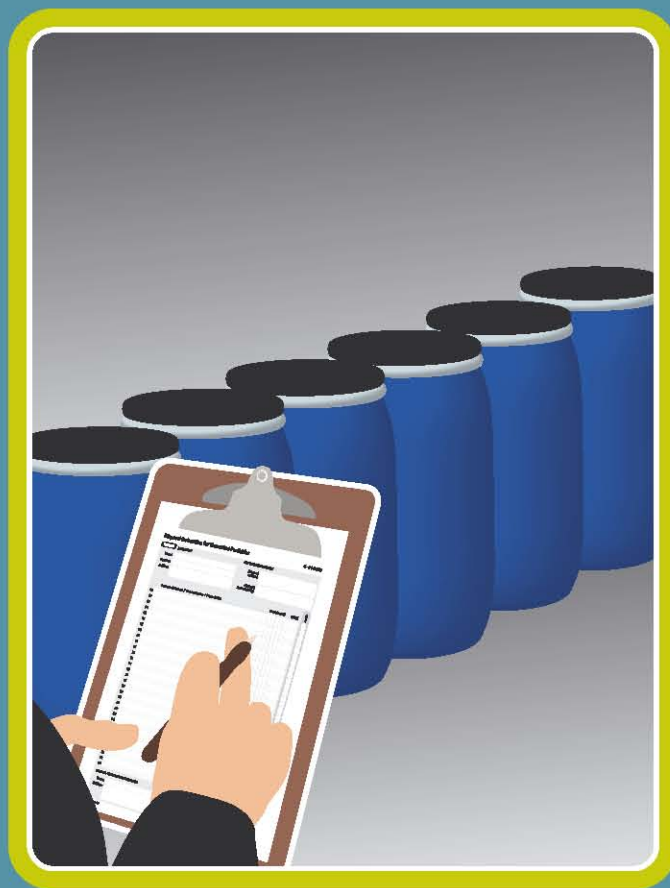
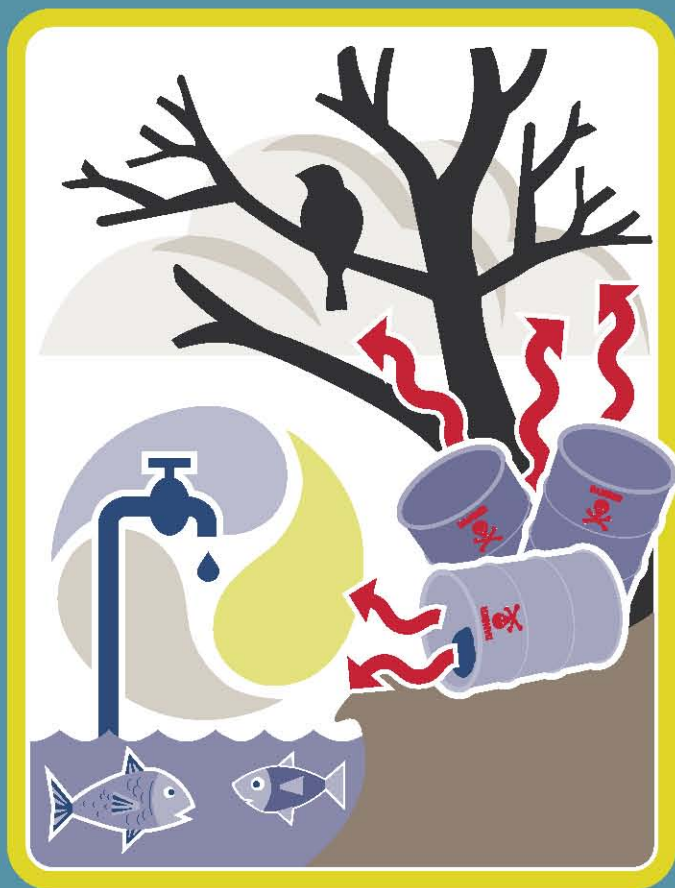


Environmental Management Tool Kit for Obsolete Pesticides



Volume 2

D. Selection of collection centres

E. Management of collection centres

F. Transport planning

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Foreword

Welcome to Volume 2 of the FAO Environmental Management Tool Kit (EMTK) for Obsolete Pesticides. The tool kit provides a practical set of methodologies to assist countries in the risk-based management of obsolete pesticides. Application of the tools in this volume is designed to help country teams prepare a comprehensive environmental management plan (EMP) for obsolete pesticides (see EMTK Volume 3).

EMTK Volume 1 described how to assess the scale of the problem posed by obsolete pesticides, based on the concept of environmental risk assessment. Volume 2 provides support in the areas of pesticide storage and transport. The principles it contains apply equally to both obsolete and useable pesticides and are based on international best practices related to the storage and transport of hazardous chemicals.

At the outset it is important to provide some practical reasons for developing the tool kit by considering the simple questions: How do pesticide managers select locations for storing pesticides? What systems do they use to ensure safe storage and good stock control? What are the rules for transporting pesticides to and from main storage locations? Many developing countries lack clear practical guidance on how these issues are managed. This guideline offers a set of systems and formats that allow countries to reduce the risk posed to public health and the environment during the storage and transport of pesticides, both useable and obsolete. The guidance does not attempt to overrule any national regulations that are in place, but rather to support such regulations through the development of practical working methods.

One of the main objectives of the EMTK series is to design a system that uses local resources and is as self-reliant as possible. The tools presented in this document are based on experience of implementing disposal projects in a wide range of developing countries since 1994. As a result, they can be applied by relatively inexperienced country teams to ensure the sound management of pesticides. The tool kit is accompanied by a training package for developing national capacity to apply the methodologies described. Following a one-week training session, the entire process of identifying suitable central storage locations, developing store management plans and designing appropriate transport systems should be completed by national teams.

The tool kit has been divided into sections for ease of reference. Tools D, E and F in Volume 2 cover all aspects of the safe storage and transport of pesticides. Tool D examines the process of selecting potential collection/storage points for pesticides, based on the environmental assessment data collected by tools A, B and C of EMTK Volume 1. Tool E provides guidance on the management of collection/storage locations, based on international best practice. This tool also covers the development of emergency plans in case of accidents at or near a store. Tool F looks at the safe transportation of hazardous materials such as pesticides, and sets minimum requirements in terms of vehicle safety, driver training, route planning and emergency response. The outputs from applying tools D, E and F are essential planning tools that should be incorporated into the project environmental assessment and EMP, which is covered in more detail in EMTK Volume 3. Application of the tools will have a direct impact on the safeguarding strategy adopted by a country and will make a large contribution to risk reduction and safe implementation.

This guideline is part of the FAO Pesticide Disposal Series. Readers are directed to complementary texts in the series covering such aspects as inventory, safeguarding, disposal and prevention of obsolete pesticides. Much of the system presented here has been integrated into the FAO Pesticide Stock Management System (PSMS). This is a web-based database, which uses the data collected from inventory and environmental assessment to identify stores that meet the minimum standards for use as collection centres/main storage locations and potential transport routes from outlying stores to collection points. Comprehensive training modules have been developed to assist readers in applying the tools contained in this guideline.¹

¹ For further information on the guidelines in the FAO Pesticide Disposal Series and associated training modules please contact the FAO Prevention and Disposal of Obsolete Pesticides Unit at opgroup@fao.org.

Contents

Foreword	iii
Acronyms	vi
Introducing the FAO Environmental Management Tool Kit for Obsolete Pesticides	1
EMTK Volume 2	1
Overview of obsolete pesticide management	2
Tool D: Selection of collection centres	5
Objectives of the tool	6
Structure of the tool	6
Practical guidelines for selecting collection centres	7
Tool E: Management of collection centres	15
Objectives of the tool	15
Structure of the tool	16
Practical guidelines for implementing a collection centre management plan	17
Tool F: Transport planning	35
Objectives of the tool	35
Structure of the tool	35
Practical guidelines for setting up a transport plan	36
References	51

Acronyms

EIA	environmental impact assessment
EMP	environmental management plan
EMTK	Environmental Management Tool Kit for Obsolete Pesticides
EU	European Union
HSE	health, safety and environment
IMDG	International Maritime Dangerous Goods Code
IMO	International Maritime Organization
M&E	monitoring and evaluation
MSDS	material safety data sheet(s)
OM	operational manual
PMU	project management unit
PSMS	Pesticide Stock Management System
UN	United Nations
UNECE	United Nations Economic Commission for Europe
WHO	World Health Organization

Introducing the FAO Environmental Management Tool Kit for Obsolete Pesticides

EMTK Volume 2

As in Volume 1 of the Environmental Management Tool Kit for Pesticides (EMTK; FAO, 2008), the guidance offered in Volume 2 is a component of FAO's support to improved management of both obsolete and useable pesticides. EMTK Volume 2 builds on the risk assessment methodology presented in Volume 1 and assists users in aspects of the storage and transport of obsolete pesticides. Both of these activities require careful management, and this document provides a set of practical, easy-to-follow instructions for the following three tools:

- Tool D supports the selection of central storage locations for consolidating obsolete pesticide stocks prior to dispatch to a final disposal facility. The tool can also be used to assist managers in the selection of appropriate locations for the storage of useable pesticides.
- Tool E supports the development of sound management systems for the storage locations, based on best international practice; it too can be applied to both obsolete and useable pesticide stocks.
- Tool F supports the development of transport plans to ensure the safe delivery of obsolete and useable pesticide stocks to major collection centres, and then on to final disposal facilities in the case of obsolete materials.

The document does not provide guidelines on implementing safeguarding measures during a repackaging exercise. Safeguarding of obsolete pesticide stockpiles requires specific environmental control and mitigation measures, which are described in a separate FAO guidance document (FAO, in preparation c).

Objectives

The tools contained in EMTK Volume 2 are based on experiences from various obsolete pesticide programmes supported by FAO in developing countries since 1994. The tools aim to:

- improve knowledge of the fundamental environmental management planning associated with the storage and transportation of obsolete, unwanted and banned pesticides;
- increase project teams' awareness of the public health and environmental risks from obsolete pesticides and the need for improved management practices;
- improve protection of the general public and the environment from the hazards posed by obsolete pesticides, by facilitating improved pesticide management at storage locations and during transport;
- provide project administrators with the necessary inputs to develop integrated and standardized procedures that protect both human health and the environment.

Audience

EMTK has been developed for the following target audience:

- **Country project managers** in charge of national obsolete pesticide programmes, to help them design and develop a series of collection centres, management systems for safe storage, and transport plans to allow safe delivery of obsolete stocks to collection centres and final disposal facilities.

- **Officers of the ministries of agriculture, environment and health**, to support them in selecting collection centres and storage areas for useable pesticides, based on assessment of potential impacts on public health and the environment.
- **Transport managers** responsible for the movement of pesticides (obsolete and useable), to support them in accident prevention and the adoption of sound transport practices when handling hazardous materials.
- **Regional and district officers and trained storekeepers**, to help them assess the environmental and public health situation prevailing in the store(s) for which they are responsible.
- **Non-governmental stakeholders** with a role in the management of obsolete pesticides, including civil society groups, the pesticide industry and other sectors involved in the pesticide life cycle.

Presentation

EMTK comprises several tools and a glossary presented in three volumes. Volume 2 focuses on issues related to:

- selection of storage points for use during the safeguarding phase of a disposal project;
- management of these locations;
- safe transportation of obsolete pesticide stockpiles from outlying storage locations to central major collection centres and then to the port of export or a national disposal facility.

The tools contained in EMTK Volumes 1 and 2 and the outputs of other guidelines in the FAO Pesticide Disposal Series are complementary and form a set of reference documents designed to assist countries in project implementation. The outputs of the EMTK process are designed to fulfil the requirements of country environmental assessments and environmental management plans (EMPs), which are presented in Volume 3.

Each tool includes an explanation of its overall aims and its basis in international regulations and other FAO guidelines. The text is supported by flow diagrams, boxes and templates.

The forms and reporting formats provided in this and other documents in the FAO Pesticide Disposal Series should be reviewed by the country team during project implementation and revised or amended to meet country-specific needs as required. Although the formats can be used in their current form, they should be considered as generic guides that are open to adjustment and revision based on lessons learned and implementation in the field. If a format does not meet the needs of the country it should be changed. Any significant changes should be sent to FAO so that the formats presented in the guideline can be adapted.

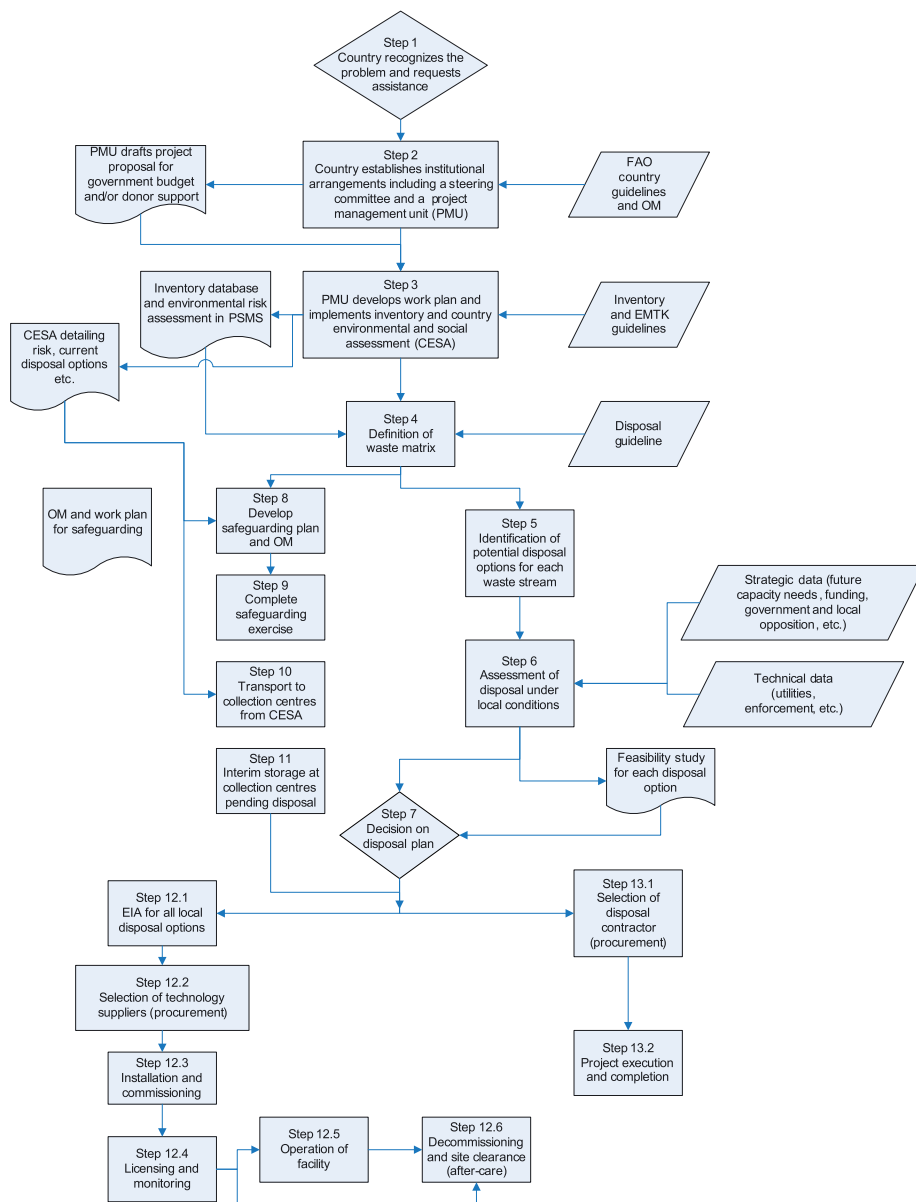
Overview of obsolete pesticide management

The selection of collection centres, development of storage systems and implementation of safe transport to collection centres and then final disposal facilities are critical steps in the effective management of obsolete pesticides. All of these steps must be completed before the safeguarding process can commence.

Figure 1 provides a step-by-step outline of the stages in successful implementation of an obsolete pesticide disposal project. A detailed review of the steps is provided in EMTK Volume 1.

Figure 1 clearly illustrates that irrespective of the final safeguarding and disposal option selected for the obsolete pesticides, the entire management process relies on three key activities: inventory, environmental assessment and safeguarding. These are common to all obsolete pesticide projects. FAO provides separate technical guidance for management of the inventory process and for safeguarding activities (FAO, in preparation a; in preparation c). A disposal guideline is also available to assist countries in developing a disposal strategy based on specific inventory data and selection of the most appropriate technologies for environmentally sound management of waste chemicals (FAO, in preparation b).

FIGURE 1
Outline of the management process for obsolete pesticides



EMTK Volumes 1 to 3 aim to complete the set of reference texts used by countries to plan effective management processes from inception to final completion – the “cradle to grave” approach.

EMTK Volume 2 utilizes data collected to calculate the environmental risk factor F_E to identify stores that meet the minimum environmental standard for use as collection centres during the safeguarding stage of a project. Existing stores with a low F_E value are evaluated further using tool D to determine whether they also meet the practical requirements for use as collection centres in terms of logistics and size. This process is automated in the FAO Pesticide Stock Management System (PSMS).

Not only does EMTK Volume 2 help the assessment and identification of potential collection centres (step 3 in Figure 1), but it also has a strong guiding influence on the safeguarding stage of a project (steps 10 and 11 in Figure 1). The development of safe transport routes and the ongoing management of obsolete stocks following centralization have a direct impact on practical aspects of project implementation, including costs and resource requirements.

Tool D

Selection of collection centres

During the initial phase of project implementation, tools A, B and C help users to carry out a general environmental and public health risk assessment, identify storage locations, and select those that should receive prior attention in a phased clean-up and disposal strategy. Tools A, B and C also assist a country in defining its national risk index, which can then be used as a monitoring and evaluation (M&E) tool during the safeguarding phase of a project. Once this phase is complete, an action plan should be developed to safeguard all stocks, ultimately leading to their environmentally sound disposal. The safeguarding phase includes stock repackaging, transport and interim storage. EMTK Volume 2 provides advice and support in the transport and storage elements of the safeguarding phase.

The safeguarding plan typically addresses high-risk locations as priorities. Remaining stocks are then collected, based on the risk posed in each geopolitical region. The safeguarding strategy generally consists of the following stages:

- Confirmation of the risk-based approach and clarification of which sites should be safeguarded first (tools A, B and C).
- Identification of centralized storage locations, where safeguarded stocks will be consolidated, and development of a work plan to ensure that these facilities are upgraded and ready to accept the waste prior to the start of safeguarding activities (tool D).
- Development of a management system for each collection centre, including an emergency plan and a draft storage plan (tool E).
- Development of transport plans from the scattered storage locations identified in the inventory to the central collection point (tool F).
- Consolidation of plans into an overall country environmental assessment and EMP (tools G and H in Volume 3).
- Safeguarding of stocks at all locations (FAO, in preparation c).
- Delivery of safeguarded materials to collection centres (tool F) and segregation/storage awaiting disposal (tool E).
- Development and implementation of transport plans to the disposal facility (tool F).
- Disposal of stocks (FAO, in preparation b).

The consolidation of stocks from outlying stores to one or a series of collection centres is a feature of most safeguarding strategies. The selection of collection centres is part of the general planning process and constitutes an important step for the successful implementation of a safeguarding strategy. The selection process must guarantee the safest possible storage conditions for the obsolete pesticide stockpiles in the country, pending dispatch for disposal. The selection process must also guarantee transparency so that proposals are accepted by all stakeholders, interested and affected parties and the broader general public.

When considering the selection criteria for collection centres, government agencies and project teams must make sure that essential environmental and public health requirements are met and logistics constraints addressed. Depending on the national context, they must also take into consideration economic restrictions and social and political factors. This tool provides guidelines for the selection of collection centres.

It is worth noting that a decision will need to be made regarding the future use of the collection centres when the obsolete pesticides have been successfully removed. If a store is to be used in the future for storage of pesticides and other inputs, the level of its upgrade and refurbishment will most likely be greater than if the store is to be used for general equipment. This is a country-by-country assessment based on the capacity needed for effective pesticide management in the future.

Objectives of the tool

The goal of this tool is to provide decision-makers and project management units (PMUs) with a step-by-step methodology for selecting interim and regional/main collection centres. Application of this tool makes it possible to:

- assess the storage needs of a country or geopolitical region, and determine the main requirements for the collection centre accordingly;
- identify among a group of stores those that meet environmental and public health criteria, and so qualify for use as collection centres;
- select the stores that will finally serve as collection centres, taking into consideration the environmental issues and practical issues related to logistics and economic constraints.

To achieve these objectives, it is assumed that:

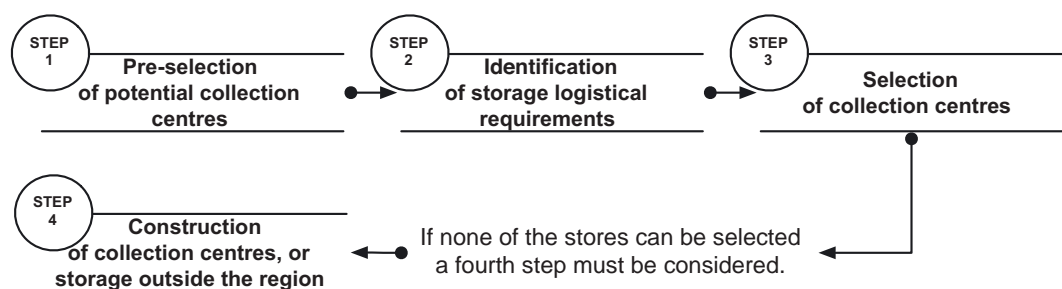
- tools A, B and C have already been used;
- an inventory campaign has been carried out, and FAO PSMS data collection forms completed for all the stores;
- PMUs have photographs and plans of the stores.

Structure of the tool

The selection of collection centres should be completed in three steps. An additional fourth step may be introduced if no existing store meets the minimum environmental criteria set in the guideline. The steps to be followed are (Figure D1):

- **Pre-select potential collection centres, based on environmental and public health constraints:** This pre-selection enables users to reject stores that present too high a level of risk for use as interim or main collection centres.
- **Identify the required surface area for each storage location,** depending on the quantity of pesticides to be stored there from surrounding locations, and the pesticides' toxicity and other chemical hazardous properties (flammability, etc.).
- **Select collection centres, based on logistics and economic constraints:** Where more than one store in a region meet the environmental and public health criteria, collection centres are finally selected based on logistics requirements and provisional expenses for the upgrade and operation of each store.

FIGURE D1
Steps in the selection of collection centres



If none of the stores surveyed in the country/region meets the minimum environmental criteria for use as a collection centre, there is need either to invest in upgrading the most appropriate store available so that it meets the standards set in the guideline, or to plan the construction of a new store that complies with the environmental requirements. It is also possible to examine the potential for transporting stockpiles of obsolete pesticides to other regions for safe storage at an approved facility. The budget has an impact on the number of collection centres selected and the level of refurbishment that can be completed. In extreme cases, additional budget may have to be allocated to allow a minimum level of improvement of the stores to allow safe storage.

Practical guidelines for selecting collection centres

STEP 1

Pre-select potential collection centres, based on environmental and public health criteria (see Box D1, use Forms A3, D1 and D2)

- Use the results of the questionnaire in Form A3.
- Assess the environmental and public health risks associated with the stores in the region (Box D1).
- Pre-select stores that could be used as collection centres on the basis of environmental criteria only, eliminating those that pose a high risk.

STEP 2

Identify the required surface area for each collection location

- Define the geopolitical area(s)/district(s) to be serviced by each collection centre.
- List the stores in the region(s) that should be centralized to each collection point (the stores have been selected using tool C).
- Analyse the inventory of all obsolete pesticides contained in these stores (using FAO PSMS and tool A).
- Calculate the amount(s) of solid pesticides to be packed into flexible intermediate bulk containers (big bags), the amount(s) of solids to be loaded into open-head drums (and the size of the drums) and the quantity of liquids to be pumped from their original containers into closed-head drums (again specifying the size of the new container).
- Calculate the numbers of flexible intermediate bulk containers and drums to be used, based on the following ratios:
 - 600 to 750 kg of solid pesticide can be loaded into a standard 1 m³ flexible intermediate bulk container, depending on the density and ease of handling of the material;
 - 100 to 150 kg of solids/sludge in small containers (of 1 to 5 litres) can be put into open-head drums (typically of 210 or 320 litre capacity);
 - 200 litres can be pumped into one standard 200-litre closed-head drum;
 - one 1 200-litre drum of solid residues from liquid pesticides can be loaded into a standard 320-litre salvage drum.
- Calculate the surface area needed, based on the “footprint” of each group of containers. Four standard 200-litre drums (open- or closed-head) occupy the same area as one flexible intermediate bulk container (approximately 1.25 m²) and fit on to a standard wooden pallet. Three standard salvage drums occupy the same area.
- Estimate the number of layers of drums to be put on to pallets (one, two or three), depending on the availability of drum-handling equipment such as forklift trucks. If no such equipment is available, drums should be stored in a single layer. Big bags are not certified for stacking and can be stacked only when they are in crates/cages that are certified for stacking in multiple layers.
- Calculate the equivalent surface area required for storage purposes, adding 60 percent as a safety margin to allow adequate inspection of the stored materials for leakages, etc. (Box E3 and Form E4).

STEP 3

Select collection centres, based on logistics and economic constraints (see Box D2, use Form D2)

- Assess all pre-selected stores using Form D2.
- Calculate and compare the different cost estimates for such elements as transportation of stocks.
- Select the most environmentally appropriate and logistically/economically sound collection centre.

Depending on the situation, anything up to four cost estimates may be completed for each store. Estimates must be summed to provide a final cost for the upgrade/development of the location for use as a collection centre. The final costs for all the stores must be compared, and the least expensive store selected for use as a collection centre.

BOX D1

Rationale for pre-selecting collection centres

The pre-selection of collection centres should follow two steps:

- Form A3 (tool A) should be used to pre-select stores that have the potential for use as collection centres. Form A3 identifies stores that meet the minimum environmental standards. All stores where store conditions (line A) and environmental conditions (line C) are equal to 0 can be pre-selected as

potential collection centres, assuming that the other criteria (i.e., size of store, security conditions, management procedures and safety conditions) can be improved as necessary.

- If none of the stores surveyed meet these criteria, Form D2 should be used to select potential collection centres.

BOX D2

Rationale for the final selection of collection centres

A pesticide store should:

- not contain materials other than pesticides;
- have a fully weatherproofed roof protecting the pesticide containers from direct and indirect effects of the weather;
- be enclosed by weatherproof walls;
- be paved with a hard, impervious floor covering;
- be well ventilated;
- be fully secure 24 hours a day;
- be watched over by somebody assigned and accountable for its management.

When no stores meet the environmental and other pre-selection criteria, the selection can be based on logistics and economic factors.

Depending on the situation prevailing at each store, improvements should be identified and the costs of improvement measures estimated. For each store, up to four cost estimates can be established (Form D2) to assess its suitability as a collection centre. Selection of the store(s) can then be based on the comparison of cost estimates in addition to a comparison of environmental factors.

If several stores can be selected, stores with a water supply, electricity, communication facilities (telephone) and at least a minimum of loading/unloading equipment (forklift truck, etc.) should be prioritized.

The option of improving an existing store is favoured over the building of a new collection centre. In instances where none of the stores

continues

BOX D2 cont.

Rationale for the final selection of collection centres

can be selected, either a construction plan for a new store should be developed or the storage of obsolete pesticides in a different geopolitical region should be considered. In such cases, the cost of constructing a new store should be compared with the cost and potential environmental impact of transporting obsolete pesticides to a neighbouring collection centre. A case-by-case review is needed. The PMU must also consider the need for a local environmental impact assessment

(EIA) according to national requirements for the construction of a new facility.

It is unlikely that a country will have a perfect pesticide store already available. As with all projects, there is need to balance the cost and long-term benefits of any store refurbishment. The long-term future use of a store after project completion also influences the level of investment in the structure.

BOX D3

Upgrading an existing store – Boane, Mozambique

The initial environmental assessment of the store at Boane near Maputo in Mozambique confirmed that the location was suitable in terms of distance from population and water sources, and other criteria. However, the assessment also indicated that it would only be suitable for use as a major collection centre if significant upgrades were made to the store structure. The building had not been used previously for the storage of pesticides, so major infrastructure improvements were needed.



A new roof and outer walls were built.



Internal walls were constructed to segregate different compartments of the store.



Existing doors were closed, to limit access.



A new concrete floor was laid and sealed with epoxy resin for chemical resistance.



The end result was a store that met both environmental needs and logistics requirements.

BOX D4 Designing a new store – Nampula, Mozambique

The need for a major collection centre in north Mozambique posed a problem to project staff. Initially, no existing store was identified as being suitable for use as a collection point, and it was only following extensive consultation with the Posto Agronomo De IIAM in Nampula that a store with some potential was found. Application of the EMTK principles indicated that significant renovations and improvements were needed before the store could be used as a collection point, so a professional architect was commissioned to design a new store based on the existing structure. Detailed engineering diagrams were prepared and a construction contractor hired to complete the work.



Large renovation projects require detailed architectural drawings so that accurate instructions can be provided to construction contractors.

The construction phase was completed and the refurbished store was finished to the required specification and in line with the project work plan and time frame.



The original store structure.



The interior was completely renovated.



A new concrete floor was laid.



The floor was sealed with epoxy resin.



New doors were added,



A separate room for the storekeeper was built.

BOX D5

Using an existing store – Gotera, Addis Ababa, Ethiopia

The store at Gotera in central Addis Ababa, Ethiopia had been derelict since the late 1980s. An FAO task force mission in 1998 recommended that the store be secured and an outer structure constructed around the original store building. Inspection of the contents of the store in 2000 indicated that it contained a large stockpile of largely unknown chemicals, which posed a high risk to public health and the environment.



An outer structure was constructed in 1998.



Large quantities of unknown materials were found inside the store.



White powder was identified as sodium arsenate.

As the site posed such a high risk, and heavy worker protection was required during safeguarding, the tasks of repackaging the stocks and emptying the store were assigned to a specialist hazardous waste contractor. Over a two-week period, contractor personnel – assisted by trained local staff – removed and repackaged all the pesticides and associated wastes in the store. Significant amounts of contaminated soil were then removed from the floor area, and soil samples were taken to indicate levels of any residual contamination. Analysis was performed at the Crop Protection Laboratory.



Contractor personnel safeguarded the stocks.



Local staff assisted, once the risk had been reduced.



The soil floor was excavated to remove contamination.

A review of existing sites indicated that a store at Gotera in the Addis Ababa area was suitable as a major collection centre for pesticide stocks prior to their onward shipment. In consultation with the national environmental protection agency, the Minister of Agriculture gave permission to upgrade this store, on the understanding that it would not be used to store animal feed or foodstuffs after project completion because of the risk of residual contamination in the underlying soil. The disposal company commissioned a local construction company to complete the renovations, which included new walls, a new roof and a new concrete floor to isolate the contaminated soil and eliminate the exposure of personnel working in the store.

continues

BOX D5 *cont.*

Using an existing store – Gotera, Addis Ababa, Ethiopia



Local contractors upgraded the site.

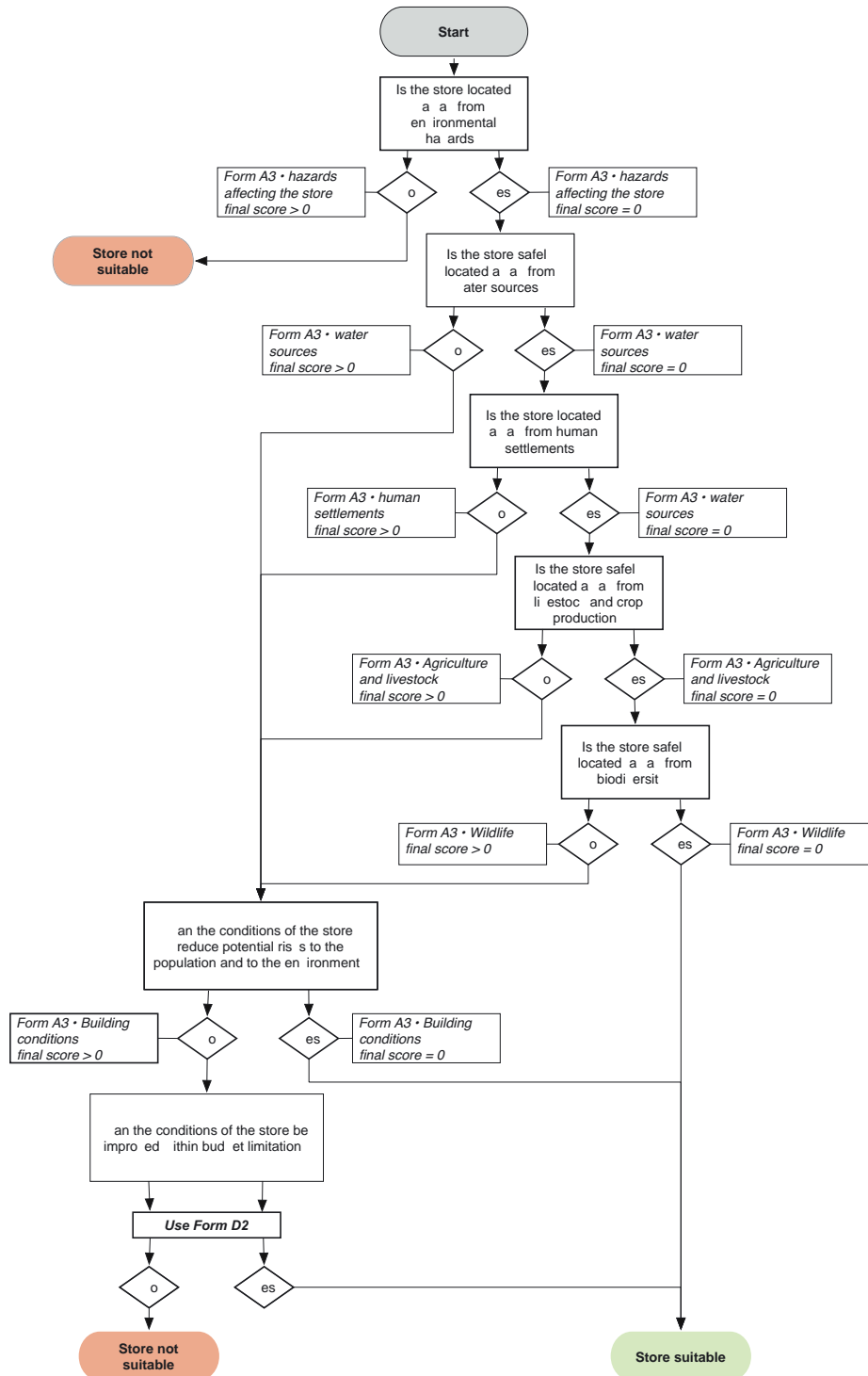


A reinforced concrete floor was laid.

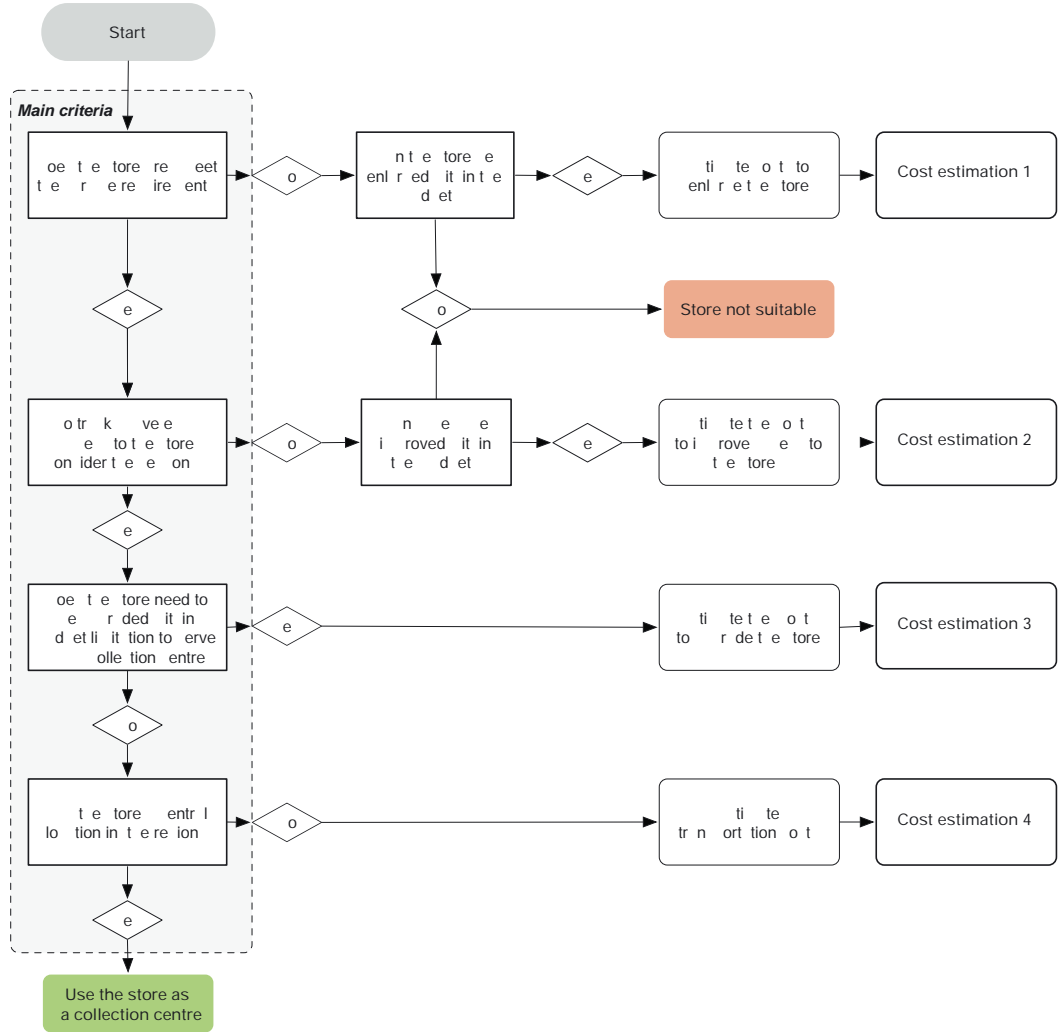


Ventilation windows and a new roof were installed.

FORM D1
Pre-selection of potential collection centres



FORM D2
Selection of potential collection centres



Tool E

Management of collection centres

Once the obsolete pesticides have been inventoried, they must be repackaged, collected and stockpiled for storage in interim and final collection centres. These activities are referred to as *safeguarding*, and are completed prior to the onward transportation of waste to the final disposal facility. The process of collecting a potentially large quantity of pesticides from many locations to a relatively few collection centres significantly increases the risk of major accident. Safety becomes a central issue and relies mainly on the management procedures for operating and monitoring stocks at the collection centres (tool E) and the systems for ensuring safe transportation (tool F). A safety management system for both the storage and the transport of obsolete pesticides must be established.

This tool should help PMUs to set-up preventive and control measures at interim and final pesticide collection centres.² The control measures should aim to reduce the risk of accident occurring as a result of an on-store initiator or an off-store event. It is recommended that the systems outlined in tool E be used for the management of any collection centre where pesticides are stored (both obsolete and useable). The tool is applicable to all stores used for hazardous materials and is based on European Directive 96/82/EC on the control of major accident hazards involving dangerous substances (the Seveso II Directive).

The tool assumes that pesticides from old and leaking containers have been repackaged into new United Nations- (UN)-approved packages prior to their arrival at the collection centre. Only pesticides in containers deemed fit for transport can be delivered to collection points for storage. This may require the use of UN-approved salvage packages to allow safe transport to a collection centre, where the items will be repackaged into their final containers for onward transport to the disposal facility. Working methods and risk assessments will be required for every store where any repackaging activity occurs, and will typically form part of the project health, safety and environment (HSE) developed for the site. This is covered in EMTK Volume 3 and the FAO guideline on safeguarding strategies (FAO, in preparation c). When repackaging is completed at a collection centre (interim or main), it is critical that the potential for an on-store initiator of accidents has been reviewed and that the HSE plan provides a complete mitigation plan to prevent any impact on public health or the environment.

Objectives of the tool

Tool E provides guidance and a framework of procedures for setting up a major accident prevention policy and safety management system in collection centres. The tool helps PMUs, field managers and storekeepers to take all the necessary measures to reduce the risk of an accident having major consequences for the general public and the environment. In particular, the tool helps to identify major accident hazards and to put in place the necessary measures for preventing and limiting the consequences of such accidents. Measures should cover the design of the collection centre, as well as its operation and maintenance, and include:

- identification of the hazards associated with the pesticides stored inside the collection centre (potential on-store initiators of accident) and those associated with the immediate environment (off-store events);

² It is assumed that the pesticide collection centres have been selected according to the instructions in tool D. A network of interim collection points may be necessary in cases where there are large numbers of stores, wide geographical distribution and large quantities of stocks to be managed. Where possible, stocks should be moved directly to central collection centres from their points of origin.

- organization of the management and monitoring of pesticide stocks, based on hazard identification, to prevent major accidents and minimize the risks, thereby limiting the potential impact on the environment and the health of the general public;
- establishment of a well-defined system of information exchange and management among all stakeholders;
- establishment of in- and off-store emergency plans in case of major accident.

Structure of the tool

As indicated, this tool is based on European Directive 96/82/EC on the control of major accident hazards involving dangerous substances (the Seveso II Directive). To reduce the risk of accident, tool E applies management procedures progressively, following the step-by-step instructions presented in the following sections. Where appropriate, recommendations and complementary information are provided in text boxes. The tool also provides a set of blank forms to help store managers implement each step.

The instructions are divided into six steps:

- **Collect initial information on the environment** surrounding the collection centre: This step aims to identify sensitive areas and potential off-site hazards.
- **Assess the accident risk and probable environmental impacts:** This step enables assessment of the nature and level of risk(s) associated with each collection centre. Possible environmental impacts are assessed using a simple form.
- **Arrange pesticide containers to minimize the risk of accident:** This step provides guidance on arranging the stock in a collection centre to minimize the risks of harmful chemical interactions.
- **Provide equipment and facilities** for the collection centre's safe management.
- **Establish safe management procedures:** This step establishes initial and ongoing management procedures aimed at minimizing the risk of accident.
- **Establish emergency plans:** This step ensures that all stakeholders follow the necessary emergency procedures in case of accident, to limit its consequences.

FIGURE E1
Steps for the safe management of collection centres

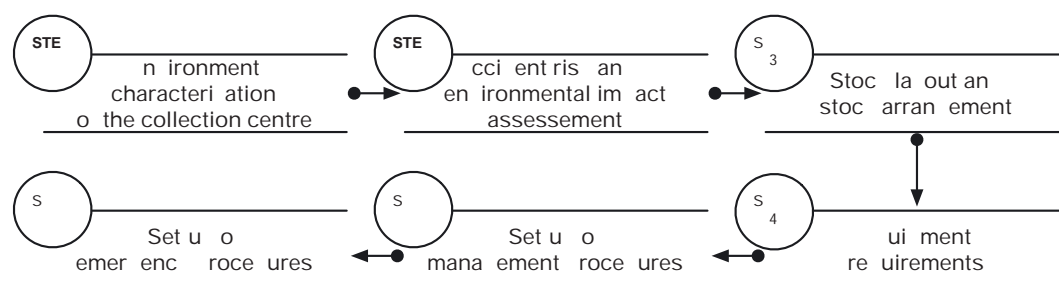
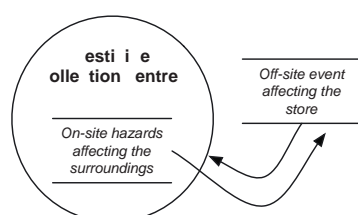


FIGURE E2
Effects of on- and off-store accidents



Practical guidelines for implementing a collection centre management plan

STEP 1:

Collect initial information on the environment (see Box E1, use Forms E1 and E2)

- List the sensitive areas that could be affected by an accident occurring within the collection centre.
- List the off-store hazards that could have a direct or indirect impact on the collection centre.
- Draw a map showing the collection centre and all the sensitive areas and off-store hazards identified.

STEP 2

Assess the accident risk and probable environmental impacts (see Box E2, use Form E3)

- Make an inventory of the pesticides to be stored according to their hazard characteristics.
- Assess the nature and level of on- and off-store accident risks.
- Assess the nature and magnitude of probable environmental and public health impacts.

STEP 3

Arrange pesticide containers to minimize the risk of accident (see Boxes E3 and E4, use Form E4)

- Determine the number of storage zones that should be established in the collection centre, based on the hazardous properties of the pesticides.
- Size the zones based on the quantity of pesticide containers to be stored in each category of hazard.
- Locate the zones, map them, and display posters and charts at strategic locations.³

STEP 4

Provide equipment and facilities for the collection centre's safe management (see Box E5)

- Ensure that the collection centre has adequate facilities.
- Provide container handling equipment.
- Provide protective and emergency equipment.

STEP 5

Establish safe management procedures (see Box E6, use Form E5)

- Assign duties and responsibilities.
- Train and supervise staff.
- Establish security and safety rules.
- Establish monitoring procedures for stock and store control.
- Keep records and store information on pesticide stocks in a separate location.

STEP 6

Establish emergency plans (see Box E7, use Forms E6 and E7)

- Establish on-store incident control procedures.
- Establish an off-store accident emergency plan.
- Design a reporting procedure for cases of accident.

³ "No smoking" and "no eating" signs, as well as appropriate toxicity and hazard symbols, should be displayed inside and outside the collection centre. The site plan should indicate the locations of first aid and fire safety equipment, along with emergency contact details in case of accident (fire brigades, hospitals, etc.).

BOX E1

Compilation of initial information on the surroundings of the collection centre

Form A1 can be used to characterize the surroundings of the collection centre. It should be accompanied by photographs and the store plan drafted during the inventory process and included in the inventory database, to show the area around the collection centre (Forms E1 and E2). These documents help characterize the areas at risk and assess the impact that an accident within the collection centre (caused by on-store hazards affecting the surrounding environment) could have on the environment and the general public. It should also help identify potential off-store hazards that could affect the collection centre were an accident to occur nearby.*

** Off-store events such as abnormal rainfall, very high temperatures, gale-force winds, flooding, landslide, fire or explosion at adjoining industrial plants (the domino effect), out-of-control vehicles and military attack can affect collection centres and cause pesticide discharge into the environment. For instance, an explosion in a nearby service station with large quantities of gasoline can initiate a fire in the collection centre.*

Particular attention should be paid to nearby population and industrial centres and environmentally sensitive areas such as surface and underground water sources. The direction(s) of dominant winds and runoff waters should be assessed to predict the potential extent of pollution in case of fire or spillage. Any drainage and sewage systems near the collection centre should also be known.

BOX E2

Main hazards associated with pesticides

Pesticides are typically classified as toxic materials in the UN classification system (Figure E3 gives the UN coding system for the hazardous properties of chemicals). They can also present several additional hazardous properties by being flammable, oxidizing, corrosive, toxic to aquatic life or reactive with water. Most solvents mixed with pesticides evaporate rapidly at ambient temperatures. They are often flammable and their vapours may be ignited by such initiators as naked flames from cigarettes, welding or even static electricity. Vapours move with air currents and can be ignited by even distant heat sources.

Special attention should be paid to dithiocarbamates and sodium chlorate:

- *Dithiocarbamates* are not generally highly toxic to humans, but they can release flammable gases when they are improperly stored and come into contact with water or moisture (Rwanda 1991).

- *Sodium chlorate* forms colourless hygroscopic crystals, which are soluble and toxic. It is strongly oxidizing, and sodium chlorate mixtures containing combustible material are extremely sensitive to impact and flames. Fine powders and surfaces impregnated with sodium chlorate are likely to catch fire and/or explode spontaneously. Although sodium chlorate is not classed as an explosive under the UN classification system, it is classed as an oxidizing agent and its explosive and unpredictable behaviour is well known. If stored in close proximity to "fuels" such as chemical fertilizer, unplanned mixtures caused by leakage from packaging may produce explosive and/or highly flammable results (FAO project in Yemen, 1996).

FIGURE E3
Hazard symbols for chemicals



FIGURE E4
Rules for pallet arrangement in collection centres

Package type	Number of layers on basal pallets	Number of packages on each pallet
Steel drums (200 litre)	1, 2 or 3 if a forklift is available	3 to 4
Steel drums (< 200 litre)	2	3 to 4
Fibre drums (> 200 litre)	1	3
Fibre drums (< 200 litre)	2	3
Plastic drums (> 200 litre)	1	2
Plastic drums (< 200 litre)	2	2
Big bags	1	1
Big bags	2 if in packing crates	1

BOX E3

Rules for pesticide stock arrangement: container stacking

Pesticide containers should be placed on pallets. The size of each storage zone depends on:

- the number of containers;
- the type of containers to be stockpiled, keeping in mind that they should be stacked at a convenient height, following the indications provided in Figure E4;
- the free space that should be kept between pallet lines to enable inspection and handling (which adds up to an additional 60 percent of the total storage space);
- the width of the path between the pallet lines, which depends on how the containers are to be manipulated; forklift handling requires greater space between pallet lines than manual handling.

BOX E4

Rules for the arrangement of pesticide collection centres: risk reduction

Occupational risk should be kept to the absolute minimum, and safe working conditions ensured at all times. To ensure safety and reduce the risk of accident, basic rules should be respected when pesticides are stockpiled at interim and final collection centres. The following are the minimum rules for pesticide collection centres:

- Store liquid and solid pesticides separately.
- Do not store materials/chemicals other than pesticides in the collection centre.
- Store all personal protective equipment outside the collection centre.
- Store fire safety equipment at strategic locations inside and outside the collection centre.
- Within the collection centre, keep a zone free for the handling/repackaging of pesticides. (Ideally, this zone should be at least 50 m².)
- Ensure sufficient space between pesticide containers to facilitate inspection and handling.

In addition, to avoid dangerous interactions among chemicals, the store should be zoned, with each zone dedicated to a pesticide category based on the hazardous characteristics of the pesticides, their physical state and the containers in which they are packed. The following rules should always be respected:

- Store flammable pesticides in zones with easy access.
- Keep flammable and oxidizing chemicals away from each other. Non-hazardous pesticide containers or fire-resistant containers such as metal drums may be used as a firewall between these classes of materials.
- Keep metal containers away from corrosive and oxidizing pesticides.
- Store dithiocarbamates and sodium chlorates in separate rooms or, if this is not feasible, at least in dry, cool and well-ventilated zones.

BOX E5

Recommended equipment and facilities for collection centres

Required facilities

- An adequate water supply, ideally with a fire hydrant capable of supplying water at a pressure of 6 bars, and with a shower for use in emergencies. Water will usually be provided through a browser or intermediate bulk container tank fitted with a suitable pump and outlet.
- An electricity supply: at a minimum a single-phase power supply of 220 V, 50 Hz for lighting and operating equipment such as pumps, to be stepped down to 110 V for use in situations where there is risk of contact with water. All equipment must be rated for the appropriate voltage. No 220 V equipment should be used

outside or in any situation where there is potential for contact with water or other conducting liquids.

Minimum equipment for handling

- Ideally, a forklift truck.
- Drum trolleys, or more usually “pump” pallet trucks.
- A supply of spare wooden pallets. (Note: The European Union [EU] does not allow the import of pallets from outside its member countries.)
- Pulley and hoists.
- Personal protective equipment adapted to the type(s) of pesticides stored in the collection centre.

continues

BOX E5 cont.

Recommended equipment and facilities for collection centres

Minimum equipment for controlling and mitigating accidents

- Bunding of the store floor area to contain leakages and prevent the runoff of contaminated fire fighting water.
- Spillage control material: proprietary absorbents for chemical spillages or locally available materials such as sand mixed with lime; a large, flat spade; a broom; a clean labelled container for collecting contaminated material; and a mop and cleaning solutions (anionic surfactants) for cleaning the floor. Sawdust should not be used as an absorbent. In some instances, sawdust mixtures can become flammable and ignite spontaneously. Hardwood sawdust is also a carcinogen. Where

possible, a commercially manufactured, non-flammable absorbent material should be used. Commercially available spill-control systems are preferred. These include a variety of materials for absorbing oil- and water-based chemicals.

- Fire control material: dry-powder fire extinguishers, buckets, sand and, if possible, fire hydrants.
- A first aid kit including, if possible, an atropine injection kit, bicarbonate sodium and activated charcoal dust. First aid and paramedic kits are of use only when trained personnel are on hand to administer the necessary assistance.

FIGURE E5
Appropriate storage for pesticide collection centres

Pesticide #2	Pesticide #1	Hazard characteristic						Type of container		Formulation	
		Highly toxic	Flammable	Explosive	Corrosive	Oxidizing	Water reactive	Metal	Non-metal	Liquid	Powder and granules
Hazard characteristic	Highly toxic		Do not store next to each other	Do not store next to each other			Do not store next to each other				
	Flammable	Do not store next to each other		Do not store next to each other		Do not store next to each other	Do not store next to each other		Do not store next to each other		Do not store next to each other
	Explosive	Do not store next to each other	Do not store next to each other			Do not store next to each other	Do not store next to each other				
	Corrosive						Do not store next to each other	Do not store next to each other			
	Oxidizing		Do not store next to each other	Do not store next to each other			Do not store next to each other	Do not store next to each other			
	Water reactive	Do not store next to each other	Do not store next to each other	Do not store next to each other	Do not store next to each other	Do not store next to each other				Do not store next to each other	
Type of container	Metal				Do not store next to each other	Do not store next to each other					
	Non-metal	Do not store next to each other	Do not store next to each other								
Formulation	Liquid						Do not store next to each other				
	Powder and granules		Do not store next to each other								

Combinations that should not be stored next to each other are shown in red.

BOX E6

Management procedures for collection centres

Duties and responsibilities

- *Storekeeper*: maintenance of suitable storage conditions; security of the pesticide store; fire prevention and contact with authorities; ensuring that all staff entering the store wear appropriate protective clothing; safe handling of pesticides into and out of the store; protection of the environment; stock recordkeeping; and health and safety of all staff entering the store.
- *Field manager*: planning of emergency procedures; training and supervision of storekeepers; organization and planning of store security and safety; and coordination and exchange of information with regional and central counterparts.
- The overall liability in case of accident should be clearly understood by all parties. Such liability may rest with government or, when commercial distribution centres are used as collection centres, with the private sector. It is essential that the level and extent of liability in case of accident are clearly established.

Staff training and supervision

- All *storekeepers* should undergo initial and in-service training. The principal areas covered should include: store and pesticide safety; accident prevention and fire precautions; basic fire fighting and security; and emergency procedures and first aid.
- *Field managers* should receive more extensive training covering chemical hazards, risks to individuals, the effects of chemicals on the human body, recognition of hazard signs, dealing with leaks and spills, and evacuation in the event of a major emergency.

- All categories of staff involved in an obsolete pesticide project should be supervised. In particular, a system of accountability should include possible disciplinary action against anyone who knowingly disregards instructions.
- Only trained, competent staff should be appointed to carry out activities. One of the major causes of accidents involving hazardous materials is the involvement of untrained personnel.

Store security and safety

- Construct a perimeter fence around the collection centre to establish a buffer security zone between the building and the immediate surroundings. Access to this zone should be limited to authorized personnel only.
- Establish a gate office that is staffed 24 hours a day.
- Keep the gates of the store and the doors of the collection centre locked. Designate staff members to keep main keys, and leave spare keys with a security guard, storekeeper or field manager as appropriate.
- If possible, install perimeter lighting.
- Restrict access to the store to authorized personnel only.
- Accompany visitors all the time they are at the store.
- Set up a designated area for vehicle movements, such as for the loading and unloading of pesticides.
- Do not allow eating, drinking or smoking at the store.

continues

BOX E6 cont.

Management procedures for collection centres

Handling and monitoring procedures

- Monitor pesticide containers at the collection centre once a week. Check for damaged containers, leakages, spillages or traces of chemical vapours inside the collection centre. Verify that the roof, walls and floor are watertight.
- Forklift trucks must be moved only when their forks are lowered. Do not leave unattended vehicles with their engines running. Do not leave keys in unattended vehicles.
- Set up measures for dealing with damaged containers.

Recording information

- Keep information on the collection centre in a separate folder, and include: 1) details of electricity system (if relevant) and drainage; 2) details and photographs of the collection centre; 3) personal protective equipment available at the collection centre; 4) inventory of fire fighting and leakage control equipment; and 5) first aid equipment available at the store.

- Keep information on the pesticides stored within the collection centre: types, quantities and storage zones, marked on a map with material safety data sheets for each substance.
- Keep specific collection centre hazard data sheets summarizing all potential hazards in case of accident, including: 1) the properties, inventory and location of dangerous substances; 2) the environment around the centre; and 3) major hazards and accident scenarios.
- Set up an information exchange system and provide all relevant information to local and regional police, health, agricultural and environmental authorities. Inform leaders of communities near the collection centre of hazards and measures to take in case of accident. The level of detail to be provided depends on the recipient's capacity to understand the information. This process forms part of the ongoing communications strategy and awareness programme of the national-level obsolete pesticide programme.

BOX E7

Emergency management

Accidents occurring in the collection centre should be contained within the store as much as possible. Authorities in charge of managing the centre should establish internal emergency plans. If the magnitude of the accident is such that it cannot be controlled within the store, an external emergency plan must be triggered. The two main accident risks associated with the storage of obsolete or useable pesticides are fire with toxic emissions and leakages (with or without fire) capable of contaminating water sources. The potential consequences of a major fire include: emission of toxic smoke; explosion; runoff of contaminated fire fighting water; thermal radiation from the flame pillar; and death or serious injury to workers and the

general public. Any of the incidents outlined in this box should be reported as soon as possible to the project manager and local/regional representatives who are aware of the project, including emergency service contacts such as the nearest fire brigade and hospital.

Internal emergency procedures: fire fighting

- Provide field managers, storekeepers and security guards with instructions in case of fire.
- Use the appropriate type of extinguisher (dry powder).
- Keep doors and windows open to avoid pressurization inside the building and to reduce the risk of explosion.
- Evacuate the area.

continues

BOX E7 cont.**Emergency management**

- Evacuate the area downwind of the store.
- Call the fire brigade or make own provisions for emergency response if no emergency services are available.

Internal emergency procedures: leakage control

- Evacuate the contaminated area and keep people away.
- Provide adequate protective clothing to trained personnel involved in the clean-up.
- Ensure any leaking containers are placed in positions that reduce or stop the leak.
- Limit the spread of the spill by surrounding it with an absorbent barrier.
- Soak spill with sand-lime mix or commercial absorbent (avoid using sawdust), brush up carefully and, if possible, place sweepings into spare packaging labelled "spillage waste". Where possible, use commercially available spillage control materials supplied to the collection centre as emergency response equipment.
- Clean yourself and any reuseable equipment such as shovels.
- Report and record the spillage and the emergency intervention taken.
- Record and report the accident, detailing its cause (if known), or likely cause, so that future occurrences can be avoided.

Internal emergency procedures: poisoning

- Check the area for your own safety.
- Remove the casualty from source of poisoning.
- Keep the casualty still, calm and reassured.
- Call supervisor and management immediately.
- Read the pesticide label and follow-up indications.
- Seek medical attention immediately from the nearest emergency centre/hospital/clinic identified in the emergency plan.
- Only competent personnel with the necessary equipment should treat the casualty.

External emergency plan

- Inform all local authorities, emergency services and community leaders immediately.
- Evacuate the contaminated area.
- Provide all relevant information to the authorities.
- Follow the authorities' instructions. Emergency services often rely on store personnel's expertise in dealing with the chemicals concerned. Store personnel are therefore likely to become part of the emergency team assigned to deal with the problem.

BOX E8 Checklist

- Have major accident hazards been identified?
- Have the necessary measures been taken to prevent and limit the consequences of major accidents?
- Has the collection centre been designed and constructed according to FAO guidance?
- Have adequate safety and reliability been incorporated into collection centre management procedures?
- Has an internal emergency plan been drawn up?
- Has all necessary information been supplied to local authorities and community leaders so that they can respond to a major accident, and has an external emergency plan been drawn up in case of a major accident?
- Have all the resources that can be mobilized to limit the consequences of a major accident to people and the environment been identified?
- Is sufficient personal protective equipment available in the event of a major accident?
- Can sufficient fire fighting and fire protection provisions be mobilized in the event of a major accident?
- Have provisions been made for minimizing the release and mitigating the consequences of airborne toxic and/or flammable substances in the event of a major accident?
- Have provisions been made for minimizing the consequences of pesticide seepage into soil or water sources?
- Can first aid/medical treatment be mobilized during the emergency response?

BOX E9 Storage of obsolete pesticides: the good and the bad

The good

Boxes D3, D4 and D5 provide excellent examples of refurbishing and upgrading stores according to a good management system. A key consideration for safe storage is adequate space.



Stores at Boane and Nampua in Mozambique: Note the spacing between rows of drums to allow the inspection of containers. All drums and big bags are on pallets.

As well as adequate space, sufficient time is needed to develop an effective store management plan. This includes mapping the store to indicate the position and contents of each container, and posting an emergency plan with contact details in case of emergency. Movement and stacking of containers is made simpler through the use of such equipment as a forklift truck.

continues

BOX E9 cont.

Storage of obsolete pesticides: the good and the bad



The training of storekeepers for this and other collection centres was carried out in cooperation with Crop Life Africa/Middle East. A Portuguese-speaking trainer of storekeepers spent ten days in Mozambique training government store staff.

The bad

Examples of poor storage of useable and obsolete pesticides are more common. One reason for this is that dedicated storage for pesticides is frequently lacking. Pesticides are often stored in close proximity to other agricultural materials and inputs, such as seed, fertilizer and farm equipment. The segregation of pesticides is a good first step in sound management. Tool E provides additional guidance on setting up management procedures at stores.



FORM E3

Accidental risk and impact assessment form

Pesticide hazard identification		On-site accidental risk			Environmental impact assessment	
Pesticide content of the collection centre	Quantity Kg / litre	Type of accident	Level of risk	Neighbouring areas at risk	Impact of a pollution	
<input type="checkbox"/> Highly toxic (Class Ia, Ib) (T+)	<input type="text"/>	On-site	High Medium, Low	Surface & Underground Waters, Soil, Air, Cultivated Areas, Natural Resources...	Limited, Significant, Serious	
<input type="checkbox"/> Flammable (F, F+)	<input type="text"/>	Type	<input type="text"/>	<input type="text"/>	<input type="text"/>	
<input type="checkbox"/> Explosive (E)	<input type="text"/>	Fire	<input type="text"/>	<input type="text"/>	<input type="text"/>	
<input type="checkbox"/> Corrosive (C)	<input type="text"/>	Explosion	<input type="text"/>	<input type="text"/>	<input type="text"/>	
<input type="checkbox"/> Oxidizing (O)	<input type="text"/>	Spillage	<input type="text"/>	<input type="text"/>	<input type="text"/>	
<input type="checkbox"/> Toxic for aquatic life (TA)	<input type="text"/>	Leakage	<input type="text"/>	<input type="text"/>	<input type="text"/>	
<input type="checkbox"/> Water reactive (WR) <small>Can release toxic gas when wet</small>	<input type="text"/>	Off-site	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Administrative information		Type	Public health impact		Magnitude of contamination	
Collection centre ref. number:	<input type="text"/>	<input type="text"/>	Routes of contamination		Limited, Significant, Serious	
Region/District/Town	<input type="text"/>	<input type="text"/>	Population at risk		<input type="text"/>	
Contact person (Name, Address, Tel.)	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> Workers on-site		<input type="text"/>	
Filled in by _____ Signature: _____	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> Adjoining human settlements		<input type="text"/>	
Checked by _____ Signature: _____	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> Village(s) around		<input type="text"/>	
Date: _____	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> Town nearby		<input type="text"/>	
		<input type="text"/>	<input type="checkbox"/> Other		<input type="text"/>	

FORM E4
Collection centre zoning and storage conditions form

Name of collection centre			Ref. no.			
Zone	Pesticides hazard category		Number of containers per pallet	Maximum stacking height	Minimum surface required per zone (based on volume per pallet)	Total surface required (add volume for inspection)
	hazard category	activity type				
Total m						

Sketch of the collection centre

	Legend		
	Pesticides		
	Packaging		
	Steel drums	●	lastic container □
	Other drums	○	Other packages ▲
	Sacks	⊠	Leakages or dust ●
	Cardboard boxes	■	
	Hazard characteristic		
	Highly toxic	T	Corrosive C
	Flammable	F	Oxidizing
Explosive	E	Water reactive W	
Quantities (example)			
litres of highly toxic and flammable pesticide stored in steel drums ● T+, F (300 l)			
Collection centre	North indication		
Window	Door		
Zone and zone no.	Scale		
Fill in by	Date		

FORM E5

Collection centre monitoring forms

Name of collection centre	Ref. no.	Date
---------------------------	----------	------

Stock and store

Date	Stock		Store				Inspected by
	Leak reported (yes / no)	Action taken	Condition (ood, Fair, ad)			Action taken	
			Floor	Wall	Roof		

Personal protective equipment

Date	Stock position			Inspected by
	Mask	Overall	gloves	

Safety equipment

Date	Condition (ood, Fair, ad)		Inspected by
	Fire safety equipment	Cleaning equipment	

FORM E6
Emergency preparedness plan

Emergency plan number _____

Name of collection centre	Ref. no.	
---------------------------	----------	--

. Emergency contact list

District	Tel.	Address	Contact person
Police station			
Health facility			
Medical doctor			
Fire brigades			
District environmental authorities			
Community leaders			
District administrative authority			
Storekeeper			
Region	Tel.	Address	Contact person
Regional hospital			
Regional environmental authorities			
Regional supervisor or the programme			
Regional administrative authority			
Country	Tel.	Address	Contact person
Project management unit			

2. Emergency preparedness plan • general considerations	CTRL
A Information on accidental risk level and magnitude one <input type="checkbox"/>	
<ul style="list-style-type: none"> Provide a copy of the safety report to local authorities, fire brigades, health facility and regional hospital Provide an updated store position to local authorities, fire brigades, health facility and regional hospital 	
Set-up of training session one <input type="checkbox"/>	
<ul style="list-style-type: none"> Provide written and oral instruction to local communities nearby in case of accident with release of pollutants Provide adequate training to local emergency services doctors, firefighters) Forewarn community leaders of adequate behaviour in case of release of pollutants into the environment <ul style="list-style-type: none"> Examples: Do not fetch water in case of contamination of water sources Remain in a confined building in case of toxic gas emission Evacuate and secure area in case of contamination 	
C Coordination of Services one <input type="checkbox"/>	
<ul style="list-style-type: none"> Set up an alert procedure adapted to each accident scenario contained into the safety report Set up a coordination board in of major accident occurring 	
D Provide adequate material and equipment to emergency services one <input type="checkbox"/>	
<ul style="list-style-type: none"> Personal protective equipments Adapted fire safe equipment Medical remedies and antidotes 	

3. Emergency preparedness plan • specific considerations

	Scenario		Probability	Mitigation measures
	Type of accident	Sequence of events		
1				
2				

FORM E7
Accident report form

Name of collection centre		Ref. no.	
----------------------------------	--	-----------------	--

1. Accident type and circumstances

Date		Time of day	
-------------	--	--------------------	--

() F, M, A, M, J, J, A, S, O, N, D

Name of collection centre	Name of operator
	1. 2. . . .

2. Environmental impact of accident

Pesticide spilled				Dispersion into the environment		
Pesticide	Quantity	Concentration	Location	Direction	Distance	Remarks

3. Protective actions taken in chronological order

Date	Time	Action	Remarks
1.			
2.			
.			

4. Corrective measures proposed

Date	Measure
1.	
2.	
.	

5. Environmental remediation measures proposed

Date	Measure
1.	
2.	
.	

Filled in by	
Date	
Signature	

Sent to	

Tool F

Transport planning

The transportation of pesticides and obsolete pesticide containers requires great care. Road transport from stores to collection centres is one of the most hazardous phases of a pesticide safeguarding and disposal operation. In general, during project implementation, many different stakeholders from both the public and private sectors may be involved in transporting stocks. In the interests of safety, all stakeholders should adopt a standard approach for road transportation that seeks to:

- reduce the risk of traffic accident and potential spillage of pesticides;
- limit the environmental and public health impacts in case of accident.

This guideline calls heavily on the regulations issued by the United Nations Economic Commission for Europe (UNECE) on Transport of Dangerous Goods (the “Orange Book”) and the European Agreement Concerning the International Carriage of Dangerous Goods by Road (the ADR regulations) which can be obtained from www.unece.org/trans/danger/danger.htm. The establishment of a safe transport plan based on an objective risk assessment is key to risk management. Tool F helps the PMU to set up such a plan for the carriage of obsolete and useable pesticides within the country. The transport plan sets procedures for minimizing the risk of traffic accident and any adverse consequences on public health and the environment that may result. It is recommended that all aspects of the plan be applied when more than 500 kg of pesticide (a standard load for a standard “pick-up” vehicle) is being transported. For smaller quantities, an objective review should be made of which aspects of the plan are appropriate to the specific circumstances. Issues such as toxicity and quality of the original container need to be assessed prior to transport, and appropriate action taken. For pesticides in World Health Organization (WHO) classes Ia and Ib, it is recommended that the plan be adopted for all loads of more than 50 kg.

The approach presented in tool F should be applied to both the consolidation of stocks at central collection centres and the forward transport of stocks from a collection centre to the point of export or to in-country disposal facilities, when available.

Regarding stocks that are sent for overseas disposal, this guideline does not deal with the onward movement by sea to final disposal facilities. The reader is directed to the website of the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal (www.basel.int) and to the International Maritime Organization’s (IMO) International Maritime Dangerous Goods Code (IMDG), which can be purchased from www.imo.org.

Objectives of the tool

This tool provides step-by-step guidelines to reduce the risk of accident or the impact of pollutant emissions into the environment. It also helps PMUs, field managers and drivers respond to emergencies if an accident occurs during project implementation.

Structure of the tool

The tool focuses on road transport planning only. As already indicated it is based on European Council Directive 96/35EC (the European Agreement Concerning the International Carriage of Dangerous Goods by Road). The following step-by-step instructions progressively establish

procedures for reducing the risk of traffic accident. When necessary, recommendations and complementary information are provided in boxes. A set of blank forms helps users to implement each step.

The instructions are divided into five steps (Figure F1):

- **Organize cargoes of pesticide containers based on the hazardous properties of the pesticides:** This step provides guidance on establishing compatible cargoes that can be loaded and transported together in one vehicle, and on characterizing the associated hazards.
- **Select the route presenting the lowest level of risk:** Using the shortest route to transport pesticides from one location to another is not always the safest option. This step helps users to survey all possible routes and select the safest one.
- **Design a transport plan:** Once the safest route has been selected, transportation must be adequately planned (duration, time, traffic safety rules, security, logistics, prevailing conditions). This step indicates how to design such a plan, based on the route survey carried out previously.
- **Strengthen transport safety** by training the crew and providing all necessary equipment and documentation.
- **Notify authorities and check load and vehicles:** Notify the relevant authorities about the transportation, prior to the checking and loading of vehicles and the completion of documentation related to the movement of the load from store to collection centre.

Practical guidelines for setting up a transport plan

STEP 1

Organize cargoes of pesticide containers based on the hazardous characteristics of the pesticides (see Box F1, use Form F1)

- Inventory the pesticide containers to be transported, according to their hazardous properties.
- Plan cargoes based on the pesticides' hazardous properties and the compatibilities among these (Box E4).
- Prepare cargo lists.
- Determine the type(s) and number(s) of vehicles, or shuttles, necessary to transport the cargoes.

STEP 2

Select the route presenting the lowest level of risk (see Box F2, use Form F2)

- List all possible routes.
- Divide each route into segments depending on road conditions; assess the accident risk.
- Assess the nature and magnitude of the probable environmental and public health impacts of an accident, based on the hazard properties of the cargoes.
- Select the route presenting the lowest level of risk.
- Choose the best travelling periods and times.

STEP 3

Design a transport plan (see Boxes F3 and F4, use Form F3)

- Divide the road into segments according to level of accident, public health and environmental risk.
- Define safety and security rules for each segment.
- Prepare a contingency plan in case of accident.

STEP 4

Strengthen transport safety (see Boxes F5, F6 and F7, use Form F4)

- Train drivers and drivers' assistants.
- Prepare and deliver safety equipment to all vehicles.
- Provide transport safety documentation.

STEP 5

Notify authorities and check load and vehicles (see Boxes F8 and F9, use Form F5)

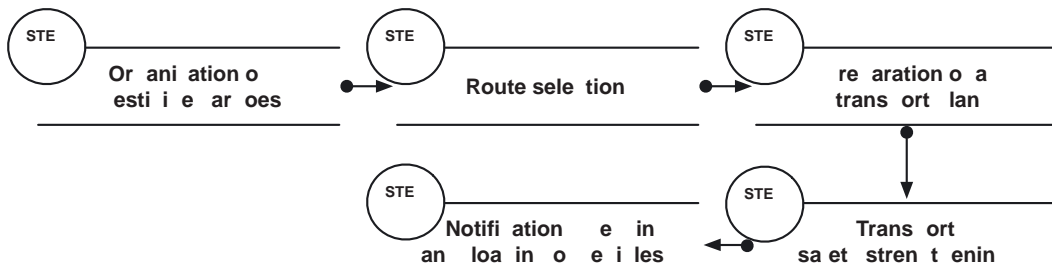
- Notify the relevant authorities of the transport departure and plan.
- Inspect vehicle(s) prior to loading, and record the inspection.
- Ensure safe loading of the cargo.
- Ensure cargo is escorted by a team of trained operators.

BOX F1

Recommendations for cargo preparation

- Label cargoes appropriately (Box E2).
- Annex the material safety data sheets of all obsolete pesticide cargoes.
- A transport unit loaded with dangerous goods can include no more than one trailer (or semi-trailer).

FIGURE F1
Steps for the safe transportation of pesticides



BOX F2

Recommendations for route selection

Route selection depends on three factors that must be separately analysed:

- *Hazardous property of the pesticides transported:* For instance, the route selected for a lorry transporting 10 tonnes of class Ia, flammable pesticide might be different from that selected for the same lorry transporting 10 tonnes of class U pesticide that is very toxic for aquatic life. In the first case, routes passing towns and cities should be avoided; in the second case, routes passing sensitive surface water sources should be avoided.
- *Road and traffic conditions:* Depending on these, the risk of accident can be dramatically increased or maintained at an acceptable level.
- *Conditions adjacent to the road:* These also influence the risk of accident, and indicate the potential impact of an accident on the environment and local population, its magnitude and gravity.

Taken together, these three factors provide a good indication of the level of accident risk associated with the cargo and the route selected. They also allow assessment of the environmental and public health impacts of a possible accident. The risk of accident should always be weighed against the environmental and public health impacts when selecting the safest route. The PMU should always provide its rationale for selecting a particular route.

Hazardous property

Refer to Box E2.

Road and traffic conditions

- Road covering (dust, gravel, asphalt, bumpy, flat, slippery, etc.): Usually, the better the conditions, the safer the road, but also the more important other traffic can be; the greater the speed of vehicles, the higher the risk of traffic accident. A bumpy and dusty road might sometimes be safer than a major asphalt road because road conditions force vehicles to move more slowly, traffic density is generally lower, and there are fewer human settlements along the road.
- Road signs (panels, lines, etc.).
- Specific dangers such as curves, intersections, railroad crossings, slopes, bridges, road width, and difficult crossings.
- Traffic density.

Conditions along the road

- Land use: urban/rural areas, villages, town, cities, cultivated land, natural parks, water sources (rivers, lakes, dams, reservoirs, etc.).
- Type and level of human activities: pedestrians using the road (schoolchildren, market day, etc.), cattle on the road, etc.
- Insecurity along the road.
- Opportunities for requesting assistance in case of accident, leakage, etc.

BOX F3

Recommendations for safety and security rules

The causes of traffic accidents are well known. The most common is drivers' failure to moderate speed in response to road or traffic conditions. Limiting the vehicle speed is the first measure to take to reduce the risk of accident. A speed control device (such as a disc) should be installed in all heavy vehicles carrying dangerous goods. The PMU should regularly review the speeds recorded on discs.

In some countries, alcohol or drug intoxication is the second most common cause of traffic accidents. During transportation, drinking alcohol and smoking in the vicinity of and inside vehicles should be strictly prohibited. It is advisable to adopt an "eight-hour rule", under which the drivers and operators of machinery such as forklift trucks should avoid alcohol for at least eight hours prior to activities that involve hazardous materials.

Other measures to reduce the risk of accident include avoiding transportation during rainy seasons, scheduling departure days and times to coincide with periods of low traffic density (bearing in mind any need to drive during daylight hours only), using police or other agency escorts when driving through cities, imposing rest stops every two hours, and avoiding leaving the vehicle unattended.

When an overnight stop is planned, the vehicle should always be parked in a secure, fenced area, under the surveillance of security guards. Ensuring access to police stations and other secure locations for overnight parking is an important aspect of transport route planning.

BOX F4

Response to emergencies along the road

Basic rules

- Never leave the vehicle unattended.
- Never smoke or light a fire near the vehicle.
- Destroy all contaminated food, feedstuffs and other goods destined for human use.

Procedures in the event of accident

- Stop the vehicle and switch off the engine.
- Observe whether there are seriously injured individuals at risk of death, and provide immediate first aid.
- Evacuate the contaminated area.
- Secure the accident area.
- Decontaminate exposed people and provide first aid and medical care to the injured.

- Inform the authorities (via radio or mobile phone): police, hospital, administrative authorities, field manager, etc.
- Provide adequate protective clothing to the personnel involved in clean-up.
- Limit the spread of the spill by, if possible, neutralizing it. For example, cover the load to prevent the migration of powders by wind, and divert any watercourses that could spread the contamination.
- Collect all spilled and contaminated material.
- Place spilled material and the contaminated items used for cleaning into empty, marked containers.
- Signpost the area to inform the local population, and indicate water sources and crops at risk.
- Record the accident.

BOX F5

Transport documentation

- List all the packages in the load, ideally using the multimodal dangerous goods form (Form F4).
- Retain information on the pesticides transported (material safety data sheets [MSDS]).
- Provide a route plan for the driver to follow.
- Have emergency contact telephone numbers for accidents.

BOX F6

Training of people involved in the carriage of dangerous goods

All the personnel involved in the carriage of obsolete pesticide (field managers, drivers, etc.) should be appropriately trained to carry out their duties and responsibilities. Training should include:

- general requirements governing the carriage of dangerous goods;
- information on environmental protection concerning the transfer of wastes;
- the main hazards associated with pesticides;
- preventive and safety measures appropriate to each hazard;
- segregation of obsolete pesticides containers (prohibitions on mixed loading within vehicles or containers), loading, unloading, handling, stowage, marking and labelling;
- first aid and emergency procedures;
- use of communication equipment;
- mechanical expertise.

BOX F7

Safety equipment for the transport of obsolete pesticide containers

- Provide the driver with personal protective equipment adapted to the type of pesticides stored in the collection centre (for further details see *FAO, Training manual for inventory taking of obsolete pesticides*, FAO Pesticide Disposal Series No. 10).
- container(s) for collecting contaminated material; and a mop.

Minimum equipment for controlling and mitigating accidents

- Two self-standing warning signs.
- Spillage control material: absorbents such as sand mixed with lime; a large, flat spade; a broom; clean labelled
- Fire control material: one portable dry-powder fire extinguisher of at least 2 kg capacity (and preferably 6 kg), suitable for fighting a fire in the engine or cab of the transport unit, or a fire involving the load.
- First aid kit including an atropine injection kit, bicarbonate sodium and activated charcoal dust.

BOX F8

Checklist prior to transportation

Prior to loading and departure, the following should be carefully checked.

Vehicle condition

- Brakes and parking brakes.
- Tyres (condition and air).
- Steering.
- Lights.

Equipment

- Communication equipment (radio, mobile phones).
- Speed control and recording system.
- Two spare tyres.
- Foot pump.
- First aid kit.
- Fire extinguisher.
- Personal protective equipment.
- Polyethylene sheet.
- Deep tray fitted to the truck.
- Essential spillage control equipment (tool E).

BOX F9

Recommendations for cargo loading and transportation

- Do not overload the vehicle.
- Always cover the carriage to keep it dry.
- Have a drip tray when carrying liquids.
- Secure the load and stow the cargo tightly, protect containers and prevent them from hitting each other on bumpy roads (for example, using salvage tyres).
- Ensure the load is properly documented, including a detailed list of the contents of each package.
- Switch off the engine during loading and unloading operations.
- Always apply parking brakes when parking transport units containing obsolete pesticides.
- Do not accept passengers other than the driver's assistant.
- Obtain escort vehicles for lorries transporting pesticides.
- Ensure regular contact between vehicles and the authority/project manager.
- Provide a copy of the instructions relating to all the dangerous goods being carried.

BOX F10 Dangers of transport

Road transport

The transport of people and goods by road is a very high-risk activity. This is especially true in developing countries, where poor road conditions, harsh climates, poorly maintained vehicles and erratic driving are common. Poor conditions coupled with the need to move personnel, equipment and hazardous pesticides over long distances pose a significant risk to project implementation. Tool F aims to limit this risk as far as possible, but responsibility for applying the tool rests ultimately with the driver of the vehicle and the manager of the project. Even when systems are properly followed, accidents can still happen. Tool F provides a mechanism for limiting the impact of any accident on public health and the environment.



This project vehicle has been hit by another vehicle, which was not driving with due care and attention.



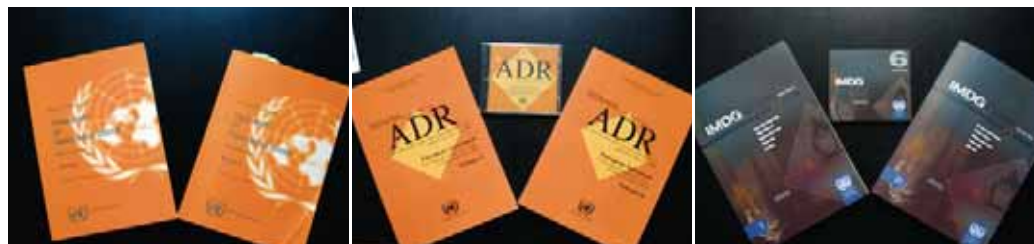
The scheduling of travel must take rainy seasons into account.



Broken-down or overturned trucks are a common sight on many roads in developing countries. Excessive speed, poor vehicle maintenance and overloading are often to blame.



Tool F applies international transport regulations as set out in the UN Recommendations on the Transport of Hazardous Goods, commonly called the UN Orange Book. The various agreements and codes covering the transport of hazardous cargo by road, rail, sea and air are based on these codes. For most obsolete pesticide projects, the most significant regulations are the European Agreement for the Transport of Hazardous Cargo by Road (ADR), which has been adopted in more than 38 countries worldwide, and the International Maritime Dangerous Goods Code (IMDG). These are updated every two years and are available as printed volumes or CD-ROMs.



continues

BOX F10 cont.
Dangers of transport

Accidents

The following photographs provide a graphic demonstration of the importance of having an adequate command structure and emergency planning in case of accidents. During the transportation of repackaged obsolete pesticides in southern Ethiopia, one of the trucks carrying waste was involved in an accident. Investigation into the cause of the accident confirmed that the brakes on the second trailer had failed, resulting in the trailer overturning and forcing the truck off the road. This occurred even though the driver was experienced and adhered to the national speed limit of 40 km an hour for trucks carrying pesticides, and the truck had an up-to-date maintenance record.



The drums of pesticide were still intact in the trailer. The cab, carrying the driver and three passengers, was totally crushed, but miraculously no-one was hurt.

The truck was escorted by a team from the local PMU and the hazardous waste contractor, who immediately secured the truck and informed the local administration at the nearest town, 2 km away. The team then covered the load with tarpaulins to prevent rainwater from spreading contamination, and placed absorbent material in strategic positions in case of leakage. The project management office in Addis Ababa was called, and sent a team – including the FAO project manager – to the site the following day.



The clean-up team was responsible for removing all drums of waste. Only one of the containers on the vehicle had leaked, with approximately 5 kg of carbaryl powder causing limited contamination, as shown above. Specialist lifting equipment was needed to move the drums.

continues

BOX F10 cont.
Dangers of transport

Close examination of the accident site confirmed that only one drum had leaked. This demonstrates the benefit of transporting repackaged waste and the need to use UN-approved packaging at all times. All signs of contamination were removed and the waste was repackaged in new containers for disposal. The accident site was inspected by representatives of FAO and the regional and federal governments to ensure that no other contamination had occurred.



Drums were loaded on to a new single-trailer truck, relabelled and transported to the main collection centre as originally planned.

The procedures and systems included in tool F are based on this experience of dealing with a real accident. It is recommended that the use of double trailers be avoided for the movement of hazardous cargo.

Sea transport

Most developing countries do not have facilities for the environmentally sound disposal of obsolete pesticide and persistent organic pollutant waste. To export the waste for disposal requires compliance with both the Basel Convention and the IMDG Code.



Shipping container units are supplied through a freight forwarder. The project must inspect them to ensure that they are clean and certified for sea transport. The loading of shipping containers can be greatly simplified through the use of a forklift truck and drum-lifting equipment. All drums containing liquid waste must be placed inside a steel drip tray to catch any spillages in transit. The minimum size of the tray is set out in the IMDG Code. Additional spillage control such as polyethylene membranes may also be used when drums are double-stacked in a container (as shown in the lefthand photograph above).

continues

BOX F10 cont.
Dangers of transport

A suitable floor needs to be inserted between the layers of drums, and drums must be placed in the container upright and not “on the roll”. Drums need to be secured by timber “tomming” to ensure that the load does not move in transit. Transport by sea is a hazardous process with large fluctuations in temperature, humidity and movement likely to occur. It is critical that all drum closures are sealed to the correct torque to prevent spillage.



Mixed loads of drums and big bags can also be shipped. In such cases, it is recommended that there be only a single layer of bags, or that the bags be placed as a second layer on top of a layer of drums. Alternatively, bags can be loaded into packing crates, which can then be double-stacked, providing the crates are certified for stacking. The risk of stacking bags on top of each other without an exterior crate is that they can easily shift in transit, resulting in mass movement of waste that the shipping container unit is unable to contain. FAO recommends that big bags be shipped as a single layer or in packing crates.



Filled shipping container units must be inspected by customs, and sealed. Cranes are needed to load the units on to suitable trucks. Documentation is needed, and only trained drivers must be used. The containers are labelled to comply with IMDG requirements before being dispatched to the port.

FORM F2
Route survey form

Route	From	To	Road covering (Asphalt Gravel Dust)	Road conditions (Wet Slippery...)	Traffic conditions (Scarce Dense)	Land use (Agricultural Natural)	Information for the user	Risk of accident	Potential impact
Segment							<ul style="list-style-type: none"> Roads and traffic conditions curves intersections road crossings difficult populated areas water sources agricultural area residential area livestock 	(High Medium Low)	(Limited Significant Serious)
1	Departure								
2									
...									
...		Arrival							
Synthesis	The route is : <input type="checkbox"/> Suitable for all cargo type <input type="checkbox"/> Suitable only for cargoes with the following hazardous property: <input type="checkbox"/> Not suitable for any cargo								
Rationale	<i>(Provide explanation)</i>								

FORM F3
Transport plan

Segment #	Route #	From	To	From		Control and preventive measures		To	Specific dangers		Emergency contacts
				Risk of accident (High, Medium, Low)	Potential impact (Limited, Significant, Serious)	Maximum speed limit (km/h)	Other measures		Description	Specific control and preventive measures	
1		Departure									Police, medical services, fire brigades, environmental authorities
2											
3...											
...n			Arrival								

FORM F4
Multimodal dangerous goods form

Shipper / Consignor / Sender	Transport document number				
	age of pages			Shipper's reference	
				Freight forwarder's reference	
Consignee			Carrier (to be completed by the carrier)		
			<p>SHIPPER'S DECLARATION</p> <p>I hereby declare that the contents of this consignment are fully and accurately described below by the proper shipping name, and are classified, packaged, marked and labelled/placarded and are in all respects in proper condition for transport according to the applicable international and national governmental regulations</p>		
<p>8. This shipment is within the limitations prescribed for: (Delete non-applicable)</p> <p>ASSEMBLY CAR AIRCRAFT NL</p> <p>CAR AIRCRAFT</p>			Additional handling information		
essel / flight no. and date		ort / place of loading			
ort / place of discharge		estination			
Shipping marks	Number and kind of packages	description of goods	gross mass (kg)	Net mass	Cube (m ³)
<p>You must specify proper shipping name, hazard class, no. packages, group, here assigned and any other element of information required under applicable national and international regulations</p>					

Sources: ADR regulations and IMDG.

FORM F5
Checklist

vehicle registration plate <input type="text"/>	Safety equipment	documentation
<ul style="list-style-type: none"> . Brakes <input type="checkbox"/> . Tyre <input type="checkbox"/> . Lights <input type="checkbox"/> . Speed recording disk <input type="checkbox"/> . Steer <input type="checkbox"/> . Spare tyre <input type="checkbox"/> . Foot pump <input type="checkbox"/> 	<ul style="list-style-type: none"> . Radio or cell phone <input type="checkbox"/> . Personal protective equipment <input type="checkbox"/> . Spillage control equipment <input type="checkbox"/> . Spare containers <input type="checkbox"/> . Fire extinguisher <input type="checkbox"/> . First aid kit <input type="checkbox"/> <p>checked by <input type="text"/> name and signature <input type="text"/></p>	<ul style="list-style-type: none"> . Log book <input type="checkbox"/> . Route plan <input type="checkbox"/> . Cargo list <input type="checkbox"/> . Emergency contacts <input type="checkbox"/> . Hazard identification symbol <input type="checkbox"/>

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