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FAO PESTICIDE DISPOSAL SERIES 2

Prevention of accumulation of obsolete pesticide stocks

Provisional guidelines

Food and Agriculture Organization of the United Nations

Foreword

These guidelines were prepared by the Food and Agriculture Organization of the United Nations (FAO) under project GCP/INT/572/NET: "Prevention and Disposal of Unwanted Pesticide Stocks in Africa and the Near East", funded by the Government of the Netherlands. Despite the limited geographical scope of the project, the guidelines are considered generally applicable and of interest to many countries, aid agencies and the pesticide industry.

They have been published as *provisional* because they have not yet received approval from the member countries of FAO. In view of the significant interest expressed in the subject, it has been decided to make the present version available as a project publication. Interested parties are invited to provide written comments to FAO based on their experience in the implementation of these guidelines. Their comments will be considered in the definitive version of the guidelines.

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Abbreviations

FAO
Food and Agriculture Organization of the United Nations

FAO/ECLO
FAO Emergency Centre for Locust Operations

GIFAP
International Group of National Associations of Agrochemical Manufacturers

GLOBE
Global Legislators Organization for a Balanced Environment

GTZ
German Agency for Technical Cooperation

IMDG Code
International Maritime Dangerous Goods Code

IPCS
International Programme on Chemical Safety

IPM
Integrated Pest Management

IVC
Integrated Vector Control

MSDS
Material Safety Data Sheet

NRI/ODA
Natural Resources Institute/Overseas Development Agency

OECD
Organisation for Economic Co-operation and Development

OECD/DACOECD
Development Assistance Committee

PIC
Prior Informed Consent

UN
United Nations

UNCED
United Nations Conference on Environment and Development

UNEP
United Nations Environment Programme

UNEP/IEO
UNEP Industry and Environment Office

UNEP/IRPTC
UNEP International Register of Potentially Toxic
Chemicals

UNEP/SBC
UNEP Secretariat of the Basel Convention

WHO
World Health Organization

A list of definitions is attached as Annex 6.

Introduction

Most developing countries have outdated and deteriorated stocks of pesticides that can no longer be used as prescribed on the label. These stocks are often stored in poor conditions and pose a threat to human health and the environment. With the exception of a few newly industrialized countries, developing countries do not have adequate facilities to dispose of such stocks in a safe and environmentally sound manner. In many cases, therefore, the recommended disposal method would appear to be shipment of the pesticides to a country that has special hazardous waste incineration facilities.

In view of the dangerous nature of these pesticides and the high costs of safe and environmentally sound disposal, the long-term solution to obsolete stocks lies in preventive measures: improved stock management and reduction of stocks.

The objective of these guidelines is to raise awareness about the mechanisms through which obsolete pesticide stocks accumulate and to enhance the formulation of policies and procedures aimed at prevention of such accumulation. The guidelines analyse the causes of this accumulation and recommend how it can be prevented. They provide guidance to the governments of developing countries, aid agencies and the pesticide industry. For developing countries, they are considered of special interest to ministries of agriculture and ministries of health, particularly for senior staff responsible for assessing the country's yearly pesticide requirements and for procuring pesticides; staff responsible for the management of national pesticide stocks; heads of departments or services responsible for plant protection, migratory pest control and vector control; directors of produce boards and cooperatives involved in large-scale pesticide distribution; and others responsible for pesticide procurement and management.

The guidelines should be regarded as a further instrument to enhance implementation of the FAO *International Code of Conduct on the Distribution and Use of Pesticides*, which was adopted by the Conference of FAO in 1985. The objective of the Code of Conduct is to set forth responsibilities and establish voluntary standards of conduct for all public and private entities engaged in or affecting the distribution and use of pesticides, particularly where there is either an inadequate national law or no law regulating pesticides. The Code of Conduct was amended in 1989 to include the Prior Informed Consent (PIC) procedure (FAO, 1990).

The guidelines supplement the *Guidelines on disposal of bulk quantities of pesticides in developing countries* (UNEP/FAO/WHOa, in preparation). Other FAO technical guidelines relevant to the subject are listed in Annex 5.

The issue of obsolete pesticide stocks is increasingly receiving international attention. A growing number of developing countries are requesting aid agencies to provide assistance for disposal of obsolete stocks and this has already started, together with assistance aimed at preventing further accumulation of obsolete pesticide stocks.

Donor assistance for the prevention and disposal of obsolete pesticide stocks is supported by several international agreements and policy documents. The most specific document in this respect is the OECD/DAC *Guidelines for aid agencies on pest and pesticide management* (OECD, 1995). Other important documents are *Agenda 21: Chapter 20 (Environmentally sound management of hazardous wastes including prevention of illegal international traffic in hazardous wastes)*, (UNCED, 1992) and the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989* (UNEP/SBC, 1994), both of which emphasize the importance of preventing the generation of hazardous waste. The World Bank also included some paragraphs on disposal of obsolete pesticide stocks in a relevant publication (World Bank, 1993). GIFAP, the international umbrella organization of national associations of agrochemical companies, also recognized the problem and established a working group on unwanted pesticides to see how the pesticide industry could contribute to preventing obsolete pesticide stocks.

Chapter 1

The problem of obsolete pesticides

1.1 WHEN ARE PESTICIDES OBSOLETE?

Obsolete pesticides are defined as stocked pesticides that can no longer be used for their original purpose or any other purpose and therefore require disposal. Common causes of this situation include the following:

- the product has been withdrawn for health or environmental reasons (e.g. through banning; withdrawal of registration; policy decision by the Ministry of Agriculture);
- the product has deteriorated as a result of improper or prolonged storage and can no longer be used according to its label specifications and use instructions, nor can it easily be reformulated to become usable again;
- the product is not suitable for its original use and cannot be used for another purpose, nor can it easily be modified to become usable.

A product has deteriorated when:

- it has undergone chemical and/or physical changes that result in phytotoxic effects on the target crop, or an unacceptable hazard to human health or the environment;
- the product has undergone an unacceptable loss of biological efficacy because of degradation of its active ingredient and/or other chemical or physical changes;
- its physical properties have changed to such an extent that it can no longer be applied with standard or stipulated application equipment.

In some publications, obsolete pesticides are also correctly referred to as *pesticide waste*. Another term used is *unwanted pesticides*, a broader definition than obsolete pesticides. Besides obsolete pesticides (the ones that definitely *cannot be used any longer* and require disposal), it also covers pesticides that, *in principle, could still be used*, but are not being used and are regarded as unwanted by their owner because there is a surplus stock in excess of requirements; the pest problem has passed; there are logistical constraints concerning distribution; the formulation is not suitable for the application equipment, etc. Although there is no immediate use for these products, they may still be in good condition and may be potentially usable without compromising environmental or occupational safety. Such products should not be regarded as obsolete so long as it has not been established that there are no solutions to the impediments hindering their use (such as more effective distribution, repackaging, procurement of different application equipment or reformulation of the product to make it usable with available application equipment, or alternative use). Therefore, unwanted pesticides are not necessarily obsolete. However, stocks that in principle are still usable, but are not being used, run a high risk of becoming obsolete as a result of prolonged storage.

Figure 1 represents a decision tree to determine whether pesticides are obsolete.

It is not always easy to establish whether old stocks have deteriorated to a level at which they have become unusable. If not stated otherwise on the label, products normally have a shelf-life of two years from the date of release, during which the manufacturer guarantees the quality of the product, provided that it is stored according to instructions precisely stated on the label. Such instructions may for instance refer to temperature, humidity and light/exposure to direct sunlight. Storage periods beyond two years, or beyond the shelf-life indicated on the label, do not automatically imply that such products have degraded beyond usability. Pesticides can often be stored for much longer than their indicated shelf-life. On several occasions, analytical results showed that five- to seven-year-old stocks of organophosphates, with an indicated shelf-life of two years, were still usable. However, the opposite may also occur. Storage under extremely high temperatures may accelerate deterioration to such an extent that the product becomes unusable before expiry of its shelf-life. For example, a temperature rise of 10°C may increase the decomposition rate by a factor of two or three (GIFAP, 1985). Temperatures inside shipping containers or in poorly ventilated stores may easily reach 40°C or higher when exposed to direct sunlight in tropical environments. High humidity, direct exposure to

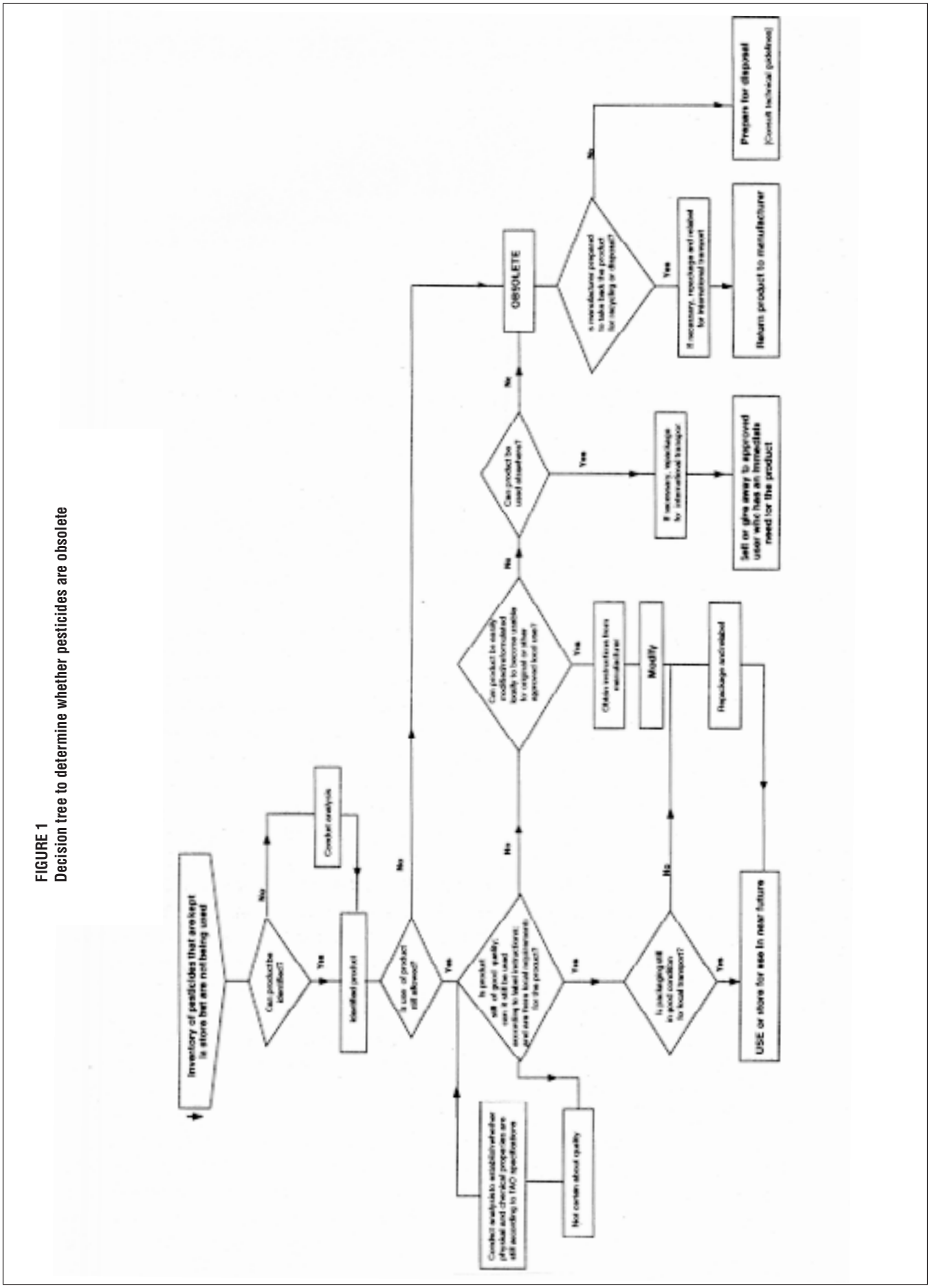

FIGURE 1
Decision tree to determine whether pesticides are obsolete

sunlight and strong temperature fluctuations may also shorten the actual shelf-life. This will depend on a number of factors that cannot always be controlled, monitored or predicted, which is why labels normally state the date of manufacture/release, instead of an expiry date. Labels may also state a "date of test", a date when analytical results confirmed that the product has not deviated from its original specifications, or that deviations are within an acceptable range.

Products that have deteriorated as a result of physical changes may be identified without difficulty: originally clear liquid formulations may have formed flakes, crystals or an emulsion; emulsions may have precipitated and solidified against the container's inside wall; powders may have solidified after becoming damp. More difficult to identify are products whose chemical properties have changed, while the visible physical properties remain unchanged. In such cases, it is often necessary to conduct chemical analysis in a laboratory to establish whether the product is still usable. The FAO specifications for plant protection products provide guidance on permitted tolerances for active ingredient contents, impurities and physical properties (FAOa, in preparation).

In some cases, a decline in active ingredient concentration may be compensated by a proportional increase in application volume, provided that the decomposition products of the active ingredient do not increase the product's toxicity beyond acceptable margins.

The *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989* (UNEP/SBC, 1994) defines "wastes" as "substances or objects which are disposed of, or are intended to be disposed of, or are required to be disposed of by the provisions of national law". Obsolete pesticides fall into this category. International transport of obsolete pesticides is therefore governed by this Convention. In addition, obsolete pesticides are subject to several international conventions regulating the transport of dangerous goods,[1] which are all based on the UN's *Recommendations on the transport of dangerous goods* (UN, 1991). National regulations governing the transport and handling of hazardous substances may be more strict on hazardous waste than on pesticides.

1.2 OCCURRENCE AND STATE OF OBSOLETE PESTICIDE STOCKS

Obsolete pesticide stocks are present in the majority of developing countries. Quantities in individual countries range from a few tonnes to several thousands. In 1994, FAO conducted an inventory of obsolete

[1] The following three conventions are based on the UN's *Recommendations on the transport of dangerous goods*, which cover principles of classification, general packaging requirements, testing procedures, marking, labelling or placarding, and shipping documents: The International Convention for the Prevention of Pollution from Ships (MARPOL) and the accompanying International Maritime Dangerous Goods (IMDG) Code, which provides standards for the shipment of dangerous goods by sea; The Convention on International Civic Aviation (Chicago Convention) and the accompanying Technical Instructions for the Safe Transport of Dangerous Goods by Air; The Convention concerning International Carriage by Rail.

FIGURE 2
Abandoned pesticide containers (barrels) blown close to disintegration by the high pressure of obsolete pesticides kept in them for years

FIGURE 3
A cocktail of obsolete, banned and unwanted pesticides. Powder pesticides spill from torn jute and paper bags, blowing into the environment or mixing with heavily leaking liquid pesticides kept in tin cans, barrels, etc. in the background. Since pesticides are in the open, accessible to passers-by, handlers and staff, exposure casualties are always common and widespread

pesticide stocks in Africa and the Near East. Results of this inventory indicate that the total of obsolete pesticides in Africa probably exceeds 15 000 tonnes.[2] In 1993, at least three Asian countries were known to have quantities of obsolete pesticides within the range of 5 000-10 000 tonnes each. Unconfirmed figures from Eastern European countries suggest that several countries hold very large quantities. The total in non-OECD countries may be well in excess of 100 000 tonnes. In addition, there are large quantities of heavily contaminated soils that should be regarded as hazardous waste.

Common types of obsolete pesticides include organochlorine compounds such as DDT, dieldrin and HCH, which have been withdrawn or banned for human health and/or environmental reasons. Countries in the migratory locust zone often still have large quantities of these compounds remaining from old strategic stocks for locust control. Several of these stocks were acquired over 20 years ago.

Another large group is organophosphates and carbamates that have deteriorated as a result of prolonged or improper storage. Examples of commonly found products that have deteriorated beyond usability include: dimethoate, fenitrothion, malathion, carbaryl and propoxur.

In many cases, obsolete pesticides are stored under conditions that do not meet the basic standards for safe and responsible storage of such hazardous materials. Stores are often poorly ventilated or do not have concrete floors. At many locations, obsolete pesticides have even been stored in the open. Bags are often torn or deteriorated. Drums are often corroded or have ballooned as a result of heat and leaking drums are a common feature. In some cases leakage has been so bad that floors of stores are completely covered with pesticides. Many stores lack basic provisions to deal safely and adequately with leakage or other emergencies.

1.3 CAUSES OF ACCUMULATION OF OBSOLETE PESTICIDES

There are many factors that have contributed to the formation of the present stockpiles of obsolete pesticides. These factors can be grouped roughly into the following categories:

- Banning of products
- Inadequate stores and poor stock management
- Unsuitable products or packaging
- Donations or purchases in excess of requirements
- Inadequate coordination among and within aid agencies
- Commercial interests of the pesticide industry and hidden factors

[2] At the time of publication of these guidelines, 18 African countries had submitted completed inventories. Extrapolation of the figures from these countries provides an overall estimate for Africa of 15 000-20 000 tonnes of obsolete pesticides (excluding heavily contaminated soils).

A detailed analysis of the causes of accumulation of obsolete pesticide stocks is provided in Chapter 2.

1.4 HAZARDS CONNECTED TO OBSOLETE PESTICIDES

Leaking drums and torn bags can seriously affect the occupational health of staff working at the storage site and of others who happen to come in contact with the pesticides. They often pose a broader general danger to public health and the environment. Factors determining the level of hazard include:

- the quantity of pesticides, the condition of containers and packaging and the degree of leakage;
- the place of storage (inside or outside a store) and the floor material of the storage site (degree of impermeability);
- the toxicity of the products;
- the behaviour of the product in the environment (persistence, mobility in soil, solubility in water, volatility);
- the location of the storage site (some are located in or near urban areas);
- the groundwater level and proximity of the storage site to water bodies (some stores are located on irrigation schemes, near rivers or in ports).

Contamination of groundwater or soil can occur through seepage of leaked pesticides into the ground or runoff during heavy rains. Poisoning of people or animals can occur through direct contact with the product, inhalation of vapours, drinking of contaminated water, or eating of contaminated food. Other hazards include:

- fire hazard. Several examples are known of pesticide stores that have caught fire as a result of poor maintenance of stores and/or stocks. The environmental contamination caused by fires can be widespread;
- unauthorized use of pesticides. Examples are known of obsolete stocks that gradually decreased as a result of pilfering. Unauthorized or inappropriate use of pesticides is a notable cause of accidents or contamination;
- improvised disposal. In several cases pesticides have been disposed of by burying or open burning, which may cause severe environmental contamination.

1.5 DISPOSAL OF OBSOLETE PESTICIDES

Disposal options

Products that can no longer be used are to be disposed of in a safe and environmentally sound manner. In most cases, the recommended method will be high-temperature incineration. Developing countries do not generally have appropriate high-temperature incineration facilities for hazardous waste. This means that obsolete products may have to be shipped to special hazardous waste incineration plants in countries that are willing to accept the waste. The costs of repackaging, shipment and incineration are high and the administrative procedures to comply with international conventions concerning the shipment of hazardous waste may be complicated and time-consuming. Alternative high-temperature incineration methods such as the use of a mobile incinerator or a local cement kiln have their limitations and are often not applicable in a safe and/or cost-effective manner.[3]

Methods such as chemical treatment or landfilling after solidification may sometimes offer solutions for relatively small quantities of specific groups of pesticides. Other methods are not recommended. Pesticides should never be disposed of by burying or open burning.

For detailed information concerning disposal options, reference should be made to the *Guidelines on disposal of bulk quantities of pesticides in developing countries* (UNEP/FAO/WHOa, in preparation).

Safe and environmentally sound disposal of pesticides can be very expensive. Costs depend on the disposal method, the total quantity of pesticides to be disposed of, the type and variety of products, the number of locations from where pesticides are to be removed, the distance to a port of exit, the degree of contamination, and so on. In 1993, the cost of a complete clean-up operation comprising repackaging,

[3] Many of the older types of cement kilns are not suitable. Only a few of the cement kilns in developing countries meet the technical requirements that, in principle, would make them suitable for incineration of certain groups of pesticides. Expert advice is needed to assess whether kilns can be used and special equipment is required to inject the pesticides into the kiln. Such equipment is expensive and should only be installed and used under expert supervision.

The use of mobile incinerators requires advanced road infrastructure, reliable and continuous supplies (fuel, electricity and chemicals) and expert supervision. In most cases, the use of mobile incinerators is unlikely to be cost-effective for quantities of fewer than 1 000 tonnes.

shipment and incineration of a bulk quantity of a single product from one location in a landlocked African country was in the order of US$4 000 per tonne. Costs of removing a variety of products that are to be collected from several locations will be even higher.

Donor assistance to disposal operations

Aid agencies may be willing to provide technical and financial assistance for the environmentally sound disposal of obsolete pesticides. The following considerations may give justification for providing such assistance:

- most of the present stocks of obsolete pesticides have accumulated over a long period of time, while the existence of such stocks has only recently been recognized as a major environmental issue. In addition, accumulation often occurred outside the control of the present authorities responsible for pesticide management;
- a substantial part of these stocks was provided under aid arrangements;
- stocks of obsolete pesticides are posing a serious threat to human health and the environment. Environmental contamination caused by obsolete pesticides may have wider environmental implications (e.g. contamination of international waters);
- environmental contamination caused by stocks of obsolete pesticides may be an impediment to the development of certain areas.

Nevertheless, even though aid agencies may be prepared to assist countries with a one-time intervention to dispose of old stocks, it is unlikely that they will be prepared to support the same countries in any subsequent disposal activities. Developing countries and aid agencies should therefore take the necessary precautions to ensure that present and future stocks of pesticides do not become obsolete.

Chapter 2

Analysis of causes of accumulation of obsolete pesticides

It is important to identify and understand the factors that have contributed to the formation of the present stockpiles of obsolete pesticides in order to formulate preventive measures. This chapter provides a further analysis of the categories of causes of accumulation as listed earlier in section 1.3.

2.1 BANNING OF PRODUCTS

In many countries, where a range of products has been banned or withdrawn for health or environmental reasons, the fate of existing stocks in the country is often given scare consideration. Stocks remain where they are stored and eventually deteriorate. This particularly applies to organochlorine compounds that are part of strategic stocks for locust control.

2.2 INADEQUATE STORES AND POOR STOCK MANAGEMENT

Insufficient storage capacity for pesticides

The government authority responsible for national pesticide stocks often does not have sufficient storage capacity to store all its pesticides safely. Many stores are poorly constructed, have insufficient ventilation, are too hot and/or do not have concrete floors. Because of space constraints, pesticides are often not properly stacked, thereby reducing access to products and making it difficult to monitor the condition of containers. At several locations, pesticides are even stored in the open for prolonged periods of time. Poor storage conditions accelerate the degradation of pesticides and their containers. New products are sometimes stored inappropriately because obsolete products are occupying the limited storage space.

Staff not trained in stock management

Storekeepers of major stores and those responsible for national stocks are often not familiar with the rules for good stock management (proper stacking, product segregation, principle of "first in – first out", etc.). Leakage and spills may not be cleaned up immediately because staff have not been trained how to handle them, or because the necessary materials and protective gear are not available. Contamination and improper stacking may affect the condition of other products and may impede a consistent application of the principle of "first in – first out". Stock records may not be regularly updated and communicated to the central authority responsible for establishing the country's pesticide requirements.

Inappropriate handling during transport

Drums and other packaging materials are often damaged through rough handling or in transport. When drums are battered, their inner and outer coatings may be damaged, which will accelerate corrosion and shorten their life. Unnecessarily long periods of exposure to direct sun during transit is another important factor that affects both the container and its contents.

Unavailability of analytical facilities

Because laboratory facilities for pesticide quality control are not available in most developing countries, it may be difficult to determine whether a pesticide may still be used after its indicated shelf-life has expired. Inadequate labelling and the absence of a date of manufacture/release on labels or on the container may complicate the matter. For this reason, there is often an understandable tendency to deviate from the principle of "first in – first out" and to use a newer product to be certain of its effectiveness; this practice leads to prolonged storage of older products.

2.3 UNSUITABLE PRODUCTS AND PACKAGING

Products may have been donated that were unsuitable for their intended use and have therefore remained in store and deteriorated.

Inappropriate active ingredient or formulation

Examples of cases where products have been considered unsuitable include the following:

- The active ingredient of a donated product was not

evaluated in the recipient country and field trials were required before it could be approved for use. This took time and the product started to deteriorate.
- The product was not effective against the target pest or against the weed it was supposed to destroy; or it had unacceptable side-effects (e.g. it appeared to have phytotoxic effects on the crop itself).
- The formulation was not stable under tropical conditions and the product rapidly degraded.
- The formulation could not be used with locally available application equipment (e.g. ULV formulation for use by small-scale farmers who only have knapsack-sprayers).

Impractical package size or poor container quality

Bulk quantities of pesticides are commonly supplied in 200-litre metal drums. For countries without good repackaging facilities this may create problems if the pesticides are intended for use by plant protection staff, extension staff or small-scale farmers. In order to transfer the contents of large drums into smaller packages, large quantities of small empty containers, a pump, labels, etc. are needed. These are often not available, or are insufficient, at the repackaging location. Consequently, pesticides may remain unused or improvised measures may be taken that are dangerous to handlers or users.

Pesticides are sometimes delivered in containers of poor durability that soon start leaking. Once drums have corroded or leak, they can no longer be transported, which makes it considerably more difficult to use their contents. The same applies to torn bags and other damaged packaging.

If the container quality is not specified in tender documents, bidders may be tempted to reduce their price by compromising on the quality of containers.

Missing or incomplete labels

In some cases, pesticides are not used because the potential user does not know the specifications of the product, or how to apply it, since labels are missing or incomplete, are illegible (as a result of rain, sunlight, leakage), or are in a language alien to the user.

Insufficient communication between aid agency and recipient country

In several cases, the quantity, active ingredient, formulation or packaging of donated pesticides are inappropriate for the intended use. Such mistakes occur because of a lack of detailed specifications in requests for pesticide donations and/or a lack of background information and justification. On their part, aid agencies often make insufficient efforts to obtain such information before processing requests for pesticide donations.

Fraudulent practices of unreliable suppliers

Examples are also known of consignments that have not been used because the product had been adulterated by an unreliable supplier in order to increase profits and was no longer suitable for the intended purpose.

2.4 DONATIONS OR PURCHASES IN EXCESS OF REQUIREMENTS

Inaccurate assessment of requirements

An assessment of the necessary quantities of pesticides is generally based on approximate estimates of the area to be treated. Insufficient consideration is often given to the actual agro-ecological conditions (e.g. variations in intensity of pest outbreaks, economic thresholds, etc.) and to factors that may limit the use of pesticides such as the local application capacity (availability of spraying equipment, protective clothing and trained staff), storage facilities and the effectiveness of distribution systems. The ability of the envisaged users to pay for the product is another factor that is sometimes overlooked. In addition, there is a tendency to overestimate requirements in order to avoid any shortages.

Centralized and up-to-date information on existing in-country stocks is sometimes not readily available or is incomplete, which complicates the assessment of additional requirements. In this case, the national authority responsible for the assessment of the country's yearly requirement of pesticides may not rely on these stocks and will keep them out of the equation when drawing up a list of products to be procured or requested from donors.

Lower than expected pest incidence

The possible extent of an expected pest outbreak is sometimes difficult to forecast. A lower pest incidence than expected may result in unused pesticide stocks.

In the past, this was particularly true for outbreaks or invasions of migratory pests. Countries that established large strategic pesticide stocks in preparation for possible upsurges or invasions often ended up with large quantities of unused products. The risk was further increased by decentralizing such stocks.

FIGURE 4
A partial view of a consignment of malathion pesticides donated from a donor to a recipient country and now obsolete. Some have leaked and seeped into the ground, while others have caused high-pressure buildup that has distended the tops of the barrels

Monitoring of locust outbreaks has greatly improved with the FAO Emergency Centre for Locust Operations programme. Internationally coordinated control strategies based on the monitoring of developments in locust outbreaks have demonstrated that pesticides can be flown in on time and that large strategic stocks are therefore no longer necessary.

Overstocking of products with a short shelf-life

Most currently used pesticides have a two-year shelf-life. Tropical conditions characterized by excessive heat, high humidity and/or strong fluctuations in temperature may reduce this already short life span. During medium- or longer-term storage periods, these products degrade and become unusable. Overstocking of such products is a common cause of pesticides becoming obsolete.

Excessive donations

Aid agencies have sometimes provided pesticide donations far in excess of requirements. In several cases this has involved products manufactured in the home country of the aid agency or funding government (see also section 2.6).

Under some agricultural input supply programmes that last for a number of years, the provision of pesticides is automatic until notice is given to stop. This system, depending on feedback, does not always work effectively. In some cases, it has led to an accumulation of pesticides when demand dropped and supply was not adjusted.

Some examples are known of unsolicited pesticide donations.

Removal of subsidies

Many countries are reducing or removing subsidies from pesticides. The rationale behind the adjustment of pricing policies is both technical and economic. Direct and indirect subsidies on pesticides are not desirable because they stimulate overuse and over-reliance on pesticides and frustrate the introduction of Integrated Pest Management (IPM). Moreover, structural adjustment programmes require the removal of subsidies from agricultural inputs to establish rational market mechanisms. This often causes a temporary or structural drop in demand. As a result, stocks may remain in store longer than planned and are at increased risk of becoming obsolete.

2.5 INADEQUATE COORDINATION AMONG AND WITHIN AID AGENCIES

Poor coordination among aid agencies

Insufficient coordination among aid agencies providing pesticides, especially for locust and other migratory pest control operations, has been a major factor in causing excess donations of pesticides. Recipient governments do not usually have any guarantee that the required pesticides will be provided by the donor agency they first contact. In emergency situations, this may lead to simultaneous requests for assistance being made to various agencies, with the hope that at least one will react in time. In the end, the requested amount may be received from more than one donor. Given this undesirable situation, FAO is enhancing donor coordination in emergency situations, both at the international level and the national level in recipient countries.

Administrative procedures within aid agencies

Slow processing of requests for pesticides, in some cases, has meant that the pesticides have arrived too late.

Project or programme funds are often allocated for spending within a certain period. Consequently, timing for the procurement of pesticides is sometimes determined by budgetary factors, rather than by actual requirements. This means that recipient countries may be pressed to accept pesticide supplies on a "now or never" basis, which in many cases conflicts with the principle of providing pesticides only when they are actually needed.

Several aid agencies have not yet assigned responsibility for the appraisal and processing of requests for pesticides to a specific technical office within the agency. Instead, such requests are processed by the country desk concerned. There may be little coordination among country desks themselves, or among country desks, technical departments and procurement departments. Without a specifically designated technical office to appraise requests for pesticides, it may be difficult to build up an institutional memory to avoid repetition of mistakes.

2.6 COMMERCIAL INTERESTS AND HIDDEN FACTORS

Agrochemical companies, or their local agents, often take the initiative to advise plant protection services and other large-scale users on their pesticide requirements. Sometimes such advice forms the basis for requests to donors. However, companies may not always put the public interest above their own commercial interest and assessments may be in excess of actual requirements. Moreover, the recommended product will probably be one the company supplies and therefore may not necessarily be the most appropriate.

Large sums of money are involved in pesticide supplies. As a result, a variety of hidden interests may play a role in decisions concerning pesticide procurement or donations. Often these interests are not strictly related to the best technical solution to pest problems. Companies may use a range of aggressive marketing methods that result in procurement of quantities in excess of actual requirements, or of low-quality products. Some individuals involved in pesticide procurement may have personal interests. Donor countries may place increased emphasis on supply of pesticides because of the spin-off for the national pesticide industry, thereby increasing the risk of donations being supply- rather than demand-based. Supply-based donations of pesticides are more likely to become obsolete. Tied aid may restrict the range from which products can be selected.

Such hidden factors often complicate a sound technical approach to pest and pesticide management and should be identified and addressed in policy decisions.

Chapter 3

Preventing the accumulation of obsolete pesticides

3.1 WHY PREVENTION IS NECESSARY

In the absence of safe and environmentally sound local disposal facilities, and in view of the high cost of shipping pesticides out to an incinerator, which most countries cannot afford, obsolete pesticides often remain in store until containers corrode and the contents leak. If no action is taken, large quantities of concentrated pesticides will eventually leak into the environment, with severe consequences for public and animal health, and the environment itself. Contamination of groundwater may be irreversible. Stocks of obsolete pesticides should therefore be regarded as chemical time-bombs that can cause environmental and human disasters.

Donor assistance may be available for the disposal of obsolete stocks, but will always be considered a one-time option, with the understanding that the country concerned will take the necessary measures to avoid further accumulation of obsolete pesticides. It is highly unlikely that aid agencies will be prepared to help dispose of newly accumulated pesticides if old stocks have already been disposed of with their assistance.

Large sums of mainly hard-currency capital are involved when pesticides are allowed to become obsolete. Costs include those for the original purchase of the unused product, transport and storage, repackaging and disposal, cleaning up contamination and product replacement. Heavy contamination of groundwater may have far-reaching economic and social implications. Costs of mitigating damage caused by leaked pesticides are generally several times those of preventing the damage.

Disposal problems should therefore be avoided by applying prior measures to reduce the risk of pesticides becoming obsolete. Several simple and straightforward measures are described in sections 3.3, 3.4 and 3.5. Some of these measures may require a certain investment (e.g. upgrading pesticide stores). However, such investment will offer returns by saving huge expenditure on disposal and clean-up operations and by avoiding costs related to environmental damage resulting from contamination.

3.2 RESPONSIBILITY FOR PESTICIDE STOCKS

Responsibility for pesticide stocks lies primarily with the owner of the pesticides, who might be the government or individual ministries (Ministries of Agriculture and Health); semigovernmental bodies (produce boards, cooperatives); the pesticide industry (stocks for sale held by companies); or private users (plantations, farmers). The owner should manage pesticide stocks in a proper, safe and environmentally sound manner and take the necessary precautions to prevent stocks from becoming obsolete. Where pesticides become obsolete, the owner is responsible for disposing of them safely and in an environmentally sound fashion and for cleaning up any related contamination.

However, a grey area appears to exist. In certain cases it might be queried whether pesticide stocks have been accepted on an entirely voluntary basis. Governments may have accepted pesticide donations that were different from what they actually wanted for fear of offending an important donor or straining political relationships with the government offering the pesticides. Present governments may have inherited stocks from previous ones or, in some cases, governments may have accepted pesticides in good faith on the basis of incorrect information about requirements, effectiveness or properties.

Apart from the responsibility attached to ownership of pesticides, suppliers also have certain responsibilities. Aid agencies providing pesticides have a moral and political responsibility to ensure that donations are appropriate (in terms of product, quantity, packaging and timeliness) and are in accordance with the specifications of the recipient government. It could also be argued that aid agencies should accept responsibility for the environmentally sound disposal of the remains of their donations if these are uncoordinated, inappropriate or have not

been used because they arrived too late. Agrochemical companies that use unethical methods to sell pesticides should also be held accountable for obsolete stocks resulting from such practices.

Aid agencies have a general responsibility to assist recipient countries in avoiding the buildup of obsolete pesticide stocks, particularly because many of the pesticides at present used in developing countries are supplied under aid arrangements, and because UNCED Agenda 21 and the Basel Convention call for assistance to developing countries in avoiding the generation of hazardous waste.

Guidance on how the generation of obsolete pesticides can be prevented is given in sections 3.3, 3.4 and 3.5 below.

3.3 GUIDELINES FOR GOVERNMENTS OF DEVELOPING COUNTRIES

It is recommended that governments and other large-scale users examine critically their policies on pesticide management, plant protection and vector control; their procedures for assessing pesticide requirements; and their procedures for procurement of pesticides. This would help to improve policies and procedures and minimize the risk of generating hazardous waste in the form of obsolete pesticides. It may moreover be necessary to revise pesticide management regulations and/or provide training for government and non-government staff responsible for stockkeeping at pesticide stores.

Recommendations on prevention for small-scale users are provided in the *Guidelines on disposal of pesticide containers and small quantities of pesticides waste. Guidance for farmers and extension staff* (UNEP/FAO/WHOb, in preparation).

The following recommendations should be considered for incorporation in pesticide management policies, regulations and procedures.

Reduce pesticide use, where possible

Give priority to IPM in plant protection programmes. For several major crops the use of pesticides may be reduced considerably through IPM.[4] The same applies to vector control programmes in public and animal health programmes. Reduced use of pesticides will also reduce the need for large stocks. Pest control policies should therefore be geared towards strengthening IPM and Integrated Vector Control (IVC) capabilities and reducing pesticide use.[5] Pesticides should be sold at realistic, unsubsidized prices to avoid excessive use by farmers and so as not to frustrate the introduction of IPM and IVC.

Reduce the amount of pesticides by careful selection of products. In many cases, conventional pesticides can be replaced by more modern products (such as biological pesticides and growth inhibitors) that are more selective, less dangerous to human beings and

[4] Rice and cotton are good examples.

[5] Tsetse flies, for example, are vectors that are successfully controlled through IVC, with a dramatically reduced use of pesticides.

FIGURE 5
A cocktail of obsolete and unwanted pesticides in corroded or rusted containers such as barrels, tin cans and torn jute bags, in substandard storage conditions. Most liquid pesticides have leaked into the ground and powder pesticides have caked

animals and of which much smaller volumes are required. A major reduction in volume will help avoid storage and distribution problems and take away the need to keep large stocks. It is recommended that present products be evaluated and alternatives to conventional pesticides investigated. Although modern products are still relatively expensive, reduced transport and storage costs may (partly) compensate for this.

Avoid overstocking of pesticides

Keep pesticide stocks as low as possible. Determine which pesticides are needed, how many, when they will be used, and how. Pesticide procurement should be based on what is actually and immediately required. Stocking more than one season's pesticide requirements should be avoided because storage under tropical conditions may further reduce the already short shelf-life of many products. In addition, several factors may cause a sudden change in requirements or use (such as the development of resistant strains; introduction of new and less hazardous pesticides or pest control methods; new scientific facts concerning environmental or health implications of certain pesticides; different pest outbreaks from those foreseen; and changes in pesticide pricing policies).

Supply/importation arrangements at short notice and efficient delivery and distribution systems make it less necessary to stockpile pesticides. Improving supply and distribution arrangements will lead to reduced stocks. Investment in distribution systems should be regarded as an alternative to investment in large stocks.

Prepositioning of stocks at the provincial level for migratory pest control emergency operations could possibly be avoided by making arrangements to distribute pesticides at short notice from a national stock. This will often be more cost-effective and, moreover, prepositioned stocks generally run a higher risk of becoming obsolete.

Make accurate assessments of requirements. Before ordering pesticides or making requests to aid agencies, need and expected use should be assessed accurately. Factors that may limit the actual use, such as the application capacity and the effectiveness of the distribution system, should be taken into account. For an adequate assessment, the following questions may be relevant:

- Is the intended use of pesticides really necessary, or are alternative approaches available within the framework of IPM?
- Does the government have to be involved in pesticide distribution or can users obtain pesticides directly from the private sector?
- How many hectares are expected to require treatment? How will the area be treated?
- What is the application capacity, taking into account the number of qualified applicators, the availability of application equipment and protective clothing? Is the application capacity a factor that might limit the extent to which pesticides will be used?
- How will the pesticides be distributed to users? Is the effectiveness of the distribution system a factor that might limit the extent to which pesticides will be used? At what price will the pesticides be distributed? Is the price affordable to all envisaged users, or might it limit the use of the product?
- What pesticides are currently kept in stock? Could these be used first?
- Does the storage capacity correspond to the pesticide requirement?

To facilitate a rational appraisal of requests for pesticide donations, the above information should be provided as standard background information with each request for pesticides from governments to aid agencies (see also p. 19 and Annex 2).

Review the role of the government in pesticide distribution. In many countries, a large quantity of pesticides is distributed by the government because it can:

- provide pesticides at subsidized prices for specific target groups;
- give farmers who are not being reached by private companies access to pesticides;
- provide pesticides for those pests of public concern (e.g. public health, migratory pests, etc.).

The first reason for government distribution may no longer be valid since many countries have adjusted their pricing policies and have abolished pesticide subsidies or are gradually removing them. In many countries, private sector distributors have expanded their retail networks, thereby reducing the need for the government to play an active role in distribution. In addition, government agricultural policies may have shifted towards IPM.

The need for pesticide distribution through government channels should be critically reviewed. A less pronounced role in distribution will reduce the necessity for governments to keep large pesticide stocks. Government involvement in pesticide

distribution should be substituted by more strict control in the private sector, allowing it to supply the market originally serviced by the government.

Anticipate the effects of changes in pricing policies. Large quantities of pesticides should not be stocked if there are plans to review, reduce or abolish subsidies or preferential tariffs for pesticides. In several countries, such measures have led to a stagnation in pesticide sales and prolonged storage of stocks.

Avoid inappropriate products

Ensure in advance that products are effective. Do not procure, or accept, products that have not been tested in trials conducted under conditions comparable to those of the intended use.

Ask the supplier for a certificate of analysis, which should confirm that the chemical and physical properties of the product correspond to the standards set out in the FAO specifications for plant protection products (FAOa, in preparation).

Provide detailed specifications when procuring or requesting pesticides. The following factors should be taken into consideration:

Formulation should be suitable for application equipment available; should be heat stable if storage under tropical conditions is foreseen; and should be stable enough to last at least as log as the foreseen storage period.

Package type should be durable enough to stand foreseen transport and storage conditions and storage period.

Package size should be suitable/practical/affordable for the end-user.

Label should contain a batch number and date of manufacture/release and should be in line with FAO *Guidelines on good labelling practice for pesticides* (FAO, 1994a); it should be well attached and should be resistant to sun, heat, water and leakages.

Pesticide consignments that have not been requested, or that deviate from the requested specifications or quantity, should not be accepted.

For further guidance concerning the procurement of pesticides see Box 1 and FAO (1994b).

BOX 1

Specifications for the tendering or procurement of pesticides

Tender documents and direct procurement orders should:

- provide strict specifications for the product (based on internationally recognized FAO or WHO pesticide specifications) and its packaging, taking into consideration the specific transport and storage conditions in tropical countries and the subsequent need for stable formulations and durable packaging and labels;
- state that each package should contain a batch number and manufacture date;
- state that a certificate of analysis is to be provided;
- state that material safety data sheets should be provided for each product;
- specify the maximum time period for delivery.

Furthermore, tenders and orders should state that the supplier will bear all expenses for the removal, upgrading or disposal of pesticides, should the supplied product deviate from the specifications as quoted in the tender document or direct procurement order.

See also FAO (1994b).

Some examples of container specifications that would increase the durability of 200-litre drums:

- apply a primer undercoat on the outside surface of the drum;
- use an epoxy outer paint instead of alkyd paint;
- use a light colour (under direct exposure to sunlight, contents of light-coloured drums can be up to 20°C cooler than products stored in dark drums);
- apply a chemical-resistant inner coating;
- use heavier duty steel (e.g. 16 instead of 18 gauge), galvanized steel or even stainless steel.

Exchange information on pesticides to enhance judicial selection of pesticides. Countries are recommended to evaluate the usefulness of different pesticides and to share this information with other countries. Specific points of evaluation would include the product's efficacy; possible development of resistant pest strains and induced pests; and the product's impact on human health and the environment. To facilitate the exchange of such information, a database could be established within an international organization, to be used by recipient countries and aid agencies to enhance judicial selection of pesticides.

Ensure proper handling, storage and stock management

Avoid damage during transport. Avoid rough handling of drums during transit, transport and storage.

Periods of temporary storage at transit points should be reduced to a minimum. Exposure of containers to sunlight should be minimized during transport and transit.

Ensure proper storage. Allocate sufficient proper storage space and ensure good storage practices. See Box 2, Annex 3 and FAO (1995).

Determine whether older products can still be used. Older pesticides should be tested to establish whether they can still be used. Expiry of the indicated shelf-life does not automatically mean that the product is no longer usable since the actual life of the pesticide, when properly stored, may be much longer. If in doubt, analysis should establish whether or not the product is still usable. Generally this would not be so after prolonged storage beyond the shelf-life of two years, or after a period of storage under unfavourable conditions. If the pesticide still meets its original specifications, then the "date of test" should be written on the label for future reference. Older products that can still be used should be given priority over more recent products.

Arrangements for quality analysis could possibly be made with a neighbouring country, an aid agency, or a commercial standards bureau, if laboratory facilities are not locally available. FAO specifications for plant protection products (FAOa, in preparation) offer guidance on acceptable deviations from the original properties of the product. Analysis costs are very small compared with costs of disposal, which may have to be incurred later if older stocks remain.

FIGURE 6
Distended barrels that have leaked liquid pesticides into the ground since the bottoms have cracked open through rust and sheer chemical pressure

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

Reduce surplus stocks and other not directly usable stocks. Avoid allowing present stocks that are unlikely to be used before their expiry date to become unusable and obsolete. It is recommended that an inventory be made of all non-operational stocks in order to identify products that are still usable, but are not likely to be used and for what reason. If there is a specific problem hindering use, it could perhaps be solved. For example, wrongly formulated products might be reformulated; products of a wrong package size could be repackaged; unidentified products could be identified through analysis; products that cannot be transported because

BOX 2

Ten rules for proper pesticide storage and stock management

The following principles for storage management should be adhered to in order to keep pesticide stocks in good condition and to enable staff to take appropriate action in the event of leakage or other emergencies.

1. Pesticide stores should not be located in or near densely populated urban areas, or near water bodies.
2. The storage capacity (total storage surface) should be sufficient to store the total stock of pesticides at any time.
3. Each store should have at least the following basic provisions:
   - Sufficient ventilation to avoid unnecessarily high temperatures.
   - Floors made of, or covered by, impermeable concrete or cement. (As a temporary measure, floors may be covered by a large thick polythene sheet.)
   - Ramps at entrances to contain any major leakage within the store.
   - Doors that are lockable and have danger signs, bars across ventilation holes and windows to prevent unauthorized entry.
4. The floor of the store should have a layout of separate blocks with aisles between them. The outline of these blocks should ideally be marked with paint on the floor. Each block should contain only one product. There should be sufficient space between blocks to move containers freely, enable inspection of containers and treat leakage. Drums should be stacked in such a way that each individual drum can be inspected from the aisles between the blocks. Drums and bags should be stored on pallets. The number of containers stacked on top of each other should not exceed the stacking recommendations for the type of container concerned (see Annex 3). Overstacking of drums may lead to rupture of drums, boxes or bags lower down. Overstacking also hinders access to the containers.
5. Pesticide stores should only contain pesticides. All other goods or objects should be removed.
6. Obsolete pesticides should be segregated from operational stocks.
7. Each store should have the following materials and equipment to deal with emergencies:
   - A few bags of sawdust and/or sand to absorb leaked or spilled pesticides.
   - A number of empty drums (preferably salvage drums that can contain a whole 200-litre drum) to repackage heavily damaged or leaking containers.
   - Empty polythene bags to repackage damaged sacks or other materials.
   - Shovel and brush.
   - Fire extinguisher.
   - Protective clothing for staff to enable them to deal with emergencies (nitrile or neoprene gloves, rubber boots, overalls, goggles, vapour masks or half-face respirators with organic vapour cartridges).
   - Tap, or container with water, to wash hands and face in the case of contamination.
   - Eyewash set.
8. The contents of leaking or heavily damaged containers should be repackaged in appropriate containers. Repackaged pesticides should be relabelled immediately. Stores should be inspected regularly. Any leakage or contamination should be cleaned up immediately (see Box in Annex 1).
9. Storekeepers should keep a record of stocks in their custody. The authority concerned should keep a central record of all stocks kept in the country. Recorded data should include: *i)* Incoming pesticides – arrival date, formulation, quantity, unit size, date of manufacture/factory release, supplier, origin; *ii)* outgoing pesticides – date, formulation, quantity, unit size, destination. Records should be updated regularly.
10. The principle of “first in – first out” should be applied consistently. In other words, old consignments should always be finished before using newly arrived consignments.

of damaged containers could be repackaged; products that are no longer needed for the purpose originally intended may be used differently, and so on.

If no solution can be found and there is no alternative use within the country, pesticides might be offered to a nearby country that is in need. It is cheaper to give away a product free of charge than, at a later stage, be faced with huge disposal costs and/or environmental contamination. If pesticides are passed on to other countries, a certificate of analysis provided by an independent laboratory should confirm that the product is still usable. International transport regulations on packaging requirements should be observed. Older products will often require repackaging prior to transportation. The type and unit size of packaging should be chosen in consultation with the recipient country.

Anticipate the effects of banning products

When banning a certain pesticide, due consideration should be given to a phasing-out period for existing stock. Prohibiting production and importation of the product, followed by a total ban on sale and use, could be started as soon as national stocks of the product are exhausted. Whether phasing out is desirable should be decided on a case-by-case basis, depending on various factors such as the actual environmental and health hazards connected to the use of the product.

Avoid pesticides that are subject to increasing international concern and are being banned in a growing number of countries. Participation in the FAO/UNEP Prior Informed Consent (PIC) scheme will help to recognize such pesticides.

Ensure safety in private sector stores

Governments are recommended to use the appropriate legislative tools to ensure that pesticide stores of private companies are adequate for the safe storage of pesticides. The principles listed in Box 2 should be adhered to. All deviating situations should be corrected immediately. Spills should be cleaned up and obsolete products disposed of in a safe and environmentally sound manner.

3.4 GUIDELINES FOR AID AGENCIES [6]

In many countries, particularly in Africa, obsolete stocks are to a large extent remains of pesticides obtained under aid arrangements. These aid arrangements comprise direct donations of pesticides, as well as financial aid packages that include the procurement of pesticides on preferential financial terms.

Aid agencies not only have a moral obligation to help prevent the buildup of obsolete pesticide stocks, but should also anticipate increasing pressure to fund the disposal of stocks remaining from their donations.

The following recommendations provide guidance for aid agencies to help avoid the stockpiling of obsolete pesticides in developing countries.

Reduce pesticide use and thereby reduce the need for large pesticide stocks

Help strengthen IPM capabilities. For several major crops the use of pesticides may be reduced considerably through application of IPM strategies. Increased emphasis on IPM would reduce the need to keep large stocks of pesticides. Aid agencies should therefore assist governments to strengthen their IPM capabilities as a sustainable alternative to merely supplying pesticides.[7]

Reduce stocks through better selection of products. Before providing pesticides, investigate whether conventional pesticides can be replaced by more modern ones (such as biological pesticides and growth inhibitors) that are more selective, less dangerous to human beings and animals and of which smaller volumes are required. The relatively high price of such products will be (partly) compensated by reduced environmental and health hazards, more sustainable production and a reduced risk of stocks becoming obsolete.

Provide appropriate products and quantities

Provide pesticides only on the basis of well-specified requests. Do not provide pesticides on the basis of requests that have not been submitted or cleared by the relevant national authority in the recipient country and that lack:

- detailed specifications of the desired product –

[6] For the purpose of these guidelines the term aid agencies not only refers to organizations actively involved in the execution of aid programmes, but also to donor governments funding aid programmes.

[7] In general, pesticides should not be supplied to sectors for which effective IPM strategies are available, unless they are part of an IPM programme in which pesticides are used as a last resort. For further guidance on strengthening IPM capabilities in recipient countries, refer to OECD (1995).

these should include details on desired formulation, quantity, package size and type of package;
- detailed background information concerning the intended use, reason why the requested product has been selected, envisaged users, and other factors relevant for a careful appraisal of the request, such as storage facilities, mode of distribution, pricing and application capacity.

The aid agency should contact the requesting country in order to obtain any missing information before concluding its appraisal procedure. (A checklist is provided in Annex 2.

The quantity provided should be consistent with actual requirements and the local capacity to store, distribute and apply the pesticides. General and vaguely specified requests for pesticides, especially for bulk quantities for programme, emergency or balance-of-payments assistance, should not be considered. Pesticide supplies that are routinely provided under ongoing input supply programmes should be reappraised.

Do not provide pesticides before they are needed. Pesticide donations should be demand- and not supply-based (see section 2.6). Do not urge countries to accept pesticides on a "now or never" basis because budget allocations have to be spent before a deadline. It is better to try to make administrative arrangements to carry over funds.

Ensure that all pesticide donations comply with national pesticide legislation and PIC. Pesticide donations should always fully comply with national pesticide legislation and relevant regulations of the recipient country. Pesticides that are provided as donations also fall under the provisions of the PIC scheme, which must be complied with.

Ensure that the supplier delivers the correct product. Tender documents or direct procurement orders should provide detailed product specifications and state the responsibilities of the supplier (see p. 16, and Box 1).

Help to avoid the buildup of large stocks

Avoid the provision of large consignments. If a large quantity of pesticides is to be provided, consideration should be given to the possibility of phased delivery, whereby each consignment is delivered once the previous one is almost finished. The extra costs for phased delivery could be regarded as an insurance fee against the risk of pesticides becoming obsolete and requiring expensive disposal operations. Single donations should never increase the national stock to such an extent that the total exceeds a one-season requirement, nor should the total exceed the local storage or application capacity during one season.

Avoid the establishment of large on-site strategic stocks. Large on-site strategic stocks for emergency operations should be avoided. Instead, "pesticide bank" arrangements should be considered. These are arrangements between the aid agency and the manufacturer, whereby pesticides are kept on hand at the location of manufacture to be flown directly to the location of use when actually required. The extra costs for air transport are largely compensated for by savings in costs of in-country storage and transport; reduced risk of strategic stocks becoming obsolete and requiring disposal; and possibly a reduced requirement of pesticides as a result of a more efficient allocation. Pesticide bank arrangements need to be effective and reliable in order to replace strategic stocks successfully.

Help improve stock management to avoid storage problems

Provide pesticides with hazard reduction packages. All pesticides should be provided with material safety data sheets as well as the following emergency equipment, if this is not yet available at the destination:
- an appropriate number of salvage drums to contain leaking or damaged drums and/or spare sacks to contain damaged sacks;
- protective clothing for storekeepers to enable them to handle leakage and spills safely;
- appropriate detergents to decontaminate spills;
- firefighting equipment.

Hazard reduction packages should also include medical instructions and antidotes for health posts, protective clothing and appropriate application equipment for users, when these items are not available at the locality of intended use.

Assist with chemical analyses of older pesticides. Respond positively to requests for assistance in conducting analyses to determine whether pesticides of doubtful quality (after prolonged storage or storage under unfavourable conditions) can still be used. Standing arrangements between aid agencies and independent laboratories in the donor country could offer a solution and should be investigated.

FIGURE 7
One of the steps necessary in decanting, repackaging and transporting obsolete, unwanted and banned pesticides in an affected country. The disposal process can be hazardous when appropriate care and precautions are not taken

Other assistance. In addition to the points mentioned above, aid agencies can help to avoid problems with obsolete pesticides by providing:

- assistance in constructing or upgrading pesticide stores;
- training in stock management and in assessing pesticide requirements;
- repackaging materials (salvage drums, new empty drums, bags) to countries that have large quantities of old pesticides in deteriorated containers;
- drum crushers for plant protection services that use large quantities of 200-litre metal drums, to enable the proper disposal of empty drums;
- support for research into pest control methods, particularly for migratory pests, which require fewer pesticides;
- support for the establishment of a database on evaluations of pesticides (see p. 17 on exchange of information).

Ensure good coordination

Interagency coordination concerning locust and migratory pest control. Pesticide donations for locust and migratory pest control emergency operations should be coordinated with the FAO Plant Protection Service (the address is given in Annex 5), which temporarily established the Emergency Centre for Locust Operations (ECLO). This would help avoid excessive donations.

Coordination within larger aid agencies. Inadequate internal coordination within larger aid agencies has sometimes led to inappropriate donations, or to delivery of donations after long delays. The arrival of pesticides in the recipient country after their need has passed has been one of the common causes of accumulation of obsolete pesticide stocks. It may often be better not to supply pesticides than to supply them too late.

To improve internal coordination with regard to pesticide donations, each aid agency should designate one of its technical offices as the focal point for pesticide matters. The responsibilities of this office would include the appraisal, approval and recording of all pesticide donations provided by the agency. This would build up an institutional memory that would help to prevent repetition of mistakes.

Evaluate large pesticide donations. Aid agencies should evaluate their major pesticide donations (over 10 tonnes) to determine whether all products have been used as envisaged. The results of such evaluations should be taken into consideration when appraising new requests for pesticide donations.

For further guidance on pesticide donations in general, reference should be made to OECD (1995).

Annex 3 contains a checklist for the appraisal of requests for pesticide donations. The purpose of this checklist is to avoid accumulation of obsolete stocks and to reduce environmental and health hazards related to the use of pesticides.

3.5 HOW THE PESTICIDE INDUSTRY CAN HELP TO PREVENT THE ACCUMULATION OF OBSOLETE STOCKS

Product stewardship should include active involvement in avoiding the accumulation of obsolete stocks. Companies should query orders for supplies of pesticides that, in their expert opinion, are unsuitable for the intended purpose, cannot be stored safely by

the authority ordering the pesticides, or are likely not to be used.

Agrochemical companies should ensure that their products contain a date of manufacture/release and a batch number. Material safety data sheets should be provided with each consignment. Provision of additional information on product stability under tropical circumstances and storage and stacking recommendations would be useful. Where the life of a product is shorter than two years, the expiry date should be printed on the label.

On the request of developing countries or aid agencies, the original producer should offer its expertise and advice on recommended disposal methods and other matters related to disposal and clean-up operations. For surplus products that can still be used, agrochemical companies should assist governments in identifying potential users in other countries.

Agrochemical companies should establish effective delivery systems to provide products at short notice so that large stocks do not need to be held in the country.

Return services should be developed to take back unused quantities of pesticides, in particular unwanted products that can be reformulated, and surplus stocks that can be used elsewhere. The modalities for such arrangements need to be worked out by the pesticide industry in conjunction with international organizations and national authorities. As an incentive for such services, the fact that companies are prepared to accept the return of unused products might be taken into consideration by governments and aid agencies when they select a supplier.

Agrochemical companies should take full responsibility for pesticide stocks at their distribution centres, stores and outlets in developing countries, including those of their local agents or subsidiaries. Responsibilities would include ensuring safe storage conditions and proper stock management (in line with the rules in Box 2); immediate clean-up of spills and other contamination; and removal of obsolete products for safe and environmentally sound destruction to international standards. Encouraging examples are known of multinational companies that have cleaned up contaminated sites at their local formulation plants or stores and shipped the obsolete products for incineration to a special hazardous waste incineration plant. Such clean-up operations should become a standard element of product stewardship.

Annexes

1. AVOIDING INCIDENTS WITH PESTICIDE STOCKS

The following action is recommended in order to avoid incidents with pesticide stocks, including stocks of obsolete pesticides.

- All pesticide stocks should be inspected by the relevant national authorities and each product recorded. Obsolete pesticides should be segregated from operational stocks. Pesticides in deteriorated containers should be repackaged and relabelled.
- Stocks of doubtful quality or age should be sampled and analysed to determine whether pesticides can still be used.
- Obsolete stocks should be centralized as far as possible, provided that container conditions are still safe for transport. The central store should meet the criteria listed in Box 2 on p. 18. Central storage of obsolete pesticides will facilitate stock control and the preparation and implementation of eventual disposal actions.
- Any contamination of floors should be cleaned up immediately (see Box).

Instructions for cleaning up spills and leaked pesticides

1. First read the instructions on the product label or material safety data sheet.
2. All unauthorized persons should be kept away from the contaminated area.
3. The store should be ventilated immediately as much as possible.
4. Work in teams of at least two people. All persons involved should wear appropriate protective clothing. Eyewash, water and soap should be kept at hand.
5. In case of leakage: pu the leaking drum into another drum, or pump its content into another drum. As a very temporary “first aid” measure, it is often possible to stop leakage by rolling the drum in such a position that the leak is on top.
6. Absorb the leaked product with absorbent material (sand, sawdust, earth, lime or spill-control material), 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.
7. Contaminated soft surfaces of earth, sand or gravel should be excavated, packed and labelled. Contaminated absorbent materials and soil should be regarded as hazardous waste and should be carefully packed and properly labelled for disposal or temporary storage until disposal can take place.

N.B. Stores that have once contained pesticides are unsuitable for storage of food items, even when floors have been decontaminated.

2. APPRAISAL OF REQUESTS FOR PESTICIDE DONATIONS

Checklist for the appraisal of requests for pesticide donations[1]

A complete request for pesticides should contain the following information.

Use

- Purpose for which the pesticides are required.
- Reason why the use of pesticides is necessary and why alternative non-chemical methods cannot be used.

Product specifications

- Specifications of the active ingredient and formulation, with a justification for the selected active ingredient and formulation (referring to efficacy; environmental considerations; occupational and public health considerations; and type of application equipment available).

Quantity

- Required quantity (referring to the extent of infestation and the size of the area to be treated; present stocks; capacity to distribute the pesticides effectively; application capacity in terms of available equipment and trained staff; and storage capacity).

Packaging requirements

- Required quality of packaging (referring to climate; storage and transport conditions; foreseen storage period; and risk of prolonged storage).
- Required package size (referring to the end-user and the available type of application equipment).
- Required languages for labels.

Hazard reduction

- Envisaged end-users and degree of knowledge about the appropriate use of pesticides and hazards connected with the use of pesticides (to determine whether training is necessary).
- Availability of protective clothing at the locality of use (to determine whether protective clothing should be supplied with the pesticides).
- Availability of antidotes at the locality of use (to determine whether antidotes should be supplied with the pesticides).
- Availability of facilities to dispose of empty containers (to determine whether a drum crusher should be supplied with the pesticides).

[1] *Source:* OECD, 1995.

3. RECOMMENDATIONS FOR STACKING CONTAINERS

If the label does not provide stacking instructions, the recommendations in the following table should be regarded as general guidelines.

Type of package	Maximum number of packs per palette	Maximum number of palettes per stack
Steel drums (200 l)	1	4
Steel drums (smaller than 200 l)	2	4
Fibre drums (200 l)	1	3
Fibre drums (smaller than 200 l)	2	3
Plastic drums (200 l)	1	2
Plastic drums (smaller than 200 l)	2	2
Paper sacks	4-5	3
Plastic sacks	4-5	3
Fibre case containing tins	4-6	4
Fibre case containing soft packages (plastic bottles, sachets)	4-6	2
Wooden cases	2-4	4

Source: UNIDO, 1983.

4. SUMMARY OVERVIEW OF RECOMMENDED PREVENTIVE MEASURES TO AVOID ACCUMULATION OF OBSOLETE PESTICIDES

Cause of accumulation	Preventive measures
Banning of product	
Left over after product banned	Formulate phasing-out clause when banning pesticides (p.19)
Inadequate storage capacity and poor stock management	
Insufficient storage capacity for pesticides	Invest in new stores or in upgrading old stores. Avoid procuring pesticide quantities that exceed the storage capacity (Box 2; Annex 1,3)
Staff not trained in stock management	Train staff in stock management, or at least provide them with copies of these and other relevant guidelines (Box 2)
Containers damaged through rough handling during transport	Train staff in the proper handling of pesticides during transport. Shorten transit periods as much as possible. Request repackaging material with each consignment
Unavailability of analytical facilities to determine product quality after prolonged periods of storage	Make arrangements with a laboratory inside or outside the country (p.17; p. 20, last para.)
Donations or purchases in excess of requirements	
Inaccurate assessment of requirements	Use checklist to determine requirements. Keep stocks as low as possible. Do not stock up more than a one-season requirement (p. 15, 19; Annex 2)
Lower than expected pest incidence	Keep stocks as low as possible. Purchase only when there is a direct need. Do not establish anticipatory stocks, but improve supply arrangements/systems instead (p. 14, 15, 20)
Overstocking of products with a short shelf-life	Do not stock up large quantities of products with 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 last (p. 15, 16, 20; Box 1)
Excessive donations	Do not accept donations in excess of requirements. Aid agencies should not accept requests without a satisfactory justification (p. 16, 19, 20; Annex 2)
Left over because of reduced demand as a result of removal of subsidies	Anticipate a drop in demand when planning requirements at a time that subsidies may be removed (p. 16, 2nd para.)
Unsuitable products	
Inappropriate active ingredient or formulation	Determine carefully what is required. Spell out product specifications in the tender document or direct procurement order. Do not accept donations of products that are considered unsuitable for the intended use (p. 15, last section; p. 16; p. 19, last para.)
Inappropriate package type or size	Determine carefully what is required. Spell out packaging specifications in the tender document or direct procurement order. Do not accept donations of products that are packaged inappropriately (p. 16; p. 19, last parr.; Box 1)
Missing or incomplete labels	Specify labelling requirements in the tender document or direct procurement order (p. 16; Box 1)
Fraudulent practices of suppliers	Follow FAO guidelines on tender procedures for procurement of pesticides (p. 16; Box 1)

5. REFERENCES AND FURTHER INFORMATION

Publications

FAO. 1988. *Guidelines on retail distribution of pesticides with particular reference to storage and handling at the point of supply to users in developing countries*. Rome.

FAO. 1990. *International Code of Conduct on the Distribution and Use of Pesticides* (Amended version). Rome.

FAO. 1991. *Guidance for governments, Joint FAO/UNEP Programme for the operation of Prior Informed Consent*, Rome. [By end-1994, decision guidance documents had been published for aldrin, chlordane, chlordimeform, cyhexatin, DDT, dieldrin, dinoseb, dinoseb salts, EDB, fluorocetamide, HCH (mixed isomers), heptachlor and mercury compounds.]

FAO. 1994a. *Guidelines on good labelling practice for pesticides* (Revised version). Rome.

FAO. 1994b. *Provisional guidelines on tender procedures for the procurement of pesticides*. Rome.

FAO. 1995. *Guidelines for packaging and storage of pesticides* (Revised version). Rome.

FAOa. *Manual on the development and use of FAO specifications for plant protection products*, 4th ed. Rome. (In preparation)

FAOb. *Guidelines on construction of simple pesticide storage facilities, using locally available materials in developing countries*. (In preparation)

GIFAP. 1985. *Options for ensuring quality in stored products*. Technical Monograph No. 10. Brussels.

GIFAP. 1988. *Guidelines for safe warehousing of pesticides*. Brussels.

GIFAP. 1991. *Disposal of unwanted pesticide stocks*. Brussels.

GLOBE. 1993. *Prevention and elimination of obsolete pesticide stocks in developing countries*, Global Legislators' Organization for a Balanced Environment. Amsterdam, AIDEnvironment.

OECD. 1995. *Guidelines for aid agencies on pest and pesticide management*. DAC Guidelines on Aid and Environment No. 6. Paris.

UN. 1991. *Recommendations on the transport of dangerous goods*, 7th revised ed. New York.

UNCED. 1992. *Agenda 21: Chapter 20 (Environmentally sound management of hazardous wastes including prevention of illegal international traffic in hazardous waste)*. Adopted 14 June 1992, Rio de Janeiro, Brazil.

UNEP/FAO/WHOa. *Guidelines on disposal of bulk quantities of pesticides in developing countries*. (In preparation)

UNEP/FAO/WHOb. *Guidelines on disposal of pesticide containers and small quantities of pesticides waste. Guidance for farmers and extension staff*. (In preparation)

UNEP/IEO. 1990. *Storage of hazardous materials: a technical guide for safe warehousing of hazardous waste*. Technical Report Series No. 3. Paris, UNEP Industry and Environment Office.

UNEP/SBC. 1994. *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989.* Decisions adopted by the First (1992) and Second (1994) Meetings of the Conference of Parties. Geneva, UNEP Secretariat of the Basel Convention.

UNIDO. 1983. *Formulation of pesticides in developing countries.* New York.

WHO. *Specifications for pesticides used in public health*, 7th ed. Geneva. (In preparation)

World Bank. 1993. *Guidelines and best practice. Agricultural pest management.* (GB 4.03, 1993). Washington, DC.

Also note: the FAO specifications for plant protection products, a continuing series of documents specifying chemical and physical properties of individual pesticides; and the WHO International Chemical Safety Cards, a continuing series of one-page information cards on the safe handling, use and disposal of specific pesticides, published by the WHO International Programme on Chemical Safety (IPCS).

Sources

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The publications mentioned above can be ordered from the following addresses:

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6. DEFINITIONS

For the purpose of these guidelines the following terms are used. Definitions marked with a "C" have been adopted from the *International Code of Conduct on the Distribution and Use of Pesticides*. Definitions marked with a "B" have been adopted from the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Unmarked definitions have been drawn up specifically for the purpose of this document.

Active ingredient means the biologically active part of the pesticide present in a formulation (C).

Banned means a pesticide for which all registered uses have been prohibited by final government regulatory action, or for which all requests for registration or equivalent action for all uses have, for health or environmental reasons, not been granted (C).

Disposal means any operation to recycle, neutralize, destruct, or isolate products. Disposal operations are specified in Annex IV to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Distribution means the process by which pesticides are supplied through trade channels on local or international markets (C).

Environmentally sound management of hazardous wastes or other wastes means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse affects which may result from such wastes (B).

Formulation means the combination of various ingredients designed to render the product useful and effective for the purpose claimed; the form of the pesticide as purchased by users (C).

Hazard means the likelihood that a pesticide will cause an adverse effect (injury) under the conditions in which it is used (C).

Integrated pest management means a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economically unacceptable damage or loss (C).

Label means the written, printed or graphic matter on, or attached to, the pesticide; or the immediate container thereof and the outside container or wrapper of the retail package of the pesticide (C).

Manufacturer means a corporation or other entity in the public or private sector or any individual engaged in the business or function (whether directly or through an agent or through an entity controlled by or under contract with it) of manufacturing a pesticide active ingredient or preparing its formulation or product (C).

Obsolete pesticides means stocked pesticides that can no longer be used for their original purpose or any other purpose and therefore require disposal. Such pesticides can no longer be used because their use has been banned, because they have deteriorated, or because they are not suitable for the use originally intended and cannot be used for another purpose, nor can they easily be modified to become usable.

Packaging means the container together with the protective wrapping used to carry pesticide products via wholesale or retail distribution to users (C).

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

Pesticide industry means all those organizations and individuals engaged in manufacturing, formulating or marketing pesticides and pesticide products (C).

Pesticide legislation means any laws or regulations introduced to regulate the manufacture, marketing, storage, labelling, packaging and use of pesticides in their qualitative, quantitative and environmental aspects (C).

Poison means a substance that can cause disturbance of structure or function, leading to injury or death when absorbed in relatively small amounts by human beings, plants or animals (C).

Poisoning means occurrence of damage or disturbance caused by a poison, and includes intoxication (C).

Prior Informed Consent (PIC) refers to the principle that international shipment of a pesticide that is banned or severely restricted in order to protect human health or the environment should not proceed without the agreement, where such agreement exists, or contrary to the decision of the designated national authority in the participating importing country (C).

Prior Informed Consent Procedure (PIC procedure) means the procedure for formally obtaining and disseminating the decisions of importing countries as to whether they wish to receive future shipments of pesticides that have been banned or severely restricted. A specific procedure was established for selecting pesticides for initial implementation of the PIC procedures. These include pesticides that have been previously banned or severely restricted as well as certain pesticide formulations that are acutely toxic (C). This procedure is described in FAO (1991), (see Annex 5).

Product means the pesticide in the form in which it is packed and sold; it usually contains an active ingredient plus adjuvants and may require dilution prior to use (C).

Protective clothing means any clothes, materials or devices that are designed to reduce exposure to pesticides when they are handled or applied (C).

Registration means the process whereby the responsible national government authority approves the sale and use of a pesticide following the evaluation of comprehensive scientific data demonstrating that the product is effective for the purposes intended and not unduly hazardous to human health or the environment (C).

Repackaging means the transfer of pesticide from any commercial package into any other, usually smaller, container for subsequent sale (C).

Severely restricted – a limited ban – means a pesticide for which virtually all registered uses have been prohibited by final government regulatory action but certain specific registered use or uses remain authorized (C).

Toxicity means a physiological or biological property which determines the capacity of a chemical to do harm or produce injury to a living organism by other than mechanical means (C).

Unwanted pesticides means pesticides that are not wanted or needed by the owner. These include obsolete pesticides (products that definitely cannot be used any more and require disposal), as well as pesticides of which the use has not been prohibited, which are in good condition and in principle could still be used, but are not being used for various reasons.

Wastes means substances or objects which are disposed of, or are intended to be disposed of, or are required to be disposed of by the provisions of national law (B).