



**RWANDA  
STANDARD**

**DRS  
589**

First edition  
2024-mm-dd

---

---

**Pesticides — Guidelines for the disposal  
of bulk quantities of obsolete pesticides**

ICS 65.100.10

---

---

Reference number

DRS 589: 2024

© RSB 2024

**DRS 589: 2024**

In order to match with technological development and to keep continuous progress in industries, standards are subject to periodic review. Users shall ascertain that they are in possession of the latest edition

© RSB 2024

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without prior written permission from RSB.

Requests for permission to reproduce this document should be addressed to:

Rwanda Standards Board

P.O Box 7099 Kigali-Rwanda

KK 15 Rd, 49

Tel. +250 788303492

Toll Free: 3250

E-mail: [info@rsb.gov.rw](mailto:info@rsb.gov.rw)

Website: [www.rsb.gov.rw](http://www.rsb.gov.rw)

ePortal: [www.portal.rsb.gov.rw](http://www.portal.rsb.gov.rw)

Formatted: German (Switzerland)

Formatted: German (Switzerland)

Formatted: German (Switzerland)

Field Code Changed

## Contents

Page

Foreword .....	iv
1 Scope .....	1
2 Normative references .....	1
3 Terms and definitions .....	1
4 Requirements .....	2
4.1 Inventory of stocks .....	2
4.1.1 Taking an inventory .....	2
4.1.2 Evaluation of inventory data .....	4
4.2 Site stabilization and temporary storage .....	6
4.2.1 Site stabilization .....	6
4.2.2 Containment .....	8
4.2.3 Cleaning up spills and contaminated storage sites .....	9
4.2.4 Safe temporary storage .....	9
4.3 Disposal .....	11
4.3.1 General introduction to disposal techniques .....	11
4.3.2 Disposal methods that may be acceptable, depending on type of product and local circumstances .....	11
4.3.3 Disposal methods unsuitable for bulk quantities of pesticides .....	1344
4.3.4 Selecting a disposal method .....	15
4.3.5 Steps in selecting a disposal method .....	16
4.3.6 Disposal of empty pesticides containers .....	17
4.4 Preventing accumulation of obsolete pesticides stocks .....	18
Annex A (Informative) Incineration options for specific products .....	21
Annex B (informative) Disposal of small quantities of pesticides .....	23
Annex C (informative) Standard inventory forms for recording obsolete pesticides .....	24
C.1 Product Form .....	24
C.2 Storage Form .....	25

**DRS 589: 2024**

## **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.

DRS 589 was prepared by Technical Committee RSB/TC 064, *Pesticides*.

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

ES 700:2002, *Pesticides — Guidelines for the disposal of bulk quantities of obsolete pesticides*

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

## **Committee membership**

The following organizations were represented on the Technical Committee on *Pesticides* (RSB/TC 064) in the preparation of this standard.

Rwanda Food and Drugs Authority

Rwanda Forensic Institute

University of Rwanda/College of Sciences and Technology

Standards of Sustainability

CYIRA Ltd

P-TECHNIKS Ltd

Rwanda Inspectorate, Competition and Consumer Protection Authority

Rwanda Investigation Bureau

RAIDO

Rwanda Standards Board (RSB) – Secretariat

## Pesticides — Guidelines for the disposal of bulk quantities of obsolete pesticides

### 1 Scope

This Draft Rwanda Standard provides the guidelines for consideration of hazards in the accumulation of bulk quantities of obsolete pesticides and its safety aspects during the disposal period.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS 406, *Pesticides — Terminology*

DRS 579, *Pesticides — Guidelines for retail, distribution, storage and handling*

### 3 Terms and definitions

For the purposes of this standard, the terms and definitions given in RS 406 and the following apply.

#### 3.1

##### **bulk quantity**

large-scale accumulations of pesticides, typically in amounts exceeding the typical on-site storage for agricultural or commercial use, often resulting from stockpiles of obsolete or banned substances.

#### 3.2

##### **obsolete**

unwanted and banned pesticide stocks continue to pose serious environmental and human health problems.

#### 3.3

##### **obsolete pesticides**

stocked pesticides that can no longer be used for their intended purpose or any other purpose and therefore require disposal.

### 3.4

#### disposal

process of removing, destroying, or otherwise managing obsolete pesticides in an environmentally sound and safe manner to prevent contamination of the environment and harm to human health.

### 3.5

#### stockpile

large accumulation of obsolete or excess pesticides stored in one or more locations, awaiting disposal.

## 4 Requirements

### 4.1 Inventory of stocks

#### 4.1.1 Taking an inventory

An inventory is the starting point for the identification of management options to deal with obsolete pesticides stocks. The purpose of an inventory is to identify and record the pesticides in stock; to determine which of these are obsolete and which might still be usable; to obtain accurate information needed to draw up a plan for site stabilization; to identify suitable disposal options; and to prepare a disposal plan. Common cause of obsolete pesticides, include:

- i) Outdated technical pesticides or formulations
- ii) Pesticides that have been withdrawn through banning or that have been severely restricted
- iii) Deteriorated products. A product has deteriorated when:
  - a) It has undergone physical or chemical changes that result in phytotoxic effects on the target crop, or an unacceptable hazard to human health or environment.
  - b) The product has undergone an unacceptable loss of biological efficacy.
  - c) Its physical properties have changed to such an extent that it can no longer be applied with standard or stipulated application equipment.

Whenever possible, one person should coordinate all activities from inventory to disposal. The task and responsibilities of this person will be to:

- a) conduct or coordinate the inventory;
- b) protect health and safety of workers;

- c) evaluate the inventory and decide which products are obsolete;
- d) draw up a plan to stabilize the site and coordinate its implementation;
- e) evaluate management and disposal options and select the preferred option(s);
- f) estimate costs, determine funding source and produce a written disposal plan;
- g) coordinate preparation and implementation of the disposal plan; and
- h) establish procedures for regular inspections of pesticide stocks and take measures to avoid new accumulation of obsolete stocks

The person concerned should have good knowledge of pesticides, particularly with regard to their hazards for public health and the environment, who also has an understanding of occupational safety and first aid.

A good inventory should contain all the information needed to make management decisions at a later stage. To promote standardization, Food Agriculture Organization (FAO) has developed inventory forms which can be copied for use. At each store one product form should be completed for each product, or batch of a product. A storage form should be completed for each store.

Required product information includes name of active ingredient; formulation; concentration; quantity; age and condition. This information will be used to determine disposal options and to prepare a disposal plan.

Required store information includes condition of the store; assessment of the extent of contamination; and available utilities, materials and equipment. The information is needed to determine material and equipment requirements when preparing a disposal plan.

Before starting work at each site, basic steps should be taken to protect the health and safety of individuals involved in taking the inventory. It may be necessary to open doors and windows of stores for some time before starting work inside, to allow adequate ventilation to remove vapours built up inside.

Samples need to be taken from unidentified products and from products that require chemical and physical analysis to determine whether they are still usable. It may be convenient to take samples during the inventory. Materials and equipment required to conduct an inventory are listed below:

- a) appropriate inventory forms and clipboard
- b) storage records, if available
- c) flashlight
- d) sampling equipment and sampling instruction
- e) personal protection equipment
- f) basic first aid and safety equipment

#### 4.1.2 Evaluation of inventory data

The next step is to classify individual products in one of the four categories listed below. Generally, this may be done on the basis of available information. Where necessary, additional expert advice should be sought.

Publications that may be useful sources of additional information for the evaluation of inventory data are listed in **Table 1**. Some of this information may be available at the office of the government department responsible for pesticide registration. The pesticide registration office should be contacted to obtain a list of products whose use has been banned, withdrawn or severely restricted.

**Table 1 Useful sources of additional product information when evaluating inventory data**

S/N	Title	Description
i.	International Chemical Safety Cards (ICSC)	Two-page sheets with brief, product-specific, Health, Safety, and Environment (HSE) information, including information on: handling spills; disposal methods; required personal protection; and medical advice for the treatment of poisoning.
ii.	Material Safety Data Sheets (MSDS)	Product-specific HSE information, including information on: handling spills; disposal methods; required personal protection; and medical advice for the treatment of poisoning.
iii.	Health and Safety Guides (HSG)	A review of available scientific publications with regard to toxicology and environmental effects of the product concerned includes information on properties and analytical methods; behavior in the environment; metabolism; and effects on humans, animals and organisms in the environment.
iv.	Environmental Health Criteria(EHC)	A review of available scientific publications with regard to toxicology and environmental effects of the product concerned. Includes information on properties and analytical methods; behavior in the environment; metabolism; and effects on humans, animals and organisms in the environment.
v.	Specifications for plant protection products	Documents specifying chemical and physical properties of individual pesticides. Useful as a standard to determine whether old pesticides are still usable.
vi.	Specifications for pesticides used in public health	Documents specifying chemical and physical properties of individual pesticides. useful as a standard to determine whether old pesticides are still usable.



vii.	Consolidated list of products whose consumption and/or sale has been banned, withdrawn, severely restricted or not approved by governments	Lists regulatory action taken by governments on individual products.
------	--	--

**4.1.2.1 Products that are definitely obsolete and require disposal**

The following are the criteria to consider for the products that are definitely obsolete and require disposal:

- a) products the use of which has been banned for health or environmental reasons, that could not be phased out because of immediate hazards or national legal rulings;
- b) products visually deteriorated beyond usability (e.g. caked powder, caked emulsions, flakes and crystals in liquids);
- c) aged products which have not visibly deteriorated, but analysis of which has established are no longer usable; and
- d) products contaminated by other products.

**4.1.2.2 Products requiring further testing**

The following are the criteria to consider for the products requiring further testing:

- a) unidentified products; and
- b) older products, past guaranteed shelf-life, that have not yet visibly deteriorated.

In the case of pesticides that do not form more toxic decomposition products than the original product, it may be possible to conduct trials to establish whether they are still usable. Expert advice on the expected decomposition products would be required, and may be available from the manufacturer.

**4.1.2.3 Products that are still usable**

These are products the use of which is still permitted, that have not yet deteriorated. If possible, these products should be used for the intended purpose, or an approved alternative purpose. Use avoids wasting the product, as well as the cost of buying new products and destroying the old. Old products should be finished before using new products. Some of the products may need to be repacked and relabeled before distribution (e.g. corroded, ballooned or otherwise severely damaged drums; and torn or damp bags).

**4.1.2.4 Products that can become usable again after reformulation**

Products that are still in good condition, but cannot be used because the formulation is not appropriate for the intended use, may possibly be reformulated to become usable. Seek advice from the manufacturer or a pesticides expert to find out whether reformulation is feasible. The manufacturer can also advise on facilities needed to reformulate the products, the formulation method, safe handling and packaging. If a local testing laboratory and a pesticide formulation plant are not available, it probably is not feasible to reformulate the product locally. Reformulation only makes sense if there is a permitted use for the reformulated product.

## 4.2 Site stabilization and temporary storage

### 4.2.1 Site stabilization

#### 4.2.1.1 Importance of site stabilization

Site should be stabilized to reduce risks and to prevent environmental contamination and accidents during handling of stock. Generally, site stabilization involves: containment (repackaging) of products in leaking and deteriorated containers; clean-up of spills; and packaging of contaminated materials.

NOTE: If there is enough working space inside the store, pesticides should not be moved outside before they are properly contained.

#### 4.2.1.2 Who should do site stabilization

Whenever possible, a specialist in handling hazardous materials should coordinate containment activities. If a specialist is not available, technical advice may be sought from the pesticide industry or aid agencies. Consideration might be given to subcontracting the entire containment and disposal operation to a company that specializes in such operations. The convenience and safety of a properly conducted disposal operation carried out by a professional company may be worth the additional expense.

Workers should receive training before starting work. Such training should comprise:

- a) basic information about hazards when handling pesticides;
- b) use of protective gear;
- c) work and safety procedures for the various tasks;
- d) what to do if anything goes wrong; and
- e) basics of first aid.

#### 4.2.1.3 Health and safety aspects

All workers involved in the handling of obsolete pesticides should be provided with the necessary protective gear and should be trained in using it correctly. The coordinator or supervisor should regularly check that workers are still using their gear as instructed (experience has shown that adherence to safety instructions tends to slacken as work proceeds). Even if there is no apparent danger, safety instructions should be fully complied with because hazards are not always immediately apparent.

Clear work and safety procedures should be established for the various tasks and should be explained to workers. These could include: use of a bundled work area; use of footwear-change-stations to avoid spread of toxic material by contaminated boots; any spills to be cleaned up immediately, before proceeding with the work; and work to be stopped immediately in the event of overalls becoming severely contaminated; any spills to be cleaned up immediately, before proceeding with the work; and work to be stopped immediately in the event of overalls becoming severely contaminated or if there is the slightest contact with skin (splashes, leaking gloves, etc.) to replace the overall, or wash the skin. Smoking, eating and drinking should not be allowed in the working area.

Special care should be taken when handling drums in which pressure has built up, particularly if the pressure is so high that it has caused the drum top to balloon. The lids of such drums should never be removed in one movement. Instead, they should be unscrewed slowly until vapour escapes; when no more vapour escapes, unscrew a little more until vapour starts escaping again; wait again until no more vapour escapes; repeat until inside and outside pressure are equal. The following is personal protective gear needed when handling obsolete pesticides:

- a) adequate respiratory protection (e.g. half-face or full-face mask for protection against toxic vapours and/or dust; or an appropriate dust mask for protection against toxic dust);
- b) Sufficient filter cartridges that give appropriate protection against toxic dust (P3 coding on the filter cartridge) and/or organic vapors (A1 or A2 coding on the filter cartridge). A simple indication: a vapour filter is likely to be inadequate if the product can be smelled with the mask on;
- c) eye protection: goggles or face shield;
- d) impermeable gloves (nitrile or neoprene);
- e) impermeable boots; and
- f) overalls (preferably liquid-resistant disposable)

NOTE: For further general information see FAO Guidelines for personal protection when working with pesticides in tropical climates (FAO, 1994).

It is recommended that workers be medically examined before involvement in large containment and/or disposal operations. They should be fit for the task and not show any medical indications related to past exposure to pesticides. Workers' insurance coverage (accident/disability) may need to be adjusted for the period of their involvement in the operation.

A local physician experienced in diagnosing and treating exposure to pesticides should be notified of the planned work. For large operations, such a physician should be supplied with antidotes and medicine to treat poisoning cases, if these are not already available.

NOTE: For further medical information regarding specific products, see Health and safety guides (WHO, series), Material safety data sheets (produced by the manufacturer of the product), or contact the National Poison Control Center in your country, if there is one.

#### 4.2.1.4 Materials and equipment

- a) Materials and equipment needed for the containment of pesticide stocks and site clean-up are:
  - i) first aid materials: first aid box (bandages, disinfectant, etc.); eyewash bottle; and emergency shower. If a fixed shower is not available, a temporary improvised shower or washing facility should be established before starting work. There should be sufficient water and soap for personal cleaning and washing of contaminated clothes;
  - ii) sufficient quantities of appropriate protective gear;

- iii) shovels and brooms;
  - iv) detergent for site clean-up; large quantities of absorbent materials such as purpose-made spill control products, sand, sawdust, or activated charcoal; neutralizing agents such as hydrated lime or sodium hypochlorite; and wiping-off tissue;
  - v) heavy duty polyethylene floor sheeting for spill containment;
  - vi) appropriate drums and bags for repack pesticides from deteriorated containers and to pack contaminated soil and materials. For guidance see United Nations Recommendations on the transport of dangerous goods.
  - vii) labels and/or markers to relabel containers;
  - viii) pumping equipment (solvent-resistant with explosion protection) to transfer larger quantities of liquids, and a large funnel for smaller quantities;
  - ix) earthing cables to prevent build-up of static electricity during product transfer operations;
  - x) drum spanners (device to open drums); and
  - xi) fire extinguisher(s).
- c) The following additional equipment may be desirable for large containment operations:**
- i) drum crusher, container shredder, drum cutting equipment;
  - ii) drum lifting equipment;
  - iii) industrial vacuum cleaner; and
  - iv) digger, excavator, pneumatic drill.

Sufficient vehicles should be available for the transport of personnel, equipment and drums. At least one vehicle should always remain on site to be available to transport people to hospital in the event of accidents or emergencies.

#### **4.2.2 Containment**

All containers should be inspected for damage and leaks. Isolate damaged containers before repacking the product. Workers should wear full-face masks when handling leaking containers.

A simple, temporary containment area (also referred to as bounded area) to control spillage and protect against further contamination of the soil during repacking, can be made from a polyethylene sheet with the sides raised (e.g. by sand bags) to contain any major spillage. Product in damaged or leaking containers should be handled as follows:

#### 4.2.2.1 Torn paper or plastic bags containing solid formulations

Place the damaged bag inside a clear, heavy polyethylene plastic bag so that the contents and label are visible; label new bags if clear bags are not available. Seal the plastic bag carefully and tightly.

#### 4.2.2.2 Leaking containers holding liquid formulations

The options for repacking include:

- a) Transfer to an undamaged container must be relabeled;
- b) Transfer to a new, or thoroughly cleaned, empty container, and relabel; and
- c) Over pack in a larger drum or specially designed over pack, and relabel.

Large volume from large containers (more than 25 liters) should be pumped. Small volumes from small containers may be poured into a new container using a large funnel.

Although over drums are much more expensive than ordinary drums, they are preferable in cases where the original drum has deteriorated to such an extent that it becomes a liability to handle. They are also useful for temporary secondary containment in emergency situations (sudden leakage, completely deteriorated drums).

All products must be packed and transported in accordance with either national legislation, whichever is the most stringent. Almost all old stocks of pesticides will fail to meet national packaging and labelling standards for international transport, and will therefore require repackaging and/or relabelling.

#### 4.2.3 Cleaning up spills and contaminated storage sites

Leaked product, spill and otherwise contaminated floors should be cleaned up. Heavily contaminated soil should be excavated or chemically treated, depending on the type of contamination. All solid toxic residues, contaminated materials and significantly contaminated soil should be packed in appropriate containers, labelled and disposed of in the same environmentally sound manner as the obsolete pesticides. Even after thorough cleaning, old storage facilities should never be used for the storage of food, fodder or animals.

#### 4.2.4 Safe temporary storage

Ideally, obsolete pesticides should be removed for disposal immediately after repackaging. However, this may not be possible because funds for disposal are not yet available, while repackaging is urgently needed because leakage is occurring. In such cases, it is necessary to store the repacked pesticides until funds for disposal have been secured.

##### 4.2.4.1 The following are instructions for cleaning up spills and leaked pesticides:

- a) First read the instructions on the product label or material safety data sheet
- b) Unauthorized persons should be kept away from the contaminated area.
- c) The store should be ventilated immediately as much as possible

- d) Work in teams of at least two persons. All persons involved in the clean-up should wear appropriate protective clothing. Eyewash, soap and plenty of water should be kept at hand.
- e) In the event of leakage: contain the leaking drum in an over drum, or pump its contents into another drum. As a very temporary "first aid" measure, it is often possible to stop leakage by rolling the drum into a position so that the leak is on top.
- f) Mop up the leaked product with absorbent material (special spill-control material, sawdust, earth or lime), sweep up and pack the material. Lay a ring (small dike) of absorbent material around the contaminated area. Wet the area with a detergent solution (e.g. 10 percent saturated sodium carbonate solution, or 5 percent caustic soda solution); scrub the floor; and then sweep the solution into the ring of absorbent material. Remove the material after all liquid has been absorbed. Repeat if necessary. Clean equipment with detergent solution.
- g) Contaminated materials (e.g. soil, soft floor material, absorbent materials) are regarded as hazardous waste and should be carefully packed and properly labelled for disposal or temporary storage until disposal can be carried out.

It may be advantageous to centralize obsolete products as much as possible in one store, provided that it is safe to transport them. A centralized stock can more easily be inspected and would facilitate disposal operations. Obsolete products should be segregated from operational stocks. Obsolete pesticides should be stored and managed in the same manner as current stocks.

**4.2.4.2** The following are the basic principles and provisional guidelines on prevention of accumulation of obsolete pesticide stocks:

- a) stores should be well ventilated;
- b) floors should be made of impermeable material;
- c) entrances should have ramps to contain any major leakage within the store;
- d) doors must be lockable and have danger signs; windows should be barred;
- e) floors should be arranged in separate blocks with aisles between them with sufficient space to move containers freely, enable inspection of containers and treat leakage;
- f) drums should be stacked in such a way that each individual drum can be inspected from the aisles between the blocks;
- g) drums and bags should be stored on pallets;
- h) stacking recommendations should not be exceeded; and
- i) each store should have the necessary materials and equipment to deal with emergencies.

Containers which have deteriorated should not be transported, until they have been repackaged. Old containers that are still in good condition may possibly be transported within the country, provided that necessary safety precautions are taken. Drums should be placed on drip-trays sufficient to contain all leakage if a container

should crack or start leaking. The safest route should be determined (good road surface; densely populated or protected areas to be avoided as much as possible).

### 4.3 Disposal

#### 4.3.1 General introduction to disposal techniques

Products that cannot be used for their intended purpose(s) or a permitted alternative, and that cannot be reformulated to become usable again, should be considered for disposal.

This clause reviews available disposal techniques and provides guidance on preparing a disposal plan. Disposal methods are divided into three categories and are evaluated on their suitability for the disposal of bulk quantities of obsolete pesticides in developing countries. The main criteria are: environmental soundness of the technology; occupational safety for operators; technical feasibility for destruction of bulk quantities of obsolete pesticides; and the suitability for common circumstances in developing countries; and cost-effectiveness.

Disposal methods that may be acceptable depending on type of product and local circumstances, are described in detail. Unsuitable options are briefly described along with the reasons that disqualify them. Promising new developments are described techniques generally depends largely on the type and quantity of product to be disposed of. A particular technique may be acceptable for one group of products, but absolutely unsuitable for another group. This means that it is essential always to consider the combination of the technology and the product on a case-by case basis. **annex A** gives a broad indication of suitable incineration methods for specific groups of pesticides.

#### 4.3.2 Disposal methods that may be acceptable, depending on type of product and local circumstances

The following are the methods used for disposing pesticides:

##### 4.3.2.1 High temperature incineration

###### 4.3.2.1.1 How incineration works

Incineration is a high-temperature thermal oxidation process whereby the pesticide molecules are decomposed into gases and unburnable solids. The solids are referred to as the residue and comprise ash and slag. A tall chimney or stack carries waste gases into the air. Stack gases may contain water, carbon dioxide, acid or toxic gases and toxic particles, including ash and metal oxides. To control pollution, the incinerator may be equipped with gas cleaning equipment, such as a scrubber and/or electrostatic filters. The solid residues are land filled.

Hazardous waste incinerators have a main chamber for burning wastes and an afterburner to achieve maximum destruction of hazardous organic by-products, by holding combustion gases at the appropriate temperature (over 1100°C) for at least two seconds (residence time). Since gas cleaning equipment cannot work at the high temperature of the gases leaving the furnace, the gases in the stack are cooled to temperatures of approximately 200 °C.

Properly managed incineration can, in principle, destroy pesticide waste with a Destruction and Removal Efficiency (DRE) rate of 99.99 percent or higher. Some incinerators even claim DRE values of up to 99.99995 percent. However, the effectiveness of incineration depends on many factors, such as: design; process control and maintenance of the correct residence time, temperature and turbulence; type of products incinerated; and capacity and effectiveness of air pollution control devices. Inappropriate use of incinerators can create

hazardous solid and airborne by-products that pose a severe threat to the environment and public health. Often such by-products are more toxic than the original product.

Of particular concern is the formation of polychlorinated dibenzodioxins and polychlorinated dibenzofurans (often referred to as dioxins and furans), which are extremely toxic and persistent in the environment. Dioxins and furans are formed as the result of a reaction during the cooling of the stack gases. Factors that affecting this reaction are: the temperature of the stack gas; the occurrence of chlorine or other halogens; and the presence of a catalyst. The risk of formation of dioxins and furans can be reduced by an incinerator design in which stack gases are cooled very quickly (quenching) past the temperature interval at which dioxins and furans are formed (250°C to 350 °C), and which has a scrubber to bind halogens (e.g. a wet scrubber using a sodium hydroxide solution). In addition, emissions of dioxins and furans can be reduced by special filter systems. Halogenate pesticides should not be incinerated if there is no effective quenching and scrubbing system.

#### 4.3.2.1.2 Selection of pesticides for incineration

Whether or not pesticides can be properly incinerated depends on the type of pesticide, the kind of incinerator, and the gas cleaning system. Inorganic pesticides cannot be incinerated. Organic pesticides containing mercury should not be incinerated. Organic pesticides must be burned at relatively high temperatures of over 110°C, and the gas must be held in the flame for at least two seconds. Organic products containing heavy metals such as tin and lead can only be incinerated in specific cases, under very strict conditions, in dedicated hazardous waste installations equipped with stack gas cleaning devices that can recover these elements. In some cases, it may be possible to export products containing heavy metals for recycling. To determine whether a specific product can be incinerated, consult **annex A**, the Material Safety Data Sheet. Alternatively, contact the product manufacturer or a reputable incinerator operator.

#### 4.3.2.2 Chemical treatment

Chemical treatment can render certain groups of pesticides less toxic and safer to store, transport and dispose of. Some active ingredients can be destroyed by chemical treatment.

A common method is hydrolysis, which is the reaction of a substance with water to break the bonds of the molecule. Alkaline hydrolysis, in which a strong alkaline substance such as sodium hydroxide, lye or lime is added, can destroy organophosphates and carbamates and greatly reduce their biological activity and environmental hazard. Acid hydrolysis works on some other groups of pesticides.

Chemical treatment should only be done by a qualified professional (chemical expert), and then only if treatment reduces toxicity to such an extent that the residue becomes suitable for a readily available disposal method. If pesticides are to be exported for incineration, there is no need for advance chemical treatment.

By-products of chemical treatment require safe disposal. This may involve biological treatment of low concentration liquids. Precipitated by-products of low toxicity may possibly be solidified and disposed of in a lined landfill.

On-site detoxification of pesticides in chemical tanks, can reduce the toxicity of highly toxic pesticides, such as organophosphates, before transport. However, the expense of on-site detoxification and the requirement for skilled technicians, chemicals, and a treatment plant where the liquid effluent can receive biological treatment, make this an unsuitable option for many developing countries. Risks related to transport can also be managed by applying the packaging standards of the recommendations on the transport of dangerous goods.

Chemical treatment of large quantities of obsolete pesticides would require: special reactor tanks; process control devices; analytical facilities to test chemicals and residues; continuous expert supervision; and disposal facilities for residues. Chemical treatment may offer a solution to relatively small quantities of pesticides,



provided that the operation is guided by a chemical expert. Under certain circumstances, treatment with lime or alkaline liquid maybe used to detoxify soil contaminated with organophosphorus insecticides.

#### **4.3.2.3 Special engineered landfill (lined landfill)**

In general, landfilling is not an acceptable option for the disposal of pesticides, because they can migrate and contaminate ground or surface water. In addition, there is a risk of them being dug up for unauthorized use. However, there are some exceptions. A properly lined landfill may be suitable for final disposal of incinerator ashes and slag, soils contaminated with pesticides, and/or powder formulations with a low active ingredient content. Special attention must be paid to the selection of landfill sites. Landfills in areas with high groundwater tables or significant rainfall are not suitable. The landfill should be a designated landfill under the authority of the government. Authorization should be obtained before land filling the product concerned.

##### **4.3.2.3.1 Incinerator ash and slag**

Ash and slag produced by high- temperature incineration of pesticides is in principle considered inert. However, to rule out any uncertainties related to the composition of the substance, ash and slag should be disposed of in a lined landfill, unless chemical analysis has established that the substance is fully inert, and that there is no risk that any toxic components might leach out, in which case the landfill does not necessarily need to be lined.

##### **4.3.2.3.2 Contaminated soil**

Whether or not it is possible to landfill contaminated soil depends on the type and extent of contamination. It may be necessary to solidify or chemically treat the soil before land filling. Expert advice is required. The landfill should have an appropriate lining.

##### **4.3.2.3.3 Fixed/solidified powder formulations with a low active ingredient content**

Depending on the circumstances, it may be possible to landfill powder formulations with a low active ingredient content after solidification/fixation. They should be encapsulated in special cement, or mixed with binding agents such as silicates and polymers, which cause the mixture to form a solid, impervious mass. Preliminary tests must be carried out to establish that it is not possible for the pollutants to leach out.

##### **4.3.2.3 Long-term controlled storage**

If all local options for treatment and disposal present serious environmental, occupational or public health risks, then storage pending export or future development may seem attractive. The store should be regularly inspected; leakages and spill should be addressed immediately; and layout and stacking recommendations should be followed. It should be realized that the allocation or construction of a store specially for obsolete pesticides may be expensive.

Generally, long-term storage in mines, underground bunkers, etc. is not recommended because stock cannot be controlled and maintained. Sooner or later containers will start leaking and the contents may find their way into the environment.

#### **4.3.3 Disposal methods unsuitable for bulk quantities of pesticides**

##### **4.3.3.1 Open burning**

Open burning of pesticides is to be strongly discouraged. Chemicals, including pesticides, should never be burned in open fires. The temperature in open fires (50 °C to 70 °C) is too low for complete destruction of

pesticides, and is likely to result in the release of toxic vapours that can harm humans, livestock, crops and the environment. Large volumes of partially combusted product, which can be very toxic, may be carried away in the smoke and cause severe contamination of the area.

#### **4.3.3.2 Burying, landfill disposal**

Landfill disposal normally involves the disposal of non-toxic household rubbish wastes in holes in the ground, either open dumps, sanitary landfill, quarries or mineral extraction sites. Sites that lack a bottom liner of plastic and a thick layer of clay are unsuitable for disposal of any toxic substances, including unwanted pesticide stocks. Sites with an appropriate liner may, under certain circumstances, be used for the disposal of incinerator ashes and slag, solidified powder formulations with low active ingredient contents.

#### **4.3.3.3 Discharge to sewer**

Pesticides affect water quality and are toxic to aquatic ecosystems. They may render water sources unsuitable for drinking-water supply. Fish are very sensitive to many pesticides that are relatively harmless to human beings. Therefore, pesticides should never be discharged to surface water or ditches. Even indirect discharge via an effluent treatment facility is not acceptable, because most pesticides are toxic to the biodegrading microbes in the sewage system.

#### **4.3.3.4 Solar evaporation**

In solar evaporation, products are placed in shallow basins that are protected from rain but exposed to wind and sun. The site where the basins are located must be completely fenced off to prevent unauthorized entry by people or livestock. The method is used to concentrate contaminated water such as from drum ashing operations. Under certain conditions, solar evaporation may be an option for small amounts of volatile and relatively non-toxic materials, but it releases vapour to the air. The solar evaporation method must not be used for bulk quantities of pesticides, because of the hazards to human health and the environment.

#### **4.3.3.5 Land farming/superficial land application**

Natural microbial flora biodegrades organic compounds placed on the ground or tilled into the soil. Since humans or animals could be exposed, and breakdown products could migrate into surface and ground waters, this method is not suitable for disposal of bulk quantities of pesticides.

#### **4.3.3.6 Deep well injection**

Liquid hazardous waste is injected through pipes deep into formations such as sandstone, limestone and shale where the injected material cannot escape. This method is costly and requires highly trained technicians and sophisticated equipment. It is not suitable for disposing of pesticides because of the environmental risk and lack of control.

#### **4.3.3.7 Other methods**

There are several methods which have been developed, or are under development, to extract or destroy low concentrations of pesticides from water or soil. They include: activated carbon adsorption; ion exchange; ultraviolet radiation; ozonation; ultraviolet radiation and oxidation with ozone and/or hydrogen peroxide; concentrated solar flux; chemical dehalogenation treatment; fluidized bed systems; and biological and bioreactor treatment. These methods are not suitable for disposal of primary pesticides, although some may eventually offer a solution for formulations with a very low active ingredient content.

#### 4.3.4 Selecting a disposal method

There are several factors that play a role in selecting a suitable disposal method and preparing a disposal plan. Some of the main ones are:

##### 4.3.4.1 Quantity and variety of products, their formulations, packaging type and size

- a) the type of product may rule out, or favour, certain options, e.g. in many cases, organochlorines should not be incinerated in small-scale incinerators; use of a cement kiln may be limited by the chlorine content; chemical treatment of most organochlorines is difficult; generally, products containing mercury cannot be incinerated; and powder formulations may be difficult to incinerate in a cement kiln;
- b) the quantity of products may rule out, or favour, certain options, e.g. quantities smaller than 1000 tonnes rule out a mobile incinerator; quantities larger than 100 tonnes rule out many models of small-scale incinerators.

##### 4.3.4.2 Legal aspects

National, regional or international regulations or agreements may form a barrier to certain disposal options.

##### 4.3.4.3 Safety of locally available disposal facilities

Environmental soundness of locally available disposal facilities, e.g. the facility may not be approved for destruction of pesticides; and the location of the facility may not be suitable for handling pesticides because of its proximity to a densely populated area or a water body.

##### 4.3.4.4 Local conditions affecting the suitability of available techniques

Specific local conditions may decrease the suitability of potential disposal options. The climate may rule out the use of certain options during rainy season or periods of extreme heat.

##### 4.3.4.5 Availability of necessary infrastructure and utilities

- a) the maximum permitted weight of vehicles on roads and bridges may rule out transport of a mobile incinerator (50 to 80 tonnes) or transport of container loads of pesticides packed for export (30 tonnes per lorry);
- b) non-availability of certain utilities may limit the possibilities for small-scale incinerators or mobile incinerators (electricity at required voltage/amperage; sufficient supply of fresh water and chemicals for the scrubber; safe site for operations and temporary storage of obsolete products; and appropriate facilities to dispose of residues and scrubber liquid in a safe and environmentally sound manner);
- c) availability of various services, utilities, materials and equipment, may affect the feasibility of certain disposal options, e.g. analytical facilities necessary for chemical treatment and use of a mobile incinerator; appropriate personal protection gear and fire-fighting equipment; transport for staff involved and for products to processing site or port; and medical services to deal with emergencies.

#### 4.3.4.6 Availability of local expertise

- a) availability of trained experts to coordinate/supervise operations; and
- b) availability of a trained work force to perform the operation safely.

#### 4.3.4.7 Cost aspects

- a) cost-effectiveness of available local options, particularly in comparison with export of the waste to an incineration plant abroad;
- b) availability of funds (national budget; or possibilities of assistance from aid agencies or the manufacturer/supplier).

#### 4.3.5 Steps in selecting a disposal method

##### 4.3.5.1 Establish the exact quantity and type of products that need to be disposal of:

- a) conduct a detailed inventory; and
- b) is it certain that none of the products can still be used? If not, analyse samples of old products that physically still seem to be in good condition; if analysis establishes that the product is still usable, then use it for its intended purpose or investigate alternative uses, repack and relabel for use.

##### 4.3.5.2 Determine approved disposal options for each product:

Use reference materials to determine the disposal options for individual products. See also **annex A**

##### 4.3.5.3 Determine what disposal facilities are in principle available locally and assess suitability of each of these:

- a) determine which disposal facilities, equipment, materials, expertise and services are locally available. Use the checklist at the end of this section,
- b) how will local conditions affect the suitability of these options?
- c) are there legal or political issues to consider?
- d) what is the potential environmental impact of each of these options? The following factors should be evaluated before making any final decisions: potential releases to air, water and soil and the risk of such releases; the hazard of released components; level of expertise to carry out operations safely; are there any specific hazard points along the transport route (densely populated areas, bodies of water, protected areas, etc.); and are risks manageable and acceptable?
- e) is there likely to be public concern or protest against local options, particularly with regard to locations and transport routes?

**4.3.5.4** Compare local options to the alternative of exporting the waste:

- a) are there any national, regional or international regulations or agreements that prevent export;
- b) compare environmental risks of local disposal, export of the waste, and leaving the waste where it is;
- c) compare the cost of local disposal with the cost of exporting the waste. If part of the waste can be disposed of locally and the remainder needs to be exported, the sum of the costs of partial local disposal and partial export could be higher than a single operation to export all of the waste;
- d) balance environmental risks against differences in costs for local disposal and export.

**4.3.5.5** Investigate funding possibilities

**4.3.5.6** Prepare disposal plan if funding is available

**4.3.5.7** Arrange for controlled storage if funding is not available

**4.3.5.8** Checklist to assess the feasibility of various disposal options

High-temperature incineration: large-scale fixed incinerator. This would be the preferred disposal option with regard to environmental soundness and occupational safety. Check whether all products can be incinerated in the plant.

#### **4.3.6 Disposal of empty pesticides containers**

The reuse of pesticide containers for storage of water, food and fuel is a major problem. The high cost of new steel drums or plastic jerry cans makes used pesticide containers a valuable commodity. However, in most cases, it is impossible to decontaminate used containers completely. Regardless of the number of washings, residues will continue to be released from the inner wall of the container and can contaminate anything placed inside. It is therefore important to arrange for the destruction and disposal or recycling of all used pesticide containers to prevent unauthorized use.

In large-scale clean-ups, it may be desirable to obtain special equipment for the treatment of empty containers, such as a shredder, drum-crusher and/or drum-rinser or pre-flusher. This equipment is relatively easy to transport and has limited energy requirements. The available options for disposal of used containers are incineration, recycling or landfilling. Containers should only be recycled or landfilled after they have been triple-rinsed and crushed. They should only be landfilled in a designated landfill under the authority of the government. Triple-rinsing should only be done by experts who know which liquid to use and how to handle the rinsate safely.

##### **4.3.6.1 Recycling**

At large pesticide stores, a number of empty steel drums that are still in good condition may be retained as spares to repack the same product from leaking or deteriorating drums, or to pack contaminated spill control material after clean-up activities. It will not be necessary to clean drums that are retained for this purpose, but they should be stored securely to prevent theft. If it is possible to return containers to the supplier, this is the preferred option. One could consider negotiating an arrangement (e.g. as part of the procurement order) under which the supplier agrees to take the empty containers back after the product has been used.

Old and deteriorated drums and surplus drums can be used as raw material at a steel melter. They should be rinsed, punctured or crushed before being sent to the melter. It may be possible to sell them to the steel melter because an empty 200 liters steel drum represents about 25 kg of good quality scrap metal. Empty drums that are still in good condition might possibly be sold to a drum reconditioning company. However, it should be agreed and ensured in advance that drums will be recovered for specific non-food uses only. The operations of the reconditioning company should be checked and monitored. A certificate of disposal should be requested.

#### 4.3.6.2 Incineration

All common types of contaminated packaging can in principle be destroyed safely in a large-scale hazardous waste incinerator. International regulations on the transport of hazardous materials apply when empty containers are exported for destruction. Under such regulations, unrinsed empty contaminated containers are regarded as a hazardous product in the same category as the original contents. This means that empty pesticide containers need to be cleaned or packaged prior to international transport. Packaging can be done by overpacking the containers in their original form, or by packaging them after cutting or shredding. They need not be packaged if they have been thoroughly cleaned (triple-rinsed).

The disadvantage of packaging is that it requires additional packaging materials, while rinsing creates additional waste in the form of rinsate. It may be possible to incinerate small quantities of contaminated bags, boxes, crates, etc. in a small-scale incinerator. Plastic containers should be cut or shredded first, and only be incinerated in plants equipped with scrubbers.

#### 4.3.6.3 Landfill

Bags and boxes can be cut up and stored in plastic bags prior to disposal in a designated sanitary landfill under authority of the government. Empty plastic and steel containers should be thoroughly emptied, triple-rinsed with water or solvent and punctured, crushed or shredded before they are sent to the landfill.

The rinsate must be drained, collected and stored separately in appropriate and clearly labelled containers. The rinsate should be managed in the same manner as the pesticide. If the product was still usable, the rinsate can be applied with the product.

#### 4.3.6.4 Temporary storage of empty containers pending disposal

All empty containers that are temporarily stored awaiting disposal, should be cleaned and rendered unusable by crushing or puncturing. Bags and boxes can be cut up and packed in plastic bags.

### 4.4 Preventing accumulation of obsolete pesticides stocks

In view of the hazards associated with obsolete pesticide stocks and the high costs of safe and environmentally sound disposal, the long-term solution to obsolete stocks lies in preventive measures. The first step in preventing the accumulation of obsolete pesticide stocks is to review whether pesticide use is actually required. Over the last few years, much progress has been made in the development and introduction of Integrated Pest Management (IPM) for various crops. IPM increasingly offers alternative strategies for effective long-term pest control while mitigating hazards to public health and the environment. Reduced dependency on pesticides reduces the use of pesticides. The lower the annual volume, the smaller the chance of large obsolete stocks accumulating. A summary overview of preventive measures for the accumulation of obsolete pesticides are provided in **Table 2**:

Table 2 A summary overview of preventive measures for the accumulation of obsolete pesticides

S/N	Cause of accumulation	Preventive measures
i.	<b>Banning of product.</b> Left over after product banned.	Include provision for phrasing out when banning pesticides.
ii.	<b>Inadequate storage capacity and poor stock management</b> Insufficient storage capacity for pesticide  Staff not trained in stock management  Containers damaged because of rough handling during transport  Unavailability of analytical facilities to determine product quality after prolonged periods of storage.	Invest new stores or in upgrading old stores. Avoid procuring pesticides in quantities that exceed storage capacity. Segregate obsolete stocks from operational stocks. Ensure good storage practice  Train staff in stock management. Ensure compliance with first-in, first-out principle. Keep stock records; place containers on pallets. Use pesticide storage and stock control manual  Train staff in the proper handling of pesticides during transport. Shorten transit periods as much as possible. Request spare repackaging material with each consignment. Request durable containers if rough handling is anticipated.  Make arrangements with a laboratory inside or outside the country. If analysis indicates that product is still usable, repack and relabel if necessary. Finish old product before using newer products.
iii.	<b>Donations or purchases in excess of requirements</b>  Inaccurate assessment of requirements    Lower than expected pest incidence	Keep stocks as low as possible. Do not stock up more than a single season's requirement. When determining needs for additional stocks, take into consideration existing in-country stocks; and agro-ecological variations within area to be treated (not all areas may need treatment). Identify factors that may limit use: storage, transport and application capacity.  Keep stocks as low as possible. Purchase only when there is a direct need. Do not build up anticipatory, strategic, decentralized stocks. Instead, improve fast supply arrangements and systems.  Do not stock up large quantities of products with

	Overstocking of products with a short shelf-life	a short shelf life. Specify the desired product stability in tender documents or direct procurement orders, in terms of the minimum storage period the product should be able to last under the circumstances in the country of destination.
iv.	<b>Unsuitable products</b> Inappropriate active ingredient or formulation	Determine carefully what is required. Spell out product specifications in tender documents or direct procurement orders. Take into consideration: suitability for end-user; agro-ecological suitability of product; and type of available application equipment. Do not accept donations of products that are considered unsuitable for the intended use. State that containers must contain batch numbers and date of manufacture; insist on a certificate of analysis.

Copy for public review



**Annex A**  
(Informative)

**Incineration options for specific products**

This annex aims to provide a broad indication (see Table 3 below) of the product limitations of various incineration methods. In practice, the suitability of individual incineration installations needs to be judged on a case-by-case basis. In particular, small-scale incinerators and mobile incinerators need to be tested to confirm their suitability for the groups of pesticides that are to be incinerated. The technical specifications and performance of the scrubber system, the incineration temperature and the residence time are important factors.

**Table 3 Suitability of incineration options for specific product groups of obsolete pesticides**

S/N	Incineration method	Limitations of the method concerned: not recommended for the following product groups
i.	High-temperature	Inorganic pesticides and pesticides containing inorganic fungicides, such as incineration in general bordeaux mix, copper oxychloride, mercuric oxide, and inorganic rodenticides, such as sodium cyanide, zinc phosphide); organometals: depending on the concentration of the active ingredient and the efficiency of stack gas cleaning devices.
ii.	Small-scale incinerator without scrubber	Bulk quantities of pesticides in general; small quantities containing chlorine, phosphorus, sulphur or nitrogen.
iii.	Small-scale incinerator with scrubber	Depending on the effectiveness of the scrubber: Organochlorine and other halogenated compounds: depends on the concentration of active ingredient and the performance of scrubber (among other reasons, because of the risk of dioxin formation). Often there will be limits to the maximum chlorine content of pesticides that can be incinerated.
iv.	Mobile incinerator with scrubber	Depending on the effectiveness of the scrubber: Organochlorine and other halogenated compounds: depends on the concentration of active ingredient and the performance of scrubber (among other reasons, because of the risk of dioxin formation). For some models, there may be limits to the maximum chlorine content of pesticides that can be incinerated.
v.	Cement kiln	Powder formulations are difficult in practice because they normally require special preparation and delivery systems; Organochlorine and other

		halogenated compounds: depends on the concentration of active ingredient in relation the risk of dioxin formation; mercury (e.g. phenoxy acetic acid derivatives: depends on the concentration of the active ingredient). In general: carbamates, organophosphates and pyrethroids can be incinerated without major limitations in an appropriate incinerator with emission control equipment or in an appropriate cement kiln; organochlorines and organometals may be restricted depending on the concentration of the active ingredient and the technical specifications of the incinerator; inorganic compounds cannot be incinerated.
--	--	--

Copy for public review

**Annex B**  
(informative)

**Disposal of small quantities of pesticides**

For the disposal of small quantities of obsolete pesticides alternative options may be available, such as land treatment, composting treatment, photolysis, and release to air.

However, the suitability of such methods very much depends on the type of product, its quantity, its behaviour in the environment, and local circumstances. The suitability of such methods should therefore be determined on a case-by-case basis by chemical experts.

Non-specialists are urged not to experiment or improvise disposal of small quantities of obsolete pesticides. Do not bury or burn them or their containers. If possible, owners of small quantities of obsolete pesticides should return these products to the supplier or to a central collection point at the plant protection service. The supplier or plant protection service can then store them safely and dispose of them later as part of a bulk consignment, or seek advice from a chemical expert on safe and environmentally sound local disposal.

Suppliers and plant protection services are recommended to establish a collection system for small quantities of obsolete pesticides.

**Annex C**  
(informative)

**Standard inventory forms for recording obsolete pesticides**

**C.1 Product Form**

A product sheet needs to be completed for each product (if one product is kept in different types of containers, one sheet should be completed for each type of container)

SHEET NUMBER: ..... DATE: .....

OWNER OF PRODUCT: ..... STORAGE SITE: .....

LABELS ON CONTAINERS: Complete information/incomplete information/ label not readable/ label missing  
trade name: ..... ACTIVE INGREDIENT (S): .....

FORMULATION TYPE: ..... CONCENTRATION g/litre or g/kg

MANUFACTURER: ..... BATCH NUMBER: .....

MANUFACTURE DATE: ..... ARRIVAL DATE: .....

CONTAINER TYPE: ..... UNIT SIZE: .....

NUMBER OF CONTAINERS: ..... QUANTITY: .....

ORIGIN: purchased by Government / received as donation (name donor): .....

Imported by private company (name company): .....

CONDITION OF PESTICIDE: usable / unknown / deteriorated CONDITION OF CONTAINERS: good/ minor  
damage / serious damage transportable / not transportable. Description of damage: .....

HAVE CONTAINERS BEEN OPENED? yes / some / no / not certain REASON FOR NOT USING THE  
PRODUCT:

expired / deteriorated / banned / wrong formulation no need / stock too large / no longer recommended

Other: .....

REMARKS: .....

**C.2 Storage Form**

A storage form should be completed for each store.

SHEET NUMBER: .....

NAME OF STORE: ..... DATE: .....

TOWN: ..... OWNER OF STOCK: .....

NAME OF PERSON WHO CONDUCTED THE INVENTORY: .....

FEATURES OF STORE: Doors lockable / sufficient ventilation inside / concrete floors / door ramps  
 AVAILABLE UTILITIES: Running water / electricity / lighting

AVAILABLE MATERIAL: Pump / shovels / spill control material / spare containers and bags/ firefighting equipment  
 AVAILABLE PROTECTIVE GEAR: Boots / gloves / overalls / goggles / dust masks / vapour masks

DESCRIPTION OF LEAKAGE AND CONTAMINATION: (Incl. extent of floor contamination inside and outside the store): .....

SPECIAL HEALTH OR ENVIRONMENTAL CONSIDERATIONS.

LOCATION IN OR NEAR: urban area / water catchment area / important water body. Describe: .....

SUMMARY TABLE OF PRODUCTS:

To obtain a quick overview of stocks at each store it is advisable to transfer key data from individual product formsto a summary table as given below.

Active ingredient (common name)	Formulation Type	Concentration (g/l or g/kg)	Unit size	Quantity	Container	Condition

## Bibliography

[1] GIFAP. 1991. *Disposal of unwanted pesticide stocks: guidance on the selection of practical options*. Groupement International des Associations Nationales de Fabricants de Produits Agrochimiques. Brussels.

[2] GLOBE. 1993. *Prevention and elimination of obsolete pesticide stocks in developing countries*. H.P van der Wulp for Global Legislators' Organization for a Balanced Environment. AID Environment. Amsterdam.

[3] World Bank/WHO/UNEP. 1989. *The safe disposal of hazardous wastes: the special needs and problems of developing countries, Vols. I - III*. World Bank Technical Paper No. 93. R. Batstone, J.E. Smith Jr. and D. Wilson. Washington, DC.

[4] FAO. 1995a. *Provisional guidelines on prevention of accumulation of obsolete pesticide stocks*. Rome.

[5] FAO. 1995b. *Guidelines for the packaging and storage of pesticides* (revised version). Rome

[6] FAO. 1996. *Pesticide storage and stock control manual*. Rome.

[7] FAO. *Guidelines on construction of simple pesticide storage facilities, using locally available materials in developing countries*.

DRS 589: 2024

Copy for public review

---

Price based on **nnn** pages

©RSB 2024 - All rights reserved