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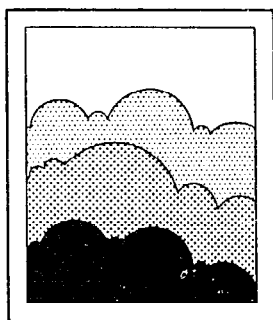
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CODE OF PRACTICE FOR SAFE USE OF PESTICIDES



Safety Booklet No. 3

CSIRO
Melbourne, Australia
1976

CSIRO Safety Booklets

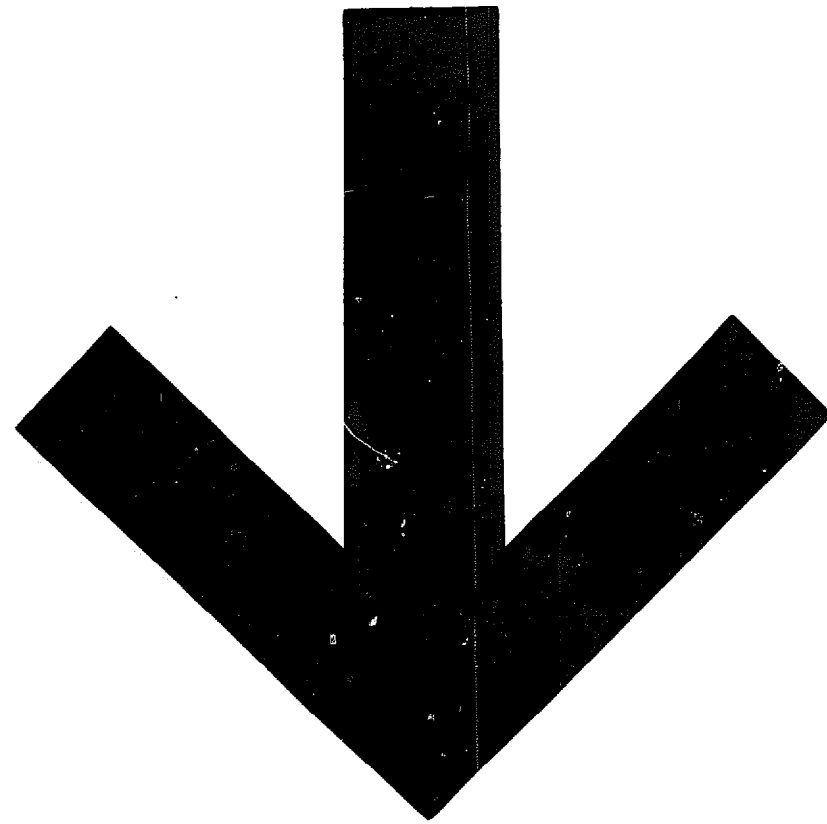
This is the third in a series of safety booklets produced by the CSIRO Safety group for the guidance of all members of staff engaged in potentially hazardous work in the field or laboratory.

Other titles in the series are:

- No. 1 Electrical Safety: A Code of Practice
- No. 2 Code of Practice for Safe Handling and Use of Cryogenic Fluids

Further copies of these booklets may be obtained from

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**Code of Practice for
Safe Use of Pesticides**

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The safe use of pesticides

Many pesticides are dangerous, but all can be handled without any danger to health providing appropriate safety precautions are observed.

The hazard of a pesticide varies with its mode of formulation – solution, gas, powder, etc. – and with the mode of application – spray, dust or gas. The solvent or dispersing agent is often harmful and may constitute a greater hazard than the pesticide, e.g. benzene, carbon tetrachloride. Some pesticide formulations also have a fire or explosion hazard.

It is essential, therefore, to ascertain the specific hazards relative to the pesticide being handled, so that the proper precautions can be taken.

The first and vital step before handling any pesticide is to **READ THE LABEL**.

DO NOT USE a pesticide if the container is not adequately labelled with details of the contents and precautions to be taken.

This Code is orientated mainly towards field application of pesticides, where experience has shown the presence of the greater hazard.

When pesticides are handled in the laboratory situation, the normal precautions taken with toxic chemicals would apply.

However, several sections in the Code are applicable to all situations.

What is a pesticide?

Definition

In this Code, a pesticide is considered to be any fungicide, herbicide, insecticide, acaricide, rodenticide or defoliant used to destroy or control an unwanted organism.

Physical form

Gas This form is typical mainly of the fumigants, e.g. methyl bromide. Although some pesticides are in the solid or liquid state, their pesticidal action is due to either vaporization, e.g. 1,4-dichlorobenzene, benzene, or chemical action, e.g. aluminium phosphide.

Other pesticides whose prime action is not as a gas can also produce hazardous vapours.

Liquid Predominantly, the action in liquid pesticides is the result of contact or ingestion by the organism to be controlled. Typical examples are parathion, mevinphos, DEF. They can also be used as aerosols, i.e. fogs. Some 'liquid' pesticides are in fact a solution of the active agent in a suitable solvent, e.g. 1080 in water or dieldrin as an emulsifiable concentrate.

Solid Action of solids is similar to liquids; typical examples are DDT and derris dust (rotenone). They can be applied as a dust or in solution. Lindane (Gammexane), for example, can also be used as an aerosol, producing a smoke when used in a thermo-regulated dispenser.

Some pesticides are received already prepared as baits, e.g. warfarin.

Health hazards

The toxicity of a substance refers to its ability to cause systemic poisoning, *after* entry into the body, and is not a measure of health hazard. The term 'health hazard' refers to the probability that a substance will cause harm in the circumstances of usage.

However, the toxicity of a substance dictates the precautions that should be taken, e.g. greater care is required when handling parathion than when handling malathion.

As the skin has the greatest occupational exposure to non-gaseous pesticides, operator hazard should be based on dermal toxicity ratings rather than oral ratings.

Mode of poisoning

Inhalation The risk of poisoning by inhalation is greatest when the pesticide is dispersed as a gas, smoke, dust or fog. Inhalation risks are greater in confined spaces such as glasshouses.

Some pesticides have a high volatility, and can produce dangerous concentrations in the atmosphere during dilution procedures and in storage.

Inhaled pesticides are almost completely absorbed by the lungs.

In some cases, a more toxic breakdown product is formed and inhaled by smoking a contaminated cigarette, e.g. the oxidation product of parathion is estimated to be 100 to 500 times more toxic than parathion.

Ingestion This is the least likely means of poisoning under normal circumstances. It is most likely to occur when pesticide concentrate is splashed into the mouth during pouring and measuring. Ingestion can also occur by licking the lips or rubbing the mouth with contaminated arms or hands, by careless actions such as attempting to blow out clogged spray nozzles with the mouth, or by eating or drinking when the face and hands are contaminated.

Dermal absorption This is probably the most important route of entry into the body. Although any given amount of pesticide is more rapidly and more completely absorbed if inhaled or ingested, by far the greatest amount of pesticide to which the body is subjected, during most exposure situations, is deposited on the skin.

Most of the pesticides in common use can be absorbed through the skin; this fact is particularly significant when handling the concentrated material.

Any break in the skin will allow a more direct route into the blood stream. Cuts and abrasions on the hands are of particular importance.

When leather boots become wet with pesticides, they will hold the pesticides, which can then easily penetrate the footwear and come in close contact with the wearer. Canvas shoes are similarly hazardous.

More pesticide applications take place in warmer weather, thus giving potentially greater hazard through skin exposure, but in addition, pesticides are absorbed through the skin more rapidly and more completely at higher temperatures.

Dermal absorption of pesticides is not uniform for all parts of the body. With parathion, for example, absorption is complete and rapid through the eyes and scrotum, about 50% is absorbed through the ear canal, and 40% through the neck-head area.

Record of exposure A record should be kept of exposure of all workers with pesticides, or exposure to materials treated with pesticides. Any home use of pesticides should be included in the record of exposure. Officers must report any symptoms which may be related to exposure to pesticides.

Personal hygiene

Personal hygiene is the most important aspect in avoiding poisoning by pesticides.

Overalls or other outer clothing should be washed daily if there has been exposure to pesticides during the day and should be removed immediately if contaminated with splashes, particularly of concentrates. Similarly underwear should be removed and washed if it has become wet with pesticide. Officers exposed to pesticides during the day should wash thoroughly after the application, if necessary during the middle of the day, and should wash immediately if splashed, particularly by concentrates.

When pesticides are being handled at distances from base, enough water should be carried for full washing; the water must be protected from contamination by pesticides.

Removal of pesticide from the skin requires thorough scrubbing with soap and water for at least 10 minutes and is harder to achieve the longer the pesticide is allowed to remain on the skin. Paper towels are preferred for drying when washing hands after handling pesticides.

Drinking, eating and smoking should not take place during exposure and after until hands and face have been thoroughly washed.

Hands can become contaminated by handling equipment or clothing that has been exposed to pesticides, e.g. footwear.

Special care must be taken to ensure that drinking water, food, cigarettes, eating utensils, etc. are protected against contamination, particularly in the field.

Protective equipment

Ideally, mixing and application of pesticides should be so arranged that there is no contact of the operator with the pesticide, and therefore no need for personal protective clothing and devices. This ideal situation is rare and, depending on the risk involved, suitable clothing and other protective equipment should be worn – but every effort must be made to minimize their need.

If protective clothing is necessary it must be donned *before* other clothing or the skin is contaminated by pesticide. Workers will often not wear protective clothing until the drift of pesticide increases to the point where they feel that protection is necessary, by which time there is often considerable contamination of the skin and clothing.

The covering of contaminated skin areas by protective clothing can create conditions under which dermal absorption is increased, particularly during hot weather when high temperatures and perspiration are involved.

Dermal

As mentioned previously, the most likely route of pesticides into the body is through the skin.

According to defined categories of risk, suitable clothing and other protective equipment should be worn. Overalls, buttoned at the wrist and neck, and a cloth hat should be worn. The need to wear gloves while mixing suggests that the procedure could be improved to eliminate contact with the skin of the hands, but if gloves are needed they should be disposable, since their use obviates need for care in washing gloves after use.

A face shield is often appropriate in mixing or application when splashes or spray on the skin of the face is a risk.

Waterproof boots should be worn, with trousers on the outside.

Under no circumstances should arms or legs be exposed to dermal contact when organophosphorus compounds or the more hazardous of the organochlorines, such as dieldrin

or endrin, are being handled. In such circumstances, the wearing of shorts, short sleeved shirts and short skirts is prohibited.

Where the risk is high and climatic conditions are temperate, full waterproof clothing should be used.

All protective clothing should be washed daily if there has been exposure to pesticides during the day, and should be removed immediately if contaminated with splashes, particularly of concentrate.

In hot weather, the wearing of full protective clothing is not practical because of heat stress. Operations could be carried out or entry made to treated areas in the cooler part of the day, or periods of exposure could be brief and repeated if necessary.

Respiratory

Where toxic dusts, gases or very small spray droplets are prevalent, or where application is in confined spaces, protection of the respiratory system is especially important.

Cartridge-type respirators, gas masks or self-contained compressed air breathing apparatus should be used.

Respirators must have proper care. The rubber face piece becomes hardened and the head straps lose their elasticity with age and exposure to heat and sunlight. These conditions lead to poor fit and allow leakage around the face piece, giving a false sense of security.

A respirator does not fit well if the wearer has a beard; spectacles also prevent a good seal with a full face mask.

The face piece should be washed with soap and water after each use; organic solvents should not be used.

Canisters or filters must be removed before washing the face piece.

The face piece should be stored in a clean plastic bag.

In most situations the use of respirators is unnecessary.

Cartridge-type respirator This type of protection is usually sufficient against dusts and droplets, as long as the pesticide is relatively non-volatile. Some cartridges also absorb gases, but this protection is limited. The average life of a canister is about 8 hours, and a record of use should be kept.

Gas masks A gas mask usually has full face protection and a large canister designed to absorb gas. Care must be taken to

ensure that the canister is of a type suitable for the gas concerned. Canister life is about 8 hours, and a record of use should be kept.

If the gas is highly toxic, self-contained compressed air breathing apparatus should be used rather than gas masks.

*Self-contained
compressed air
breathing apparatus*

This equipment has its own supply of compressed air. It is seldom necessary, but its use is recommended when fumigating or applying highly toxic pesticides in confined spaces, so that none of the contaminated ambient air is inhaled. In the case of a unit with an air tank, ensure that there is sufficient air for the proposed period of use.

Storage

Separate lockable storage should be provided for pesticides. Access should be limited and keys issued only to responsible informed persons. Records should be kept of all pesticides entering and leaving the store.

The transfer of pesticide concentrates from the original to other containers should be discouraged, but if transfers are made the new containers must be appropriately labelled.

The location and design of the pesticide store should take into account the risks of fire and explosion.

Proper ventilation is essential.

Pesticides must be stored so that decontamination of a spill can be facilitated.

Emergency clothing, respirators, showers and eyewash fountains should be available.

Emergency and first aid instructions should be posted in a prominent place, together with the names, addresses and telephone numbers of persons to contact; if possible, a telephone should be installed.

Proper storage should be provided for clothing.

Transport

It is important that personnel involved in transportation and handling of pesticides know the proper precautions.

Pesticides must not be transported in close proximity to clothing, foodstuffs, feeds or other material intended for consumption by humans or animals. It is essential that pesticide containers are sealed and uncontaminated by spillage to prevent contamination of the transporting vehicle. In the event of spillage, the vehicle must be thoroughly decontaminated if it is used for other purposes and before any maintenance work is carried out on the vehicle.

Knowledge of the potential toxicity of the pesticide involved in a spillage accident is important to prevent possible poisoning from the more toxic materials and to minimize unnecessary precautions and concern if the chemicals involved are of low toxicity.

In the event of a highway accident, injured persons should be checked to determine if their skin has become contaminated with pesticide.

Dilution and preparation

Dilution of concentrates and preparation of spray mixes should be done under specified conditions by persons trained therein, using no-touch methods preferably in the open or in a well-ventilated area. **READ THE LABEL.** Strict adherence shall be kept to directions supplied with the pesticide.

Intermediate tools and equipment shall be thoroughly decontaminated on completion of the operation.

Fire precautions appropriate to the materials being handled should be taken.

Permeable stirrers, e.g. wood, should not be used as decontamination is almost impossible.

Appropriate protective clothing must be worn, and extreme care should be taken to prevent splashing, particularly of the concentrate. Some containers are hazardous to open, e.g. 100-litre cans; others are difficult to pour from without spilling.

Add the concentrate to the bulk solvent to help avoid splashing.

Pour wettable powder on the surface of water and allow it to wet and settle.

The exterior of all containers must be thoroughly cleaned before returning them to storage or work site.

Application

Application of pesticides should be in accord with good agricultural practice.

Excessive concentrations, amounts or frequency of application should be avoided.

Spraying, particularly with semi-concentrates, should be done in circumstances which avoid unnecessary contact of pesticide with the skin.

Equipment should be checked for leaks in all lines and for operation at specified tolerances, and should be decontaminated before being worked on by mechanics.

Fumigants

Fumigants are generally extremely toxic, and as they are gaseous the hazard from inhalation is high.

Only trained personnel should be used in fumigation operations.

Fumigation is normally carried out in specially designed rooms or cabinets, but can be done in the field or open by the use of plastic sheeting.

After fumigation is complete, excess fumigant must be removed preferably by forced draught ventilation before handling the material being fumigated. If fumigation is carried out in the open, uncover the material when standing upwind, first ascertaining that there are no personnel or livestock in the downwind vicinity. Use appropriate respiratory protection.

Even after removal of excess fumigant, some chemicals (e.g. methyl bromide) can be adsorbed by soils, etc. and are slowly released later.

Wherever possible, use a fumigant with a readily detectable odour, e.g. methyl bromide is available containing 2% of chloropicrin as a warning odour.

Sprays

Give special attention to susceptible crops and livestock in the vicinity of the crop being sprayed. Make sure spray or drift does not enter watercourses or storages.

Aerial No human markers shall be used. Although relating more specifically to the aerial spraying of cotton in New South Wales, reference should be made to 'Avcacode No. 1' (November 1973) published by the Agricultural and Veterinary Chemicals Association.

Ground Spraying should only be carried out in low wind conditions. Every effort must be made to minimize spray drift.

Spray with as low a pressure and as large an orifice size as possible. When using high-powered equipment delivering very fine mists, and when overhead application to trees makes exposure to spray inescapable, protective clothing must be worn.

If effectiveness is similar, band spraying is to be preferred to blanket spraying.

Spraying animals Spraying should be carried out in low-velocity wind conditions, particularly if attendants are located downwind from the booth. If an animal balks while in the booth, the spray pump must be switched off before attempts are made to move it. The handling of freshly sprayed animals should be avoided.

Smokes

Pesticides in this form are liberated in confined spaces, e.g. glasshouses. They can be in the form of bombs, candles or pellets volatilized in a thermo-regulated applicator.

All personnel should vacate the area during smoke liberation and for some period afterwards. Respiratory protection should be worn, as the smoke particles are concentrated pesticide.

Dusts

These are frequently applied by hand or hand-held dispensers. Appropriate protective clothing should be worn. Clothing is likely to be contaminated during the

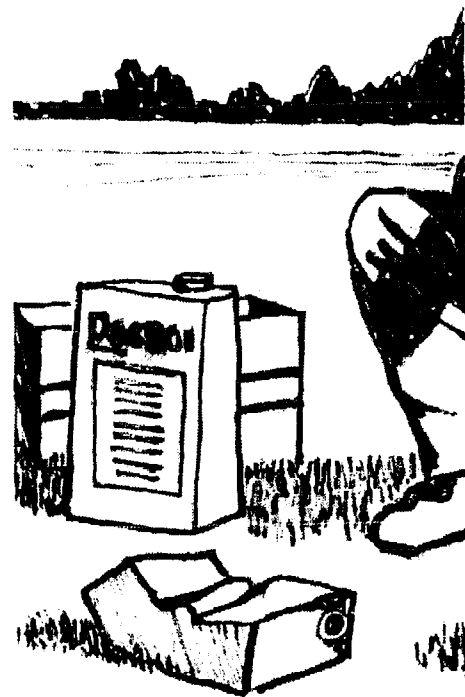
SOME EXAMPLES OF BASIC PRECAUTIONS IN THE HANDLING OF PESTICIDES



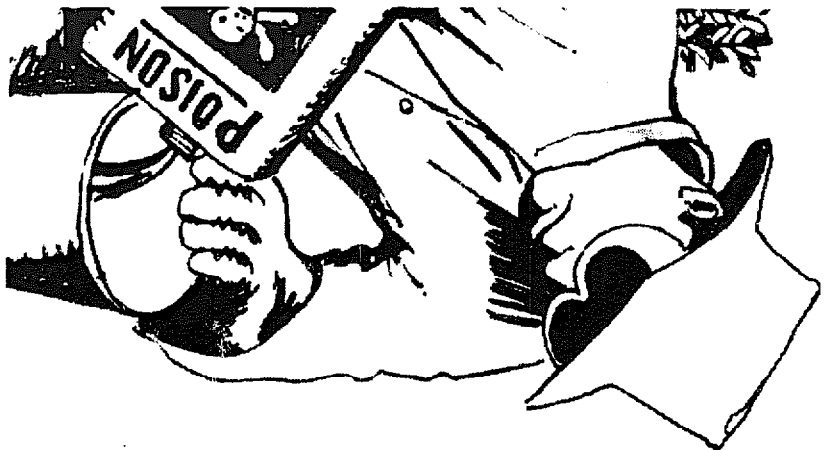
Protect skin when handling con



Before eating, drinking, or smoking, wash thoroughly and move away from sources of contamination



Bash and bury empty containers



Intrates



Full protection is necessary when using concentrate sprays



To prevent re-use



Stand upwind if burning pesticide cartons

application and should be changed as soon as possible unless the pesticide is of very low toxicity; even then, it is wise to change and shower.

Dips

This refers mainly to animals. In this operation, attendants are frequently splashed with pesticide, particularly when recalcitrant animals are encountered. Frequent washing is essential.

Sites of application

Closed systems

Glasshouses Appropriate protective clothing must be worn during application. On completion of application, clothing shall be changed and the operator shall shower or wash thoroughly. Special care must be taken to prevent the contamination of ancillary equipment, e.g. telephone, where such contamination could later be transferred to an operator.

The application of non-gaseous pesticides in any closed system will contaminate everything within the confines, and special care is essential when handling pots, benches, etc., especially when persistent pesticides such as dieldrin have been used.

After the application of the pesticide, the glasshouse must be sealed and an appropriate 'NO ENTRY' notice displayed. The glasshouse should preferably be locked.

Before re-entry is permitted, unless the operator wears adequate protective clothing and equipment, the glasshouse shall be thoroughly vented, preferably by forced draught ventilation. Care must be taken to ensure that contaminated exhaust air does not enter other buildings containing personnel.

Fumigation chambers Fumigants are, in the main, highly toxic gases and fumigation should only be undertaken by highly trained personnel. Entry should normally be prohibited during fumigation, but if personnel must enter the area full respiratory protection must be used.

Semi-closed systems

This group includes fume cupboards, controlled temperature rooms, laboratories, phytotron.

Care must be taken to prevent the escape of hazardous concentrations of air-borne pesticide into other parts of the building. This is of particular importance where forced draught ventilation is installed.

Open

This is probably the most hazardous situation, where exposure is greatest to non-technical personnel and on-site supervision is minimal. Operators must be made aware of the hazards involved, and they should be allowed sufficient time to wash thoroughly at meal breaks and at the end of the day.

Contaminated plants, livestock and equipment

Contaminated plants, growing medium and contaminated containers should be handled with the same caution as the pesticide used, particularly with persistent types. Discarded materials should be properly disposed of, and not left for disposal by personnel who would be unaware of the hazard. Similarly, containers should be decontaminated before re-use.

Livestock

Personnel handling animals, alive or dead, should be warned of the inherent danger if the animal has been recently treated with pesticide.

Equipment

This covers a wide range of items, including benches, etc. from glasshouses, field spraying equipment and bulk dilution equipment. Some equipment, particularly if contaminated with pesticide concentrate, cannot be satisfactorily decontaminated and should be discarded – unsealed wood is a typical example.

With spraying equipment, any machines or equipment used with pesticides must be decontaminated at the end of the operation or end of the day. Particular care is necessary with field spraying equipment, as pesticide will remain in tank, pipe lines, booms, nozzles, etc. It is probable that pesticide contamination is present on prime mover controls, particularly steering wheel and hand controls.

Warning signs and permits

All areas treated with pesticides shall have well-displayed warning notices. The notices should show the pesticide being used, date of application, date of re-entry and the name of the responsible officer. In some locations it may be necessary to display additional notices in a language other than English.

Glasshouses

As an added precaution, it is desirable that glasshouses are locked after the application of pesticide. This is particularly advisable if children are likely to be around.

Fumigation chambers

Precautions are the same as for glasshouses. Where fumigation is being done outside a building, the area should be roped off or clearly marked.

If children are likely to be in the vicinity the decision to fumigate in the open should be carefully considered, unless an officer is in constant attendance.

Aerial spraying

Occupants of neighbouring properties must be warned of intention to spray at least 1 day prior to scheduled spraying.

Before aerial spraying is begun, make sure no personnel are in the area.

Ground spraying

Preferably, occupants of adjacent properties should be advised if spraying is to be close to boundaries. Personnel should be kept out of area until re-entry is safe.

Entry-to-area permits

These permits should only be issued under special circumstances, for entry before it is considered safe to do so. Appropriate precautions must be taken, including relevant protective clothing, etc.

Personnel issued with entry permits must have a thorough knowledge of the risks involved.

Entry permits should only be issued by senior professional officers.

Waste disposal

Disposal of waste pesticides shall be under the supervision of a responsible officer.

Selection of disposal site

Select a disposal site that will be used only for surplus pesticides and pesticide containers. It should not be an area that might later be returned to crop land or some other use. It should be well away from homes, wells, streams, crops and livestock. Level ground is best because it will allow the residue to be absorbed through the soil and lessen the chances that it will be carried away in water run-off. Sandy soil is preferred. Do *not* select a site on the watershed of a water supply or where livestock have access to it. In addition, avoid deep pits, creek beds, erosion gullies, quarries, 'sinks' and sites within the normal range of groundwater levels.

Spills

Concentrates should only be stored or handled in areas where decontamination can be readily accomplished.

The following procedures have been recommended by the Agricultural and Veterinary Chemicals Association.

- Full protective clothing should be worn, including rubber boots, gloves, goggles and, where necessary, respirator.
- Do not smoke, eat or drink during clean-up operations.
- Wherever possible, work from the windward side of the spill.
- Prevent the spread of the pesticide, if a liquid, by the use of sand or soil to form a small dam around the spill area.
- Dose the entire spill area with a 50/50 mixture of sodium hypochlorite (laundry bleach) and water.
- Spread hydrated lime over the area and leave for at least 1 hour.

- Absorb all excess liquid in sand or soil, and shovel into drums for subsequent disposal. Sweep the area, adding the sweepings to the drum.
- Dose the spill area again with bleach solution, allow to stand for about 30 minutes, then hose down the area with water.
- Bury the sand/lime sweepings under half a metre of soil in a selected dump, remote from dams and watercourses.
- Remove and wash all protective clothing and equipment. Change contaminated clothing immediately and launder as soon as possible. If contaminated with highly toxic concentrate, destroy clothing by burning.
- Shower thoroughly on completion of mopping-up operation.

Note: Some pesticides of very low toxicity may be cleaned up without extreme precautions, but it is recommended that the operator is 'over protected' when handling concentrates.

Containers

Before disposing of containers, rinse at least twice with water to remove the greater portion of the container's contents. The rinsing water can be added to the diluted spray tank. DO NOT use pesticide containers where they could be a source of food or water contamination.

Large drums may be returnable to the supplier. In other cases, remove lids or bungs and chop holes in the container to prevent its re-use. Glass containers should be crushed and plastic or fibreboard containers punctured before disposal.

All containers should be buried under half a metre of soil at the selected disposal site.

Surplus concentrates

Dilute the concentrate to spraying strength. Prepare a pit at the disposal site, at least 0.5 m deep, and spread about 2 cm hydrated lime over the bottom. Pour the diluted pesticide into the pit and allow it to soak in. Add more lime if necessary, to a ratio of at least 10 g of lime for every litre of 1% pesticide solution or suspension. Cover with at least 10 cm of soil.

DO NOT BURN unwanted pesticides.

Surplus diluted stock

Treat as for the diluted concentrate above.

Decontamination procedures

This subject has been partially covered in previous sections, but is repeated because of its extreme importance. The class, hazard and relative toxicity of the pesticide being handled must be ascertained before any operations are undertaken. Depending on these, the urgency and degree of decontamination procedures will vary. It would be unrealistic to insist on the same precautions with respect to human health hazard with pyrethrins and parathion. The following procedures relate to the more toxic pesticides with a high degree of skin absorption.

It is emphasized, however, that erring on the over-cautious side is recommended.

Personnel

Protective clothing should be washed daily if there has been exposure to pesticides during the day, and should be removed immediately if contaminated with splashes, particularly of concentrates. Personnel exposed to pesticides during the day should wash after applications, if necessary during the middle of the day, and must wash immediately if splashed, particularly by the concentrates. Removal of pesticide from the skin requires thorough scrubbing with soap and water for at least 10 minutes and is harder to achieve the longer the pesticide is allowed to remain on the skin. Paper towels are preferred for drying when washing hands after handling pesticides.

Drinking, eating and smoking should be prohibited during exposure and after until face and hands have been washed.

Special care is required and speed of decontamination is essential when handling organophosphorus pesticides.

Protective clothing

Protective clothing contaminated with pesticides must be thoroughly washed with soap and water, taking care that no pesticide enters the inside of boots, gloves, goggles, etc.

Clothing contaminated with highly toxic concentrates should be burnt, as decontamination could be hazardous.

Equipment

On completion of each phase of operation, equipment must be decontaminated. Special care is necessary with measures and intermediary containers which have contained pesticide concentrate. They should be thoroughly hosed down, special attention being paid to nozzles and hoses.

The prime mover (e.g. tractor) will also need decontamination, with special attention to hand controls, steering wheel, etc.

Decontamination must take place in an area where the 'run-off' of the washings will not adversely affect the environment or create any hazard to personnel.

First aid

Every officer who is exposed to pesticides, and his supervisor, should be given the name and telephone number of a hospital and doctor (together with relieving doctor's name and number) with whom arrangements should previously have been made for treatment of poisoning.

First Aid instructions relating to pesticides being handled should be clearly displayed in the concentrate store, together with emergency telephone numbers as above.

Specific appliances and antidotes should be held at the site.

Any officer who has symptoms or illness during or within 12 hours of exposure should be taken immediately, NOT SENT, to hospital or doctor. Artificial respiration may be necessary.

Organophosphorus exposure

With organophosphorus pesticides, the onset of poisoning can be dramatic, and the difference between death and survival can depend on the early administration of specific remedies.

Personnel exposed to organophosphorus pesticides must report any symptom or illness which may be related to such exposure. They should not work alone, and should not take alcohol, sedatives or tranquilizers on the job.

If the exposure occurs when more than 30 minutes would elapse before hospitalization or doctor's care can be sought, atropine tablets should be given. While the patient is being taken to medical aid two 0.5 mg tablets of atropine should be swallowed every 15 minutes until the mouth becomes dry.

Ingestion

When pesticide containing no hydrocarbon solvents (e.g. kerosene) has been swallowed, vomiting should be induced by administering ipecac syrup or gagging. If a hydrocarbon is the solvent, treatment will need to be modified according to the toxicity of the pesticide. For example, with pyrethrum or methoxychlor in the usual dilute proportions, vomiting should not be induced. If the ingested pesticide is dieldrin or chlordane in the concentrated form, vomiting should be induced. In both cases, seek immediate medical aid.

Medical examinations

Specific clinical tests are available for 'monitoring' exposure to some pesticides, e.g. benzene, mercury, organophosphorus.

The interval between tests should be determined by the frequency and severity of exposure.

It is highly desirable that pre-exposure levels be determined, particularly in the case of organophosphorus pesticides.

The need for testing will have to be assessed for existing jobs by observation of levels over a trial period. A person who has only rare contact need not be tested unless a single exposure is likely to be massive. Extra tests should be taken when excessive exposure is suspected or known.

It may be desirable to test at different intervals through the spraying season, depending on exposure.

In general, all persons who are exposed to organophosphorus pesticides from time to time through the spraying season should have a test taken before spraying starts and at intervals of from 1 week to 1 month until the end of the season. Appropriate intervals could be established for particular occupations, tasks and pesticides.

Testing should be extended to personnel not directly associated with the handling of pesticides, e.g. mechanics who service spraying equipment and tractors.

Personnel who are repeatedly exposed to the more hazardous organohalogens, e.g. dieldrin, may need biological monitoring, although testing for these compounds is more difficult than with organophosphorus compounds.

Staff training and supervision

A senior officer should be nominated as responsible for the training and supervision of staff handling pesticides, and shall be directly responsible for the following:

- Availability and proper maintenance of adequate protective clothing and equipment.
- Storage of pesticide concentrates.
- Training of selected personnel in the handling of concentrates.
- Decontamination procedures.
- Medical examinations.
- Selection of disposal site.
- Training of personnel supervising application of the diluted pesticide, who in turn will train the actual operators.
- Emergency services, i.e. local arrangements with doctors and hospital.

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