAINERS SHOULD BE MORE THAN ½ METRE BELOW THE
SURFACE.**

**ALL CONTAINERS SHOULD BE PIERCED OR CRUSHED BEFORE BURYING
(except aerosol containers).**

Subsidiary points:

1. It is difficult and often dangerous to perforate or crush metal containers, and therefore this method of disposal is most suited to paper drums and plastic containers and liners. It is not possible to decontaminate these containers and they **MUST** be destroyed. It is not necessary to rinse them before burying. Aerosol containers must not be perforated.
2. Addition of manure or other rotting organic matter to the hole before filling will assist microbial breakdown of the pesticide.
3. If an approved disposal site for chemical wastes is in the vicinity, all empty containers should be sent there.

For discussion:

What protection must be worn by those handling empty containers for disposal?

Other information:

The priorities in the methods of disposal will depend on the facilities available in different countries.

Suggested visual aid: Photograph of card drums and plastic bags being placed in a deep pit, prior to burying.

Section: IV Protection of others
Subject: B Other organisms: the environment
Number: 5 Disposal of containers by burning

Main points:

This method of disposal can be used for boxes, card drums, plastic liners, and other combustible materials, **but should only be considered if a pit cannot be dug and there is no other way of disposing of the containers in an approved site for chemical wastes.**

**THE SMOKE MAY CONTAIN POISONOUS FUMES
AND THE PUBLIC MUST NOT BE PUT AT RISK.**

THE FIRE MUST BE DOWN WIND OF ANY BUILDINGS.

THE FOLLOWING RULES MUST BE FOLLOWED:

- FIRST EMPTY THE CONTAINERS OF ANY PESTICIDE AND RINSE OUT PLASTIC LINERS;
- DISPOSE OF THE RINSINGS AS FOR WASH WATERS;
- MAKE THE FIRE IN A PIT, AT LEAST 100 METRES FROM ANY WELL, RIVER, OR HOUSE;
- AT LEAST ONE WORKER MUST STAND BY THE FIRE UNTIL THE CONTAINERS HAVE BEEN REDUCED TO ASH;
- THE WORKER MUST BE SURE TO STAND AT THE WINDWARD SIDE OF THE FIRE, AND AVOID THE SMOKE;
- WHEN ALL THE CONTAINERS ARE BURNT, COVER THE ASH WITH EARTH AND REFILL THE PIT.

For discussion:

What type of protection should the worker wear?

Other information: In some countries disposal by burning, except in an approved furnace, is prohibited.

Suggested visual aid: Photograph of worker tending fire, wearing correct protection.

Section: IV Protection of others
Subject: B Other organisms: the environment
Number: 6 Decontamination of containers

Main points:

THE ONLY CONTAINERS THAT CAN BE DECONTAMINATED ARE THOSE MADE OF METAL OR RIGID PLASTIC, AND HAVE CONTAINED PESTICIDE CONCENTRATES OF MODERATE HAZARD OR LESS.

Containers made of polyethylene, and which have contained organophosphorous or carbamate pesticides cannot be decontaminated. These pesticides are selectively absorbed by the polyethylene.

DECONTAMINATION SHOULD ALWAYS BE CARRIED OUT IN A WELL DEFINED AND SECURE AREA.

FOR SAFE DECONTAMINATION, THE FOLLOWING RULES MUST BE OBSERVED:

- CAREFULLY EMPTY OUT ANY REMAINING PESTICIDE IN THE CONTAINER AND DISPOSE OF THIS SAFELY;
- RINSE THE CONTAINER CAREFULLY WITH AT LEAST HALF OF ITS VOLUME OF CLEAN WATER AND DISPOSE OF THE RINSE AS WASH WATER;
- FILL THE CONTAINER COMPLETELY WITH CLEAN WATER AND LEAVE TO SOAK A MINIMUM OF 24 HOURS;
- EMPTY THE WATER INTO A WASH WATER DISPOSAL PIT;
- REPEAT THE OPERATION FOR TWO MORE 24 HOUR PERIODS;
- OBLITERATE THE LABEL.

THE CONTAINER SHOULD NOT BE USED FOR THE STORAGE OF HUMAN OR ANIMAL FOOD OR DRINK, AND SHOULD BE MARKED ACCORDINGLY.

Subsidiary point:

Decontamination operations must be carefully supervised, and only conscientious workers should be employed in this task.

For discussion:

What protection should workers decontaminating containers wear?

Suggested visual aid: Photograph of containers in a secure area, standing filled to the brim with water.

Section: IV Protection of others
Subject: B Other organisms: the environment
Number: 7 Disposal of large quantities of unwanted pesticide

Main points:

The disposal of large quantities of unwanted pesticide is difficult, and the method used will depend on national circumstances. It should **NEVER**:

- be put in any river, lake, or sea;
- be put in any landfill unless it has been specifically approved for the disposal of chemical wastes;
- used for any purpose other than those stated on the label;
- given to any other person or organization unless it is legal to dispose of it in this way, and for the other party to receive it.

THE FOLLOWING ARE SOME OF THE OPTIONS:

- RETURN IT TO THE SUPPLIER.
- INCINERATION AT A HIGH TEMPERATURE WHICH WILL VARY WITH THE FORMULATION.

IN HIGHLY EXCEPTIONAL CIRCUMSTANCES:

- DEEP BURIAL IN A DRY HOLE OR DISUSED MINE.
- WALLING UP IN A DRY CAVE.

Subsidiary points:

1. It should be realized that disposal of unwanted pesticide almost always involves expenditure, and this should be budgeted.
2. All pesticides have a limited shelf life, and the active ingredient diminishes during storage. No pesticide should be used after two years from the date of manufacture or formulation, or, if these are not on the label, from the date received in store, without an analytic test for the concentration of the active ingredient. If there has been a marked reduction in this, or if there has been a change in the physical form or colour of the formulation, its acute toxicity should also be checked. The manufacturer or the formulator should be consulted about this.

Suggested visual aid: No special aid needed.

CHEMICAL GROUPS AND MODES OF ACTION OF PESTICIDES

A. APPLICATORS

Subject A: Should know how pesticides are named.

B. SUPERVISORS, SANITARIANS, AND AGRICULTURAL EXTENSION OFFICERS:

Subject A: Should know how pesticides are named, their mode of action in general, and the significance of mixtures, manufactured and in the field.

Subjects B,C, & D: Should know the modes of action of those pesticides which they use or might be used in their area in the immediate future, and the approved and trade names of these pesticides.

C. OTHER HEALTH AND MEDICAL PERSONNEL:

Subject A: Should know how pesticides are named, and their mode of action in general. May need to know the significance of mixtures.

Subjects B,C, & D: Should know the chemical groups of pesticide, and their modes of action. Should know the approved and trade names of pesticides in use or otherwise available in the area that they work.

D. PESTICIDE REGISTRATION PERSONNEL:

Subject A: Should know how pesticides are named, their mode of action in general, and the significance of mixtures, manufactured and in the field.

Subject B,C, & D: Should know the outline of the mode of action of all chemical groups. May need to know the approved and trade names of the products registered in the country.

Section: V Chemical groups and modes of action of pesticides
Subject: A General points
Number: 1 Names of pesticides

Main points:

**A REGISTERED PESTICIDE HAS TWO NAMES.
THE COMMON OR APPROVED NAME IS A NAME GIVEN TO IT BY
THE INTERNATIONAL (OR A NATIONAL) STANDARDS ORGANIZATION.**

**THE PROPRIETARY NAME IS THE NAME GIVEN TO IT BY THE MANUFACTURER.
THIS IS ALSO KNOWN AS THE TRADE NAME**

**BOTH NAMES MUST APPEAR ON THE LABEL,
BUT THE PROPRIETARY NAME IS USUALLY MORE PROMINENT.
NEVERTHELESS, IT IS THE COMMON OR APPROVED NAME THAT IS IMPORTANT,
ESPECIALLY WHEN POISONING OCCURS, AS IT GIVES CLUES AS TO THE
CHEMICAL GROUP TO WHICH THE COMPOUND BELONGS, AND THESE INDICATE
THE TREATMENT NEEDED.**

Examples: Reldan is chlorpyrifos-methyl
Sevin is carbaryl.
Tomorin and Ratilan are coumachlor.

Subsidiary points:

1. Proprietary names are written with a capital first letter as in the examples above. Common or approved names are written with a small first letter.
2. Common or approved names always refer to the same chemical compound, except for some minor national differences. Proprietary names for the same compound may differ between countries. Some refer to mixtures in which the constituents may change, or they may be reallocated to a pesticide replacing another that has become obsolete.

For discussion:

Are there labels available? Can the proprietary and common or approved names be found?

Other information: Apart from the examples given above, only common or approved names are used in this course.

Suggested visual aid: Examples of local labels.

Section: V Chemical groups and modes of action of pesticides
Subject: A General points
Number: 2 Modes of action of pesticides

Main points:

1. **A GREAT NUMBER OF DIFFERENT BODY SYSTEMS ARE NECESSARY FOR LIFE. SOME ARE SHARED BETWEEN ALL SPECIES, BUT OTHERS VARY WITH THE CLASS OF ANIMALS OR PLANTS, OR BETWEEN SPECIES IN A SINGLE CLASS.**

PESTS INCLUDE ORGANISMS FROM MANY CLASSES, SUCH AS PLANTS, GERMS, MOULDS, INSECTS, SPIDERS, MITES, WORMS, FISH, BIRDS AND MAMMALS.

PESTICIDES KILL BY INTERFERING WITH ONE OR MORE ESSENTIAL BODY SYSTEMS IN THE PEST.

THE MORE THAT THESE SYSTEMS ARE SHARED BY MAN, THE GREATER IS THE HAZARD OF THE PESTICIDE TO MAN.

2. **MOST PESTICIDES BELONG TO A FEW CHEMICAL GROUPS, EACH OF WHICH HAS ITS OWN EFFECTS ON CERTAIN BODY SYSTEMS.**

SMALL CHANGES IN THE CHEMICAL STRUCTURE OF COMPOUNDS IN A GROUP RESULT IN SOME SPECIES BEING AFFECTED MORE BY THOSE CHEMICALS THAN BY OTHERS IN THE SAME GROUP.

This is why some chemicals are more selective than others
in their action on certain pests.

For discussion: What animal pests are most likely to share essential body systems with man?

Suggested visual aid: No special aid needed.

Section: V Chemical groups and modes of action of pesticides
Subject: A General points
Number: 3 Mixtures of pesticides in the field

Main points:

DO NOT MIX TWO OR MORE FORMULATIONS IN THE FIELD UNLESS THE LABELS OF EACH STATE CLEARLY THAT THEY ARE COMPATIBLE.

THE MIXING OF TWO ACTIVE INGREDIENTS OF THE SAME CHEMICAL GROUP IS UNLIKELY TO INCREASE THE EFFICACY OF THE MORE POTENT COMPOUND.

THE TOXICITY IS LIKELY TO BE AT LEAST ADDITIVE.

WHILE SYNERGISM BETWEEN ACTIVE OR OTHER INGREDIENTS IS UNLIKELY, THERE IS A THEORETICAL CHANCE THAT IT MAY OCCUR.

Subsidiary point:

If the toxicity of a mixture of two or more active ingredients is not known, the hazard is also unknown. Therefore, if such home-made mixtures must be used, the precautions to be taken should be those needed for a hazard one class higher than the hazard class of the more hazardous active ingredient.

For discussion:

Are any mixtures made in the field locally?

Other information:

This practice is prohibited in some countries.

Suggested visual aid: None indicated.

Section: V Chemical groups and modes of action of pesticides
Subject: A General points
Number: 4 Manufactured mixtures of pesticides.

Main points:

Mixtures made by formulators are of two types:

- mixtures of chemicals, one of which will be the active ingredient in a formulation containing non-pesticidal synergists, such as piperonyl butoxide, and
- mixtures of two or more active ingredients in a formulation.

IN THE FIRST TYPE, THE SYNERGIST IS INCLUDED TO INCREASE THE TOXICITY OF THE ACTIVE INGREDIENT FOR THE TARGET SPECIES.

IN THE SECOND TYPE, IF THE ACTIVE INGREDIENTS BELONG TO THE SAME CHEMICAL CLASS, THE TOXICITY WILL USUALLY BE ADDITIVE. IF THE ACTIVE INGREDIENTS BELONG TO DIFFERENT CHEMICAL CLASSES, EACH WILL EXERT ITS OWN EFFECTS, AND THE RESULTING TOXICITY OF THE MIXTURE IS LIKELY TO BE THAT OF THE MORE TOXIC CONSTITUENT.

WHILE UNINTENDED SYNERGISM BETWEEN ACTIVE AND OTHER INGREDIENTS IS A THEORETICAL POSSIBILITY, THERE HAVE BEEN FEW STUDIES OR REPORTS OF THIS OCCURRING TO ANY EXTENT.

HOWEVER, MANUFACTURERS SHOULD ALWAYS CONFIRM THAT THIS IS NOT OCCURRING, AND SHOULD CARRY OUT A FULL RANGE OF ACUTE TOXICITY TESTS ON ALL MIXTURES OF BOTH TYPES.

REGISTRATION AUTHORITIES SHOULD INSIST ON THE PRODUCTION OF THIS DATA, AND FORMULATORS SHOULD NOT BE ALLOWED TO CHANGE THE COMPOSITION OF MIXTURES WITHOUT THE PERMISSION OF THE REGISTRATION AUTHORITY.

Suggested visual aid: None indicated.

Section: V Chemical groups and modes of action of pesticides
Subject: B Insecticides
Number: 1 Organophosphorous compounds

Main points:

**THE MAIN TARGET OF ORGANOPHOSPHORUS COMPOUNDS
IN THE BODY IS THE ENZYME CHOLINESTERASE.
THIS ENZYME IS ESSENTIAL FOR THE
PASSAGE OF NERVE IMPULSES BETWEEN CELLS.**

ORGANOPHOSPHORUS COMPOUNDS ARE NOT STORED IN THE BODY FOR LONG PERIODS, BUT THEIR EFFECTS CAN ACCUMULATE OVER A PERIOD OF WEEKS.

Examples with hazard class of technical product:

parathion (Ia)	diazinon (II)	malathion (III)
dichlorvos (Ib)	fenitrothion (II)	chlorpyrifos methyl (III)
fenthion (Ib)	bromophos (III)	temephos (Table 5)

Level: ADVANCED

Subsidiary points:

1. The degree of inhibition of red cell or whole blood cholinesterase indicates the possibility of the onset of symptoms and the outcome. Inhibition of plasma cholinesterase is only an indication of exposure to an inhibitor.
2. Inhibition of the enzyme may be fully reversible, partially reversible, or irreversible. The rate and degree of spontaneous reactivation depends on the nature of the compound.
3. Reactivation of red cell or whole blood cholinesterase is usually slow without treatment, and therefore the effects of small exposures resulting in a degree of inhibition can accumulate until symptoms can occur after a relatively minor exposure.

For discussion:

What are the common or approved and trade names of the chemicals most commonly used by the group?

Other information:

1. In this and the following modules, only a selection of pesticides can be given, and these should be modified to accord with local use.
2. The information on hazard classes in this section is to enable the toxicological 'scatter' of the chemical groups to be compared but does not give any information as to the hazard of formulations as this depends on concentration. (For definitions of classes, see module I B 2.)

Suggested visual aid: List of local common or approved names with trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: B Insecticides
Number: 2 Carbamates

Main points:

CARBAMATE COMPOUNDS

**ACT IN A SIMILAR WAY TO ORGANOPHOSPHOROUS COMPOUNDS
BY INHIBITING CHOLINESTERASE IN THE BODY.**

**CHOLINESTERASE IS ESSENTIAL FOR THE PASSAGE OF
NERVE IMPULSES BETWEEN CELLS.**

**THE INHIBITION MAY BE FASTER BUT IS USUALLY OF SHORT DURATION.
EVEN IF NO TREATMENT IS GIVEN, THE CHOLINESTERASE IS REACTIVATED
WITHIN MINUTES OR HOURS.**

**CARBAMATES ARE NOT STORED IN THE BODY,
AND ACCUMULATION OF EFFECT DOES NOT OCCUR.**

Examples with hazard class of technical product:

aldicarb (Ia)
methomyl (Ib)

bendiocarb (II)
carbaryl (II)

propoxur (II)
fenthioncarb (III)

Subsidiary points:

The effect of carbamates on red cell cholinesterase is transient and inhibition is difficult to measure. The level in a blood sample can change, even while the blood sample is being processed.

For discussion:

What are the common or approved and trade names of the carbamates most commonly used by the group?

Other information:

Carbamate insecticides must not be confused with thio-dithiocarbamate compounds. These do not inhibit cholinesterase.

Suggested visual aid: List of local common or approved names with trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: B Insecticides
Number: 3 Organochlorine compounds

Main points:

ORGANOCHLORINE COMPOUNDS STIMULATE THE NERVOUS SYSTEM IN THE BRAIN. LARGE DOSES OVER A LONG PERIOD MAY AFFECT THE FUNCTION OF THE LIVER.

THESE COMPOUNDS ARE STORED IN BODY FAT.

MOST COMPOUNDS ARE ALSO PERSISTENT IN NATURE AND HAVE EFFECTS ON NON-TARGET WILDLIFE THAT ARE NOT SEEN IN HUMANS.

FOR THIS REASON, USE OF SOME COMPOUNDS IS RESTRICTED OR BANNED IN MANY COUNTRIES.

Examples with hazard class of technical product:

aldrin (Ib)	chlordane (II)	endosulfan (II)
dieldrin (Ib)	DDT (II)	heptachlor (II)
endrin (Ib)	HCH (ex BHC) (II)	methoxychlor (Table 5)

Level: ADVANCED

Subsidiary points:

1. Stimulation of the central nervous system accounts for all the acute symptoms, and determines the treatment. Induction of liver enzymes in humans only occurs after very heavy continuous exposure.
2. Levels in human fat are related to intake, and are of little significance.
3. DDT has caused liver cancer in one species of mouse, but not in other animals. It is not thought by most experts to be carcinogenic for humans.

For discussion:

What are the common or approved and trade names of organochlorines permitted to be used in the country?

Other information:

1. The banning of these compounds has been due to their persistence in the food chain, and to some special effects, such as the thinning of bird egg shells. DDT has an outstanding safety record for man as it is very weakly absorbed through the skin except in oily solution.
2. The reference to table 5 in the examples above refers to Table 5 in the WHO Recommended Classification of Pesticides by Hazard, a list of active ingredients unlikely to give rise to hazard to humans in normal use.

Suggested visual aid: List of common or approved and trade names of compounds locally permitted for use.

Section: V Chemical groups and modes of action of pesticides
Subject: B Insecticides
Number: 4 Pyrethroid compounds

Main points:

**PYRETHROID COMPOUNDS ACT ON NERVES, PROLONGING ANY STIMULATION.
THEY PASS EASILY THROUGH THE CUTICLE OF INSECTS.**

**THEY ARE HIGHLY BIOACTIVE AND USED IN HIGH DILUTION.
THEREFORE THE HAZARD OF FORMULATIONS TO HUMANS IS LOW.**

**PYRETHROIDS ARE RAPIDLY BROKEN DOWN AND EXCRETED FROM THE BODY.
THEY ARE NOT STORED IN THE BODY, AND THEIR EFFECTS DO NOT
ACCUMULATE.**

Examples with hazard class of technical product:

bioallethrin (II)	deltamethrin (II)	allethrin (III)
cyhalothrin (II)	fenvalerate (II)	resmethrin (III)
cypermethrin (II)	permethrin (II)	bioresmethrin (Table 5)

Level: ADVANCED

Subsidiary points:

1. Very few accidental poisoning cases have been reported in humans, after very high exposure.
2. In rats, the toxicity is high only on parenteral application
3. The paraesthesia (a feeling of tingling or burning in the skin) reported after exposure to some pyrethroids is due to lengthening of the refractory period of dermal nerve endings. It remits spontaneously after a few hours.

For discussion:

What are the common or approved and trade names of pyrethroids used by the group?

Other information:

1. These compounds are chemical developments of the insecticidal chemical found in the pyrethrum plant.
2. The reference to table 5 in the examples above refers to Table 5 in the WHO Recommended Classification of Pesticides by Hazard, a list of active ingredients unlikely to give rise to hazard to humans in normal use.

Suggested visual aid: List of local common or approved compounds with trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: C Rodenticides
Number: 1 Warfarin

Main points:

**WARFARIN PREVENTS VITAMIN K PRODUCTION IN THE BODY
AND DECREASES PRODUCTION IN THE LIVER OF A CHEMICAL, PROTHROMBIN.
THIS IS ESSENTIAL FOR THE CLOTTING OF BLOOD.**

THIS CAUSES BLEEDING INTO THE SKIN AND OTHER PARTS OF THE BODY.

Warfarin is used as a drug for man to reduce the clotting power
of the blood and thus prevent heart attacks.
The dosage has to be carefully controlled.

Subsidiary points:

1. Warfarin does not act immediately. It is usually eliminated quickly, although its effect lasts longer. Several doses are needed to kill a rat. The hazard for humans or other large animals who might accidentally eat a single dose, is very small.
2. Rats in many places have developed a genetic resistance to warfarin.

For discussion:

Under what trade names is warfarin sold in this country?

Other information:

Since rodenticides have to be highly toxic to mammals if they are to be effective pesticides, their hazard to man is high. Warfarin is in class Ib, although the need for multiple dosage reduces its hazard in practice. This safety factor does not apply to other rodenticides with a similar action.

Suggested visual aid: List of local trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: C Rodenticides
Number: 2 Warfarin derivatives

Main points:

Warfarin derivatives were developed to counteract
the genetic resistance to warfarin in rats.

**THESE COMPOUNDS HAVE THE SAME ANTICOAGULANT ACTION AS WARFARIN,
BUT REQUIRE ONLY A SINGLE DOSE TO KILL A RAT.**

**AS THEY ALSO INHIBIT VITAMIN K PRODUCTION
AND AFFECT THE CLOTTING FACTORS FOR BLOOD,
THEY ARE THEREFORE MORE HAZARDOUS THAN WARFARIN TO HUMANS
AND OTHER ANIMALS IF ACCIDENTALLY EATEN.**

Examples:

coumafuryl (Ia)
diphacinone (Ia)

brodifacoum (Ia)
chlorphacinone (Ia)

difenacoum (Ia)

Subsidiary points:

Although there is a specific antidote, the hazard class of these compounds indicates the care with which they must be handled.

For discussion:

Under what trade names are these compounds sold in this country?

Suggested visual aid: List of local trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: C Rodenticides
Number: 3 Other rodenticides

Main points:

1. **CALCIFEROL RELATED COMPOUNDS ARE NEW. THESE COMPOUNDS AFFECT THE METABOLISM OF CALCIUM AND PHOSPHOROUS, AND THUS CAUSE SEVERE METABOLIC DISTURBANCE.**

Examples:

ergocalciferol (Ib) cholecalciferol (Ib)

2. **FLUOROACETATES ARE VERY HIGHLY TOXIC COMPOUNDS THAT INHIBIT RESPIRATION AT THE CELLULAR LEVEL.**

Examples:

sodium fluoroacetate or 1080 (Ia) fluoroacetamide or 1081 (Ib)

3. **ZINC PHOSPHIDE HAS BEEN USED FOR MANY YEARS. IT HAS AN IRRITANT AND CORROSIVE ACTION ON THE ALIMENTARY TRACT, AND ALSO INTERFERES WITH PROTEIN SYNTHESIS. IT IS IN HAZARD CLASS Ib.**

4. **CHLORALOSE HAS A NARCOTIC ACTION. IT SLOWS DOWN METABOLISM AND LOWERS BODY TEMPERATURE. IT IS IN HAZARD CLASS II.**

5. **THALLIUM IS A CUMULATIVE AGENT WHICH AFFECTS THE NERVOUS SYSTEM CAUSING POLYNEURITIS AND CAUSES LOSS OF HAIR. ITS USE AS A RODENTICIDE IS NOT RECOMMENDED. IT IS IN HAZARD CLASS Ib.**

For discussion:

Which of these compounds are available in this country, and under what trade names are they sold?

Suggested visual aid: List of local trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: D Other pesticides
Number: 1 Paraquat and diquat

Main points:

**THESE BIPYRIDYL DERIVATIVES ARE HERBICIDES
WHICH ARE INACTIVATED ON CONTACT WITH SOIL.**

**THEY ARE WEAKLY CORROSIVE TO THE EYES AND LOCALLY PROLONGED OR
REPEATED CONTACT CAN AFFECT THE SKIN, FINGERNAILS, AND THE LINING
OF THE NOSE, CAUSING BLEEDING.**

**THEY ARE ABSORBED THROUGH THE SKIN WHEN CONTACT IS PROLONGED.
IN NORMAL USE THEY ARE OF MODERATE OR SLIGHT HAZARD,
THE TECHNICAL PRODUCTS BEING IN HAZARD CLASS II.**

**HOWEVER, IF TAKEN BY MOUTH, THE OESOPHAGUS AND STOMACH MAY BE
AFFECTED BY THE CORROSIVITY, AND KIDNEY AND LIVER FAILURE MAY
OCCUR RAPIDLY. IF THIS IS SURVIVED, PARAQUAT AFFECTS THE LUNGS.
THIS IS USUALLY FATAL WITHIN A FEW WEEKS.**

Subsidiary point:

Paraquat reacts biochemically in the body, and the molecule exerts a toxic action on cells at the reaction sites.

For discussion:

Under what trade names are these compounds available in this country?

Other information:

Paraquat has caused few problems occupationally, but there have been many instances of the compound being taken deliberately by mouth in attempted (and usually successful) suicide attempts. Diquat does not present the same problems. Its effects on the liver and kidneys are similar, but no late effect is seen on the lungs.

Suggested visual aid : List of local trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: D Other pesticides
Number: 2 Pentachlorophenol and related compounds

Main points:

THESE FUNGICIDES AND HERBICIDES ACT BY STIMULATING METABOLISM IN MAMMALS.

**THIS RESULTS IN AN INCREASE IN THE RATE OF BREATHING,
AND A RISE IN BODY TEMPERATURE TO HIGH LEVELS.**

CONTACT WITH THE SKIN CAN CAUSE CHLORACNE.

**THE COMPOUNDS ARE VERY SLOWLY EXCRETED IN URINE
OVER A PERIOD OF ABOUT ONE WEEK,
AND THEREFORE THERE IS A TENDENCY TOWARDS ACCUMULATION
IN THE BODY ON REPEATED EXPOSURE.**

Examples:

pentachlorophenol (Ib)
dinoseb (Ib)

dinoterb (Ib)
medinoterb (Ib)

DNOC (Ib)
dinocap (III)

For discussion:

Under what trade names are these compounds available in this country?

Suggested visual aid: List of local trade names.

Section: V Chemical groups and modes of action of pesticides
Subject: D Other pesticides
Number: 3 Metals

Main points:

Several metals are or have been used as pesticides.
Modes of action of metals are to be found in textbooks of industrial toxicology.

1. **ARSENIC SALTS HAVE BEEN USED AS RODENTICIDES, HERBICIDES AND LARVICIDES. INORGANIC ARSENICALS ARE HIGHLY TOXIC AND PROBABLY CARCINOGENIC FOR MAN. THEY SHOULD NOT BE USED.**

Examples:

arsenous oxide (Ia)	lead arsenate (Ib)	dimethyl arsinic acid
calcium arsenate (Ia)	cupric arsenoarsenite (Paris Green) (Ib)	(cacodylic acid) (III)

INORGANIC ARSENICALS ARE HIGHLY TOXIC AND PROBABLY CARCINOGENIC FOR MAN. THEY SHOULD NOT BE USED.

2. **ORGANIC MERCURY SALTS ARE USED AS A FUNGICIDE ON SEEDS.**

Examples: phenyl mercury acetate and nitrate (Ia)

**THESE AND SIMILAR COMPOUNDS ARE HIGHLY TOXIC,
AND CAUSE LASTING DAMAGE TO THE NERVOUS SYSTEM.**

THEY SHOULD ONLY BE USED IF THERE IS NO OTHER POSSIBLE SUBSTITUTE.

3. **ORGANIC TIN COMPOUNDS ARE ACTIVE AGAINST SNAILS AT VERY LOW CONCENTRATIONS IN WATER.**

Examples:

azocyclotin (Ib)	fentin acetate and hydroxide (II)	cyhexatin (III)
bis-(tributyl)tin oxide (Ib)		fenbutatin (Table 5)

4. **COPPER SALTS HAVE FUNGICIDAL ACTION.**

Examples:

cuprous oxide (Ib)	copper sulphate (II)	copper oxychloride (III)
		oxine-copper (Table 5)

Subsidiary points:

1. Thallium sulphate and zinc phosphide, are rodenticides.
2. Aluminium phosphide is a fumigant. It reacts in the same way as zinc phosphide.

For discussion: Under what trade names are metals marketed as pesticides in this country?

Suggested visual aid: List of local trade names.

FIRST-AID TREATMENT OF PESTICIDE POISONING

A. APPLICATORS, PESTICIDE REGISTRATION PERSONNEL:

- Subject A: May need to know the early symptoms of poisoning by pesticides to which they are exposed, and the local effects of pyrethroids.
- Subject B: Should know the general principles of treatment of a case of possible pesticide poisoning.
- Subject C: Should know how to treat splashes of pesticide on the skin and in the eye.

B. SUPERVISORS, SANITARIANS, AGRICULTURAL EXTENSION WORKERS, AND OTHER PERSONNEL TRAINED TO CARRY OUT FIRST AID.

- Subject A: Should know the symptoms and signs of poisoning by all the chemical groups to which local applicators may be exposed.
- Subject B: Should know the management and treatment of cases exposed to all the chemical groups studied in Subject A.
- Subject C: Should know how to treat splashes of pesticide on the skin and in the eye.

NOTES TO TRAINERS:

1. The modules contain only very brief notes on the resuscitation of patients who are unconscious, pulseless, and not breathing. This subject is important, but is best taught by practical demonstrations. Alternatively, new modules can be prepared with expert assistance, illustrated with a series of photographs showing the techniques.
2. Trainers may wish to prepare and distribute a list of local medical facilities or doctors to whom poisoning cases could be sent.

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs
Number: 1 General

Main points:

Pesticides can affect the body in two ways: they can cause a local reaction where they touch exposed parts of the skin and the eye, or they can be absorbed into the body and cause a systemic reaction. Local reactions vary from direct irritation following a single contact to allergic reactions, usually after multiple contacts with the same compound. Pesticide poisoning is the appearance of systemic reactions.

**PESTICIDE POISONING CAN MIMIC THE SIGNS AND SYMPTOMS
OF OTHER COMMON DISEASES.**

IT IS IMPORTANT TO FIND OUT EXACTLY WHAT HAPPENED.

**PESTICIDE POISONING IS LIKELY ONLY WHEN THE PERSON
IS KNOWN TO HAVE HAD RECENT EXPOSURE TO A PESTICIDE.**

**THE PERSON MAY BE WEARING SOAKED CLOTHING OR BE KNOWN
TO HAVE SWALLOWED PESTICIDE, EITHER ACCIDENTALLY OR DELIBERATELY.**

ALL CASES SHOULD BE SEEN BY A DOCTOR AS SOON AS POSSIBLE.

**IT WILL BE IMPORTANT FOR THE DOCTOR TO KNOW
TO WHICH PESTICIDE THE PERSON HAS BEEN EXPOSED.**

**IF THE CONTAINER IS AVAILABLE, SEND IT WITH THE POISONED PERSON
FOR THE DOCTOR TO SEE.**

**OTHERWISE, COPY THE TRADE AND APPROVED NAMES OF THE PESTICIDE
FROM THE LABEL.**

**THE LABEL MAY INCLUDE IMPORTANT NOTES ON THE TREATMENT OF
POISONING, WHICH SHOULD BE FOLLOWED.**

Subsidiary point:

Always check first whether the poisoned person is breathing and has a pulse. If necessary, start resuscitation immediately, and do not waste time getting the information above. However, someone else should be asked to find the name of the pesticide, as it is important that antidotes should be used for some types of pesticide poisoning.

Suggested visual aid: Text, if needed.

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs
Number: 2 Organophosphorous poisoning.

Main points:

Poisoning by organophosphorous insecticides is the commonest form of pesticide poisoning, and needs immediate treatment.

ONSET: ½ - 24 HOURS AFTER EXPOSURE

**AT FIRST: PERSON FEELS SICK,
COMPLAINS OF HEADACHE,
GENERAL WEAKNESS OR TIREDNESS.**

**THEN: PERSON BEGINS TO SWEAT AND SALIVATE (WATER AT
THE MOUTH), MAY VOMIT AND HAVE DIARRHOEA,
COMPLAINS OF STOMACH CRAMPS,
PUPILS BECOME VERY SMALL,
PERSON MAY MENTION BLURRED VISION,
MUSCLES TWITCH, AND HANDS SHAKE,
BREATHING BECOMES BUBBLY,
PERSON MAY HAVE A FIT AND BECOME UNCONSCIOUS.**

Subsidiary point:

All cases should be seen by a doctor as soon as possible.

Other information:

For first aid treatment, see modules VI B 1 and 2.

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

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs
Number: 3 Carbamate poisoning

Main points:

Carbamate insecticides have the same action as the organophosphorous compounds, but they are much faster in onset, and recovery is much faster. If a man is applying these compounds and does not take the proper precautions, he may feel so ill after a while that he has to stop work. Soon after exposure ends, he will start to feel better, unless he is still absorbing pesticide from contaminated skin or clothing.

ONSET: SOMETIMES AT WORK - 3 HOURS.

**AT FIRST: PERSON FEELS SICK AND MAY VOMIT,
COMPLAINS OF HEADACHE AND DIZZINESS,
TIREDNESS AND TIGHTNESS IN CHEST**

**THEN: PERSON MAY BEGIN TO SWEAT AND SALIVATE,
MAY MENTION BLURRED VISION,
MUSCLES MAY TWITCH.
RARELY, A PERSON MAY HAVE A FIT AND BECOME
UNCONSCIOUS.**

Subsidiary point:

If the first aider is sure that exposure has ceased, all contaminated clothing has been removed and the skin washed, and there is no recovery after one hour, the case must be seen by a doctor as soon as possible.

Other information:

For treatment, see module VI B 3.

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

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs
Number: 4 Organochlorine poisoning.

Main points:

Poisoning by organochlorine pesticides is uncommon, and most of the more hazardous compounds have been withdrawn from the market for some years. Organochlorine poisoning is unlikely to occur from any exposure to DDT. Signs and symptoms of poisoning are due to excitation of the nervous system.

AT FIRST: PERSON COMPLAINS OF HEADACHE AND DIZZINESS, THE PERSON MAY APPEAR VERY WORRIED AND MAY BECOME EXCITED.

**THEN: PERSON MAY VOMIT,
SHOW WEAKNESS IN ARMS AND LEGS,
HANDS MAY SHAKE,
PERSON MAY BECOME DISORIENTED IN TIME AND SPACE.
FITS MAY FOLLOW.**

Other information:

For treatment, see module VI B 4.

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

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs
Number: 5 Pyrethroid insecticides

Main points:

Although pyrethroids have been used for many years, there have been few reports of systemic poisoning by these compounds. This is because, although they are absorbed as other pesticides, they are very quickly broken down to harmless products in the body after absorption. However, they do have a

LOCAL REACTION.

**WITHIN HOURS OF FIRST EXPOSURE,
PYRETHROID COMPOUNDS MAY CAUSE TINGLING ON EXPOSED SKIN,
ESPECIALLY AROUND THE MOUTH AND NOSE.**

THE TINGLING IS PERSISTENT AND UNCOMFORTABLE, BUT NOT PAINFUL.

**THERE IS NO MARK OF REDNESS OR IRRITATION ON THE SKIN
WHERE THE TINGLING OCCURS.**

**APART FROM WASHING THE AFFECTED SKIN WITH SOAP AND COLD WATER,
THERE IS NO TREATMENT THAT WILL MAKE ANY DIFFERENCE.**

**THE TINGLING WILL DISAPPEAR OF ITS OWN ACCORD
WITHIN 24 HOURS AFTER THOROUGH WASHING.**

Other information:

There is no separate treatment module for pyrethroid compounds.

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

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs; treatment
Number: 6 Poisoning by rodenticides

Main points:

- 1. ANTICOAGULANT RODENTICIDES: ONSET: USUALLY SLOW.**
THERE ARE SIGNS THAT THE BLOOD WILL NOT CLOT SUCH AS EASY BRUISING AND PROLONGED BLEEDING FROM MINOR INJURIES, OR PAINFUL SWELLING OF A LARGE JOINT AFTER NO APPARENT INJURY.

TREATMENT: IF THE PERSON HAS BEEN POISONED BY MOUTH, INDUCE VOMITING. THE PERSON NEEDS TO BE SEEN BY A DOCTOR AS A BLOOD TEST IS NECESSARY FOR DIAGNOSIS. THE DOCTOR CAN ALSO GIVE A SPECIFIC ANTIDOTE, VITAMIN K.
- 2. CALCIFEROL DERIVATIVES: ONSET: USUALLY SLOW.**
LOSS OF APPETITE, FEELING SICK WITH PAIN IN THE ABDOMEN, HEADACHES IN THE BACK OF THE HEAD AND SENSITIVITY OF THE SCALP; LATER, MENTAL CONFUSION AND LOSS OF MEMORY

TREATMENT: IF THE PERSON HAS BEEN POISONED BY MOUTH, INDUCE VOMITING. THE PERSON HAS TO BE SEEN BY A DOCTOR, WHO WILL NEED TO MAKE TESTS TO CONFIRM THE DIAGNOSIS.
- 3. ALL OTHER RODENTICIDES: EXCEPT FOR ZINC PHOSPHIDE, IF THE PERSON HAS BEEN POISONED BY MOUTH, INDUCE VOMITING. MEDICAL TREATMENT IS NEEDED FOR ALL CASES. ZINC PHOSPHIDE IS CORROSIVE, AND ALL CASES MUST BE SEEN BY A DOCTOR.**

Suggested visual aid: Text showing treatment.

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs: treatment
Number: 7 Poisoning by paraquat and diquat

Main points:

Paraquat and diquat cause little trouble when used according to the formulators' directions. Repeated use without skin or face protection may cause malformation of the fingernails and nosebleeds. These will disappear slowly after proper precautions are taken in use. However, if these compounds are accidentally or deliberately drunk, they are very dangerous.

ONSET: IMMEDIATE WITH BURNING SENSATION IN THE MOUTH AND THROAT.

FOLLOWED BY: NAUSEA AND VOMITING,
PAIN IN THE STOMACH

LATER: TIGHTNESS IN CHEST, BUBBLY BREATHING.

TREATMENT: VOMITING SHOULD BE INDUCED.
TAKE THE PERSON TO HOSPITAL IMMEDIATELY.
THERE IS NO SPECIFIC ANTIDOTE.

IF THERE IS LIKELY TO BE ANY DELAY
IN GETTING THE PATIENT TO HOSPITAL,
FIND SOME UNCONTAMINATED FINE EARTH OR CLAY, MAKE A WATERY MIX
WITH IT, AND GIVE AS MUCH AS POSSIBLE TO THE PERSON TO DRINK.
ACTIVATED CARBON SHOULD ALSO BE GIVEN IF AVAILABLE.

Subsidiary point:

Both of these compounds are highly toxic if drunk, but paraquat causes the most deaths. This is because lung damage occurs after a week or so, even if the person seems to be recovering from the first wave of symptoms. Once lung damage has occurred, it is very difficult to treat, and accounts for the high mortality among these cases some weeks after ingestion has taken place.

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

Section: VI First aid treatment of pesticide poisoning
Subject: A Symptoms and signs; treatment
Number: 8 Pentachlorophenol and related compounds

Main points:

ONSET: RAPID

**AT FIRST: MENTAL AND PHYSICAL FATIGUE,
HEADACHE AND DISORIENTATION,
LOSS OF APPETITE,
FEELING OF SICKNESS AND VOMITING,
FEVER AND SWEATING.**

**LATER: HIGH FEVER AND PROFUSE SWEATING,
SOME COMPOUNDS CAUSE FITS
(NOT PENTACHLOROPHENOL)
DEATH IS DUE TO HEART FAILURE.**

**TREATMENT: THERE IS NO SPECIFIC ANTIDOTE
KEEP THE PERSON COOL WITH DAMP CLOTHS,
AND TAKE TO HOSPITAL AS SOON AS POSSIBLE.**

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

Section: VI First aid treatment of pesticide poisoning
Subject: B Treatment
Number: 1 General principles

Main points:

IF THE FIRST AIDER KNOWS TO WHAT CHEMICAL TYPE THE PESTICIDE BELONGS, TREATMENT CAN BE STARTED FOR SOME TYPES OF POISONING. OTHERWISE THE GENERAL RULES FOR THE TREATMENT OF THE SYMPTOMS AND SIGNS SHOULD BE APPLIED.

CHECK FIRST FOR RESPIRATION AND PULSE.

IF EITHER IS ABSENT, START RESUSCITATION.

IF PERSON IS UNCONSCIOUS, MAKE SURE AIRWAY IS CLEAR BY PULLING THE CHIN UPWARDS AND BACKWARDS. REMOVE ANY FALSE TEETH.

LIE PERSON ON SIDE OR ¾ FRONT DOWNWARDS, WITH HEAD TURNED TO ONE SIDE. IF PERSON IS TO BE TRANSPORTED, USE THIS POSTURE IN ORDER TO PREVENT VOMIT ENTERING THE LUNGS. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PATIENT.

PREVENT FURTHER EXPOSURE TO THE PESTICIDE.

IMMEDIATELY REMOVE ANY CONTAMINATED CLOTHING AND WASH THE SKIN WITH SOAP AND WATER.

IF A PERSON HAS TAKEN ANY PESTICIDE BY MOUTH (EXCEPT ZINC PHOSPHIDE), AND IS CONSCIOUS, VOMITING CAN BE INDUCED, BUT READ THE LABEL FIRST.

IF VOMITING IS PERMITTED, TICKLE THE BACK OF THE THROAT WITH THE TIP OF A FINGER.

DO NOT USE A SALT SOLUTION OR ANY OTHER EMETIC. MAKE SURE THAT THE PERSON IS SEEN BY A DOCTOR AS SOON AS POSSIBLE.

IF A PERSON HAS HAD ONLY SLIGHT SYMPTOMS, AND HAS NOT BEEN SEEN BY A DOCTOR, DO NOT LEAVE THE PERSON UNTIL HE/SHE HAS APPEARED NORMAL FOR 2-3 HOURS.

SYMPTOMS AND SIGNS OF POISONING BY SOME PESTICIDES CAN REAPPEAR SUDDENLY IN THE FIRST 24 HOURS.

Suggested visual aid: Text, using part of the text above with emphasis on subjects underlined.

Section: VI First aid treatment of pesticide poisoning
Subject: B Treatment
Number: 2 Poisoning by organophosphorous compounds

Main points:

There are two antidotes for organophosphorous poisoning. One of these must be given by a doctor. The other, **ATROPINE**, should be given immediately upon diagnosis by a first aider.

START TREATMENT IMMEDIATELY IN THE FOLLOWING SEQUENCE:

1. CHECK RESPIRATION AND SEE THAT AIRWAY IS CLEAR.
2. GIVE ARTIFICIAL RESPIRATION, IF NEEDED.
3. CHECK NEED FOR DECONTAMINATION TO STOP EXPOSURE, AND REMOVE CLOTHING AND WASH AS NECESSARY.
4. GIVE ATROPINE TWO MILLIGRAMS BY A SYRINGE, OR BY AUTO-INJECTOR INTO THE THIGH OR UPPER ARM.
5. REPEAT EVERY 10 MINUTES UNTIL:
 - THE FACE FLUSHES, OR
 - THE TONGUE BECOMES DRY, OR
 - THE PUPIL OF THE EYE DILATES, OR
 - THE PULSE BEATS AT MORE THAN 140 BEATS PER MINUTE.
6. TRANSPORT TO MEDICAL ATTENTION QUICKLY, BUT ONLY AFTER THE ABOVE TREATMENT HAS BEEN STARTED.
7. DURING TRANSPORTATION, CONTINUE TREATMENT, OR CONTINUE TO OBSERVE THE PERSON AND GIVE MORE ATROPINE IF CONDITION WORSENS. DO NOT GIVE ANY MORPHINE OR BARBITURATES. IF THE PERSON HAS A FIT, GENTLE RESTRAINT SHOULD BE USED.

ENLIST OTHERS TO HELP IF NECESSARY.

Subsidiary point:

When organophosphorous insecticides are being used on a large scale, suitable supplies of atropine should be readily available in the field.

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

Section: VI First aid treatment of pesticide poisoning
Subject: B Treatment
Number: 3 Poisoning by carbamate compounds

Main points:

Carbamate poisoning must be clearly distinguished from organophosphorous poisoning (modules VI A 2 and VI B 2). The latter can have a fatal outcome if medical treatment is not prompt, while fatalities are very rare with carbamate poisoning. It is important that the first aider should know the type of compounds that have been in use on the day when the poisoning occurs.

RECOVERY IS RAPID IN CARBAMATE POISONING.

**AFTER EXPOSURE HAS BEEN TERMINATED
BY REMOVING CONTAMINATED CLOTHING AND WASHING THE SKIN,
OBSERVATION MAY BE THE ONLY TREATMENT REQUIRED.**

**IF THE PATIENT IS COLLAPSED,
A SINGLE DOSE OF ATROPINE, 2 MILLIGRAMS, SHOULD BE GIVEN
BY A SYRINGE OR BY AUTO-INJECTION INTO THE THIGH OR UPPER ARM.**

THIS DOSAGE OF ATROPINE CANNOT HARM THE PERSON.

Subsidiary point:

In rare cases of carbamate poisoning, if symptoms recur after a single dose of atropine, more atropine may be needed. The question must then arise whether exposure has in fact ceased or some other agent or medical condition is responsible for the patient's symptoms.

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

Section: VI First aid treatment of pesticide poisoning
Subject: B Treatment
Number: 4 Poisoning by organochlorine compounds

Main points:

THERE IS NO SPECIFIC ANTIDOTE FOR ORGANOCHLORINE POISONING.

**TREATMENT SHOULD FIRST BE DIRECTED AT PREVENTING
FURTHER EXPOSURE, BY REMOVING CLOTHING
AND WASHING THE SKIN WITH SOAP AND WATER,
OR BY INDUCING VOMITING IF THE COMPOUND HAS BEEN TAKEN BY MOUTH.**

**BREATHING MUST BE WATCHED AND MAINTAINED IF IT FAILS
BY ARTIFICIAL RESPIRATION.**

**THE PERSON MUST BE KEPT AS QUIET AS POSSIBLE.
EXCITABILITY MUST BE CONTROLLED, AND THE PERSON MAY BE GIVEN
A NORMAL DOSE OF A BARBITURATE OR A TRANQUILLIZER, IF CONSCIOUS.
PATIENTS HAVING FITS MUST BE GENTLY RESTRAINED.**

**OBSERVATION MUST BE CONTINUED
UNTIL THE PERSON HAS BEEN TRANSPORTED TO MEDICAL CARE.**

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

Section: VI First aid treatment of pesticide poisoning
Subject: C Local treatment of splashes of pesticides
Number: 1 In the eye.

Main points:

Pesticides splashed into the eye are rapidly absorbed. The eye may also be directly irritated by the pesticide or by other products in the formulation.

**THE ONLY FIRST AID TREATMENT FOR ANY CHEMICAL SPLASH IN THE EYE
IS PLENTY OF CLEAN WATER.**

**THE EYE MUST BE WASHED OUT IMMEDIATELY,
AND THE WASHING MUST BE CONTINUED FOR AT LEAST 10 MINUTES.**

**THE WATER CAN BE APPLIED FROM AN EYE-WASH BOTTLE.
IF THIS IS NOT AVAILABLE, A TEAPOT CAN BE USED.
THE WATER MAY BE COLD OR TEPID BUT NOT HOT.**

**NO OTHER CHEMICALS, USED AS ANTIDOTES OR NEUTRALIZERS, SHOULD EVER
BE ADDED TO THE WATER.**

**THE EYELIDS MAY HAVE TO BE HELD OPEN GENTLY DURING WASHING.
THE FIRST AIDER MAY NEED AN ASSISTANT TO DO THIS.**

**ALTERNATIVELY, THE PERSON SPLASHED MAY HAVE TO HOLD HIS EYE
OPEN UNDER A RUNNING TAP.**

Subsidiary points:

Organophosphorous compounds splashed into the eye can cause blurring of vision which may last several hours.

Suggested visual aid: Photograph showing an eye being washed out. A demonstration is often useful.

Section: VI First aid treatment of pesticide poisoning
Subject: C Local treatment of splashes of pesticides
Number: 2 On the skin

Main points:

Most pesticides are readily absorbed through the skin, either through soaked clothing or directly splashed on to the skin. Exposure to any pesticide should always be kept to a minimum, even though they may present only a very slight hazard.

ANY SOAKED CLOTHING SHOULD BE REMOVED AT ONCE.

SPLASHES ON THE SKIN SHOULD BE WASHED OFF WITH SOAP AND CLEAN WATER.

NO OTHER CHEMICALS, USED AS ANTIDOTES OR NEUTRALIZERS, SHOULD EVER BE ADDED TO THE WATER.

If the splash has been large, the wash water from the first wash should be disposed of in the same way as other contaminated wash waters.

IF A LARGE AREA OF SKIN HAS BEEN CONTAMINATED, THE WORKER SHOULD SHOWER.

IF THE PESTICIDE FORMULATION WAS OF MODERATE OR GREATER HAZARD, THE WORKER SHOULD NOT RISK ANY FURTHER EXPOSURE TO THE PESTICIDE FOR THAT WORKING DAY, AND SHOULD BE ADVISED TO REPORT ANY SICKNESS TO A MEDICAL CENTRE.

Subsidiary point:

The rules above apply to any splashes of industrial chemicals on the skin.

Suggested visual aid: Photograph of worker washing arm or other part likely to be splashed.

MEDICAL TREATMENT OF PESTICIDE POISONING

A. MEDICAL STAFF, AND TRAINED NURSING STAFF:

Subjects A and B: Should know the importance of history, the symptoms and signs, and the treatment of cases of poisoning from all the chemical groups used by applicators or available to the public in their area.

B. PRIMARY HEALTH CARE WORKERS:

Subject A: Should know the importance of history, and the symptoms and signs of poisoning from all the chemical groups in the area. (See note below.)

Subject B: Should know the general principles of the management of cases of poisoning. May need to know specific treatment for cases of poisoning by some chemical groups.

NOTE TO TRAINER:

Depending on the level of training of primary health care workers, it may be more appropriate for the trainer to use the modules in Section VI.

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs, and symptoms
Number: 1 History

Main points:

Pesticide poisoning may mimic several other conditions. Organophosphorous poisoning particularly may at first sight simulate syndromes which are common in tropical countries.

**THE DIAGNOSIS OF PESTICIDE POISONING IS NOT EASY.
A HISTORY OF EXPOSURE IS ESSENTIAL.**

IMPORTANT POINTS TO BE ESTABLISHED ARE AS FOLLOWS:

1. HAS THE PATIENT BEEN EXPOSED TO A PESTICIDE?
2. IF SO, TO WHICH PESTICIDE, AND TO WHICH CHEMICAL GROUP DOES IT BELONG?
If a package or name of the pesticide has arrived with the patient, this information will be available through a poisons centre. The label may also include a brief indication of the line of treatment.
3. BY WHAT ROUTE HAS THE PATIENT ABSORBED THE PESTICIDE?
4. FOR HOW LONG WAS THE PATIENT EXPOSED, AND WHEN DID EXPOSURE CEASE?
Has exposure in fact ceased? Is the patient still wearing contaminated clothing, or is the stomach full?
5. WHAT WAS THE TIME BETWEEN EXPOSURE AND THE ONSET OF SYMPTOMS?

Subsidiary point:

It is important that once it has been established that a pesticide is the probable cause, time should not be lost in obtaining a detailed history. If an insecticide was being used, the chances are that the symptoms will be due to either an organophosphorous or a carbamate compound, and treatment with an initial dose of atropine should be started. This may be lifesaving, and even if the initial diagnosis turns out to be incorrect, no harm will be done to the patient by this dose. However, all the details mentioned above should be recorded on the case history sheet as soon as possible.

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

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs, and symptoms
Number: 2 Organophosphorous poisoning

Main points:

As a chemical group, organophosphorous insecticides cause more serious accidental poisonings than any other group of pesticides. The signs and symptoms are related to acetylcholinesterase inhibition. The compounds may be retained in the alimentary tract or in body fat, and slowly absorbed or released. The onset of signs may be delayed, or may be recurrent during treatment.

ONSET: ½ - 24 HOURS AFTER EXPOSURE.

AT FIRST: NAUSEA, HEADACHE, FATIGUE

**THEN: HYPERSALIVATION, AND EXCESSIVE SWEATING,
VOMITING, AND ABDOMINAL
CRAMPS, DIARRHOEA,
MYOSIS AND BLURRED VISION,
MUSCULAR FASCICULATIONS,
TREMOR,
BRONCHIAL HYPERSECRETION,
CONVULSIONS AND COMA.**

PROGNOSIS: DEATH OR RECOVERY WITHIN A MONTH.

**USUALLY NO RESIDUAL DISABILITY, EXCEPT RELATED
TO ANOXIA.**

Subsidiary points:

1. The confirmatory test is erythrocyte cholinesterase activity which usually shows a 60-70% fall below the patient's pre-exposure level. **TREATMENT SHOULD NEVER BE DELAYED TO AWAIT THE RESULT OF THE TEST.** The level recovers at a rate of approximately 1% per day depending on the type of pesticide and therefore may take six weeks or more to return to normal. The patient should not be employed in contact with any cholinesterase inhibitor until the enzyme activity rises to over 70%.
2. Plasma cholinesterase activity only indicates exposure, and even a marked fall or virtual absence of activity does not itself confirm poisoning.

Other information:

For treatment, see module VII B 2. For interpretation of cholinesterase levels, see module VII B 2.

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

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs, and symptoms
Number: 3 Carbamate poisoning

Main points:

Carbamate insecticides (not to be confused with thio- or dithiocarbamate pesticides) are inhibitors of cholinesterase like the organophosphorous compounds, but they are very rapid inhibitors, and the enzyme is only temporarily inactivated. Although in presentation, there are no differences (except in timing and degree) from organophosphorous poisoning, it is important that the distinction should be made as this affects treatment. The history and course of the case should provide the clue.

ONSET: SOMETIMES AT WORK - 3 HOURS.

AT FIRST: NAUSEA AND VOMITING,
HEADACHE AND DIZZINESS,
FATIGUE AND TIGHTNESS IN CHEST.

THEN: HYPERSALIVATION AND EXCESSIVE SWEATING,
BLURRED VISION,
MUSCULAR FASCICULATIONS,
TREMOR,
TACHYCARDIA OR BRADYCARDIA,
RARELY, CONVULSIONS AND COMA.

PROGNOSIS: COMPLETE RECOVERY IN 24 HOURS,
UNLESS DOSAGE HAS BEEN MASSIVE.
NO SEQUELAE OR RESIDUAL DISABILITY.

Subsidiary points:

1. If cessation of work ends exposure, recovery usually starts immediately, and no signs may be found on medical examination.
2. It is unlikely that erythrocyte cholinesterase test will show significant reduction in the enzyme activity, even if the blood is taken while symptoms are severe, unless the activity is measured instantly with an appropriate technique. Spontaneous reactivation of the enzyme activity continues even while the blood is being processed.

Other information:

For treatment, see module VII B 3.

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

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs, and symptoms
Number: 4 Organochlorine poisoning

Main points:

Poisoning by organochlorine pesticides is uncommon. It may be due to massive contamination, occupationally, or to accidental or deliberate ingestion. The signs and symptoms are all related to the excitation of the central nervous system by these compounds.

ONSET: WITHIN HOURS OF EXPOSURE.

**AT FIRST: HEADACHE,
APPREHENSION,
EXCITEMENT,
DIZZINESS.**

**THEN: DISORIENTATION,
VOMITING,
MUSCLE WEAKNESS,
TREMORS,
EPILEPTIFORM CONVULSIONS.**

**PROGNOSIS: DEATH OR RECOVERY IN 1-3 DAYS.
NO SEQUELAE OR PERSISTENT DISABILITY
EXPECTED.**

Subsidiary points:

1. Laboratory tests can be carried out to confirm the diagnosis, consisting of detection of the compound at an adequate level in blood or urine. These tests take time, and cannot be carried out except in well equipped and experienced laboratories. There is no specific antidote. **TREATMENT SHOULD NEVER BE DELAYED TO AWAIT THE RESULTS OF TESTS.**
2. Detection of small amounts of organochlorine compounds in biological material is very common. It only indicates exposure at some time in life.

Other information:

For treatment, see module VII B 4.

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

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs, and symptoms.
Number: 5 Pyrethroid insecticides

Main points:

Pyrethroids have been very widely used in agriculture, public health, and household insecticidal formulations since the late 1970's. They can be absorbed by all routes, and have high toxicity if injected. However, when absorbed these compounds are very rapidly metabolized. As a result, systemic toxicity in humans has only been reported when few precautions have been taken during a spraying programme, and exposure of the whole body has been considerable and prolonged through the wearing of soaked clothing. Systemic signs in animals are non-specific, but include tremor or choreoathetosis, according to the type of the compound under test.

PYRETHROID COMPOUNDS CAN PRODUCE PARAESTHESIA ON AREAS OF EXPOSED SKIN, ESPECIALLY ON THE FOREARMS, FACE AND NECK.

This is a local effect, due to prolongation of the refractory period in nerves in the affected skin.

THE COMPOUNDS CAUSING THIS VARY, WITH DELTAMETHRIN BEING THE MOST LIKELY.

ONSET: WITHIN HOURS OF FIRST EXPOSURE. INDIVIDUALS VARY IN THEIR SUSCEPTIBILITY, AND NO RELATIONSHIP WITH DOSE HAS BEEN IDENTIFIED. THERE IS NO SIGN ON THE AFFECTED SKIN.

PROGNOSIS: THE SYMPTOM DISAPPEARS WITHIN 24 HOURS AFTER EXPOSURE CEASES. NO SEQUELAE HAVE BEEN REPORTED OR ARE TO BE EXPECTED.

Subsidiary point:

The only laboratory test is for blood or urine levels of the compound and/or its metabolite. This is a very sophisticated test and is not recommended, especially as few tests have been able to be carried out in time to give any significant results.

Other information:

For treatment, if needed, see module VII B 5.

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

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs, and symptoms
Number: 6 Rodenticides

Main points:

Poisoning by rodenticides is often accidental in children and deliberate in adults. The oral route is usual, and gastric lavage is needed if the ingestion was within hours.

1. **ANTICOAGULANT RODENTICIDES:** THE SYMPTOMS AND SIGNS ARE THOSE OF OVERDOSAGE BY WARFARIN. THE PROTHROMBIN TIME IS PROLONGED.
2. **CALCIFEROL DERIVATIVES:** THESE NEW COMPOUNDS ACT BY INDUCING THE SIGNS AND SYMPTOMS OF VITAMIN D OVERDOSAGE. AS THEY HAVE BEEN INTRODUCED RELATIVELY RECENTLY, FEW HUMAN CASES HAVE BEEN STUDIED. SYMPTOMS INCLUDE ANOREXIA, NAUSEA AND VOMITING, AND ABDOMINAL PAIN. HEADACHE HAS AN UNUSUAL DISTRIBUTION, BEING OCCIPITAL AND ASSOCIATED WITH SENSITIVITY OF THE WHOLE SCALP. MENTAL CONFUSION AND LOSS OF MEMORY FOLLOW. AS MIGHT BE EXPECTED, FOCAL CALCIFICATION HAS BEEN FOUND IN ANIMALS, AND OTHER SIGNS, INCLUDING RENAL FAILURE ARE ASSOCIATED WITH THIS. DIAGNOSIS IS CONFIRMED BY BLOOD CALCIUM AND PHOSPHOROUS LEVELS.
3. **OTHER RODENTICIDES:**
ZINC PHOSPHIDE IS ASTRINGENT AND CORROSIVE. IN THE STOMACH IT REACTS WITH ACID TO FORM PHOSPHINE, RESULTING IN NAUSEA, THIRST, CHEST TIGHTNESS, FAINTNESS, AND PULMONARY OEDEMA.
FLUOROACETIC ACID AND DERIVATIVES GIVE RISE TO NONSPECIFIC BUT SEVERE SYMPTOMS. SEVERE EPILEPTIFORM CONVULSIONS ALTERNATE WITH COMA AND DEPRESSION. CARDIAC IRREGULARITIES ARE ALSO SEEN WITH VENTRICULAR FIBRILLATION AND ARREST. THERE ARE NO CONFIRMATORY TESTS AND CASES MAY GO UNDIAGNOSED.
CHLORALOSE IS OF MODERATE TOXICITY, AND LARGE DOSES ARE NEEDED FOR MAN TO BE AFFECTED. IT SLOWS THE METABOLISM AND LOWERS BODY TEMPERATURE. THERE IS NO DIAGNOSTIC TEST.

Other information: For treatment, see module VI B 6.

Suggested visual aid: Local names of compounds concerned.

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs, and symptoms
Number: 7 Paraquat and diquat poisoning

Main points:

Paraquat is an unusual compound in that it is an excellent herbicide which does not have any adverse environmental effects since it is inactivated with contact with soil. Many thousands of litres have been applied without adverse effects on humans, unless exposure is repeated and careless. There is then a corrosive action on the fingernails and on the nasal mucosa causing epistaxis. Paraquat is not absorbed readily through intact skin unless contact is prolonged. However, if swallowed, the effects are catastrophic with a very high mortality. Such cases are due to accidental or deliberate ingestion.

1. **PARAQUAT:** ONSET IS IMMEDIATE WITH CORROSIVE EFFECTS ON THE MOUTH AND PHARYNX, LEADING TO ULCERATION. SEVERE CASES DIE RAPIDLY FROM PULMONARY OEDEMA AND ACUTE OLIGURIC RENAL FAILURE. LESS SEVERE CASES SHOW SIGNS OF RENAL IMPAIRMENT AND LIVER DAMAGE. ANXIETY, ATAXIA AND CONVULSIONS MAY OCCUR. EVEN IF THE PATIENT IS SHOWING SIGNS OF IMPROVEMENT AT THE END OF THE FIRST WEEK, THE SIGNS OF PULMONARY FIBROSIS MAY APPEAR, WITH GRADUALLY INCREASING DYSPNOEA AND HYPOXEMIC PULMONARY FAILURE.
2. **DIQUAT:** Diquat poisoning is less common. The remarks above concerning the use and misuse of paraquat also apply to diquat.
ONSET IS IMMEDIATE. DIQUAT ALSO HAS CORROSIVE EFFECTS ON THE MOUTH AND PHARYNX. IN SEVERE CASES, VOMITING AND DIARRHOEA FOLLOW WITHIN HOURS. LIVER FUNCTION IS DISORDERED AND PROTEINURIA IS FOUND. METABOLIC ACIDOSIS DEVELOPS WITH THROMBOCYTOPENIA AND ANURIA. DISORIENTATION AND CONVULSIONS FOLLOW, AND IN SEVERE CASES DEATH OCCURS FROM RENAL OR CARDIAC FAILURE WITHIN THE FIRST WEEK. RECOVERY IS USUALLY COMPLETE. THE DELAYED PULMONARY EFFECTS SEEN WITH PARAQUAT DO NOT OCCUR AFTER INGESTION OF DIQUAT.

Other information:

For treatment, see module VII B 7.

Suggested visual aid: List of symptoms.

Section: VII Medical treatment of pesticide poisoning
Subject: A History, signs and symptoms; treatment
Number: 8 Pentachlorophenol (PCP) and related compounds

Main points:

These compounds are irritant to the skin, mucous membranes and the respiratory tract. Chloracne sometimes occurs. Systemic poisoning may occur occupationally on prolonged and excessive exposure, or if there is a sudden massive exposure. The general public has little significant contact with these compounds, which are mainly used in timber treatment, but there have been many cases of accidental or deliberate ingestion.

**MOST SIGNS AND SYMPTOMS ARE RELATED TO THE INCREASE
IN THE METABOLIC RATE.**

**DEATH IS USUALLY DUE TO HYPERPYREXIA AND CARDIAC ARREST
WITH EARLY ONSET OF RIGOR MORTIS.**

**COMMON SYMPTOMS AND SIGNS INCLUDE: FATIGUE AND ANOREXIA,
ATAXIA, DIZZINESS, VERTIGO (PCP) AND DISORIENTATION,
HYPERPYREXIA, WITH NAUSEA AND VOMITING, DYSPNOEA, AND
TACHYCARDIA.**

**PULMONARY OEDEMA MAY OCCUR AFTER ORAL OR RESPIRATORY EXPOSURE.
FITS MAY OCCUR AT A LATE STAGE (NOT PCP).**

**THERE MAY BE SOME KIDNEY AND LIVER DAMAGE AND
SLIGHT FALLS IN T-CELLS.
APLASTIC ANAEMIA HAS BEEN REPORTED.**

**TREATMENT: THERE IS NO SPECIFIC ANTIDOTE.
TREATMENT IS SYMPTOMATIC WITH EMPHASIS ON REDUCING BODY
TEMPERATURE.**

Suggested visual aid: None indicated.

Section: VII Medical treatment of pesticide poisoning
Subject: B Treatment
Number: 1 General principles

Main points:

**TREATMENT OF ANY PESTICIDE POISONING DEPENDS
ON HISTORY OF EXPOSURE,
AND THE CHEMICAL CONCERNED.**

**TREATMENT MUST NEVER BE DELAYED PENDING THE RESULT OF A
LABORATORY TEST.**

**SUPPORTIVE THERAPY IS THE SAME AS FOR ANY CHEMICAL POISONING.
SPECIFIC ANTIDOTES SHOULD BE USED AS SOON AS POSSIBLE.**

THE FOLLOWING IS A SUGGESTED SEQUENCE OF TREATMENT:

- 1. CHECK VITAL SIGNS AND APPLY RESUSCITATIVE MEASURES IF REQUIRED.**
- 2. CHECK NEED TO STOP FURTHER ABSORPTION, BY REMOVAL OF WET CLOTHING, DECONTAMINATION OF SKIN, OR EMPTYING STOMACH (EXCEPT IN PARAQUAT POISONING).**
- 3. GIVE ANTIDOTE(S) IF REQUIRED.**
- 4. MONITOR PROGRESS OF PATIENT FREQUENTLY OVER FIRST HOURS, AND REGULARLY FOR DAYS, AS REQUIRED.**
- 5. KEEP FULL NOTES ON CASE PROGRESS.**

Subsidiary points:

- 1. In areas of high pesticide usage, stocks of antidotes should be readily available.**
- 2. The possibility of pesticide poisoning should be borne in mind in treating attempted suicides. In some countries, pesticides are frequently used for this purpose because of the ready availability of highly toxic formulations.**

Suggested visual aid: Text, if needed, using words in capital letters.

Section: VII Medical treatment of pesticide poisoning
Subject: B Treatment
Number: 2 Poisoning by organophosphorous compounds

Main points:

**THERE ARE TWO ANTIDOTES FOR ORGANOPHOSPHOROUS POISONING, AND
THEY ARE USED TOGETHER.**

**ATROPINE COUNTERACTS THE EFFECTS OF ACCUMULATED ACETYLCHOLINE,
AND SOME OXIME COMPOUNDS ARE ABLE TO REACTIVATE CHOLINESTERASE
IF IT HAS NOT BEEN IRREVERSIBLY ALTERED.**

Even before removal of nonabsorbed material, atropine should be injected intramuscularly in large doses, 2 - 4 mg for most adults, 4 - 6 mg in severe cases, and repeated in 2 mg doses at 5 - 10 minute intervals, depending on response. Aim to keep pulse over 90 and below 140, which indicates mild atropinisation. The tongue should also be monitored for dryness. Quarter or half dosage for children, depending on age.

Atropine should be slowly reduced over one or more days after symptoms disappear. If symptoms reappear, the dosage will probably need to be increased again.

**CONCURRENTLY, GIVE PRALIDOXIME INTRAMUSCULARLY OR
VERY SLOWLY INTRAVENOUSLY OR IN DRIP,
1 - 2 G FOR ADULTS OR 50 MG/KG BODY WEIGHT FOR CHILDREN,
(OR 250 MG OBIDOXIME CHLORIDE FOR ADULTS) 6-HOURLY.**

**MORPHINE AND OTHER RESPIRATORY DEPRESSANTS ARE CONTRAINDICATED.
DIAZEPAM, 5 - 10 MG INTRAVENOUSLY FOR ADULTS, IS USEFUL IN REDUCING
THE SEVERITY AND FREQUENCY OF MUSCLE FASCICULATIONS.
IN MILD CASES ORAL DIAZEPAM RELIEVES ANXIETY.**

Subsidiary points:

1. Atropine is life-saving, and hundreds of milligrams have been given to severe cases in the first 24 hours.
2. High dosage with obidoxime has been associated with liver damage.
3. Pulmonary oedema is treated in the usual way.

Suggested visual aid: Text, indicating dosage, if needed.

Section: VII Medical treatment of pesticide poisoning
Subject: B Treatment
Number: 3 Poisoning by carbamate compounds

Main points:

**THERE IS ONLY ONE ANTIDOTE FOR CARBAMATE POISONING
- ATROPINE.**

**REACTIVATION OF CHOLINESTERASE IS SPONTANEOUS AND RAPID.
OXIMES MUST NOT BE USED.**

**IF NEEDED, ATROPINE IS ADMINISTERED AS IN MILD CASES
OF ORGANOPHOSPHOROUS POISONING.**

THE PATIENT MUST BE MONITORED TO PREVENT OVER-ATROPINISATION.

Suggested visual aid: Text, if needed.

Section: VII Medical treatment of pesticide poisoning
Subject: B Treatment
Number: 4 Poisoning by organochlorine compounds

Main points:

THERE IS NO SPECIFIC ANTIDOTE FOR ORGANOCHLORINE POISONING.
THE AIM OF TREATMENT IS TO MAINTAIN VENTILATION,
AND CONTROL HYPERACTIVITY AND CONVULSIONS.

IF THE COMPOUND HAS BEEN INGESTED,
GASTRIC LAVAGE IS INDICATED,
AND A SALINE NON-OILY PURGATIVE SHOULD BE GIVEN.

IF THE COMPOUND HAS BEEN ABSORBED THROUGH THE SKIN,
SOAP AND WATER DECONTAMINATION OF THE SKIN SHOULD BE THOROUGH.

TO CONTROL OR PREVENT CONVULSIONS,
BARBITURATES, PARALDEHYDE OR DIAZEPAM SHOULD BE USED.
THE DOSAGE OF DIAZEPAM IS 5 - 10 MG INTRAVENOUSLY FOR ADULTS,
0.1 MG/KG BODY WEIGHT FOR CHILDREN,
REPEATED AT 2 - 4 HOUR INTERVALS AS NECESSARY.

IN SEVERE CASES, CURARIZATION AND INTUBATION MAY BE NEEDED.

CONTRAINDICATED ARE OILY PURGATIVES WHICH INCREASE ALIMENTARY
ABSORPTION,
AND EPINEPHRINE WHICH MAY CAUSE VENTRICULAR FIBRILLATION
DUE TO SENSITIZATION OF THE HEART MUSCLE.

MONITORING MUST BE CONTINUED FOR SEVERAL DAYS.

Suggested visual aid: Text, indicating dosage and contraindications.

Section: VII Medical treatment of pesticide poisoning
Subject: B Treatment
Number: 5 Pyrethroid insecticides

Main points:

THERE IS NO SPECIFIC ANTIDOTE.

**LOCAL PARAESTHESIA REQUIRES NO TREATMENT
OTHER THAN WASHING OF THE SKIN IN THE AREA AFFECTED
TO REMOVE ANY SKIN CONTAMINATION.**

**THE PATIENT CAN BE REASSURED
THAT THE SYMPTOM WILL HAVE DISAPPEARED BY NEXT DAY,
AND IS OF NO LONG TERM IMPORTANCE.**

Subsidiary points:

In the unlikely event that systemic symptoms may be suspected after massive exposure, treatment is only supportive while awaiting the metabolism of the absorbed compound. Anxiety and muscle weakness should pass off rapidly.

Suggested visual aid : Text, if needed.

Section: VII Medical treatment of pesticide poisoning
Subject: B Treatment
Number: 6 Poisoning by rodenticides

Main points:

1. ANTICOAGULANT RODENTICIDES:

VITAMIN K₁ (PHYTOMENADIONE) IS A SPECIFIC ANTIDOTE. A DOSE OF 5 - 10 MG IN 5% DEXTROSE SHOULD BE GIVEN INTRAVENOUSLY THREE TIMES ON THE FIRST DAY, IRRESPECTIVE OF SYMPTOMS. IN SEVERE CASES, FRESH BLOOD SHOULD ALSO BE GIVEN, EVEN IN A DOSE OF 50 ML. TREATMENT WITH VITAMIN K₁ MUST BE CONTINUED UNTIL THE PROTHROMBIN TIME BECOMES NORMAL. COUMARIN DERIVATIVES ARE SUSCEPTIBLE TO INTERACTION WITH OTHER DRUGS.

2. CALCIFEROL DERIVATIVES:

CALCITONIN HAS BEEN USED WITH GOOD RESULTS. STEROIDS HAVE ALSO BEEN FOUND TO BE EFFECTIVE BUT SLOWER IN ACTION. CHELATING AGENTS ARE INEFFECTIVE.

3. OTHER RODENTICIDES: THERE ARE NO SPECIFIC ANTIDOTES FOR ZINC PHOSPHIDE, THE FLUOROACETIC ACID DERIVATIVES, AND CHLORALOSE. TREATMENT IS SYMPTOMATIC

Subsidiary points:

1. Normally, recovery from rodenticide poisoning will be complete. However, the corrosive action of zinc phosphide can give rise to sequelae in those who survive ingestion of this highly toxic rodenticide.
2. If coumarin derivatives (second generation warfarins) have been ingested, large doses of vitamin K₁ may be needed for an extended period.

Suggested visual aid: Text with dosages.

Section: VII Medical treatment of pesticide poisoning
Subject: B Treatment
Number: 7 Paraquat and diquat poisoning

Main points:

Similar treatment is given for both compounds.

THERE ARE NO SPECIFIC ANTIDOTES.

**TREATMENT IS AIMED AT REDUCING ABSORPTION IN THE GUT,
AND ON REMOVAL OF ADSORBED COMPOUND.**

GASTRIC LAVAGE IS CONTRAINDICATED.

**AS SOON AS POSSIBLE, GIVE 300 GRAMS OF FULLERS EARTH
OR 70 GRAMS OF BENTONITE IN 1 LITRE OF WATER.**

ACTIVATED CARBON SHOULD ALSO BE GIVEN IF AVAILABLE.

**A CATHARTIC AGENT SUCH AS MAGNESIUM SULPHATE
SHOULD ALSO BE GIVEN**

TO AVOID INTESTINAL OBSTRUCTION BY THE ADSORBENT.

TREATMENT OF ABSORBED COMPOUND IS SYMPTOMATIC.

DIALYSIS HAS BEEN TRIED BUT HAS USUALLY BEEN INEFFECTIVE.

AFTER PARAQUAT HAS BEEN INGESTED,

OXYGEN IS CONTRAINDICATED IN ACUTE POISONING

SINCE PARAQUAT IS MORE TOXIC IN THE OXYGENATED LUNG.

Subsidiary point:

The recovery rate from paraquat poisoning has been 32% to 65% in large series. Recovery is usually complete, but once the delayed pulmonary effects have been established, the prognosis is very poor.

Suggested visual aid: Text showing dosages and contraindications.

OTHER RELATED SUBJECTS

This section provides modules on a number of points which cannot be fitted readily into any of the other sections. They are divided into administrative and scientific subjects.

DECISION-MAKERS, SUPERVISORS AND MEDICAL PERSONNEL:

May need to understand any of the modules in Subjects A and B that are relevant to their work.

Other modules can be inserted under these headings to meet local needs, and can include other aspects of reporting or record keeping.

Section: VIII Other related subjects
Subject: A Administrative subjects
Number: 1 Selection of staff

Main points:

FOR JOBS IN WHICH THERE WILL PROBABLY
BE REGULAR OR PROLONGED EXPOSURE TO PESTICIDES,
A MEDICAL EXAMINATION BEFORE EMPLOYMENT IS HIGHLY DESIRABLE.
THIS PROTECTS THE EMPLOYER
AND REMINDS THE WORKER THAT HE WILL BE HANDLING CHEMICALS
OF A HAZARDOUS NATURE.

IT IS ALSO AN OPPORTUNITY TO ASSURE THE WORKER
THAT HE/SHE WILL COME TO NO HARM
IF THE CORRECT SAFETY PRECAUTIONS ARE FOLLOWED.

THE MEDICAL EXAMINER MUST CONSIDER WHETHER ANY EXISTING DISEASE
MIGHT BE EXACERBATED BY EXPOSURE TO PESTICIDES, OR WHETHER
ABSORPTION OF PESTICIDES MIGHT BE INCREASED. RELEVANT CONDITIONS
ARE ASTHMA, A SKIN DISORDER ON EXPOSED SKIN, PHYSICAL OR MENTAL
NERVOUS DISEASE OR A MAJOR LIVER DISORDER.

IF THE WORKER IS TO HANDLE ORGANOPHOSPHOROUS FORMULATIONS
OF MODERATE OR GREATER HAZARD

A PRE-EMPLOYMENT CHOLINESTERASE TEST IS ESSENTIAL
FOR ESTIMATING HIS/HER EXPOSURE IN THE FUTURE.

IT MAY PREVENT UNNECESSARY SUSPENSIONS FROM CONTACT
WITH THESE PESTICIDES.

Subsidiary point:

As when exposure to any toxic chemical is likely to occur, the possibility of pregnancy and lactation in female workers of child-bearing age must be considered.

Other information:

For details on the interpretation of cholinesterase tests, see modules VII A 2 and VII B 2.

Suggested visual aid: None indicated.

Section: VIII Other related subjects
Subject: A Administrative subjects
Number: 2 Records of exposure to pesticides

Main points:

**WHEN WORKERS ARE HANDLING PESTICIDE FORMULATIONS
OF MODERATE OR GREATER HAZARD,
BRIEF RECORDS OF EXPOSURE SHOULD BE KEPT.**

**THE RECORDS ARE OF USE IF THE WORKER SHOWS ANY SIGN OF
INTOXICATION BY A PESTICIDE.**

Subsidiary points:

1. These records are additional to, or can form a part of a register of operational details. This is always desirable and may be required in some operations.
2. The following table is an example of the form in which the records might be kept.

Name		Week beginning													
Product Applied	Day														
	1		2		3		4		5		6		7		
	H	P	H	P	H	P	H	P	H	P	H	P	H	P	

H = Total hours worked in spraying (or bagging or mixing or loading) during day.
P = Number of sprayer tankfuls (pump charges) sprayed, or any other appropriate quantitative index.
Only one column, H or P, need be completed, but it should be consistent for all workers.

Suggested visual aid: Diagram of form to be adopted.

Section: VIII Other related subjects
Subject: A Administrative subjects
Number: 3 Reporting of cases of poisoning

Main points:

**WHENEVER A CASE OF POISONING BY PESTICIDES OCCURS
IT IS IMPORTANT THAT FULL DETAILS SHOULD BE RECORDED.
THIS IS NOT JUST AN ADMINISTRATIVE EXERCISE.
ITS OBJECTIVE IS TO DEFINE THE HAZARD.
TO PREVENT THE WORKER BEING POISONED AGAIN,
AND OTHERS BEING POISONED AT ALL .**

Subsidiary points:

The following are the points on which basic information should be obtained. Other points can be added according to local circumstances. The information may have to be collected from several sources before it is complete.

Name, age and sex of the person.
Occupation, spare time occupation.
Date and time of onset of symptoms.
Nature and progress of symptoms and signs.
First aid treatment and referral of case.
Dose and time of any medication given before referral.

Pesticides to which the person might have been exposed.
Common or approved names of these pesticides.
Percentages of pesticides in formulations used.
Method of application.
Exposure of the person, with quantitative data, if possible,
e.g. sprayer tankfuls (pump charges) sprayed, hours of work, wind
direction, etc.
Protective measures taken by case, type of clothing worn,
use of washing facilities, etc.
Condition of application equipment.
Any other workers affected.

Details of medical examination.
Results of biological tests.
Treatment given, dosage and times.
Course of case.
Any residual disability on discharge from treatment.
Follow-up.

For discussion:

What are the local procedures for investigating and reporting cases of poisoning?

Suggested visual aid: Text giving details of local procedures.

Section: VIII Other related subjects
Subject: B Scientific subjects
Number: 1 Field testing of cholinesterase activity

Main points:

THE FIELD TESTING OF CHOLINESTERASE ACTIVITY IS NEEDED WHENEVER ORGANOPHOSPHOROUS FORMULATIONS OF MODERATE OR HIGHER HAZARD ARE APPLIED FOR PERIODS OF SEVERAL DAYS OR MORE, OR WHEN ANY WORKER HAS SHOWN ANY OF THE EARLY SYMPTOMS OR SIGNS OF POISONING.

THERE ARE TWO MAIN METHODS, USING BLOOD FROM THE FINGER OR EARLOBE.

THE FIRST IS A COLORIMETRIC METHOD A TRAINED TECHNICIAN CAN CARRY OUT 10 TESTS IN ONE HOUR. ALL THE EQUIPMENT AND REAGENTS CAN BE OBTAINED COMMERCIALY IN A KIT. THIS METHOD CANNOT BE USED AFTER CARBAMATE EXPOSURE.

THE SECOND METHOD IS SPECTROPHOTOMETRIC, USING A BATTERY OPERATED INSTRUMENT. IT IS ALSO AVAILABLE IN A KIT. THIS METHOD IS MORE ACCURATE BUT REQUIRES MORE EXPERIENCE IN ITS USE. INDIVIDUAL TESTS TAKE ABOUT 3 MINUTES EACH.

Subsidiary points:

1. The ambient temperature in which the tests are carried out must be recorded and adjustments made according to the correction charts available with the kits.
2. Whenever the kits are used, the care and replacement of reagents is essential, and must be budgeted.

Other information:

Details on the cost and availability of the kits and their reagents are available from WHO.

Suggested visual aid: Photograph of a kit, set out.

Section: VIII Other related subjects
Subject: B Scientific subjects
Number: 2 Interpretation of results of cholinesterase tests

Main points:

Organophosphorous pesticides inhibit cholinesterase activity, and results of tests are expressed as a percentage of 'normal' pre-exposure activity of the worker, as this varies widely between individuals. Ideally, the 'normal' value of a man should be the value obtained before he was exposed to any organophosphorous or carbamate pesticide. Otherwise, a community norm is used, or in field testing, the value obtained in the same series of tests on the blood of the technician.

**TWO TYPES OF CHOLINESTERASE ACTIVITY CAN BE MEASURED:
THE ACETYLCHOLINESTERASE IN ERYTHROCYTES,
AND THE PSEUDOCHOLINESTERASE IN THE PLASMA.
WHOLE BLOOD CONTAINS MOSTLY RED CELL CHOLINESTERASE,
AND IS ADEQUATE FOR FIELD TESTING.**

**ANY FALL TO 70% OF NORMAL CHOLINESTERASE ACTIVITY INDICATES A NEED
TO INVESTIGATE WORKING METHODS, AND MORE FREQUENT
CHOLINESTERASE TESTS ON THE INDIVIDUAL CONCERNED.**

**SYMPTOMS OF POISONING MAY APPEAR WHEN THE BLOOD OR RED CELL
CHOLINESTERASE ACTIVITY IS LESS THAN 35% OF NORMAL.**

**IF BLOOD OR RED CELL CHOLINESTERASE ACTIVITY IS LESS THAN 50% OF
NORMAL, THE WORKER MUST BE SUSPENDED FROM ALL CONTACT
WITH ORGANOPHOSPHOROUS OR CARBAMATE PESTICIDES
UNTIL THE LEVEL RISES ABOVE 70% OF NORMAL.**

**PSEUDOCHOLINESTERASE ACTIVITY IN THE PLASMA CAN FALL
TO VERY LOW LEVELS WITHOUT EVIDENCE OF SYMPTOMS.
THIS ONLY INDICATES UNDESIRABLE EXPOSURE.**

Subsidiary point:

For field testing, venous blood is more accurate, but finger-tip or earlobe blood can more conveniently be used. The skin must be carefully cleaned with alcohol to remove any pesticide residues, and the puncture must not be squeezed as this dilutes the sample with plasma.

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

Section: IX Evaluation of content of course.
Subject: Method

Main points:

Each course should end with an evaluation of whether the main points of the course can be recalled by the participants. This helps the trainer to plan future courses, to see if any changes in emphasis are needed, and to reinforce important points to the participants.

**PARTICIPANTS SHOULD BE TOLD AT THE BEGINNING OF A COURSE THAT THEY
WILL BE ASKED QUESTIONS ON IT AT THE END.**

**THE TIME ALLOWED FOR EVALUATION SHOULD BE AT LEAST 5% OF THE
TOTAL TIME FOR THE COURSE.**

**FROM EACH SECTION USED DURING THE COURSE, THE TRAINER SHOULD
SELECT THE POINT CONSIDERED MOST IMPORTANT IN THAT SECTION.**

**IF TIME PERMITS, OTHER POINTS SHOULD
BE SELECTED IN DESCENDING ORDER OF PRIORITY.**

**FOR EACH POINT SELECTED, PREPARE A VISUAL AID FOR DISCUSSION.
NUMBER THESE VISUAL AIDS IN THIS SECTION IX.**

**TRAINERS MAY WISH TO KEEP THEIR OWN RECORDS OF THE RESPONSES,
GIVING THE GROUP A MARK OUT OF TEN FOR THE RESPONSE TO
EACH QUESTION.**

THE AVERAGE MARK INDICATES THE RECEPTIVITY OF THE GROUP.

Examples of visual aids:

1. Photographs already shown during the course.
2. Other photographs taken for possible use during the course, but not selected. These may be accurate, or may have been rejected because an error in composition meant that the point was not well illustrated (such as the inclusion in the picture of a bystander surrounded by application equipment and smoking!).
3. Texts of procedures to put in correct order.
4. Texts of names of local products for identification as to approved name or chemical group.
5. Texts of 'For discussion' questions in the modules.

Suggested visual aids: As suggested above.

Handwritten notes in a cursive script, likely from a 19th-century manuscript. The text is arranged in several vertical columns, with some lines appearing to be part of a list or a series of entries. The ink is dark and the paper shows signs of age and wear.