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Safety procedures for the disposal of surplus pesticides and associated toxic waste — Code of practice

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

RS 210 was prepared by Technical Committee RSB/TC 013, *Water and Sanitation*.

In the preparation of this standard, reference was made to the following standard:

- 1) MS 675: 2005, Safety procedures for the disposal of surplus pesticides and associated toxic waste — Code

The assistance derived from the above source is hereby acknowledged with thanks.

This second edition cancels and replaces the first edition RS 210: 2014 which has been technically revised.

Committee membership

The following organizations were represented on the Technical Committee on Water and Sanitation (RSB/TC 013) in the preparation of this standard.

Ministry of Emergency Management (MINEMA)

Ministry of Trade and Industry (MINICOM) Paragraph of participants

Ruliba Clays

Rwanda Development Board (RDB)

Rwanda Mines, Petroleum and Gas Board (RMB)

Rwanda Polytechnic (RP)

Rwanda Utility Regulatory Authority (RURA)

Shine Engineers Multisectoral Company Ltd (SEMC)

Standards for Sustainability (SFS)

University of Rwanda- College of Science and Technology (UR-CST)

Rwanda Standards Board (RSB) – Secretariat

Copy for public review

Safety procedures for the disposal of surplus pesticides and associated toxic waste — Code of practice

1 Scope

This Committee Draft covers the following aspects of the safe disposal of pesticide waste and empty pesticide containers:

- a) general precautions to be taken during the use of pesticides;
- b) directives for the disposal of pesticides waste;
- c) directives for the decontamination and disposal of empty pesticide containers;

directives for the treatment of pesticide spillages and leakage spillages and leakage, and the action to be taken in the case of fires and freight emergencies that involve pesticides.

2 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

2.1

caustic soda

Sodium hydroxide (NaOH)

2.2

consumers

Manufactures and formulators of pesticides, and all industrial and general public users of household and agricultural chemicals, e.g. farmer, pest control operators and aerial applicators of agricultural chemicals (excluding disposal organizations)

2.3

conveyor

any organization or individual undertaking the transportation of pesticides

2.4

data bank

manual or computerized information retrieval system maintained by the Pesticides Control Board and from which information is readily available regarding the safe disposal of pesticides and other hazardous chemicals, the treatment of spillage and the procedures to be followed during freight emergencies

2.5

decontamination

removal of detectable traces of pesticides from containers equipment, and contaminated surfaces, by washing them with detergent or with any other cleaning solution prescribed by the manufacturer or by chemical degradation

2.6

disposal

process whereby pesticide waste and contaminated empty containers and material are disposed of, e.g. burial at suitable sites, or chemical or thermal destruction

2.7

Disposal Organization (DO)

Individual or an organization, e.g. a manufacturer, a formulator or a disposal company, that is approved by the competent authority to undertake the disposal of pesticides in bulk or packed form

2.8

disposal site

site that is licensed for the disposal of solid waste that fulfils the recommendations of designated authority and that complies with all the relevant requirements of the applicable Environment Management Laws and regulations

2.9

formulator

organization that formulates pesticidally-active ingredients into various products that are marketed or exported

2.10

hazchem

international coding system for the labelling of bulk transport of hazardous chemicals so that the contents and the associated hazards of a cargo may be readily identified in an emergency, together with the applicable safety precautions and emergency procedures

2.11

manufacturer

organization that manufactures pesticides or their formulations

2.12

operating area

area in which pesticides are used or disposed of as relevant

2.13

poison information centre

manual or computerized information retrieval system maintained by Competent authority and from which information is readily available regarding the toxicity of poisons, and the treatment of suspected cases of poisoning

2.14

Pest Control Operator (PCO)

person registered by relevant authority

2.15

Pesticide

Substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest or weeds

2.16

Soda ash

Anhydrous sodium carbonate (Na_2CO_3) or washing soda

2.17

Sponsor/pesticide handler/supplier = provider or User (researchers, consumer as user)

2.18

Triple-rinse

To flush a pesticide container three times, each time using a volume of the normal diluents equal to approximately 10 % of the capacity of the container, and to add the rinse liquid to the spray mixture or dispose of it by a method suitable for the disposal of the pesticide.

3 Symbols (and abbreviated terms)

DO Disposal Organization

IATA International Air Transport Association

ICATO International Civil Aviation Organisation

IMO International Maritime Organization

4 Toxicity and other hazards of pesticides

4.1 Unless adequately protected, no person shall be allowed near an area that has accidentally been contaminated with pesticides (if s/he fails to take this precaution, s/he endangers her/himself as well as others who may have to rescue her/him). It shall be borne in mind that, at first approach, hazards such as flammability, corrosiveness or toxicity or any combination of these may be present.

4.2 During decontamination and disposal procedures, the appropriate protective equipment described in 11.1 shall be worn and the medical precautions outlined in 11.2 and 11.3 shall be observed.

4.3 Information about the toxicity of the symptoms produced by, and the treatment of poisoning by the many pesticides available is obtainable from the manufacturers of the compounds in question or from the competent authority (See also Annex C).

5 Directives for domestic users

5.1 Domestic users of pesticides shall:

- a) be fully aware of the hazards involved in the use of pesticides, as noted in clause 4, and of the further information given in Annex C regarding the toxicity of pesticides and the first-aid treatment in cases of suspected poisoning;
- b) be familiar with the information about the safe handling and application of pesticides, and
- c) be familiar with the relevant procedures for the safe disposal of pesticide waste and empty pesticide containers.

5.2 When empty pesticide containers are being disposed of, the relevant instructions appearing on the label(s) of the container shall be followed. Aerosol cans shall never be punctured or heated other empty containers, before disposal shall be rinsed three times with water and then shattered (in the case of glass containers), punctured or heated. Other empty containers, before disposal, shall be rinsed three times with water and then shattered (in the case of glass containers), punctured (in the case of plastics and metal containers), punctured (in the case of plastics and metal containers), or so otherwise rendered unserviceable as to prevent re-use, and then deposited in district refuse receptacles. Pesticides may under no circumstances be dumped or disposed of into any sewerage system. If excess household pesticides cannot be delivered to a DO for disposal householders shall consult their designated authorities for advice. All pesticides and empty containers shall be closed securely and stored under lock and key until they can be safely disposed of.

6 Directives for farmers

6.1 The directives given in 5.1 apply also to farmers, when disposing of pesticide waste and empty pesticide containers, farmers shall also pay attention to the relevant instruments appearing on the label(s)

6.2 To alleviate the problems of disposal, farmers shall adhere to the following procedures:

- a) when disposing of pesticide is purchased the quantity bought shall be limited to what is needed during one season;
- b) only as much pesticide as needed at one time of a specific application shall be prepared, and it shall be prepared, and it shall be used strictly in accordance with the instructions on the label;
- c) when a dilution of a pesticide concentrate being prepared, the container(s) or other vessel(s) used to measure out the required quantity of the concentrate shall be well drained and then triple-rinsed with the relevant diluents and the rinsing added to the pesticide formulation before it is made up to the final volume for application;
- d) if all of the formulation prepared for any single application is not used, any formulation that remains after the application shall be sprayed onto a strip at the side of the land or over an area where it causes no change. Where possible, the formulation shall be ploughed into the soil.

6.3 Farmers shall, where facilities are available, return empty triple-rinsed metal containers to the nearest authorities. When containers are to be sold as scrap metal to recycling plants, they shall be compressed. Combustible containers shall not be burned. It shall be borne in mind that when herbicides volatilize, the resulting vapour may damage nearby crops, and that herbicides and defoliant that contain chlorate may explode when heated or when brought into contact with organic materials such as wood, sawdust, paper, etc.

6.4 Where no DO operates in a farmer's district, the farmer shall consult the manufacturer about the disposal of surplus pesticides and shall note the relevant procedures for the decontamination and disposal of empty pesticide containers as outlined in 11.8.

6.5 Livestock-dipping tanks on farms shall be cleaned out (by the owner or other responsible person) from time to time, as follows:

- a) the level of the dip shall be reduced as far as possible by the normal dipping of animals;
- b) the remaining liquid in the tank shall be removed by either pumping or baling it out over a large area of the surrounding ground, which shall be so fenced as to keep out animals, children, etc. Care shall be taken to ensure that dams or rivers nearby are not contaminated; and
- c) sludge shall be removed from the bottom of the and deposited in a pile on the ground within a safe, fenced area or, where possible, ploughed into the ground.

6.6 Pesticide waste and empty punctured containers may be buried in a dumping site on the farm, but the farmer shall ensure that such site is situated on ground that is relatively high and flat, or that slopes gently away from any surface or subsurface water supply, and that is at least 30 m, and preferably 50 m or more, away from any source of water. The dumping site shall be identified and securely fenced, and trespassing on the site shall be forbidden.

6.7 The dumping site shall be excavated to a depth of at least 1 m and, when appropriate depending on the type of pesticide to be disposed of, lime shall be spread over the bottom of the excavation in a continuous layer of thickness approximately 10 mm. The pesticide shall be diluted to at least the minimum dosage (lowest concentration) recommended on the label, and then poured evenly or sprayed over the surface of the lime. The deposited pesticide shall immediately be covered with a layer of ash and a layer of soil or other covering material of thickness at least 450 mm.

6.8 An aircraft landing strip on a farm on which aerial application of pesticides is to be carried out shall be made secure from approach by livestock and by unauthorized persons, and shall preferably have a concrete slab with a suitable drainage system into which aircraft spraying tanks may be emptied. The pesticide shall then be either pumped or baled out from the drainage system, and disposed of as described in 6.2 (d).

7 Directives for aerial application

7.1 Aerial applications shall be registered pest control operators. They shall be fully aware of the hazards involved in the use of pesticides, as noted in clause 4, and of the further information given in Annex C regarding the toxicity of pesticides and the first-aid treatment in cases of suspected poisoning. They shall be familiar with the relevant procedures described for the safe disposal of pesticides, pesticide waste and empty pesticide containers.

7.2 After the last application, aircraft shall return to the landing strip at the operating area (see 6.6 and 6.2). The spraying tanks shall then be cleaned as follows:

- a) The tank(s) shall be filled with a solution in water of a suitable detergent at a concentration of at least 0.12 % (v/v), i.e. at least 120 mL of solid detergent per 100 L of water.
- b) with the aircraft stationary on the landing strip, a suitable volume of the detergent solution shall be released through the spray nozzles until they are free from pesticide, and the rest of the solution shall then be drained from the tank(s).
- c) If the landing strip is not equipped with a concrete slab and drainage system, care shall be taken to ensure that water sources nearby are not contaminated by drainage from the tank(s).
- d) the tank(s) shall be refilled with clean water, the nozzles flushed out and the tank(s) drained as in (b) above.

8 Directives for pest control operators

8.1 Pest Control Operators shall be fully aware of the hazards involved in the use of pesticides, as noted in clause 4, and of the further information given in Annex C regarding the toxicity of pesticides and the first-aid treatment in cases of suspected poisoning.

8.2 Pest Control Operators shall be familiar with the relevant procedures for the safe disposal, pest control operators shall adhere to the following procedures:

- a) Only as much pesticide as needed at one time of a specific application shall be prepared, and it shall be strictly in accordance with the instructions on the label.

- b) When the entire contents of a container are to be used, the container shall be emptied as far as possible, and the container and the measuring vessel shall then be triple-rinsed with the diluents, and the rinsings added to the mixture before it is made up to the final volume for application.
- c) To prevent unauthorized access to full or empty containers until they can be used or disposed of, all such containers shall be kept securely closed, stored under lock and key as described in 11.4, and records of such containers shall be kept.

9 Directives for conveyors of pesticides

9.1 Conveyors of pesticides shall acquaint themselves with the general procedures and precautions for the decontamination of vehicles and the disposal of pesticide waste as outlined in this standard. They shall also be familiar with the Hazchem system for the labelling of trucks and other bulk containers, and with the use of the Data bank.

9.2 Conveyors shall be fully aware of the hazards involved in the handling of pesticides, as stated in clause 4, and of further information given in Annex C regarding the toxicity of pesticides and the first-aid treatment in cases of suspected poisoning.

9.3 Conveyors shall also be familiar with the relevant procedures described in clause 11 for the safe disposal of pesticide waste and empty pesticide containers.

9.4 Conveyors shall note carefully the markings and internationally accepted cautionary and warning labels, as well as the product labels relating to commodities that are to be transported.

9.4.1 Toxicity classifications. The toxicity groups appearing on labels are explained in Annex C 1.1. A further toxicity classification for transportation purposes, i.e.; A, B1 or B2, appears on the label. Group I pesticides include A, or B1, and Group II, III and IV pesticides include those classified as B2.

9.4.2 Hazard labels. All pesticides bear additional precautionary marking on both the immediate and the outer containers, e.g. the "square-diamond" labels prescribed by IMO, ICAO, and IATA.

9.4.3 Where possible, pesticide waste shall be transported from the sponsor to the DO in their original labelled container. When the original container is damaged or defective, the pesticide shall be transferred to a suitable clean, compatible container, and the new container shall be adequately labelled to indicate the relevant active ingredient(s) of the pesticide waste.

Alternatively, damaged containers shall, for transportation to the DO, be placed in clearly labelled, chemically inert, water-proof packs or larger containers. Each container, whether empty or not, that is destined for storage or disposal, shall bear the appropriate square-diamond hazard label(s) (see 9.4.2).

9.5 In order to minimize problems that may be caused by accidents during the transportation of pesticides; conveyors shall adhere to the following guidelines:

- a) bulk containerization is preferable for all pesticides but shall be used for pesticides in quantities of 500 L or more, and all containers shall bear the relevant Hazchem label;
- b) vehicles with wooden floors shall not be used:

- c) pesticides of Group I (see 9.4.2 shall not be transported in the same vehicle as certain other goods such as foods, feed and clothing;
- d) during transportation, herbicides shall be kept separate from other pesticides, seeds and plant materials;
- e) when a relatively small quantity of pesticides is to be transported, it may be loaded together with other goods (excluding foods or feeds) on condition that it is adequately secured on a bed of sawdust or vermiculite of thickness at least 25 mm, and covered with a plastics tarpaulin;
- f) where practicable, supplies of absorbent material, laundry beach, hydrated lime or soda ash, an empty drum of adequate size, a shovel and a broom shall be kept in the vehicle for use in the event of an accident.
- g) welding or cutting of metal shall not be carried out at the scene of an accident until the area has been declared safe by a knowledgeable, responsible person, even when gas detection tests and explosimetry tests are involved (see 9.6(a).

9.6 In the event of an accident involving pesticides, the emergency shall be handled as follows:

- a) all power sources of the vehicle(s) (e.g engine, lights and battery disconnection switch) shall be turned off immediately. No smoking, sparks or flames shall be allowed until the decontaminator procedures have been completed. Gas detection tests and explosimetry tests are essential to establish the nature and extent of the hazard at the earliest possible stage of the emergency, and shall be performed wherever possible;
- b) road users in the vicinity of the accident shall be warned of the danger of contamination and prevented from passing through any spillages of pesticides on the road. If necessary, traffic shall be delayed or diverted until the road has been cleared;
- c) spectators shall be kept away from the contaminated area. During windy weather, if pesticidal gases, dusts or volatile shall be evacuated from down-wind areas that are likely to be affected.
- d) the contamination of streams and sewers shall be prevented as far as is possible. Ditches shall be dug around the contaminated area, and existing drainage ditches shall be so dammed as to prevent the run-off of pesticides. During windy weather, pesticidal dusts shall be so covered with plastics or canvas sheeting as to prevent scattering of the dust.
- e) No person shall be permitted to enter the vehicle(s) involved in the accident without the protective equipment described in 11.1. The nature of the spillage shall be identified from the available labels, and the police the manufacturer (or his agent), the local authority, fire and traffic authorities and the environmental officer shall be notified as soon as possible of the accident and of the pesticides involved.
- f) where doubt exists regarding the decontamination procedures to be applied, the manufacturer (or his agent) or the Poison information Centre shall be consulted, and the necessary cleaning material shall be obtained from the manufacturer (or his agent), a fire station or a farmers' cooperative.
- g) spillages and leakage shall be treated as described in 11.5 and the exterior or contaminated neighbouring containers that are still intact shall be washed thoroughly with concentrated detergent solution and rinsed

with water. Care shall be taken not to lose information on labels by inadvertently washing them off the containers.

- h) if any doubt exists about the contents of a container that has no label, the manufacturer, if known, shall be consulted, or otherwise the container shall be returned to the consignor.
- i) where pesticide spillages have leached into the soil, suitable treatment measures shall be applied to the contaminated area.
- j) if a particular vehicle is used on a permanent basis solely for the transportation of pesticides, contaminated flooring boards shall be cleaned thoroughly as described in 11.5, taking care to avoid any possible vapour hazards. In all other cases, contaminated flooring boards in a vehicle shall be removed and, if so required by the local authority, burned. In all cases, the vehicle shall be inspected and found to be free from contamination before it is re-used.

10 Responsibilities of pesticide provider

10.1 Pesticide provider shall investigate the following routes of disposal for surplus unwanted pesticides in the order of preference given below:

- a) when pesticides can be reconstituted, they shall, subject to the prior approval of the manufacturer (or her/his agent) be returned to the manufacturer or his agent;
- b) when the use of the pesticide(s) is prohibited in Rwanda, they shall be, subject to the prior approval of the manufacturer (or her/his agent), be returned to the manufacturer (or her/his agent) be returned to the manufacturer (or her/his agent); and
- c) when pesticides cannot be reconstituted or returned, they shall be delivered to or collected by a DO for disposal (see 9.3) or, where no convenient method of disposal exists for a pesticide, for safe storage (see 11.4) until an appropriate method of disposal can be developed.

10.2 Only unopened pesticide containers that are not unduly damaged may be returned to manufacturers by road transport. The contents of open or damaged containers shall be repacked in suitably relabelled product compatible containers that comply with the relevant laws and regulations on transportation of dangerous and toxic goods. Empty containers shall be recycled in accordance with national regulations.

11 Directives for disposal organisations

11.1 Protective equipment

11.1.1 The workers in a disposal organization shall understand clearly that even though protective clothing and respiratory safety devices are worn, great care shall still be taken in the handling of pesticides. Equipment and washable/disposable protective clothing as described in 11.1.1 - 11.1.3 below shall be provided by the DO.

11.1.2 Clothing, for reasons of both comfort and safety, a two-piece garment shall be worn in conjunction with cotton or other suitable underwear. PVC (never leather or cloth) aprons and boots and neoprene or PVC gloves shall be chemical-resistant and impermeable, and gloves shall extend to at least 75 mm above the wrists.

11.1.2 Protectors for Face and Head, Hoods that may incorporate a wide shield with a built-in respirator shall be made of the relevant materials and shall cover the entire head and neck, and face shields shall cover the entire face.

11.1.3 Respirators shall be either of the type that covers the whole of the face or of the type of poison and the physical characteristics of the poison (e.g. dust, liquid, vapour or gas), and they shall be capable of eliminating the risk of a wearer inhaling air polluted by the poison. A respirator shall form an airtight seal with the face, and filters and cartridges shall be within their rated shelf life, and readily replaceable. Users shall take cognizance of the type of canister and shall read the instructions of the label.

11.1.4 Self-contained breathing apparatus shall be available for emergency use, and the DO shall ensure that workers are trained in the proper use of this apparatus.

11.1.5 When a situation is being dealt with in which bursts, spillages or explosions may occur (e.g. PVC respiratory protection) shall be worn.

11.1.6 Maintenance of Protective Equipment, The DO shall ensure that protective equipment is maintained in a thoroughly serviceable condition. Spare articles, particularly filters, cartridges and canisters for respirators and air cylinders for self-contained breathing apparatuses shall be available.

11.1.7 Clean protective clothing, used protective clothing and the worker's personal clothing shall be kept apart from one another. At the end of each day, all protective clothing and respirators shall be decontaminated, washed, rinsed and dried.

11.1.8 If a worker's clothing becomes grossly contaminated during the course of a day's work it shall be replaced immediately with clean clothing, washed at the end of the day. Respirator canisters shall be replaced at the frequencies recommended by the manufacturer, and also when indicated by the expiry date. Before a canister is attached to a respirator, the seal on the canisters shall be checked to ensure that it is intact. Canisters that have reached the expiry date shall be punctured and safely disposed of.

11.1.8.1 During the cleaning of equipment and protective clothing, contamination of all sources of drinking water shall be prevented. Wash water shall drain into sewers and shall not be allowed to enter storm water drains.

11.1.8.2 Careless handling of contaminated protective equipment can cause injury, e.g. through skin contact, therefore caution shall be exercised when removing and cleaning such equipment.

11.2 Health precautions

The following precautions shall be observed by the DO:

- a) only workers who have been medically examined and found to fit for work involving exposure to pesticides may be employed for that purpose. May be employed for that purpose;
- b) workers shall not be allowed to eat, drink or smoke in an operating area. Before workers eat, drink, smoke, or use the toilet, their gloved hands shall have been washed with soap and water, their masks removed and their gloves removed (in that order), and their hands and faces then washed thoroughly with soap and water;

- c) it shall be ensured that workers removed all protective clothing at the end of each day or operation. In addition, whenever a worker becomes grossly contaminated, even if operations are incomplete, he shall be made to remove all protective clothing immediately, to soap, wash and rinse himself thoroughly, and to don clean protective clothing before continuing operations. (See also 11.1.3);
- d) the DO shall ensure that no worker wears any used protective equipment that has not been thoroughly cleaned;
- e) soap, clean towels and clean water shall be available near the operating area but shall be so located as to avoid contamination. Workers shall not be allowed to use unregulated compressed air to clean the body of dust, and care shall be taken to ensure that there is no interchange of towels between workers;
- f) where possible, running water shall be used for washing. When running water is unavailable, each worker shall be provided with separate, clearly marked containers for the washing, when necessary (see (c) above), of the body and of the protective equipment;
- g) the DO shall consider the problem of pollution caused by contaminated running water, and shall, when relevant, provide a facility for effluent treatment;
- h) the DO shall ensure by frequent atmospheric monitoring, that excessive inhalation of pesticidal vapours by workers does not occur, and that if the pesticide comes into contact with any part of a worker's skin, the affected part is washed immediately with soap and water;
- i) subjected to any restriction or further requirement laid down by the Ministry of Health, workers-exposure record card shall be kept by the DO for each employee engaged in the handling of pesticides. The card shall provide the following details:
 - 1) the name and address of the employee;
 - 2) each date on which pesticides were handled and the number of hours so spent each day by the employee;
 - 3) the common name (s) of the active ingredient(s) and the physical state of the formulation(s) involved;
 - 4) the fullest possible details of any occupational accident (including incidents that do not result in bodily injury);
 - 5) the date and nature of each case of poisoning;
 - 6) the medical practitioner's notes that include, inter alia, for each visit, the doctor's name, the date of examination and, when relevant, the dates of suspension from work and resumption of duty.
- j) the DO shall ensure that the following measures are strictly applied:
 - 1) each worker shall undergo a full medical examination at least once annually;

- 2) each worker shall, when he first assumes duty, undergo a blood test to determine his cholinesterase baseline level. Thereafter, if he is engaged in handling organophosphate or carbamate pesticides (or both), he shall undergo routine tests to determine his blood cholinesterase activity. If it has fallen to a level in one of the following ranges, the corresponding actions shall be taken:
 - i) **100% to 75% of normal:** Retest within 48 h; if the result is confirmed, the worker shall be suspended from handling organophosphate and carbamate pesticides for two weeks and shall then be retested routinely (e.g. every two days) until his cholinesterase baseline level is reached,
 - ii) **50% to 25% of normal:** Retest within 48 h; if the result is confirmed, the worker shall be excused from handling all pesticides and shall be retested routinely at the discretion of the medical practitioner, or
 - iii) **below 25% of normal:** Retest within 48 h; if the result is confirmed, the worker shall be **SUSPENDED FROM ALL WORK** and the medical practitioner shall be consulted.
- 3) Cholinesterase activity is expressed as a percentage of the activity in normal blood. The cholinesterase baseline level of each individual is specific for that individual and may, when expressed as an activity, be much lower than 100 %, Routine tests on such persons shall be carried out at the discretion of the medical practitioner.
- 4) Cognizance of other cholinesterase inhibitors, diet patterns etc, shall be taken.
- 5) A worker who has, in terms of (2) above, been suspended from carrying out any duty, shall be permitted to resume such duty, with the approval of the medical practitioner.
- 6) when employees are engaged in handling pesticides that contain bromide (s), blood samples shall be taken quarterly to determine bromide level of 3 mg (or greater) per 100 mL of blood is found, the worker shall be removed from a particular contaminant. Monthly blood tests shall then be done until his blood levels return to normal. He may then resume duty
- 7) if a worker complaints of ear ache, he shall be examined for burst ear-drums by a medical practitioner;
- 8) No worker shall be allowed to take part in handling pesticides while he is suffering from any clinical complaint or stomach ailment, or if he has burst ear-drums;
- 9) if any worker shows symptoms of illness or discomfort (e.g. headache, dizziness, vomiting diarrhea, tightness of the chest) , or if unusual neuropsychiatric behaviour becomes apparent, the worker shall be suspended from work without delay, and a medical practitioner consulted immediately;
- 10) in the event of illness or an accident, the employee's works-exposure record card and in the case of suspected poisoning due to a pesticide, the label, or at least the name of the active ingredient of the pesticide, shall be handed to the medical practitioner in attendance; and

- 11) no worker who on medical grounds has been advised to abstain from working with one type of pesticidal compound, shall be allowed to work with another type without, the prior approval, endorsed on his works-exposure record card, of a medical practitioner.

11.3 Medical and first-aid facilities

11.3.1 Medical facilities, before establishing his business, the DO shall acquaint himself with the locality of the nearest hospital or medical consulting rooms and their hours of attendance, and shall inform the hospital and the medical practitioner of the nature of the intended operations.

11.3.2 First-aid facilities, a first-aid kit (see Annex A for a description of a suitable kit) shall be on hand at all times when pesticides are being disposed of, and it is imperative that at least two members of each team be trained to apply first-aid treatment, with particular reference to the hazards likely to be encountered (see Annex C).

In addition to the first-aid kit, a supply of medical grade oxygen and a suitable mask, or a manual resuscitating device shall be available. All equipment shall be regularly checked.

11.3.3 Antidotes, Antidotal tablets or injections for the treatment of cases of poisoning by the chemicals involved shall be available at all times and shall be carried to each operating area in a separate sealed package, with the nature of antidotes clearly marked and with instructions as to their administration. Antidotal injections shall be administered by an appropriated qualified person as soon as the cause of poisoning has been confirmed. The antidote package, together with the poisoning has been confirmed. The antidote package, together with the poisoned worker's works-exposure record card (see 11.2(i) and the label of the pesticide concerned, shall be handed to the person treating the case of poisoning.

11.3.4 In case of poisoning, the first-aid treatment shall be given immediately by a suitably qualified first-aid-er.

11.4 Storage of pesticides and pesticide waste

11.4.1 In accordance with the applicable and regulations, a license is necessary for the supply or keeping for supply of all pesticides. A licensee has to keep separately all hazardous substances in his possession in a securely locked poison store.

The DO shall, when relevant, notify the appropriate local authorities of the existence on his premises of such a poison store.

11.4.2 All pesticides shall be kept under lock and key. Herbicides and all phenoxy compounds shall be stored separately from other pesticides.

11.4.3 Unless the mixture is registered in terms of the applicable and regulations, a mixture of two or more pesticides shall not be prepared and then stored, because disposal techniques may differ for the different pesticides.

11.4.4 When an original pesticide container is damaged, the pesticide shall be transferred to a suitable clean compatible container, and the new container clearly labelled. All containers shall be inspected regularly for leaks.

11.4.5 The DO shall keep, in an area away from the storage room/area, an inventory of all containers of waste pesticides on the premises, and this inventory shall be available at all times for inspection by the local authorities.

11.4.6 To facilitate the cleaning-up of spillages and leaks, the storage room/area shall have a suitable floor that has at least the impermeability of reinforced concrete. The floor shall be bunded, and shall slope slightly, so that spit liquids drain into specific areas.

11.4.7 The storage room/area shall be so ventilated as to prevent the build-up of vapours.

11.4.8 Suitable fire extinguisher, preferably foam or dry powder extinguishers (or both), together with sawdust or sand to absorb leakage, and suitable empty containers, shovels, squeegees and brooms, shall always be available and easily accessible from the storage room/area.

11.4.9 The storage room/area shall be secured against unauthorized entry and against burglary. Warning notice shall be posted on the outside face of the door of the storage room or around the storage area; they shall be legible at a distance of 8 m, shall bear skull-and-crossbones and shall read as follows;



The warning notices shall be in all official languages. Alternatively, internationally accepted cautionary labels may be used.

11.4.10 Suitable symbolic safety signs shall be posted in and around the storage room/area.

11.4.11 Signs which are likely to be suitable cover warnings about fire, explosion and corrosion hazards, and prohibitions against smoking, fire and water shall be posted within the vicinity of the pesticides.

11.5 Spillages and leakage on storage premises

11.5.1 Precautions

The following precautions shall be taken in the event of a spillage or leakage from a container:

- a) care shall be taken to avoid skin contact with, and inhalation of gases from, the product. While cleaning up spillages or leakages, workers shall wear the appropriate protective clothing described in 10.1.1 and 10.1.2 and shall work from the up-wind side of the spillage wherever possible. The affected area shall be isolated, and access shall be denied to unauthorized persons;

- b) the identity and nature of the hazards of a leaking pesticide shall be established, and if procedure for the cleaning-up of the contaminated area are unknown, the manufacturer of the product (or her/his agent) shall be consulted for advice;
- c) to prevent cross-contamination, broken end leaking containers shall be removed from the remainder of the stock and placed in suitable larger containers to prevent the leaking pesticide from spreading over a large surface. If possible, the contents of broken containers shall be placed in suitable, clean compatible containers that are carefully labelled, and held pending instructions from the manufacturer (or his agent) for their return or disposal. Damaged or leaking 200 L drums shall be placed in commercially available unlined steel over drums;
- d) slings shall be available for the easy handling of the over drums; and
- e) Severely contaminated wooden or concrete floors of building can never be completely decontaminated by washing. Concrete floors shall be thoroughly washed and then sealed and, if so required by the local authority, wooden floors shall be taken up and burned.

11.5.2 Dry spillages

11.5.2.1 Powders shall be swept up, or picked up with an appropriately filtered industrial vacuum cleaner and placed in compatible containers. If the spilt powder is very fine and no vacuum cleaner is available, the powder shall be sprinkled with small quantities of water or covered with damp sawdust or sand to prevent it from spreading.

11.5.2.2 In the case of those pesticides that contain metallic phosphides, special precautions are necessary. Any spilt powder shall be swept up and placed in a metal drum containing water. As phosphine gas will be liberated, the operators shall wear effective respirators, and the operation shall be carried out in an open area well away from spectators.

11.5.2.3 The entire contaminated area shall be doused with a 1:1 mixture of a laundry bleach and water. Hydrated lime or soda ash shall then be spread over the contaminated area and left for at least 1 h. Soda ash shall be handled with care and stored in a closed container, in a dry place. The excess liquid shall then be absorbed in sand (or any other absorbent material, such as sawdust or cotton waste) and the mixture shovelled into marked compatible containers. The entire area shall be swept, and the sweepings added to the container(s). The area shall be doused again with the bleach solution, allowed to stand for 30 min and then washed down with water as a final clean-up, taking care to limit run-off water. The rinse water, shall, if possible, be absorbed as before, preferably with cotton waste, and added to the sweepings in the container(s). The sweepings and the used brooms shall be buried immediately in a landfill (see 11.6.5), and the empty damaged containers disposed of as described in 11.8.3.

11.5.3 Liquid spillages

A small dam shall be formed around the spillage, using absorbed material as outlined in 11.5.2.2 to prevent further spread of pesticide. The spillage shall be soaked up in absorbent material which shall then be placed in open-headed metal drums. Finally, the contaminated area shall be treated in the manner described in 11.5.2.2.

When dealing with spillages or leakage of chemical formulations that chlorates, extreme care shall be taken not to bring the chemicals into contact with reducing agents (see also 6.3).

11.6 General methods for the safe disposal of pesticides

11.6.1 Incineration

11.6.1.1 Incineration is applicable to wastes, containers and sweepings of organic pesticides only, excluding organo-metallic and hormone pesticides.

11.6.1.2 Experimental investigations of a wide range of pesticides have shown that the temperature ranges for complete combustion of reference standards and formulations are from 250 °C - 879 °C and from 508 °C – 852 °C, respectively.

11.6.1.3 However, there are a few exceptions, and it seems safe to assume that temperature near 1 000 °C a residence time of at least 2 sec is sufficient to degrade at least 99 % of most commercial pesticides. The rest of these pesticides require temperatures in excess of 1 200 °C for degradation.

11.6.1.4 Ash that results from the incineration of pesticides, pesticide waste or pesticide containers shall be removed from the incinerator at regular intervals and buried in a landfill (see 11.6.5);

11.6.2 Types of incinerators

11.6.2.1 Plant incinerator, a plant incinerator is a permanent installation, and consists essentially of a primary (and sometimes a secondary) combustion chamber with supply points for fuel, pesticide waste and air. Hazardous and corrosive gases (such as chlorine, fluorine, bromine, oxides of nitrogen and sulphur, and ammonia) produced during the incineration of pesticides shall be removed from the exhaust by scrubbing systems. The exhaust gases may be scrubbed with an alkaline medium or scrubbed with water and the resulting acids neutralized.

NOTE 1 In addition to the information contained in this subsection, DO's are advised to consult the recommended additional literature listed in Annex B.

NOTE 2 Disposal of pesticides where ground or surface water resources can be endangered is not permitted.

The typical flow diagram for a plant incinerator for pesticide waste and contaminated containers is given in Figure 1.

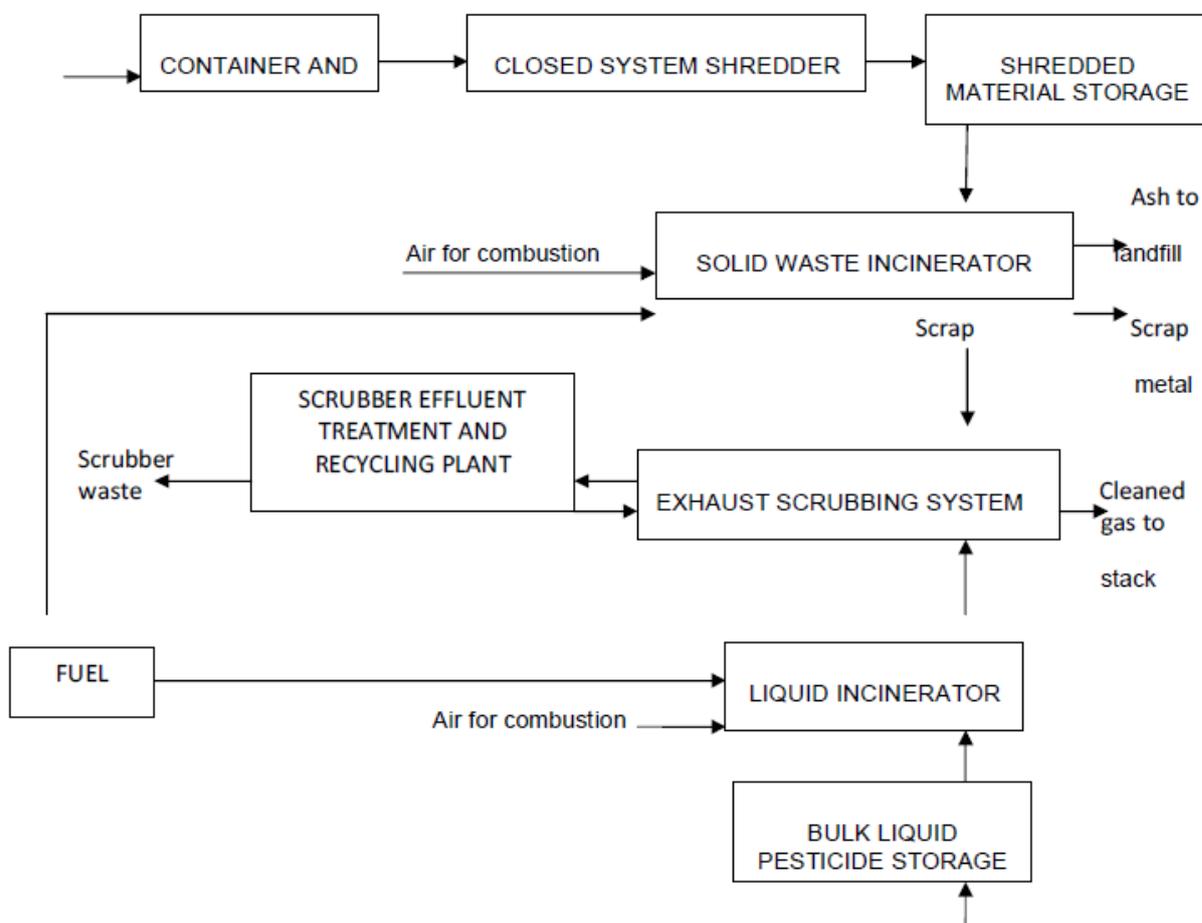


Figure 1 — Typical flow diagram for plant incinerator

11.6.2.2 Pit incinerator, the pit incinerator is the simplest and the least costly. It is suitable for the incineration of solid waste such as low pesticide content formulations, containers, contaminated cloth and sweepings. It is especially suitable for use by pesticide formulators and DO, but its use is limited by the production of fly ash and the relatively narrow range of waste products that can be burned with production of clear effluent gases.

The pit incinerator consists of a steel enclosure that has an open top and lined with firebricks. The waste is fed in from the top, and ash is collected from a door in the side. The unit shall be equipped with an auxiliary burner if the waste cannot maintain its own combustion. Other wastes can be maintained and promoted by an abundance of air supplied by a fan unit via nozzles spaces along the top of one pit wall. The air jets are directed in such a way, i.e. 30 downwards from the horizontal plane, as to induce a rolling flame.

Because of the abundance of air supplied for combustion and the relatively long residence time of the effluent gases induced by the rolling flame principle, the effluent gases are practically transparent and have a high average combustion temperature (1 000°C - 1 200°C).

11.6.3 Physical degradation

High-energy irradiation of dilute suspensions of pesticides has proved successful in breaking down the molecular structures, particularly in the case of chlorinated hydrocarbons.

11.6.4 Chemical degradation

Some formulations may be detoxified and reconstituted to a different product that has fewer toxic properties or converted into a more acceptable form of the same compound. One or more of the following methods may be applicable and appropriate investigations shall be carried out before a pesticide is buried in the soil:

- a) removal of ions by precipitation;
- b) concentration of dissolved substances by ion-exchange or coagulation – the concentrated substances may then be disposed of or re-used;
- c) oxidation with hydrogen peroxide, potassium permanganate, oxygen, chlorine, etc;
- d) degradation by the action of liquid ammonia (in the presence of metallic sodium or of metallic lithium), or by the action of sodium biphenyl;
- e) rapid separation of compounds may be effected by the action of lime or alum or ferric compounds,
- f) treatment with strong acids or alkalis, and
- g) Most of the chemicals referred to above are hazardous and shall be used with care.

11.6.5 Biological degradation

Biodegradable pesticides are detoxified by micro-organisms. Pesticides that are resistant to biodegradation break down to products when thermally shocked at 200 °C - 400 °C for 10 min. Biological filters, sewage lagoons, activated sludge plants, or landfills may be used as sources of micro-organisms.

11.6.6 Ground disposal

Landfills shall be situated on a disposal site owned by DOs and registered and licensed the designated authority. Cognizance of the classification of a landfill site in terms of the above regulations shall be taken before disposal of toxic wastes or their empty containers is attempted.

11.7 Methods for the safe disposal of specific pesticides

11.7.1 Disposal of organophosphorus pesticides

Organophosphorus pesticides shall be safely buried in a landfill (see 11.6.5) or incinerated (see 11.6.5) or incinerated (see 11.6.1).

11.7.2 Disposal of organohalide pesticides

These chemicals are best disposed of by incineration in a plant incinerator (see 11.6.1.1) Organohalide pesticides release the corresponding acid vapours when burned. These acids shall be removed from the exhaust gases by scrubbing as described in 11.6.1.1.

Alternatively, organohalide pesticides shall be encapsulated in relatively impenetrable material, e.g. concrete, and then buried in a landfill (see 10.6.5).

11.7.3 Disposal of organometallic and inorganic pesticides

11.7.3.1 Organometallic and inorganic pesticides shall be incinerated before the heavy metals have been removed from the compounds. When it is a viable proposition, consideration shall be given to the recycling of these metals.

11.7.3.2 The removal of heavy metals before incineration of organo-metallic pesticides, other than those mentioned in (b) below, shall preferably be by appropriate chemical or physical treatment. If satisfactory methods are unavailable for the appropriate treatment and incineration of these organometallic pesticides, the pesticides may be buried in a landfill (see 11.6.5).

11.7.3.3 All inorganic pesticides and organic pesticides that contain mercury, lead, cadmium or arsenic shall be chemically deactivated to form non-hazardous compounds, and the heavy metals shall be removed, if chemical deactivation facilities are unavailable, such pesticides shall be encapsulated in relatively impenetrable material, e.g. concrete, and then buried in a landfill. Records sufficient to permit location for retrieval shall be maintained by the DO.

11.8 Empty pesticides containers

11.8.1 Re-use of pesticide containers

11.8.1.1 In terms of the Pesticides Control Act, containers of Group I poisons shall not be re-used except as Group I poison containers (provided they are still in a sound condition). If any container is to be considered for re-use, the following shall be established.

- a) the nature of its previous contents;
- b) the condition of the container;
- c) the nature of its future contents; and
- d) the availability of facilities for decontamination and, if necessary, reconditioning of the container.

11.8.1.2 The container shall not be re-used if there are any doubts about 11.8.1.1(a), (b) or (c). Re-use shall only be considered when the future contents are the same or of the same type as the previous contents. If the container requires reconditioning, the work shall be entrusted to competent professionals who possess facilities for the safe decontamination of containers and for disposal of product residues. The DO shall ensure that decontaminated containers intended for re-use by manufacturers are so-free of residues as not to pose any hazard. Lacquer-lined metal containers shall not be re-used.

11.8.2 Decontamination of pesticide containers

11.8.2.1 Non-combustible and re-usable container. Non-combustible and Re-usable containers, especially those of pesticides that are susceptible to chemical degradation by alkalis, may be decontaminated as follows:

- a) the container shall be drained as completely as possible (see (h) below); and
- b) a mixture of water, detergent and caustic soda in the appropriate proportions given in table 1 shall be added carefully to the container.

11.8.3 Table 1 – Rinse solution mixtures for pesticide

Containers of various sizes			
1	2	3	4
Container size, L	Volume of water t	Volume of dry detergent mL	Mass of caustic Soda g
L ≤ 20	0.5	15	120
20 < L ≤ 50	2.0	60	120
50 < L ≤ 100	6.0	60	230
100 < L ≤ 200	11.5	120	500
L > 200	19.0	230	1 000

11.8.2.2 For glass containers, the caustic soda shall first be dissolved in water in a separate metal container, and the solution poured into the glass container only after it has cooled enough to avoid breaking the glass. It shall be borne in mind that caustic soda itself poses a hazard.

11.8.2.3 The bungs and other closures shall be tightened and the container rotated carefully to wet all inner surfaces with the rinse solution.

11.8.2.4 Any pressure that builds up during this operation shall be released carefully.

- a) the container shall be left to stand for at least 15 min, and occasionally agitated;
- b) all bungs and closures shall be removed carefully and the container drained;
- c) the container shall be thoroughly flushed with clean water and allowed to dry thoroughly;
- d) all bungs and closures shall be replaced and tightened; and
- e) all used solutions shall be disposed of in a landfill as described in 11.6.5.

11.8.4 Disposal of pesticide containers

The method of disposal of empty pesticide containers depends on the nature of the container.

11.8.4.1 Combustible containers

Combustible containers such as paper bags (single-wall or multi-wall), plastic bags (single-wall or multi-wall), plastic bags, cardboard boxes, fibre drums, fibre canisters, wooden boxes, cloth bags and burlap bags shall not be burned, except by incineration (see 11.6.1). If an incinerator is not available, these containers shall be buried in a landfill (see 11.6.5).

Containers of organic and metallic pesticides produce a toxic smoke which may be hazardous to homes, people or livestock nearby, and such containers shall therefore not be incinerated, but shall be buried in a landfill.

11.8.4.2 Non-combustible containers

Examples of non-combustible containers are those made of certain plastics, glass and metal. All noncombustible containers, except those that have contained herbicides and inorganic or metallic pesticides (see 12.8.3.5).

Metal containers that have a capacity of less than 20 L and all other non-combustible containers (except aerosol cans) shall first be triple-rinsed or otherwise decontaminated as directed by the manufacturer, the local government authorities or by the Ministry of Health. They shall then be punctured and crushed (in the case).

11.8.4.3 Aerosol cans

11.8.3.3.1 Empty aerosol cans that cannot be discharged because of faulty valves shall be emptied as far as possible in accordance with the following procedure:

- a) cool the can to -30 °C in a dry-ice chest for 1 h.
- b) remove the can from the dry-ice chest and puncture it immediately with a suitable sharp instrument.
- c) place the punctured can in a suitable container, and leave it to warm in a well-ventilated space (e.g. a fume cupboard) so as to vaporize the propellant.
- d) the can and any remaining contents shall finally be buried in a landfill (see 11.6.5).

11.8.4.4 Metal containers

Metal containers that have a capacity of at least 20 L shall be disposed of in one of the following manners, when relevant:

- a) the containers shall be triple-rinsed or otherwise decontaminated, and then returned promptly to the manufacturer or formulator for possible re-use for pesticides of the same group;

- b) empty drums shall, where necessary, be decontaminated and reconditioned prior to re-use (see 11.8.1), by triple-rinsing followed by the mechanical removal of the heads. The drums shall then be inverted and heated by direct flame to at least 600 °C for about 10 min in a special drum furnace. After cooling, the interior and exterior surfaces of the drums shall be shot-blasted or sand-blasted to remove all traces of foreign matter, after which the interior surfaces shall be relined with a protective coating, and the exterior surfaces shall be repainted; or
- c) empty drums that are not suitable for re-use may, after triple-rinsing, be recycled in a steel-melting plant for scrap metal. They may, before melting be supplied to engineering firms as containers for metal shavings, etc, that are also to be melted down. In such cases, the engineering firms shall be responsible for safe storage and handling of the drums from the time of receipt to the time of delivery to the steel-melting plant.

11.8.4.5 Containers of herbicides, and inorganic or metallic pesticides

These containers shall be triple-rinsed, broken or punctured and crushed, and buried in a landfill (see 11.6.5).

12 Treatment of pesticides during fires

12.1 Appropriate fire-fighting and ancillary equipment shall be available in places where pesticides are stored and shall be carried by vehicles that are used for the transportation of pesticides. A list of suitable items is given below (see also Annex C):

- a) protective clothing, respirators and self-contained breathing apparatus, as described in 11.1;
- b) gas sampling pumps and appropriate detection tubes;
- c) dry chemical powder fire extinguishers;
- d) alcohol-resistant fire extinguishing foam plus delivery equipment;
- e) explosimetre;
- f) 25 kg bags of hydrated (sacked) lime or soda ash;
- g) 5 L containers of laundry bleach;
- h) 25 kg bags of dry sawdust;
- i) a supply of empty sacks and labels for contaminated sawdust;
- j) two large brooms, two shovels and squeegee;
- k) one stainless steel 250 mm funnel;
- l) one 25 L open-head drum;

m) one 200 L open drum, and

n) over drums and slings for transferring leaking drums into the over drums.

12.2 When a fire breaks out in a storage area or during transport, e.g. at a road accident, the nearest fire station, the manufacturer (or her/his agent) and other relevant authorities shall be notified immediately.

12.3 Spectators shall be kept away from fires that involve pesticides, and all persons down-wind from such fires shall be evacuated. It is essential that respiratory equipment, preferably self-contained (air-supplied) breathing apparatus, be worn by all persons involved in extinguishing the fire, and that when there is wind they do not work from and that when there is wind, they do not work from the down-wind direction. Fire fighters shall not eat, drink or smoke in the fire-fighting area.

12.4 Small fires involving pesticides may be extinguished with dry chemical powder (or a hand foam unit) or carbon dioxide. Fire extinguishers that have a halogenated hydrocarbon base may be used in well-ventilated areas.

12.5 Foam shall be used where large volumes of pesticides and, in particular, flammable liquids are burning. Alcohol-resistant foam shall be used where flammable water-soluble concentrates or emulsifiable concentrates are involved.

12.6 Water fog or fire spray shall be used to extinguish medium-size fires, unless stacks of paper – or fibreboard containers or phosphine-releasing compounds are involved. Water mists or fogs, or soft streams of water shall be used to preclude the breakage of glass containers. The volume of water used to extinguish the fire shall be kept to a minimum so that the least possible toxic run-off is produced. When relevant, the run-off shall be dammed (see 11.5.3) to prevent it from entering sewers, water supplies or low-lying areas. Drums containing liquids shall be cocked with a water spray to prevent them from exploding or rupturing. Stacks of paper or fibreboard containers may be protected by a water curtain if care is taken to avoid wetting them.

12.7 When the fire has been extinguished, the area shall be cleaned as described in 11.5.2.

Annex A (normative)

First-aid kit

A.1 A first-aid kit for use in the cases of poisoning shall contain at least the following items;

- a) an eye wash-bottle containing distilled water or rinse solution;
- b) a drinking glass or feeding cup;
- c) emetic-ipecacuanha syrup;
- d) about 200 g of activated charcoal in powder or tablet form;
- e) a demulcent, e.g milk of magnesia or soluble starch; and
- f) any special equipment antidotes, etc. That may be required, in view of the specific chemicals to be applied.
- g) a flask of fresh water (at least 5 L)
- h) washing basins/airs
- i) towels;
- j) soap
- k) sponges
- l) disposable gloves for the person treating the case;
- m) blankets;
- n) spare clothing;
- o) spoors;
- p) a manual respiratory resuscitating device; and
- q) an oxygen resuscitation kit.

A.2 Antidotes shall be kept separate from the other items (see 11.3.3).

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Annex B (normative)

Freight emergency kit

The following freight emergency kit, consisting of five boxes, is recommended for use by DOs, major transport companies, manufacturers and formulations

Table B.1 — Freight emergency kit

<p>Box No.1</p> <p>1 woodier mallet Assorted wooden burgs Assorted wooden wedges rolls of PIFE tape rolls of adhesive tape Associated jubilee clips 1 ball of nylon twine Open-ended spanners 1 set metric up to 38 mm 1 set imperial up to 1 1/2 1 hacksaw 10 pare hacksaw blades 1 adjustable pipe-wrench, 355 mm 1 adjustable spanner, 203 mm 1 cold chisel, 178 mm 1 pair of pliers 1 screwdriver pair of scissors pair of in snips 1.2 kW angle grinder 1 extension lead.</p> <p>Box No.2</p> <p>PVC suits visors and hoods 2 pains of PVC gloves</p>	<p>Box No 2 (continued)</p> <p>pairs of PVC Sleeves pairs of goggles 2 pairs of PVC gumboots (sizes 256 and 280) high visibility motorway jackets Gas detection instrument and appropriate tubes Explosimeter Technical information files 2.5 L liquid detergent In liners Polythene bags, small Rags Sample bottles and a suitable scoop 2 hand torches (intrinsically safe) 1 earthing cable, of length 3 m - 5 m Route guide Road maps</p> <p>Box No 3</p> <p>1 self-contained breathing kit with compressed air bottles and spare bottles. NOTE Training in their use is imperative. 1 oxyacetylene cutter, with cylinder and valve key</p>
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Freight emergency kit (continued)

Box No 4	Box No.5
2 PVC suits (elasticized at wrist and ankle) 2 pairs of rubber gloves 2 pairs of rubber boots (with protected toe caps) 2 visors 2 gasmasks with canisters 2 self-contained treating kits with compressed air bottles and spare bottles (NOTE Training in their use is imperative) Safety helmets Goggles Solution to prevent blurring of goggles Spare canisters for respirators	1 flameproof portable generator (3 KW or more) "jaws of life" or similar emergency equipment 1 hydraulic lifting jack 1 electric centrifugal pump plus suitable hoses 1 electrically driven winch with steel cables (rated at 50 t) 1 electrically driven winch with steel cables (rated at 50 t) 1 electric blower with flexible pipes Floodlights (flameproof) 1 loudhailer

Annex C (normative)

The toxicity of pesticides, the symptoms of poisoning, and first-aid treatment in cases of suspected poisoning

C.1 Toxicity of pesticides

C.1.1 Degree of toxicity

The labels on pesticide containers indicate the degree of toxicity of the active ingredient in accordance with the applicable regulations.

This classification is based on the toxicity of the active ingredient and does not necessarily reflect the hazardous nature of the formulation under conditions of disposal; caution shall therefore be observed when dealing with pesticides despite their group toxicity classification.

- a) Group I includes pesticides containing active ingredient(s) that have an oral LD50 of less than 50 mg/kg and a dermal LD50 of less than 200 mg/kg, or that are extremely hazardous for some other reason. Containers are marked "POISON. EXTREMELY TOXIC" and bear the skull-and-crossbones sign.
- b) Group II includes pesticides containing active ingredient(s) that have an oral LD50 of 51 mg/kg - 500 mg/kg and a dermal LD50 of 201 mg/kg - 2 000 mg/kg and a dermal LD50 of 201 mg/kg - 2 000 mg/kg. Containers are marked "POISONOUS".
- c) Group III includes pesticides containing active ingredient(s) that have an oral LD50 of 501 mg/kg - 5 000 mg/kg and a dermal LD50 of more than 2 000 mg/kg. Containers are marked "CAUTION".
- d) Group IV includes pesticides containing active ingredient(s) that have an oral LD50 of more than 5 000 mg/kg and a dermal LD50 of more than 2 000 mg/kg. Containers bear no special markings.

C.1.2 Nature and routes of poisoning

C.1.2.1 The poisonous action of pesticides is based on the intake of these substances by the body via three routes, i.e. through:

- a) the skin and the mucous membranes.
- b) the mouth; and
- c) the respiratory organs.

C.1.2.2 The poisoning can be either acute (i.e. caused by single intake or a few smaller intakes of a sufficiently large quantity of chemical) or chronic (i.e. caused by repeated intakes of small sub lethal quantities

of a chemical over an extended period of time). In addition, skin or eye irrigation can occur in individuals who are susceptible to these chemicals.

C.2 Symptoms of poisoning

C.2.1 Medical condition and symptom

- **Anoxemia** Low tension of oxygen in arterial blood;
- **Antabuse effect** Ingestion of alcohol after exposure to dithiocarbamates causes intense vasodilatation of face and neck, tachycardia, followed by nausea, vomiting, pallor, hypotension, convulsions, vertigo, cardiac arrhythmia, myocardial necrosis, coma and death.
- **Ataxia** lack of co-ordination;
- **Cyanosis book;** blue colouring of skin and mucous membranes owing to lack of oxygen in the
- **Delinium** conditions of extreme mental and motor excitement;
- **Dysphoea** rapid shallow breathing;
- **Hypotension** subnormal arterial blood pressure
- **Incontinence** inability to prevent discharge of bladder and bowels;
- **Lacrymation** excessive secretion of tears;
- **Mania** a mental disorder characterized by excitement and violence
- **Myocardial** relating to the heart muscle,
- **Narcosis** unconsciousness produced by narcotics;
- **Necrosis** death of cellular tissue;
- **Neuritis** inflammation of a nerve or nerves;
- **Cedema** accumulation of fluid in intercellular tissue;
- **Oliguria** scanty urination;
- **Parkinsonism** progressive chronic disorder of the central nervous system;
- **Psychosis** any form of severe mental disorder;

- **Pulmonary** relating to the lungs;
- **Tachycardia** rapid heart beats in excess of 100/min
- **Tachypnoea** very rapid breathing;
- **Tenesmus** effective straining to empty bowels or ladder;
- **Tetany** intermittent muscular contractions;
- **Uremia** accumulation of waste products in the blood;
- **Vertigo** dizziness.

NOTE The explanations may be of assistance in understanding the lesser-known medical terms.

C.2.2 Chemical poisoning and symptoms

C.2.2.1 Carbon disulphide

Carbon disulphide is a cumulative poison and chronic exposure to it leads to disturbance of peripheral nerve functions and of vision (absence of corneal reflex). These symptoms are followed by weight loss, neuropsychiatric effects (such as emotional disorders, depression, psychoses, mania, hallucinations and parkinsonism), multiple peripheral neuritis, weakness and paralysis. Acute poisoning is characterized by irritation of the skin, eyes and mucous membranes, headache, garlicky breath, nausea, vomiting diarrhea, abdominal pain, weak pulse, palpitations, fatigue, unsteady gait, neuropsychiatric effects (as with chronic poisoning), central nervous system depression with respiratory paralysis, and coma or convulsions resulting in death.

C.2.2.2 Chlorinated hydrocarbons

The main symptoms of mild poisoning are vertigo, nausea, vomiting and diarrhea. In case of severe poisoning, twitching of eyelids, trembling of head and neck, system, and coma occur.

C.2.2.3 Chlorophenoxy compounds

Poisoning by these compounds (which are usually used as herbicides) has been observed after ingestion only. It causes stupor, muscular weakness, twitching of eyelids, disturbances in the body temperature regulation, incontinence, ataxia and paralysis.

C.2.2.4 Dithiocarbamate fungicides

Dithiocarbamates possess a very low order of mammalian toxicity but could be strongly irritating to the skin, eyes and mucous membranes, and could cause dermatitis. A dangerous toxic reaction to alcohol after exposure to dithiocarbamates has been observed ("Antabuse effect").

C.2.2.5 Ethylene dibromide

Inhalation of ethylene dibromide causes pulmonary lesions and liver damage. It is a recognized potential carcinogenic. Symptoms of poisoning are nausea and vomiting, headache, irritation of mucous membranes, abdominal pain, excitability, drowsiness, dizziness, delirium, respiratory slowing, hypotension, twitching of muscles, central nervous system depression, pulmonary oedema, cyanosis and coma.

C.2.2.6 Ethylene dichloride

Symptoms of poisoning are drowsiness, vertigo, headache, irritation of mucous membranes, corneal clouding and lacrymation, mental confusion, insomnia, abdominal cramps, nausea and vomiting. More severe symptoms may follow one or two weeks later, especially cellular necrosis of the kidneys and liver, uremia, oliguria, dyspnoea and convulsions. Central nervous system depression and respiratory failure may precede death.

C.2.2.7 Ethylene oxide

Ethylene oxide causes intense irritation of the skin (blisters), mucous membranes and lungs, with the production of pulmonary oedema. Further symptoms of severe poisoning are nausea, vomiting, diarrhea, headache, vertigo, central nervous system depression with dyspnoea and respiratory arrest, and liver and kidney damage, all resulting in death.

C.2.2.8 Hydrogen cyanide

Symptoms of chronic poisoning are fatigue, weakness, vertigo, nausea, vomiting, increasing irritation of the mucous membranes of the eyes, throat or upper respiratory track, and a sensation of pressure in the forehead. Symptoms of acute poisoning include those of chronic poisoning as well as a burning sensation on the tongue, a metallic and irritating taste in the mouth, constriction of the throat, with the exhaled breath sometimes smelling of bitter almonds. There is general oppression, confusion, disturbed equilibrium, stabbing pain in the head, forming at the mouth, dilated pupils, hypotension, violet tenesmus and convulsions, tachycardia, tachypnoea changing to dyspnoea accompanied by a rush of blood to the head, and paralysis, respiratory arrest, and coma. Death may occur within 1/4 h to 1 h.

C.2.3 Metallic pesticides

Metals may appear in pesticide compounds but they are not usually responsible for the toxic properties of the formulating e.g. maneb and zineb which primarily shall be regarded as dithiocarbamate fungicides. However, in the case of compounds such as triphenyltin, arsenic trioxide and arsenic pentoxide, the tin and arsenic contained in the compounds are themselves toxic. Symptoms of tin poisoning are stimulation and subsequent depression of central nervous system, vomiting and diarrhea. Symptoms of arsenic poisoning are severe gastric pain. Vomiting, profuse watery diarrhea, numbness and tingling of the extremities, particularly of the feet, followed by intense thirst and muscular cramps.

C.2.3.1 Methyl bromide

Symptoms of chronic poisoning are central nervous systems depression and renal failure. Acute poisoning shows the following symptoms. Vertigo followed by double or blurred vision, impaired or slurred speech, mental confusion, hyperactivity, numbness of the extremities, nausea and vomiting, skin rashes of various types, unusual fatigue, headache, loss of appetite, abdominal pain, ataxia, mania, convulsion, renal failure, coma, and circulatory and respiratory failure.

Exposure to high concentrations may also cause pulmonary edema and narcosis. Symptoms may be delayed from 8 h - 48 h.

C.2.3.2 Organophosphorus and carbamate compounds

Symptoms of poisoning are headache, vertigo, nausea, pain in the chest, anxiety, lacrimation, and papillary constrictions. In a serious case of poisoning there may be cramp, diarrhea, excessive perspiration, tightness of chest, and convulsions. Whole-blood cholinesterase activity determinations are imperative for guidance in taking preventative action. (Depressed levels of cholinesterase activity indicate poisoning).

C.2.3.3 Phosphine

Depending upon the quantity of gas inhaled, symptoms of poisoning may appear immediately or only after a few hours. The symptoms are general fatigue; a feeling of coldness, nausea, abdominal pain, vomiting, diarrhea, vertigo and staggering gait, pains in the chest, dyspnea and oliguria. Very serious poisoning rapidly results in strong dyspnea, bronchitis, cyanosis, agitation, tetany, ataxia, anoxemia and unconsciousness. Death may be caused immediately or days after by pulmonary edema and collapse or paralysis of the central nervous system, as well as by edema of the brain.

C.3 First-aid treatment in case of suspected poisoning

C.3.1 In case of a suspected poisoning a medical practitioner shall be summoned immediately while first-aid measures are applied, or else first-aid shall be initiated and the poisoned person taken to the medical practitioner as a matter of urgency. The medical practitioner shall be informed of the label or chemical name of the active ingredient of the pesticide.

The label of the pesticide and the works-exposure record card of the poisoned worker shall be shown to the medical practitioner without delay.

C.3.2 The following preliminary first-aid measures shall be taken immediately by one of the trained members of the team.

- a) if the poisoning was caused by inhalation of a chemical the patient shall be removed from exposure to the contaminated atmosphere;
- b) if breathing has stopped, artificial respiration shall be applied. If breathing is difficult, oxygen shall be administered for a maximum period of 1 h;

NOTE Where poisoning was caused by phosphine, methyl bromide or hydrogen cyanide, mouth-to-mouth resuscitation could be fatal to the first-aider.

- a) if the heart has stopped beating, cardiopulmonary resuscitation shall be applied;
- b) clothing soiled with chemicals shall be removed, the skin (and hair, where relevant) rinsed with cool clean water (to avoid heating of the skin which could promote absorption), sponged gently with cool water and soap (and shampoo where relevant, and finally rinsed with fresh clean cool water. For his own protection, the person washing the patient shall wear clean impermeable gloves;

- c) if the eyes are contaminated they shall be flushed with clean cool water for at least 15 min, and a medical practitioner shall be consulted;
- d) if the eyes are contaminated, they shall be flushed with clean cool water for at least 15 min, and a medical practitioner shall be consulted;
- e) a patient shall never be given anything to drink if he is unable, for reasons other than incapacitating hand injuries. To hold the drinking glass himself. If a pesticidal emulsifiable concentrate, an ultra-low volume formulation or a solution that contains volatile liquids/solvents has been swallowed and the patient is fully conscious, DO NOT INDUCE VOMITING Administer instead copious quantities of a demulcent (such as boated egg whites, a solution of starch, or milk of magnesia). When dilute material THAT DOES NOT CONTAIN VOLATILE SUBSTANCES has been swallowed, induce vomiting by getting the patient to drink 50 mL of emetic. Ipecacuanha syrup followed by a glass of cold water to facilitate emesis;
- f) administer 4-5 tablets or one tablespoon of activated charcoal in a glass of water after emesis;
- g) if the patient is unconscious he shall preferably be put on his right side with the right knee straight, the left knee drawn up and the head so bent back that the respiratory track is kept clear, dentures shall be removed, clothing round the neck, chest and abdomen shall be loosened, and patient kept quiet and lightly covered; and
- h) if the patient vomits, his mouth and throat shall be cleaned out. If there is any possibility that the pesticide has been swallowed, all vomit us shall be retained for analysis, and when relevant, the medical practitioner shall be advised of the presence of petroleum distillates or other hydrocarbon solvents.

Bibliography

[1] ISO 18889: 2020 Protective gloves for pesticide operator and re-entry workers — Performance requirements

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