IS 4015 (1998): Guide for Handling Cases of Pesticide Poisoning [FAD 1: Pesticides and Pesticides Residue Analysis]

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भारतीय मानक

विषाक्त कीट नाशकों के मामलों को निपटाने की मार्गदर्शिका

(पहला पुनरीक्षण)

Indian Standard

GUIDE FOR HANDLING CASES OF PESTICIDE POISONING

(First Revision)

ICS 65.100

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 8

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pesticides Sectional Committee had been approved by the Food and Agriculture Division Council.

The use of various chemical pesticides for the control of pests of agricultural and public health importance is on the increase in the country. Large-scale and long-term use of some of these chemicals has often been found to result in toxic manifestations both in man and livestock. As some of these compounds are highly toxic, it is extremely essential to exercise great care in their use. Pesticide poisoning may result from careless handling by the people engaged in its application. Such poisoning may result even from continuous contact, by absorption, through skin or by inhalation of toxic vapour by the workers in the course of normal handling of the material, or by swallowing it accidently or intentionally. In all such cases of poisoning, immediate medical attention is essential, but even before this becomes available, application of certain well accepted first-aid measures is necessary. It was, therefore, suggested that an Indian Standard guide should be published covering both the first-aid measures and necessary information for the physician who has to attend cases of pesticide poisoning.

It is very essential that all the necessary precautions, such as wearing protective gloves, overall and masks should be taken before commencing the application of pesticides in the field. The use of gas-masks, respirators and safety goggles is imperative before commencing any fumigating operation indoors. During the application of pesticides strict care should be taken not to come into contact with pesticides in any manner. Washing of hands and the exposed parts of the body with soap and plenty of water is very important after completing any kind of pesticides operation. The containers of pesticides should be tightly closed and stored in a safe place beyond the reach of children, pets and livestock after using the same.

Keeping the above in view, this standard was published in 1967 in two parts. The standard has been revised to incorporate the following changes in addition merging both parts in one document:

a) Routes of entry of the pesticides;

b) Inclusion of World Health Organisation (WHO) classification by hazard; and

c) Preventive measures of pesticides poisoning.

These are the general guidelines for treatment of pesticide poisoning cases. However, the treatment of individual patient should be undertaken considering the physical and medical status of the patient. Symptomatic and supportive therapy should be given to every patient depending on the condition. In case any further details are required any standard text books of medical toxicology may be consulted.

Indian Standard

GUIDE FOR HANDLING CASES OF PESTICIDE POISONING

(First Revision)

1 SCOPE

1.1 This guide outlines the basic informations intended for the use of a physician with regard to the definition/classification of pesticides, routes of entry in the body, first-aid measures, supportive therapy, specific chemical antidotes, signs and symptoms of poisoning, diagnosis and treatment of different groups of pesticides, preventive measures in relation to poisoning due to different types of pesticides and their formulations during their manufacture, testing or in the field applications.

2 ABBREVIATIONS

2.1 The abbreviations used in this standard to indicate each class of pesticides and their formulations are given below:

Abbreviations	*Class of Pesticide or Formulation*
Ac	Acaricide
Bc	Bactericide
CB	Bait Concentrate
DP	Dustable Powder
DS	Powder for Dry Seed Treatment
EC	Emulsifiable Concentrate
FC	Flowable Concentrate
Fg	Fungicide
Fu	Fumigant
Gr	Granule
Hr	Herbicide
In	Insecticide
L	Liquid
LV	Low Volume
Mo	Molluscide
OC	Organo-Chlorine
OP	Organo Phosphorus
PGR	Plant Growth Regulator
RB	Bait (Ready for use)
Ro	Rodenticide
SL	Soluble Concentrate
SP	Soluble Powder
Sol	Solution
Tc	Technical
ULC	Ultra low Volume Liquid
WP	Wettable Powder
WS	Water Dispersible Powder for Slurry Treatment

3 DEFINITION

Pesticide means any substance or mixture of substances intended for preventing, destroying, controlling or mitigating any pest including vectors of human or animal diseases, 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 foodstuffs 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.

4 CLASSIFICATION OF PESTICIDES

4.1 Pesticides are generally classified according to the type of pests against which they are used. These are given under **4.1.1** to **4.1.9**.

4.1.1 *Insecticides*

These are substances or mixture of substances used for the control of insects. Common examples are BHC, DDT, Malathion.

4.1.2 *Fungicides*

These are substances or mixture of substances used for the control of fungi. Common examples are Carbendazim, Copper oxychloride, Mancozeb.

4.1.3 *Acaricides*

These are substances or mixture of substances used for the control of mites. Common examples are Dicofol and Chlorobenzilate.

4.1.4 *Rodenticides*

These are substances or mixture of substances used for the control of rats, mice and other rodents. Common examples are Zinc phosphide, Warfarin and Bromadialone.

4.1.5 *Fumigants*

These are substances or mixture of substances which are used in the control of insects or other pests by fumigation. Common examples are Methyl bromide, Ethylene dibromide.

4.1.6 *Molluscicides*

These are substances or mixture of substances which are used in the control of slugs and snails. Common examples are Metaldehyde, Fentin acetate.

4.1.7 *Nematicides*

These are substances for mixture of substances which are used in the control of nematodes. Common examples are Aldicarb.

4.1.8 *Plant Growth Regulators*

These are substances or mixture of substances applied with the objective of regulating or enhancing the growth and development of plants. Common examples are Alpha naphthyl acetic acid, Ethepon, Gibberellic acid.

4.1.9 *Herbicides*

These are substances or mixture of substances used for the control of weeds. Common examples are 2, 4-D, isoproturon, Paraquat.

4.2 Classification According to Chemical Structure

On the basis of their chemical structure, the pesticides may be classified as given in **4.2.1** to **4.2.13**.

4.2.1 *Organochlorine*

BHC, DDT, Lindane, Endosulfan, etc.

4.2.2 *Organophosphorus*

Chlorpyriphos, Diazinon, Dichlorvos, Phorate, etc.

4.2.3 *Carbamate*

Aldicarb, Benthiocarb, Carbofuran.

4.2.4 *Pyrethroids*

Allethrin, Alphamethrin, Cypermethrin.

4.2.5 *Coumarins/Indandiones (Anticoagulants)*

Bromadialone, Coumachlor, Warfarin.

4.2.6 *Halogen Fumigants*

Methyl bromide, Ethylene dibromide and Carbon tetrachloride mixture.

4.2.7 *Cyanide Fumigants*

Sodium cyanide, Calcium cyanide.

4.2.8 *Phosphine Fumigants*

Aluminium phosphide, Zinc phosphide.

4.2.9 *Organic Acids Including Chlorophenoxy Group and Phenolic Compounds*

2, 4-D, Dinocap.

4.2.10 *Inorganic and Organometallic (Arsenicals, Mercurials, Copper Compounds)*

Ethyl mercury chloride, Phenyl mercury acetate, Copper oxychloride, etc.

4.2.11 *Pthalamide Fungicides*

Captafol, Captan.

4.2.12 *Thiocarbamates*

Cartap Hydrochloride, Chlorothalonil, Thiram, Zineb.

4.2.13 *Miscellaneous*

Nicotin Sulphate, Sulphur.

4.3 Classification of Pesticides Based on Acute Toxicity Under the Insecticides Rules, 1971 — (*See* Table 1)

4.4 Classification of Pesticides by Hazard as per WHO Recommendation

4.4.1 *Basis of Classification*

The classification distinguishes between the more and the less hazardous forms of each pesticide in that it is based on the toxicity of the technical compound and on its formulations. In particular, allowance is made for the lesser hazards from soilds as compared with liquids.

The classification is based primarily on the acute oral and dermal toxicity to the rat since these determinations are standard procedures in toxicology. Where the dermal LD 50 value of a compound is such that it would place it in a more restrictive class than the oral LD 50 value would indicate, the compound, will always be classified in the more restrictive class. Provision is made for the classification of a particular compound to be adjusted if, for any reason, the acute hazard to man differs from that indicated by LD 50 assessments alone.

4.4.2 Guidelines to WHO classification of pesticide by hazard.

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	:	Technical products unlikely to present acute hazard in normal use.
Table 6	:	Technical products not included in the classification and believed to be obsolete or discontinued for use as pesticides.

Table 1 Classification of Pesticides Based on Accute Toxicity under the Insecticides Rules, 1971

(*Clause* 4.3)

Sl No.	Categorical Classification	Symbol	Oral LD 50 in Rats (mg/kg)	Dermal LD 50 in Rats (mg/kg)	Statement Specified on Label of the Container	Calculated Probable Lethal Dose for 70 kg. Person
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Extremely toxic pesticides		1 - 50	1 - 200	a) Keep out of the reach of children b) If swallowed or if symptoms of poisoning occur, call physician immediately	A taste (less than 7 drops) to one teaspoonf (t.s.f)
ii)	Highly toxic pesticides		51 - 500	201 - 2 000	Keep out of the reach of children	Between 5 to 30 ml
iii)	Moderately toxic pesticides		501 - 5 000	2 001 - 20 000	Keep out of the reach of chidren	Between (1 lb) 30 ml to 475 ml
iv)	Slightly toxic pesticides		More than 5 000	More than 20 000	—	More than 475 ml

Table 7 : Gaseous or volatile fumigants not classified under the WHO Recommended classification of pesticides by hazard.

5 ENTRY OF PESTICIDES BODY

5.1 Pesticide exposure to human beings can be acute or chronic. It may be occupational or non-ocupational, intentional or unintentional, accidental or incidental. On exposure the entry of pesticides in the human body may be by either of the following routes (*see* Fig. 1):

i) Oral (by mouth),
ii) Respiratory (by inhalation),
iii) Dermal (through skin), and
iv) Ocular (through eye).

5.2 Since individuals are often exposed in more than one way, the total exposure from all sources needs to be considered while assessing the health risks. The other factors at the time of exposure like duration of exposure, formulation (its acidity or *p*H, vehicle, physical state that is solid, liquid, gas and concentration of active ingredients) task performed, weather conditions (temperature, humidity, wind direction) and the conditions of skin (soreness or abrasions, wetness, location or part exposed) all influence the absorption of toxic ingredients and the actions of these materials on vital tissues. Well nourished, comfortably housed workers, enjoying adequate rest and hygiene, are less vulnerable to toxic chemicals than persons who are burdened with malnutrition, disease and fatigue.

5.3 Absorption by way of lungs is very rapid (a few seconds); by the gut intermediate in rate (minutes to hours); and across the skin usually slower still (hours to days). Chemicals absorbed by the lungs and skin enter the systemic circulation directly; those absorbed from the gut are carried mainly by the portal circulation to the liver, where biotransformations may occur before they enter the systemic circulation.

5.4 Ingestion of pesticide may occur as a result of contamination of food, drink and smoking material. Dermal exposure is of particular importance in workers who have extensive body surface exposure to foliage residues. This commonly occurs during the harvesting of fruit crops previously treated with pesticides.

6 PREVENTION OF POISONING

6.1 Pesticide poisoning or adverse effects due to pesticides can be prevented by using these pesticides

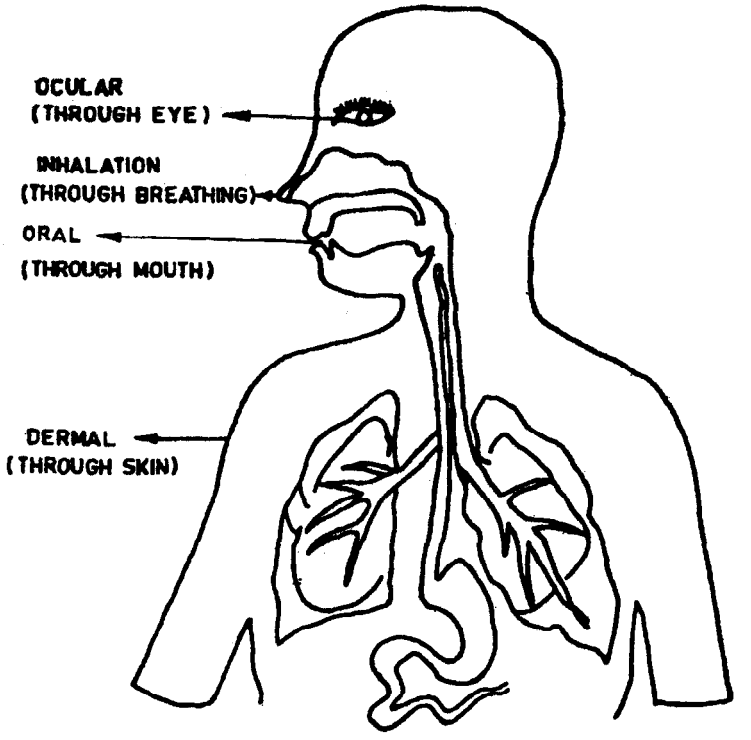

FIG. 1 WAY OF ENTRY OF PESTICIDES IN HUMAN BODY

safely and judiciously. The following precautions are required to be taken during use of pesticides:

i) Always use registered and approved pesticide in appropriate doses and by correct technology with all the precautions as indicated on the labels and leaflets.

ii) Pesticides should not be stored in insecure places or along with food, feed or fodder. These should be stored in lock, away from the reach of children, incompetent persons and animals.

iii) To avoid the skin contamination and inhalation during the use of pesticide, protective garments and equipments like apron, goggles, face mask, gum boots and respirator (in case of highly toxic pesticides) should be worn.

iv) In case of any spillage or splash over the skin, it should be washed first with cold water then with water having normal temperature and then with lukewarm water.

v) Adequate ventilation is essential at places where pesticides are measured, mixed, bagged or otherwise transferred from one container to another.

vi) Eating, drinking or smoking should be avoided while working with pesticides.

vii) Pesticide containers should not be used for storing any other things like grains, fodder, water, etc. Empty pesticide containers should be disposed off safely.

viii) Water sources/lines and grounds should not be contaminated by left over pesticides.

ix) Clogged nozzles of sprayers should not be opened by blowing. These may be opened by pin or stick or by washing with soap and water.

x) Pesticides should not be sprayed in excessive heat or strong wind conditions or before or during the rainfall. Care should be taken of the wind direction and the spray should be done in the direction of wind not against it.

xi) Re-entry (entry in field after last spray) into the pesticide sprayed field should be made after a minimum period of 24 h or prescribed period which is indicated on the label of the containers

7 MANAGEMENT OF PESTICIDE POISONING

7.1 First-Aid Measures (Pre-hospital Care)

In order to prevent further deterioration in the condition of the affected person certain first-aid measures can be undertaken before doctor reaches the site or the patient is sent to hospital.

7.1.1 *Termination of Exposure*

Shift the affected person from the contaminated environment.

7.1.2 *Decontamination*

7.1.2.1 *Skin contact*

Remove all contaminated clothings and the contaminated part should be washed with lot of water and soap. First wash should be done with cold water, if available, then with water having environmental temperature and subsequently with lukewarm water.

7.1.2.2 *Eye contamination*

Wash the eyes with plenty of clean cold water or tap water.

7.1.2.3 *Inhalation*

Carry the person to the open to fresh air. Clothings around the neck and chest must be loosened.

7.1.2.4 *Ingestion*

If victim is fully conscious and vomiting is to be induced then induce it by making the patient drink one or two glasses of water rapidly. Induce vomiting by tickling the back of the throat with fingers. Milk, alcohol and fatty substances should not be administered to such victims because it may enhance the absorption of fat soluble pesticides.

NOTE — The common practice of inducing emesis by hypertonic saline or common salt solution is neither safe nor very effective and therefore should be avoided. Do not induce vomiting or give anything by mouth to unconscious patient.

7.1.3 *Position/Posture of Unconscious Patient*

If the person is unconscious lay him in semi-prone position, head down and turned to one side.

7.1.4 *Body Temperature Control*

If the patient is feeling extremely hot or excessive sweating is there then water sponging may be done. If the person is feeling cold then body temperature may be maintained by covering him with sheets or blankets.

7.1.5 *Difficulty in Breathing*

Observe the respiratory passage for any obstruction with foreign bodies such as artificial dentures, viscid secretions, dropping back of tongue etc, and remove/correct the cause. If the condition persists and person is unable to breath on his own then give artificial respiration. The patient is laid on his back, airway cleared by pulling chin up and head tilted back and mouth cleaned with a soft, clean cloth. Then

mouth to mouth or mouth to nose respiration may be given by filling the chest of the person with air 10 times per minute and ensuring the chest movement with such blow. In case of poisoning by fumigants like Aluminium phosphide, Ethylene dibromide, Methyl bromide continuous mouth to mouth breathing should not be given by one person for more than 1 min.

7.1.6 External cardiac massage may be done in case the heart beat ceases.

7.1.7 *Other Measures*

7.1.7.1 If the person suffers from convulsions then a spoon or wooden block may be placed in the mouth between the jaws. Minimize noise and any manipulation of the patient that may trigger seizure activity.

7.1.7.2 Patient should be placed in a peaceful environment and should not be disturbed. Very fast driving over the bumpy roads may be avoided.

7.1.7.3 Person attending the victim should avoid direct contact with heavily contaminated clothings and vomitus. Wear gloves and apron while washing pesticide from skin and hair.

7.2 Supportive Threapy (Hospital Care)

7.2.1 *Stabilization*

7.2.1.1 *Evaluation of airway*

See for any dyspnoea, air-hunger, hoarseness stridor, substernal or intercostal retractions and cyanosis. In case of respiratory insufficiency, following mesures should be taken:

i) Lift the chin and tilt the head back,
ii) Clear secretions,
iii) Use nasopharyngeal or oropharyngeal airways if needed,
iv) Tracheal intubation in comatose patients, and
v) If above mesures fail, cricothyroidectomy or tracheostomy may be attempted as a last resort.

7.2.1.2 *Assessment of ventilation and oxygenation*

Signs of inadequate ventilation or oxygenation are cyanosis, tachypnoea hypoventilation, suprasternal and/or intercostal retraction and altered mental stauts. In case of inadequate ventilation or oxygenation, oxygen supplementation and if required, intubation may be done.

7.2.1.3 *Maintenance of circulation*

Look for signs and symptoms of shock or cardiac dysfunction and treat accordingly by infusing intra veinal (*i.v.*) fluids normal saline or ringer lactate vasopressors, like dopamine or antiarrhythmic drugs depending on type of arrhythmia. If facilities are available then Central Venous Pressure may be monitored.

7.2.1.4 *Management of CNS functions*

Look for state of consciousness and condition of pupil. If convulsions occur, treat as follows:

Diazepam - S - 15 mg *i.v.* at the rate of not more than 2 mg/min. If necessary repeat for every 10-15 min to a maximum of 30 mg. In children - the dose is 0.25 - 0.40 mg/kg body weight, which may, be repeated every 10-15 min if necessary to a maximum of 10 mg. However, while administering diazepam, precaution is to be taken to administer it slowly to avoid hypotension and respiratory depression. Facilities should be available for intubating the patient in case of diazepam related respiratory depression. If seizure recurr following diazepam then either of the following drugs may be used:

i) Phenytoin Sodium (Dilantin, Epileptin)	:	The dose is 15-18 mg/kg at a rate not more than 15 mg/ min.
ii) Phenobarbitone Sodium (Luminal, Gerdinal)	:	5 mg/kg *i.v.*, at a rate not more than 50 mg/min repeated every 20 min upto a maximum of 3 doses.

NOTE — Phenobarbitone may produce respiratory depression.

7.2.1.5 Fluid, electrolyte and acid base balance should be maintained.

7.2.1.6 *Measures to reduce absorption*

The following measures may be taken to reduce absorption:

i) Eye
Irrigate with neutral solution (Normal saline) for 15-20 min.
ii) Skin
Remove contaminated clothes. Irrigate with copious amount of water or saline. Do not use neutralizing substances.
iii) Gut
a) Gastric lavage,
b) Absorption by activated charcoal, and
c) Cathartics.

a) *Gastric Lavage*

Contraindications

— Ingestion of strong corrosives.
— Coingestion of sharp objects.

— Unconscious patients with seizures.
— Unconscious patients should be intubated before lavage.
— Kerosene oil (if kerosene oil is used as vehicle/solvent in pesticide formulation then gastric lavage should be done).

Method

— Patient should be in left lateral position.
— Gastric intubation may be done with an orogastric tube 32-40 F in adults and 16-26 F in children.
— First sample of lavage fluid should be saved for analysis. In children (upto 6 years age) 25-50 ml of warm isotonic saline should be used for lavage every time. In children between 7-12 years 50-100 ml and in adults 200-250 ml tap water should be used. The lavage fluid be left inplace for about 1 min and then allowed to drain by gravity for several minutes and the lavage should be continued until clear fluid is recovered or until a minimum of 2 L has been used.

Complications

— Pulmonary aspiration
— Oesophageal perforation, tension pneumothorax and empyema.
— Epistaxis if large tubes are inserted nasally.
— Electrolyte imbalance if lavage solutions other than saline are used in children (upto 6 years of age).

b) Absorption by Activated Charcoal

Activated charcoal is very effective in preventing the absorption of ingested substances when given within first few hours of exposure.

Indications — Since neither emesis nor lavage completely removes ingested substances, administration of activated charcoal after initial decontamination procedures is recommended in most cases of overdose.

Contraindications— Ingestion of strong acids, alkalis.

Dosage — A minimum of 0.5 - 1.0 g/kg body weight of activated charcoal or 10 times the estimated amount of ingested chemical should be given in form of slurry (diluted at least 1 : 4 with water) orally or via orogastric tube.

Precautions — The charcoal slurry must be mixed thoroughly to prevent the formation of charcoal plugs. A minimum of 250 ml of fluid is recommended if the powder form is used. Once the poison in the stomach or upper bowel is fully adsorbed on the charcoal particles, it is innocuous unless desorption occurs during its transit down the alimentary canal. Though the therapist who administers charcoal to a poison victim is not obliged to remove it by inducing emesis or by aspirating the stomach contents, but it may be safer to do so if the poison is known to be highly toxic. To minimize the time available for desorption, it is probably useful to speed transit of charcoal poison complex through the bowel.

c) Cathartics

The usefulness of cathartics in the treatment of poisoning has not been proved unequivocally. The commonly used cathartics are saline cathartics (for example Magnesium citrate, Magnesium sulphate, Sodium sulphate, Disodium phosphate) and Saccharide (Sorbitol). Dosage of each of cathartics are given below.

Magnesium sulphate — 150-250 ml of 10 percent solution in adults and 1-2 ml/kg in children. It contains 8.3 milliequivalent of magnesium per gram of salt.

Magnesium citrate — 250 ml of 10 percent solution in adults and 4 ml/kg in children. It contains 16 milliequivalent of magnesium per gram of salt.

Sodium sulphate — 150-250 ml of 10 percent solution in adults and 1-2 ml/kg in children. It contains 14 milliequivalent of sodium per gram of salt.

Sorbitol — Commercially Sorbitol suspension is available a 20 percent (*w/v*) activated charcoal in 70 percent Sorbital. In serious patients 300 ml of undiluted solution and in ambulatory or less serious patients 300 ml diluted with water in ratio of 1 : 1 (that is 35 percent solution) is given. For children recommended doses are 4.3 ml/kg of commercial solution diluted to 1 : 1.

Precautions — Magnesium cathartics should be avoided in patients with pre-existing renal failure or in those who are likely to develop renal dysfunction. Sodium cathartics should be avoided in severe hypertension, renal failure and heart failure. Cathartics use should be avoided in case of ingestion of corrosives, severe diarrhoea, paralytic ileus, electrolyte imbalance or recent bowel surgery.

7.2.1.7 *Measures to enhance elimination*

The following measures may be taken to enhance elimination:

i) *Forced diuresis and pH alteration*

Forced diuresis or alteration of the urinary *p*H may enhance the renal excretion of certain poisons. Altering the urinary *p*H may increase the excretion of certain weakly acidic or basic drugs by increasing the amount of the ionized (polar) form in the urine for

example 2, 4-Dichlorophenoxy acetic aid (2, 4-D), poisoning cases may get benefit from alkaline diuresis.

ii) *Extracorporeal removal*

Peritoneal dialysis, hemodialysis, plasmapheresis exchange transfusion and haemoperfusion are capable of removing many toxin from the blood stream.

7.2.1.8 *Specific chemical antidotes*

Though for many of the pesticides specific chemical antidotes or specific pharmacological antagonists are not available, but wherever available, they should always be administered, as early as possible after establishment of diagnosis (*see* Table 2).

7.2.1.9 *Emergency treatment of a chemically injured eye*

Examine the eye and periorbital structures in good light by a magnifying glass. 0.5 percent buffered solution of tetracaine/xylocaine may be used as local anaesthetic for facilitating the examination of an injured eye. It may be instilled with a sterile dropper gently over the outer canthus. Irrigate eye, lids etc, thoroughly with isotonic saline (0.85 percent NaCl) for 10 to 15 min. It will reduce the local injury and may be helpful in some cases to limit the systemic intoxication. If local ocular sign and symptoms are severe than instill a 2 percent buffered sterile solution of fluorescein. Greenish areas of stain mark the regions where the conjunctiva, cornea or sclera is damaged and eroded. If these areas are extensive, a dry sterile pad should be applied to the eye and the patient should be referred to an ophthalmologist.

8 SYMPTOMS, SIGN, DIAGNOSIS AND TREATMENT OF PESTICIDE POISONING

8.1 Organochlorine Compounds

8.1.1 *Signs and Symptoms*

The onset of symptoms after oral ingestion are within 45 min to several hours. Nausea and vomiting frequently occur after oral ingestion. However, the common symptoms of poisoning are due to CNS toxicity and manifest as apprehension, excitability, paraesthesia, dizziness, headache, disorientation and tremors. In severe cases stupor, coma and convulsions occur. Other features of exposure are cardiac arrhythmias, seizures with resultant hypoxemia, severe metabolic acidosis, respiratory depression and death. Hydrocarbon pneum onitis due to solvent vehicle (xylene, benzene, toluene) is also reported.

8.1.2 *Treatment*

If convulsions occur, place the victim in the left lateral decubitus position with the head down and put a padded tongue blades between the teeth to protect the tongue. Remove dentures. Aspirate oral and pharyngeal secretions and, if possible, insert an oropharyngeal airway to maintain an open air passage unobstructed by tongue. Avoid any stimuli which may provoke/exaggerate convulsions.

8.1.3 To control convulsions drugs like diazepam, phenytoin sodium and phenobarbitone sodium may be administered. Diazepam dosage for adults is 5-15 mg *i.v.* at a rate of not more than 2 mg/min if necessary, repeat every 10-15 min to a maximum of 30 mg. In children the dose is 0.25-0.40 mg/kg body weight, which may be repeated every 10-15 min, if necessary, to a maximum of 10 mg. While administering the diazepam, precaution is to be taken to adminster it slowly to avoid hypotension and respiratory depression. Facilities should be available for intubating the patient in case of diazepam related respiratory depression. If *i.v.* administration of diazepam is not possible then it may be given undiluted in dosage of 10 mg in adults and 5 mg in children by per rectum route. The same dosage may be repeated in 2 to 4 h if required.

i) Phenytoin Sodium, (Dilantin, Epileptin)	:	The dose is 15-18 mg/kg at a rate not more than 50 mg/min.
ii) Phenobarbitone Sodium (Luminal, Gerdinal)	:	5 mg/kg *i.v.*, at a rate not more than 50 mg/min repeated every 20 min upto a maximum of 3 doses. Respiratory depression and hypotension may occur as a result of *i.v.* administration.

8.1.4 Decontaminate the patient concurrently. Monitor pulmonary ventilation and cardiac status. If available cholestyramine mixed with pulpy fruit or liquid may be given in dose of 4 g, 4 times a day before meals and at bedtime. It accelerates the biliary-faecal excretion of the more slowly eliminated organochlorine compounds.

— DO NOT GIVE EPINEPHRINE, OTHER ADRENERGIC AMINES OR ATROPINE.

— DO NOT GIVE MILK, ANIMAL OR VEGETABLE OILS OR FATS BY MOUTH.

8.2 Organophosphorus Compounds

8.2.1 *Symptoms and Signs*

Early symptoms of poisoning are headache, nausea, dizziness, anxiety and restlessness. Worsening of poison state is manifest as muscle twitching, weakness, tremor, incoordination, vomiting, abdominal cramps, urinary and faecal incontinence, increased bronchial secretions, bronchospasm, cough and occasionally pulmonary oedema. Sweating, lacrimation, salivation, miosis, bradycardia, conduction block and hypotension also occurs. In severe cases twitching, fasciculation, weakness of muscles, diminished respiratory effort, hypertension, tachycardia, tremors, convulsions, confusion and coma may also occur. Rarely normal sized or dilated pupils (mydriasis) and cardiac conduction defects may be seen. Usually recovery is within 24-48 h. In fatal cases the cause of death is increased pulmonary secretion and inadequate ventilation. Some patients develop intermediate syndrome after 34-96 h which is characterized by weakness of proximal limb muscles, neck flexors and respiratory paralysis manifesting as acute ventilatory insufficiency.

8.2.2 *Treatment*

Establish a clear airway by aspiration of bronchial secretions. Administer oxygen. In severe poisoning, it may be necessary to support pulmonary ventilation mechanically for several days.

8.2.3 In adults administer atropine sulphate *i.v.* 1-5 mg every 5 to 15 min till atropinization is achieved (that is flushing of skin, dry mouth, dilated pupils). In the process of atropinisation the pulse rate may go upto 140/min. No maximum dosage have been prescribed, even dosage of upto 200 mg during 1st hour of treatment has been given. The signs of atropine intoxication are fever and delirium. Maintain atropinization for 2-12 h or longer depending on the severity of the poisoning. In children atropine in dose of 0.05 mg/kg body weight should be administered and repeated every 5-15 min until atropinization is achieved. Maintain atropinization by repeated doses of 0.02-0.05 mg/kg body weight.

Administer pralidoxime (protopam, 2-PAM), a cholinesterase reactivator in case of severe poisoning by organophosphorus compounds. 1.0 to 2.0 g dissolved in 100 ml of normal saline *i.v.* over a period of 15-20 min may be administered in adults at a rate not more than 0.2 g/min. In children doses are 20-50 mg/kg body weight *i.v.*, injecting not more than half the total dose per minute. Doses of pralidoxime may be repeated in 1-2 h, then at 10-12 h intervals if needed. Blood pressure should be monitored during *i.v.* administration because of occasional occurrence of hypertensive crises. If seizure activity develops oxygenation benzodiazepines and antidotal therapy should precede the use of barbiturates or phenytoin.

8.2.4 Decontamination of skin, eyes or gut as the case may be continued simultaneously. Monitor respiratory and cardiac status. Patient must be observed closely for atleast 96 h or longer in case of organophosphate ingestion for occurrence of intermediate syndrome. For intermediate syndrome only symptomatic treatment is required.

8.3 Carbamates

8.3.1 *Signs and Symptoms*

Sign and symptoms of carbamate poisoning are similar to the organophosphate poisoning, but are less severe and has a shorter duration.

8.3.2 *Treatment*

Establish clear airway. Administer oxygen. If required, ventilate the patient mechanically. Administer atropine sulphate *i.v.* in the doses as indicated in case of organophosphate poisoning.

8.3.3 Persons not poisoned or only slightly poisoned by N-methyl carbamates (for example Baygon, Sevin, Furadan, Lannate, MIPC) may develop signs of atropine toxicity from such large doses. Fever, and delirium are the main signs of atropine toxicity. If these signs appear while patient is fully atropinized, atropine administration should be discontinued, at least temporarily, and severity of poisoning is re-evaluated. Use of pralidoxime is contraindicated in carbaryl and chemically related (N-methyl carbamate poisoning. However, in case of mixed poisoning of organophosphate and carbamate or unknown anti-cholinesterase poisoning with significant nicotinic effects like muscular fasciculation and muscle weakness etc, cautious administration of pralidoxime may have to be considered.

Decontamination should be done concurrently. Monitor respiratory and cardiac status. Observe patient closely for atleast 24 to 48 h. The use of morphine, theophylline, phenothiazines and reserpine and succinyl choline is probably contraindicated in N-methyl carbamate poisoning cases. Adrenergic amines should be given only in cases of specific indication such as marked hypotension.

8.4 Synthetic Pyrethroids

8.4.1 *Signs and Symptoms*

Mammalian toxicity is extremely low. Contact dermatitis (erythema, vesiculation, bullae) anaphylactoid reactions (pallor, tachycardia, diaphoresis) and rhinitis and asthma may occur

following exposure. Symptoms usually begin several hours after cutaneous exposure and resolves within 24 h. Tremors, ataxia, laboured breathing and salivation may occur after heavy exposure.

8.4.2 *Treatment*

Treatment is supportive and symptomatic. Topical vitamin E may be used for paraesthesia due to pyrethroids containing an alphacyano group (for example Fenvalerate, Cypermethrin, Flycythrinate). Antihistaminics are effective in controlling most allergic reactions. Severe asthmatic reactions may require administration of epinephrine, theophylline and/or corticosteroids.

8.5 Coumarin and Indandione (Anticoagulant) Rodenticides

8.5.1 *Signs and Symptoms*

Clinical effects result from bleeding when compounds are consumed over several days. The casual ingestion of warfarin in a toddler will not result in symptoms; however, the new super warfarin rodenticides (difenacoum and brodifacoum) cause prolonged severe depression of clotting factors and mild bleeding in a dose of 0.12 mg/kg. Acute clinical effects depend on the site of hemorrhage and include hemoptysis, hematuria, gastrointestinal bleeding, abdominal or back pain, haemarthrosis, epistaxis, cerebrovascular accidents and multiple ecchymotic lesions. Maximum depression of coagulation factors occurs 36-72 h after warfarin ingestion. The superwarfarin compounds produce coagulation defect lasting 6-8 weeks. However, depression of prothrombin time upto 8 months has been reported after ingestion of 10 mg of Brodifacoum.

8.5.2 *Diagnosis*

Prothrombin time determination (if facilities exist) — An increase in prothrombin time occurs. Complete haemogram provide baseline to mesure blood loss prospectively.

8.5.3 *Treatment*

Administer specific antidote phytonadione (Vitamin K1) orally in doses of 15-25 mg in adults and 5-10 mg in children alternatively aquamephyton may be given intramuscularly in doses of 5-10 mg in adults and 1-5 mg in children. Vitamin K1 has a shorter duration of action and so must be given repeatedly. Antidotal therapy in cases of severe bleeding should be supplemented with transfusions of fresh blood or fresh frozen plasma. Determine prothrombin time and haemoglobin concentrations every 6-12 h to assess effectiveness of antihemorrhagic measures. Ferrous sulphate therapy may be given to rebuild lost erythrocyte mass.

NOTE — Vitamin K3 (Menadione) and Vitamin K4 (Menadiol) are not specific antidotes for these anticoagulants.

8.6 Halogen Fumigants

8.6.1 *Signs and Symptoms*

Early symptoms of acute poisoning include headache, dizziness, nausea, vomiting, tremor and ataxia. Repeated prolonged exposure may lead to incoordination, muscle weakness and areflexia. In case liquid comes in contact with skin, severe burning, blister formation and skin necrosis may occur. Ethylene dibromide causes severe irritation of skin, eyes and respiratory tract. The liquid causes blistering and erosion of skin and is corrosive to eyes. After absorption person may suffer from pulmonary oedema and CNS depression. If ingested, the liquid forms often cause pulmonary oedema and shock within a minute. Death is due to respiratory or circulatory failure. If victim survives, injuries to the brain, liver and kidney are life threatening.

8.6.2 *Diagnosis*

Determination of blood bromide concentations if facilities available. Normal levels are less than 1 mg/100 ml.

8.6.3 *Treatment*

No specific antidote is available, therefore treatment is supportive and symptomatic. Decontamination of skin, eyes or gut depending on the type of exposure. If pulmonary oedema occurs then treat it accordingly by placing the victim in a sitting position with a back rest and administer oxygen and furosemide, 40 mg *i.v.* Morphine 3.5 mg *i.v.* slowly may be administered to allay anxiety and promote deeper respiratory excursions. Aminophylline 0.25-0.5 g slowly *i.v.* may also be given.

8.7 Phosphine Fumigant

8.7.1 *Signs and Symptoms*

Aluminium phosphide and zinc phosphide release phosphine gas upon contact with moisture and cause fatalities. Zinc phosphide hydrolyses slowly as compared to aluminium and magnesium phosphide. The fatal dose of aluminium phosphide for a 70 kg adult is 0.5 g. For zinc phosphide lethal dose veries, but most fatal cases have ingested more than 20 g zinc phosphide. Ingestion of phosphides may cause nausea, vomiting, diarrhoea, retrosternal and abdominal pain, tightness in the chest and coughing, headache and dizziness. In more severe cases this may progress to cardiovascular collapse, pulmonary oedema, cyanosis and respiratory failure. Pericarditis, renal failure, and hepatic damage including jaundice, may develop later. Symtoms may be delayed and death may occur upto one week after posioning.

Inhalation of phosphine or phosphide may cause severe pulmonary irritation. Mild exposure may cause only mucous membrane irritation, with initial symptoms mimicking an upper respiratory tract infection. Other symptoms may include nausea, vomiting, diarrhoea, headache, fatigue, and coughing whilst more severe symptoms may include ataxia, paraesthesia, intention tremor, diplopia and jaundice. Very severe cases may progress to acute pulmonary oedema, cardiac arrhythmias, convulsions, and coma. Renal damage and leukopenia may also occur. Exposure to 1 400 mg/cubic metre (1 000 ppm) for 30 min may be fatal. There is no evidence for cumulative effects from intermittent low level exposure averaging 14 mg/ cubic metre (10 ppm or less).

8.7.2 *Diagnosis*

The typical garlic odour of phosphine is best guideline for diagnosis. Change of silver nitrate impregnated paper to black after treatment with victim's vomitus or gastric aspirate confirms the diagnosis.

8.7.3 *Treatment*

No specific antidote is available, therefore, treatment remains supportive and symptomatic. Serum electrolytes should be frequently monitored and maintained. Cardiac monitoring should be done for cardiac arrythmias and blocks. Xylocaine (Xylocard) 2-3 mg *i.v.*/kg bolus followed by 1-4 mg/ kg/hour may be given in cases of ventricular arrhythmias till arrhythmias stop. It may be continued till 24 to 48 h depending on the condition of patient. For block, pacemaker may be implanted, if facilities exist. Aluminium phosphide will release phosphine gas in stomach, if it comes in contact with water. Therefore, if ipecac is administered, it should perhaps be not followed with fluids. Gastric lavage may also be dangerous. If activated charcoal is administered, it should perhaps be mixed with sorbitol not with water. For maintenance of blood pressure, give 1-2 l normal saline or Ringer lactate. If there is no improvement in blood pressure then central venous line should be put in and a pressure of 8-12 cm of water is to be maintained with *i.v.* fluids. If central venous pressure is more than 12 cm of water or *i.v.* fluids fails to increase the blood pressure, start dopamine drip at rate of 10 µg/kg/min and titrate according to blood pressure. Magnesium sulphate has been tried in aluminium phosphide poisoning cases. However, its therapeutic efficacy has not been established. If facilities are available, the magnesium levels should be monitored, if magnesium sulphate therapy is to be given. 3 g of magnesium sulphate in 500 ml of 5 percent dextrose should be given in first 3 h. This is followed by 6.0 g in 500 ml of 5 percent dextrose in next 24 h.

8.8 Phenolics, Nitrophenolic and Nitrocresolic Herbicides

This does not include the household disinfectants like Carbolic Acid, Phenol, Cresol, etc.

8.8.1 *Signs and Symptoms*

Yellow staining of skin and hair occur as a result of topical contact and systemic absorption of toxic amount of nitrophenolic and nitrocresolic compounds. It results in staining of sclera and urine. Early symptoms of poisoning include sweating, thirst, fever, headache, confusion, malaise and lassitude. Warm flushed skin, tachycardia, tachypnoea, convulsions, laboured breathing and cyanosis are indicative of severe poisoning.

8.8.2 *Diagnosis*

Clinical.

8.8.3 *Treatment*

Do not await confirmation before commencing treatment but save urine and blood samples for confirmation. No specific antidote exists. Treatment is symptomatic and supportive. Decontamination, reduction of elevated body temperature by physical means (like sponge bath, cool blankets etc), *i.v.* fluids and diazepam in cases with agitation and involuntary motor activity may be attempted. Haemodialysis (if facilities exist) may be considered in very severe cases.

NOTE — Do not administer atropine, aspirin or other salicylates which may enhance the toxicity of phenols.

8.9 Chlorphenoxy Compounds

8.9.1 *Signs and Symptoms*

The compounds are moderately irritant to skin, eyes and respiratory and gastrointestinal tract. Inhalation of spray may cause burning sensation in nasopharynx and chest and coughing may results in coughing. Ingesion of large quantities cause irritation of stomach, vomiting, pain in chest and abdomen, diarrhoea, headache, mental confusion, bizzare behaviour and finally unconciousness. Myotonia (stiffness of muscles of extremities) occurs in 2, 4-D poisoning. Areflexia is sometimes observed body temperature may be moderatley elevated. Metabolic acidosis, moderate temporary elevations of blood urea nitrogen and serum creatinine, liver cell injury, T-wave flattening and inversion have been reported.

8.9.2 *Diagnosis*

Clinical.

8.9.3 *Treatment*

START TREATMENT IMMEDIATELY. Treatement is symptomatic and supportive. No

specific antidote exists. Decontaminate eyes, skin and/or gut depending on the exposure. *i.v.* fluids may be given a urine flow of 4-6 ml/min is desirable to limit concentration of the toxicant in the kidney. Forced alkaline diuresis alkalinization of urine by adding sodium bicarbonate (44-88 mEq/litre) in *i.v.* fluids is effective. Urine *p*H should be maintained in the range of 7.6 to 8.8. Potassium chloride 20-40 mEq/litre may be added in *i.v.* fluids to combat the potassium losses.

8.10 Thiocarbamates and Related Compounds

8.10.1 *Signs and Symptoms*

They are moderately irritating to human skin, eyes and respiratory mucous membranes. SYSTEMIC POISONING IS RARE but in high dosage nausea, vomiting, headache, diarrhoea hypothermia, ataxia and muscle weakness occur which may result in respiratory paralysis. If high dosage of thiram and metallic bis-dithiocarbamate are ingested with alcohol then disufiram like reaction may occur.

8.10.2 *Diagnosis*

Clinical and estimation of urinary xanthurenic acid for confirming the absorption of thiram.

8.10.3 *Treatment*

No specific antidote exists, therefore treatment is supportive and symptomatic. Decontaminate of skin, eyes and gut. Administer *i.v.* fluids to accelerate excretion of toxicants. In case of dithiocarbamate (Ziram) poisoning ascorbic acid in dose of 10-20 mg/kg may be administered *i.v.* at a rate not exceeding 0.2 g/min "AVOID INTAKE OF ALCOHOLIC BEVERAGES FOR THREE WEEKS".

8.11 Bypyridylium (Paraquat and Diquat)

8.11.1 *Signs and Symptoms*

Corrosive effects of paraquat leads to early symptoms of burning pain in mouth, throat chest and upper abdomen. Giddiness, headache, fever, myalgia and diarrhoea also occur. Proteinuria, haematuria, pyruria and azotemia reflect renal injury while oliguria and anuria indicate tubular necrosis. Cough, dypnoea, tachypnoea, progressive cyanosis, air hunger are the pulmonary mainfestations which can appear 2-14 days after exposure. Late complications include pulmonary fibrosis which is the cause of death in most of the cases. Other manifestations are hepatic failure and toxic myocarditis. Classical sign of paraquat poisoning is formation of a pharyngeal membrane which resembles that of diphtheria. Local effects of concentrated form are fissures of the skin, loss of fingernails, dryness, blistering and ulceration. Inhalation causes bleeding from nose. Eye contact leads to severe conjuctivitis and corneal opacification. *Occurrence of vomiting due to poisoning or due to* addition of emetic in the paraquat preparations should not give false sense of security to the treating physician and treatment for poisoning should be continued. Diquat is less damaging to skin than paraquat. Early symptoms are similar to those of paraquat but pulmonary injury is less prominent. However, the toxicity to CNS is more as compared to paraquat.

8.11.2 *Diagnosis*

Clinical.

8.11.2.1 *Simple colorimetric test of urine*

Take one volume of urine. Add 0.5 ml of freshly prepared 1 percent sodium hydrosulphite in 1 N sodium hydroxide. Development of blue colour at the end of 1 min indicate the presence of paraquat at a concentration of more than 0.5 mg/l.

8.11.3 *Treatment*

No specific antidote is available, therefore treatment is symptomatic and supportive. Decontaminate skin and eyes. If paraquat or diquat have been ingested in any amount IMMEDIATE ADMINISTRATION OF ADSORBENT is the therapeutic measure most likely to affect the outcome of paraquat or diquat ingestion favourably BENTONITE (7.5 percent suspension) and FULLER'S EARTH (30 percent suspension) are highly effective, but sometimes not available. Administration of activated charcoal along with sorbital in suspension is also beneficial. Because corrosive damage to the osophagus and stomach may render these structures vulnerable to perforation, the gastric lavage tube must be introduced very gently. CHECK FREQUENTLY FOR BOWEL SOUNDS. *Ileus* occurs commonly in diquat poisoning but less often in paraquat poisoning. Cathartics should not be administered if the gut is atonic. Morphine sulphate may be given to control the pain associated with deep mucosal erosion of mouth, pharynx and oesophagus. Mouth washes, cold fluids, ice creams or anaesthetic lozenges may relieve pain in the mouth and throat. Haemoperfusion and haemodialysis may be considered, however these may offer only marginal benfit.

NOTE — DO NOT ADMINISTER SUPPLEMENTAL OXYGEN because it may enhance the pulmonary injury.

8.12 Urea Derivatives

8.12.1 *Signs and Symptoms*

Irritation of eyes and mucous membrane occur with some compounds. Ingestion of large quantities may result in nausea, vomiting and diarrhoea.

8.12.2 *Diagnosis*

Clinical.

8.12.3 *Treatment*

No specific antidote is available, therefore treatment is supportive and symptomatic.

8.13 Arsenical Compounds

8.13.1 *Signs and Symptoms*

Symptoms usually appear within 1 h but may be delayed for several hours. Garlic odour of breath and feces may halp to identify the toxicant in severely poisoned patient. Inflammation of mouth, pharynx and oesophagus, or bloody diarrhoea, proteinuria, hematuria, glycosuria, oligouria, casts in urine and in severe cases acute tubular necrosis may occur. Headache, dizziness, muscle weakness, spasms, hypothermia, lethargy, delirium, coma, convulsions, shock, cyanosis and cardiac arrhythmias may also occur. Injury to blood forming tissues may result.

8.13.2 *Diagnosis*

8.13.2.1 *Clinical and gutzeit test*

Add 5 ml of urine to few drops of concentrated sulphuric acid and few granules of elemental zinc. Cover the top of the tube with a piece of filter paper to which a drop or two of 1 percent silver nitrate solution has been added. Browning or blackening of the paper indicates that arsine has been evolved from the urine.

8.13.3 *Treatment*

The general supportive treatment remains the same except that the cathartics should not be administered. Specific antidote BAL or dimercaprol given intramuscularly increases the excretion of arsenic.

Doses schedule

	Severe poisoning	*Mild poisoning*
1st day	3.0 mg/kg every 4 hourly	2.5 mg/kg every 6 hourly
3rd day	3.0 mg/kg every 6 hourly	2.5 mg/kg every 12 hourly
4th day	3.0 mg/kg every 12 hourly	2.5 mg/kg per day

NOTES

1 Dimercaprol is provided as a 100 mg/ml solution in oil. It may produce some side effects like nausea, headache, burning and tingling sensation, sweating, pain in back and abdomen, tremors, restlessness, tachycardia and hypertension. Fever, coma and convulsions may occur at very high doses. Sterile abscess may form at injection sites. Acute symptoms usually subside in 30-90 min. Antihistaminic drugs given few minutes before injection of BAL may prevent some of the side effects. After the gastrointestinal tract is free of arsenic (indicated by passage of charcoal black stool, if activated charcoal is given) BAL should be replaced by d- penicillamine orally. Dosage is as follows:

Adults : d-penicillamine 0.5 g 6 hourly 30-60 min before meals and bedtime for 5 days.

Children under 12 years of age d-penicillamine 0.1 g/kg body weight not exceeding 1.0 g divided into 4 doses given 30-60 min before meals and at bedtime for 5 days.

2 d-penicillamine should not be given to individuals allergic to penicillin. Discontinue chelation therapy when 24 h urinary arsenic excretion falls below 50 mg/day.

8.13.4 Various pesticides, their groups, acute LD 50 and antidotes are given in Table 2.

Table 2
(*Clauses* 7.2.1.8 *and* 8.13.4)

Sl No.	Name of Pesticides	Group/Chemical Family	Acute LD 50 (mg/kg b.wt) Oral/Dermal	Antidote
(1)	(2)	(3)	(4)	(5)
1.	Acephate	In/O.P	945/2000	Atropine, possibly in conjunction with PAM.
2.	Alachlor	HR/Anilides/Acetamide	930/13300	No specific antidote, symptomatic and supportive therapy.
3.	Aldicarb	In/Carbamate	0.93/5.0	Atropine
4.	Allethrin	In/Pyrethroids	685/>2500	No specific antidote, symptomatic and supportive therapy.
5.	alpha Naphthyl acetic acid	IPGR/Carboxylic Acid derivative	1000	- do -
6.	alpha-cypermethrin (Alphamethrin)	In/Pyrethroids	79/>500	No specific antidote, symptomatic treatment, if ingested do not induce vomiting or give liquids
7.	Aluminium phosphide	Fu/Inorganic		No specific antidote, symptomatic and supportive therapy.
8.	Anilophos	HR/O.P	400	Atropine in conjunction with 2-PAM.
9.	Atrazine	HR/Triazine	3080/7500	No specific antidote symptomatic and supportive therapy.
10.	Aureofungin	Antifungal/Antibiotic	540/15000	- do -
11.	Barium Carbonate	RO/Inorganic	900	Symptomatic and supportive therapy. Add 5-10 g of sodium sulphate to lavage solution.
12.	Benomyl	Fg/Benzimidazole	10000/>10000	No specific antidote, sympotmatic and supportive therapy.
13.	Benzene Hexachloride (BHC)	In/OC	100	No specific antidote, symptomatic treatment.Give *i.v.* Diazepam to control convulsions.
14.	Benthiocarb (Thiobencarb)	HR/Carbamate	1300/>200	Atropine
15.	Bitertanol	Fg/Triazole	5000/>5000(rat)	No specific antidote, symptomatic and supportive therapy.
16.	Bromadiolone	RO/Coumarin	1.12/2.1	Vitamin K1
17.	Butachlor	HR/Acetamide/Anilide	3300/>13000	No specific antidote, symptomatic and supportive therapy.
18.	Captafol	Fg./Phthalimide	5000/>15400	- do -
19.	Captan	Fg./Phthalimide	9000/15400	- do -
20.	Carbaryl	In/Thiocarbamate	500/>2000	Atropine
21.	Cartap Hydrochloride	In/Thiocarbamate	325/>1000	Sulphydryl agents, *i.v.* injections of L-Cysteine or I.M. Injections of BAL, apply steroids against dermatitis.
22.	Carbendazim	Fg./Benzimidazole carb	15000/10000	No specific antidote, symptomatic and supportive therapy.
23.	Carbofuran	In/Carbamate	5.0/2550	Atropine, if in eyes then 1 drop of homatropine.
24.	Carboxin	Fg./Anilide	3820/>8000	No specific antidote, symptomatic and supportive therapy.
25.	Chlormequatchloride (CCC)	PGR	670/440	Choline chloride (or other choline salts) scholine salts) or neostigmine sulphate
26.	Chlorpyriphos	IN/OP	135/2000	Atropine, possibly in conjunction with PAM.
27.	Chlorothalonil	Fg/Phthalimide	10000/10000	No specific antidote, symptomatic and supportive therapy.
28.	Copper Oxychloride	Fg/Inorganic copper comp.	1440	- do -
29.	Copper Sulphate	Fg/Inorganic copper compound	300	- do -
30.	Coumachlor	Ro/Coumarin	900/33(rat)	Vitamin K1

Table 2 — *Continued*

Sl No.	Name of Pesticides	Group/Chemical Family	Acute LD 50 (mg/kg b.wt) Oral/Dermal	Antidote
(1)	(2)	(3)	(4)	(5)
31.	Coumatetralyl	Coumarin	16/25-50	Vitamin K1
32.	Cuprous Oxide	Fg/Inorganic copper compound	470/n.a	BAL and subsequent penicillamine administration.
33.	Cypermethrin	In/Pyrethroids	303/>2400	No specific antidote, symptomatic treatment. If ingested do not induce vomiting or give liquids.
34.	Dalapon	HR/OC, Ali Carboxylic acid	9330/>2000	No specific antidote, symptomatic and supportive therapy.
35.	Decaethrin (Deltamethrin)	In/Synthetic Pyrethroid	80/>2000	- do -
36.	Dichlorodiphenyl l trichloro ethane(DDT)	In/OC	113/2510	- do -
37.	Diazinon	In/OP	300/540-650	Atropine, possibly in conjunction with PAM.
38.	Dichlorvos	In/OP	56/107	-do-
39.	Dichloropropene and Dichloropropane Mixture (DD Mixture)	Fu/Halocarbon	-	No specific antidote, symptomatic and supportive therapy.
40.	Dicofol	AC/DC, Bridged Diphenyl	690/2100	-do-
41.	Diflubenzuron	In/Urea Derivative	4620/>2000	-do-
42.	Dimethoate	In/OP	150/800	Atropine, possibly in conjunction with PAM.
43.	Dinocap	Fg/Nitrophenol	980/4700	No specific antidote, symptomatic and supportive therapy.
44.	Dithianon	Fg/Quinone	638	-do-
45.	Diuron	HR/Urea derivative	3400	-do-
46.	Dodine	Fg/Guanidine	1000/>1500	-do-
47.	24-Dichlorophenox-yacetic acid (2, 4-D) Sodium, Anine & Ester Salt	HR/Chlorophenoxy	375/>1600	-do-
48.	Ehtylene Dichloride and Carbon Tetrachloride Mixture (EDCT Mixture 3 : 1)			Treatment of Ethylene Dibromide and carbon tetrachloride.
49.	Edifenphos	Fg/OP	150/700-800 (rats)	Alropine, possibly in conjunction with PAM.
50.	Endosulfan	In/OC, Sulfurous acid derivative	80/360	No specific antidote, symptomatic treatment.
51.	Ethepon	PGR/Ethylene generation	4000/5730	No specific antidote, symptomatic and generation supportive therapy.
52.	Ethion	In/OP	208/915	Atropine, possibly in conjunction with PAM.
53.	Etofenprox	Bridged diphenyl	NA/>2140	No specific antidote, symptomatic and supportive therapy.
54.	Ethylene Dibromide	Fu	146 mg/kg/n.a	No specific antidote, symptomatic and supportive therapy. In Acidosis, Sod.bicarbonate is administered and urine is monitored. After inhalation move victim to fresh air, keep lying down and warm.
55.	Fenarimol	Fg	2500/>2000	No specific antidote, symptomatic and supportive therapy.
56.	Fenitrothion	In/OP	503/890-1300	Atropine, possibly in conjunction with PAM.
57.	Fenthion	In/OP	291-315/330	- do -

Table 2 — *Continued*

Sl No.	Name of Pesticides	Group/Chemical Family	Acute LD 50 (mg/kg b.wt) Oral/Dermal	Antidote
(1)	(2)	(3)	(4)	(5)
58.	Fenvalerate	In/Pyrethroids	451/2500	No specific antidote, if ingested perform gastric lavage.
59.	Ferbam	Fg/Dithiocarbamate	1700	No specific antidote, symptomatic and supportive therapy.
60.	Fluchloralin	HR	550	-do-
61.	Formothion	In/OP	3655/>1000	Atropine, possibly in conjunction with PAM.
62.	Fluvalinate	In/Pyrethroids, Trifluromethyl	261/>2000	No specific antidote, symptomatic treatment gastric lavage.
63.	Fosetyl-Al	Fg/OP, Organoalumi	5400/>2000	No specific antidote, symptomatic and supportive therapy.
64.	Glyphosate	HR/OP,Glycine derivative	43/5000	-do-
65.	Gibberellic acid	PGR	>15000	-do-
66.	Isoproturon	HR/Urea derivative	1800/>2000(rat)	-do-
67.	Kitazin	Fg	490	-do-
68.	Lindane(Gamma BHC)	In/OC	88.900	-do-
69.	Lime Sulphur			-do-
70.	Malathion	In/OP	2100/4100	Atropine, possibly in conjuction with PAM.
71.	Meleic Hydrazide	PGR/Pyridazine	6950/>2000	No specific antidote, symptomatic and supportive therapy.
72.	Methomyl	In/Carbamate	17/>5000	Atropine
73.	Methylchlorophenoxy acetic acid (MCPA)	HR/Chlorphenoxy	700/>1000 (rat)	No specific antidote, symptomatic and supportive therapy.
74.	Metolachlor	Acetamide	2780/3100	No specific antidote, symptomatic treatment
75.	Mancozeb	Fg/Dithiocarbamte	8000/>10000 (rat)	No specific antidote, symptomatic treatment, if swalloved induce vomiting wash out the stomach administer saline laxaives, provide circulatory support, etc.
76.	Metaldehyde	MO/Aldehydes	600/>5000	No specific antidote, symptomatic and supportive therapy.
77.	Methabenzthiazuron	HR/Urea	2500/>500 (rat)	-do-
78.	Methyl Bromide	Fu	0.63 (6 hours)	No specific antidote, symptomatic. In Acidosis, Sod.bicarbonate is administered and urine is monitored. After inhalation, move victim to fresh air, keep lying down and warm.
79.	Methyl Parathion	In/OP	14.0/420	Atropine, possibly in conjuction with PAM.
80.	Methyl Bromide Ethylene Dibromide (1:1 & 3:1)			See Methyl Bromide and Ethylene Dibromide.
81.	Metoxuron	HR/Urea	3200>2000(rats)	No specific antidote, symptomatic and derivatives supportive therapy.
82.	Metribuzin	HR/Triazine	2200/>20000	-do-
83.	Monocrotophos	In/OP	14.0/130-250	Atropine, possibly in conjuction with PAM.
84.	Metalaxyl	Fg/Acylalanine	670/>3100	No specific antidote, symptomatic and supportive therapy.
85.	Mickel Chloride	Fg/Inorganic	135	No specific antidote, content symptomatic and supportive therapy.

Table 2 — *Continued*

Sl No.	Name of Pesticides	Group/Chemical Family	Acute LD 50 (mg/kg b.wt) Oral/Dermal	Antidote
(1)	(2)	(3)	(4)	(5)
86.	Nicotine Sulphate	In/Alkaloids	50-60/50	-do-
87.	Oxydemeton-methyl	In/OP	65/250	Atropine possibly in conjuction with PAM.
88.	Oxyfluorfen	HR/Diphenyl Ether, Trifluromethyl	5000/>10000	No specific antidote, symptomatic and supportive therapy.
89.	Paradichlorobenzene	Fg	1000	No specific antidote, symptomatic and supportive therapy.
90.	Pendimethalin	HR/Nitro Compound	1050/>5000	No specific antidote, symptomatic, if ingested do not induce vomiting.
91.	Permethrin	In/Pyrethroids	500/>2000	No specific antidote, symptomatic treament. If ingested obtain immediate medical attention.
92.	Phenthoate	In/OP	400/2100	Atropine, possibly in conjunction with PAM.
93.	Phorate	In/	2.0/2.5-6.2	-do-
94.	Phosalone	In/Op	120/>1000	-do-
95.	Phosphamidon	In/OP	7.0/267	-do-
96.	Pirimiphos-methyl	In/OP	2018/>2000	-do-
97.	Phenylmercuryacetate (PAM)	Fg/Organomercury	30	Stomach wash with 5 percent Sod bicar bonate solution, egg white or medicinal charcoal suspension, administer medical BAL or Penicillamine. Give Sod.citrate (1-4 gm orally) every 4 hours.
98.	Propanil	HR/Acetamide/Anilides	1400/7000	No specific antidote, symptomatic andsupportive therapy.
99.	Propetamphos	OP	119/2825	Atropine in conjuction with 2-PAM.
100.	Propoxur	In/Carbamates	95/>500	Atropine
101.	Pyrethrum	In/Pyrethrum	500/5000	No specific antidote, symptomatic treatment.
102.	Quinalphos	In/OP	62/1750	Atropine, possibly in conjuction with PAM.
103.	Carbaryl:Gamma BHC(4:4)	In/misc		See Carbaryl and gamma BHC.
104.	Simazine	HR/Triazine	5000/>10200	No specific antidote, symptomatic and supportive therapy.
105.	Sirmate	HR	2165	-do-
106.	Sodium Cyanide	Fu	6	-do-
107.	Streptocyline (streptomycin sulphate + tetracyclin hydrochloride(9:1)	BC	900	-do-
108.	Sulphur	Fg./Inorganic	>3000	-do-
109.	Temephos	In/OP	4600/1300-1930	Atropine, possibly in conjunction with PAM.
110.	Triallate	HR/OC,Carbanate	2165/3200	-do-
111.	Trichloro acetic acid (TCA)	HR	400	-do-
112.	Trichlorphon	In/OP/oC	560/>2000	Atropine, possibly in conjunction with PAM.
113.	Tricyclazole	OP	314/>2000	Atropine, possibly in conjunction with 2-PAM.

Table 2 — *Concluded*

Sl No.	Name of Pesticides	Group/Chemical Family	Acute LD 50 (mg/kg b.wt) Oral/Dermal	Antidote
(1)	(2)	(3)	(4)	(5)
114.	Tridemorph	Fg/Morpholine/Anilides	650/>4000 (rat)	No specific antidote, symptomatic and supportive therapy
115.	Thiometon	In./OP	120/>1000	Atropine possibly in conjunction with PAM.
116.	Thiram	Fg/Dithiocarbonate	560/>1000	No specific antidote, symptomatic andamatesupportive therapy. If swallowed, induce vomiting, wash out the stomach, administer saline laxatives, provide circulatory support.
117.	Triadimefon	Fg/Triazole	602/>2000	No specific antidote, symptomatic and supportive therapy.
118.	Thiophanate-methyl	Fg/Benzimidazole carbonate	6000/>10000	-do-
119.	Triazophos	In/OP	66/1100	Atropine, possibly in conjunction with PAM.
120.	Warfarin	RO/Cumarin	10	Vitamin K1 Combined with blood transfusion.
121.	Zinc Phosphide	RO/Inorganic	45/2000-5000	No specific antidote, symptomatic and supportive therapy.
122.	Zineb	Fg./Dithiocarbamate	>5200/6000	No specific antidote, symptomatic treatment. If swallowed, induce vomiting, wash out stomach, administer saline laxatives, provide circulatory support.
123.	Ziram	Fg/Dithiocarbamate	1400/>6000 (rat)	-do-
124.	Bacillusthuringiensis	In/Biopesticide	/>5000 (rat)	No specific antidote, symptomatic treatment.
125.	Chlorobenzilate	AC/Benzilate	2784-3880/>10,000	-do-
126.	Chlorfenvinphos	In/OP	24-39/31-108 (rat)	Atropine, possibly in conjunction with PAM.
127.	Cyfluthrin	In/Pyrethroid	500(oxylol)/>5000 900 (PEG 400)/20(water/ Gramphor)	No specific antidote, symptomatic treatment.
128.	Dieldrin	In/Cyclodiene (oc)	46/50-120	-do-
129.	d-trans allethrin	In/Pyrethroid	315/>2000	-do-
130.	Fenobucarb(BPMC)	In/Carbamate	524M/>5000(rat)425F	Atropine
131.	Hexaconazole	Fg./Triazole	2189M/>2000 6071F/	No specific antidote, treat symptomatically.
132.	Iprodione	Fg./Imidazolidine	>2000/>2500	-do-
133.	Lambdacyhalothrin	In/Pyrethroid	79M/1293-1507 56F/	-do-
134.	Myclobutanil	Fg/Triazole	1600M/5000 2290F	-do-
135.	Neem Products	In/Biopesticide	>5000/>10000	-do-
136.	Oxaxiazon	HR/Oxadiazole	>5000/2000	-do-
137.	Oxycarboxin	Fg/Oxathion	>2000/>16000	-do-
138.	Paraquat dichloride	HR/Paraquat ion	157/236-500 mg. Parqut ion/perks.	-do-
139.	Penconazole	Fg/Triazole	2125/>3000(rat)	-do-
140.	Prallethrin	In/Pyrethroid	640M/>5000 (rat)460F/	-do-
141.	Pretilachlor	HR/Acetanilide	6099/>3100	-do-
142.	Profenofos	In/OP	358 3300 (rat)	Atropine, possibly in conjunction with PAM.
143.	Propiconzole	Fg./Triazole	1517/>4000 (rat)	No specific antidote. Treat symptomatically.
144.	Trifluralin	HR Dinitroaniline	5000/>5000	-do-
145.	Validamycin	Fg./Glucopyrnoside	20000/>5000	-do-
146.	Methoxy ethyl mercury chloride	Fg./Organomercurial	—	D-penicillamine.

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