

---

# **Pest Management for Warehouses Storing Contraceptive Products in Developing Countries**

Program for Appropriate  
Technology in Health (PATH)





# **Pest Management for Warehouses Storing Contraceptive Products in Developing Countries**

Program for Appropriate Technology in Health (PATH)



## **FPLM**

The Family Planning Logistics Management (FPLM) project is funded by the Office of Population of the Bureau of Global Programs of the U.S. Agency for International Development (USAID). The agency's Contraceptive and Logistics Management Division increases the awareness, acceptability, and use of family planning methods, and expands and strengthens the managerial and technical skills of family planning and health personnel.

Implemented by John Snow, Inc. (contract no. CCP-C-00-95-00028-00), the FPLM project works to ensure the continuous supply of high quality health and family planning products in developing countries. FPLM also provides technical management and analysis of two USAID databases, the contraceptive procurement and shipping database (NEWVERN), and the Population, Health, and Nutrition Projects Database (PPD).

This document does not necessarily represent the views or opinions of USAID. It may be reproduced if credit is given to FPLM.

## **Recommended Citation**

Program for Appropriate Technology in Health (PATH). 1994. *Pest Management for Warehouses Storing Contraceptive Products in Developing Countries*. Family Planning Logistics Management/John Snow, Inc., for the U.S. Agency for International Development.

## **Abstract**

Details various methods of pest management for warehouses that store contraceptives.



**FPLM**



Family Planning Logistics Management  
John Snow, Inc.  
1616 North Fort Myer Drive, 11<sup>th</sup> Floor  
Arlington, VA 22209 USA  
Phone: 703-528-7474  
Fax: 703-528-7480  
E-mail: [fplm\\_project@jsi.com](mailto:fplm_project@jsi.com)  
Internet: [www.fplm.jsi.com](http://www.fplm.jsi.com)

# Contents

Acronyms .....	v
1. Introduction .....	1
2. Integrated Pest Management .....	3
3. Prevention .....	5
Inside the Warehouse .....	5
Outside the Warehouse .....	6
4. Guidelines For Using Chemical Pesticides .....	9
5. Methods For Pest Management .....	11
Recommended Methods .....	11
Alternative Methods .....	14
6. Planning Ahead .....	15
Appendix A Most Hazardous Pesticides .....	17
Appendix B Toxicity .....	21
Appendix C Contacts .....	25
References .....	29



# Acronyms

BIRC	Bio-Integral Research Center
CDC	Centers for Disease Control and Prevention
EPA	Environmental Protection Agency (U.S.)
FEFO	first-to-expire, first-out
FPLM	Family Planning Logistics Management
JSI	John Snow, Inc.
MSDS	material safety data sheets
PAN	Pesticide Action Network
PPD	Population, Health, and Nutrition Projects Database
UN	United Nations
USAID	U.S. Agency for International Development





# 1. Introduction

The potential for pest damage in warehouses storing contraceptive commodities for family planning programs is a worldwide problem. Given the pervasiveness of the problem, the development of universally applicable pesticide use guidelines holds a great appeal. Unfortunately, broadly based pest management recommendations would be superficial at best and would not adequately address prevention, which is highly situation-dependent. General recommendations for pesticide use in contraceptive warehouses would be inadequate because (1) little available information is available; (2) there is a wide range of warehouse conditions, types of pests, warehouse structures, stored products, and environmental conditions (e.g., geographical locations); (3) every country and region of the world has insects specific to its area, and different insects respond differently to chemical pesticides; and (4) most countries have some restrictions on pesticide products, and generally pesticides must be registered by a government regulatory body in order to be used.

Additionally, routine management of insects and rodents through chemical pesticides (insecticides and rodenticides) can pose risks—not only to the products being stored in the warehouses, but also to the people using the pesticides, people nearby, and the surrounding environment. Ideally, local pest management specialists, entomologists, or government agencies should be consulted about appropriate and safe pesticides to use in warehouses where contraceptive products are stored.

Pests cannot be “controlled,” but they can be “managed.” And not all pests harm stored products. In keeping with the notion of pest “control,” warehouse staff may believe that the best way to solve a pest problem is by spraying a broad-spectrum chemical at regular intervals throughout the year. In the long term, this 100 percent chemical solution to pest problems is only creating problems that can be deleterious to human and environmental health. Moreover, a 100 percent chemical solution does not address the cause of the pest problem and therefore does not lead to a preventive solution. As a result of chemical overuse, 595 species of the most economically important insects (those that cause the most damage) are resistant to one or more types of chemicals, a large percentage of which are used in developing countries. Resistance to rodenticides is also very high.

In dealing with pest problems, the use of local resources should not be overlooked. It may be economically feasible to explore traditional methods for dealing with pest problems in residential settings and apply those techniques in the warehouse. In addition to local resources, there are an increasing number of innovative, nontoxic methods for dealing with pests that can be employed.

The following three basic questions should be answered in developing a pest management strategy:

- What type of pests is present?
- What problems are the pests causing?
- What warehouse conditions led to the pest infestation?



## 2. Integrated Pest Management

The first step in establishing guidelines for the use of pesticides in contraceptive warehouses is to develop an integrated pest management strategy. An integrated pest management approach to solving pest problems involves implementing a series of steps, with chemicals used only as a last resort. This approach can save money (since pesticides are often expensive) as well as protect human and environmental health. An important aspect of an integrated pest management strategy is to identify the causes of pest infestation as part of developing the solutions. Prevention is the principal objective.

If pests are present in the warehouse, development of an integrated pest management strategy involves the following steps:

1. Identify the pests.
2. Determine whether the pests pose a significant problem.
3. Identify the conditions that might enable the pests to thrive in the warehouse.
4. Identify the possible solutions, taking into account the—
  - time of the year
  - life stage of the pests (some life stages are not vulnerable to certain pesticides or nonchemical actions)
  - setting/site condition (e.g., warehouse adjacent to water source, presence of children).



### 3. Prevention

Good warehouse management and maintenance practices serve to reduce the risk of pest infestation.

#### **Key preventive measures are—**

1. Identify the pests and the potential pests, and identify and contact persons in the country or region who are knowledgeable about managing these pests.
2. Design, modify, and maintain the warehouse structure to prevent entry of potential pests or prevent conditions that favor pests.
3. Carry out regular warehouse inspections for signs of pests.

#### **Inside the Warehouse**

1. Design or modify the warehouse to facilitate cleaning. Key design issues include the following:
  - Ensure adequate air circulation/ventilation to reduce warehouse temperatures and prevent moisture build-up.
  - Position water faucets for easy access to water.
  - Use pallets or shelves so floors can be hosed down.
  - Locate drains to collect water run off.
  - Orient the grade of the floor toward drains for water run off.
2. Maintain a sanitary environment. General guidelines for keeping the warehouse clean include the following:
  - Do not store or consume food in the warehouse.
  - Securely store trash and refuse in appropriate receptacles inside the warehouse, with proper disposal outside at the end of each day or more frequently, if conditions warrant.
  - Clean floors and empty shelves daily.
  - Dust all stored cartons weekly.
  - Cover windows with 32 mm mesh screens.
  - Ensure doors close/seal properly.
  - Provide restroom facilities with the following:
    - > running water
    - > lids for toilet water tanks
    - > covers for toilets (in place at end of day)
    - > rain siphons to prevent rodent entry
    - > drain plugs for nightly placement.

## **Pest Management for Warehouses Storing Contraceptive Products in Developing Countries**

---

- Pour four gallons of water through drains each week to prevent evaporation of water barrier that could allow rodent and insect entry.
  - Remove and properly destroy, as necessary, all expired, damaged, or otherwise unusable products.
3. Keep the structure as dry as possible.
    - Immediately repair leaks of any kind since insects and rodents are attracted to moist places.
  4. Paint or varnish structural wood as needed to help prevent the infestation of wood-damaging insects such as termites.
  5. Use pallets and/or shelving. This will—
    - promote air circulation (leave space [one foot] between pallets and outside walls)
    - facilitate cleaning
    - protect stored goods from moisture and, more serious, flood damage.
  6. Prevent pests from entering the building:
    - Seal or screen any cracks or holes large enough to allow entrance of pests, particularly rodents (use galvanized netting—steel wool is a good screening material—or cement). Rodents can enter any crevice they can get their heads through.
    - Keep doors and windows closed when not in use.
    - Place metal roof flashing around the base of the building up to a height of 12 inches and buried in the soil to a depth of six inches to act as a rodent barrier.
    - Place gravel to a three-inch depth around the foundation of the building to discourage rodents from burrowing.

## **Outside the Warehouse**

7. Treat wood frame facilities with water seal every two years.
8. Regularly clean the outside of the warehouse, including key cleaning points:
  - Clean gutters and rainwater pipes (downspouts) once a month to prevent rotting of the structure (a bamboo rod or hose can be used for cleaning).
  - Repair any roof cracks or breaks.
  - Maintain a five-meter clearance around the warehouse that is void of trash, piles of debris, or heavy foliage (people tend to throw trash in bushes, and bushes are a convenient place for rodents to hide); prune remaining bushes regularly.
  - Store garbage securely in appropriate receptacles, preferably metal, approximately 12 inches above the ground and away from the building.

## **Lighting**

9. Select and locate lighting to minimize attraction of pests.

High-pressure sodium vapor lighting attracts the fewest insects; mercury vapor attracts the most. Mercury vapor lights are very bright ultraviolet and have good color rendition. Sodium vapor lights put out as

much light as mercury vapor lights but have a yellow-orange cast. Identify the type of vapor lighting on the bulb. Both mercury and sodium vapor lights are widely available and comparable in price.

- Replace mercury light bulbs with high-pressure sodium vapor lights, if feasible.
- Place outside lighting away from warehouse entrances/exits.
- Attach lights apart from but directed toward warehouse buildings, rather than affixed to the building.

### **Make Regular Inspections**

10. Regularly inspect the warehouse to identify potential pest problems before they become major ones:

- Conduct a periodic visual inspection of cartons looking for the presence of insects and rodents or their eggs and feces.
- Conduct a monthly visual inspection of shelves, walls, floors, and ceilings for the presence of insects and rodents and physical damage to the structure, such as holes and cracks in the walls, ceilings, floors, and ventilation screens that lead to the outside environment. Look also for build-up of dust, particularly from wood shavings that would indicate a problem with wood-damaging insects (e.g., termites).
- Inspect the external perimeter of the warehouse periodically for the presence of insects, rodents, and other pests or their eggs and feces.
- Periodically dust with talcum powder near access points and along walls to determine the extent of any rodent activity.





## 4. Guidelines for Using Chemical Pesticides

If the use of chemical pesticides is necessary to manage an existing pest problem, follow some basic but important rules for selection and use.

1. Choose the least toxic chemical available considering the conditions established in step 4 of the integrated pest management strategy outlined earlier. Minimize human and environmental exposure to the chemical(s). Appendix A contains a list of some chemicals known to be most hazardous to human and environmental health and also a chart listing countries restricting the use of these products. See appendix B for important, detailed information on toxicity. Anyone involved in the selection or application of a chemical pesticide should be familiar with toxicity of any pesticide under consideration.
2. Choose the chemical with the shortest residual period (i.e., the length of time it takes for the chemical to completely dissipate), taking into consideration the conditions identified in step 4 of the integrated pest management approach and the severity of the pest problem. The longer the residual, the more dangerous it is to the health of the person applying the product and to the people working in the immediate area, as well as to the environment. It is difficult to determine residual periods of pesticides because they vary widely depending on the product, environmental conditions, and how the pesticide is applied. However, some pesticides—DDT, for example—have exceedingly long residuals. Residual periods are likely to increase if the amount applied is in excess of the product label guidelines. Anyone involved in the selection or application of a chemical pesticide should be familiar with residual periods of any pesticide under consideration.
3. Evaluate the effect of a chemical pesticide on all materials stored in the warehouse. Different products may be affected differently.
4. Use professional, licensed applicators to apply the chemicals. In many countries, applicators must be certified to apply “restricted use” pesticides, i.e., those that could have potentially unreasonable adverse effects on human or environmental health.
5. Select an applicator who is familiar with all national or local restrictions and regulations governing the use of chemicals. The applicator should take the following precautions:
  - Read the label of the product. Instructions on the label of the chemical should be strictly followed.
  - Wear adequate, protective clothing during spraying (shoes, not sandals; long pants; and a long-sleeved shirt). Wash clothing worn during spraying as soon as possible.
  - Wear protective eye covers and rubber, disposable gloves.
  - Thoroughly wash the entire body after spraying.
  - Immediately clean up any chemical spilled.
  - Wash any chemical spills on skin with soap and water immediately.
  - Do not mix wash water with drinking water supply.
  - Keep any on-site chemical containers clearly marked and out of the reach of children.
  - Protect children and pregnant or breastfeeding women from exposure to all chemical pesticides.

## **Pest Management for Warehouses Storing Contraceptive Products in Developing Countries**

---

- Pay attention to wind direction when spraying outside the building. Corners of buildings are particularly dangerous. The applicator's back should be kept to the wind to limit exposure to the chemicals. Do not spray outside the building on a windy day.
6. Restrict public use of treated areas during application and until the reentry period has elapsed. "Re-entry" is defined as the period in which it is safe for people to return to the area after spraying and/or fumigation. The re-entry period should be determined by an expert and also should be printed on the product label.
  7. Consider the following risks when choosing to use chemical pesticides:
    - Pesticides can be harmful to humans, animals, and the environment.
    - Many common pesticides kill bees and bats, which pollinate flowers, vegetables, etc.
    - Some pesticides remain in the environment for years—they are found in ground water used for drinking, in streams and lakes, and in rain.
    - Pesticide use does not offer a long-term solution to a pest problem.
    - A broad-spectrum pesticide may harm "good" insects (and possibly bats), not just those that are causing problems.

Pests can become resistant to pesticides over time.

## 5. Methods For Pest Management

Although every warehouse is unique with respect to the pest problem and physical structure (wood, aluminum, concrete, etc.), there are generally applicable techniques for chemical management of pest problems. Use of a combination of pest management methods (toxic and nontoxic) seems most effective.

### Recommended Methods

The following general guidelines are recommended by U.S. pest control specialists for managing rodents, crawling insects, flying pests, and termites and other structural pests. Note: these methods are not necessarily the best and/or most appropriate methods for every situation, but provide some possible approaches.

#### Rodents

Examples of rodents: rats, mice, moles, and squirrels.

Rodent problems can be best solved through preventive measures. If their shelter, food and water sources, and points of entry are taken away, theoretically rodents will leave. If they remain, however, rodents can be managed through several methods.

1. Snap traps are traditional, spring-loaded mousetraps with some sort of food substance to attract the rodents; these are placed on the floor at various points around the warehouse, particularly points of possible entry. Examine traps regularly and wear rubber gloves when handling traps. To disinfect after use, wash gloved hands first in a general purpose disinfectant and then in soap and water. After removing the gloves, wash hands again with soap and water.
2. Glue boards are disposable plastic or wood trays, 12" L x 6" W x 0.5" H, partially filled with nontoxic, extremely adhesive glue placed at various points, particularly possible entry points, around the warehouse. Glue boards not only trap rodents, but also provide a good indicator of what other pests are present. Examine glue boards regularly, always wearing rubber gloves. Disinfect gloves and wash hands as indicated above.
3. Bait boxes are shoe-size, heavy-duty plastic boxes with lids and two holes on each end containing 1.5-ounce toxic rodenticide packets. Bait boxes are secured to the ground at various points inside and outside the warehouse. Rodents enter the box to eat and build nests, but are unable to get out before they die from the poison. These boxes must be tamper-proof. Bait boxes should be examined regularly. Wear rubber gloves when handling boxes and wash as indicated above.

The U.S. Environmental Protection Agency (EPA) recommends that any use of a rodenticide should be preceded by use of a suitable insecticide to reduce the risk of plague transmission. According to a document from the U.S. Centers for Disease Control and Prevention (CDC), "Plague Transmission," the two most current recommended insecticides for flea management are permethrin and carbaryl. CDC notes that permethrin and carbaryl are widely used, have low mammalian toxicity, and are considered "environmentally-friendly." Both insecticides have proven to be very effective in controlling plague transmission. Application for both chemicals is considered low-tech. However, as with use of any chemical pesticide, labeling information, including warnings, must be factored into the evaluation of the appropriateness of the product.

## **Pest Management for Warehouses Storing Contraceptive Products in Developing Countries**

---

4. Electric ultrasonic devices can be placed in warehouses. Once activated, they emit high-frequency sounds creating auditory stress in rodents that causes them to avoid the sound-protected area. The stress also makes rodents less trap wary and more susceptible to eating baits, so these devices can be used in conjunction with the methods previously described. These devices also can be used to drive rodents away from an area where traps and baits cannot be used for safety or sanitary reasons and into an area where those methods can be used to effectively eradicate them. The ultrasonic frequency is above the normal range of human hearing.

Ultrasonic devices (price range: U.S.\$69–U.S.\$169) may not be registered for use in all countries. The cost per unit of high output is quite low relative to the cost of traps and baits, which must be constantly replaced.

Always wear rubber gloves when removing rodent carcasses from traps, bait boxes, or glue boards. Place the carcasses in a plastic bag containing a sufficient amount of a general-purpose disinfectant to thoroughly wet the carcasses. The bag should be sealed and then disposed of by burying in a two- to three-foot-deep hole or by burning. Always disinfect gloves and wash hands as indicated above. For clean up of rodent-contaminated areas, thoroughly mop or spray floors with a general-purpose disinfectant solution after proper removal of the deceased rodents (see above).

### **Crawling Insects**

Crawling insects can include ants, beetles, ticks, lice, spiders, earwigs, silverfish, fleas, and roaches.

After the pest has been identified and a chemical approach determined, U.S. pest experts recommend maintaining a three-foot chemical band around the outside perimeter of the building until the insects no longer pose a problem. Inside the building, a chemical barrier should be maintained where the walls, those leading to the outside, meet the floor. Spray the chemical six inches up the wall and six inches on the floor out from the wall. Also, spray and seal (where feasible) any cracks and crevices where potential entry of insects occur, such as doors, windows, and baseboards. Depending on the extent of the problem/damage (e.g., if insects are nesting inside cartons), chemicals may need to be sprayed around the edges of cartons but should not be sprayed inside cartons or directly on products.

As a starting point, U.S. pest experts recommend chemicals be sprayed every six months inside the building. Outside the building, chemicals should be sprayed once a month where frequent spraying is warranted, because of the decrease in chemical residual due to water and sunlight exposure. Monitor the effectiveness of the spraying and adjust it as necessary. For instance, if it appears that the inside spraying has not addressed the problem, spraying should take place inside the building on a quarterly basis.

Use a chemical with the least toxicity and shortest residual period, as appropriate. As stated above, chemicals should not be sprayed directly on products or in cartons containing products, because some chemicals can volatilize some types of packaging. Outside spraying does not present a danger to the integrity of the stored products.

## **Flying Pests**

Examples of flying pests (both nocturnal and diurnal): flies, bees, wasps, mosquitoes, moths, and bats.

Two methods can be used to reduce flying pest problems (the second method applies only to insects):

1. Keep all doors and windows of the warehouse facility closed or screened off from the outside.
2. Insect-electrocuting light traps (bug zappers) are electric grids hung outside or inside a building that attract flying insects via a bright fluorescent or ultraviolet light. Insects landing on the electric grid are instantly electrocuted. Light traps can also be used to gather information about exactly what types of insects are frequenting the warehouse vicinity. These traps draw more pests when placed near sources of attractive odors (such as garbage areas) than if they are placed in odor-free areas. Preventive maintenance of light traps is very important: the lamps must be replaced at least once a year and cleaned weekly (dead insects will attract larger predators). Proper positioning and location are important for use of the light trap's fullest potential and so that dead insects do not fall into or onto goods stored in the warehouse. Light traps should be positioned differently for night flyers and day flyers. Light traps are not effective with all flying insects, but they are effective in attracting many. These traps can also be ineffective in areas with competing light sources.

Safety precautions must be taken when using these devices, particularly to—

- Isolate equipment from combustible material.
- Guard electrically charged parts to prevent an accidental shock when working near the unit.
- Properly ground the device.

This method is more expensive than other methods (for industrial use, insect light traps with large surfaces are most efficient; prices range from U.S.\$350 to U.S.\$500). Light traps require electricity and will probably not be feasible to obtain or maintain by all facilities in developing countries.

Devices such as these also may not be registered for use in all countries.

## **Termites and Other Structural Pests**

There are several different types of termites; examples of other wood-damaging pests are carpenter ants, carpenter bees, and powder post beetles. Structural pest problems are handled differently from other insect problems.

Subterranean termites are common in some countries, including the United States. They live in the soil and build mud tubes up to wood structures. They thrive in moist wood. There are two primary treatments to resolve problems with subterranean termites within an existing facility. Both treatments are expensive and require a termite expert.

1. The soil in the ground beneath the facility is injected with a termiticide by drilling holes through the floor and foundation of the building. The injection of a termiticide into the ground soil does not pose a risk to the stored products. Prior to construction of a facility, if there is a high probability of structural pests at the facility site, the soil can be pre-treated by injecting a termiticide.
2. If the problem is severe enough or it is not feasible to inject the ground beneath the building, the building must be fumigated. This is an extremely dangerous procedure and involves placing a tent over and around the entire building to seal it off and fumigating the building with an extremely toxic chemical such as methyl bromide.

## Pest Management for Warehouses Storing Contraceptive Products in Developing Countries

---

When fumigating, all stored goods must be removed from the warehouse during the fumigation. This type of chemical will kill all living organisms and poses a significant health risk to people who come in contact with the products. The chemical fumes can collect in the storage cartons and inner boxes. If the chemical has not dissipated completely, a person opening the cartons or boxes is at risk of serious injury or death by chemical exposure. Appropriate safeguards must be taken to restrict all re-entry into the fumigation area. A specialist will know when it is safe for workers to return to the facility and safe for the products to be returned to the warehouse. If wood has been severely damaged by termites and other structural pests, it must be replaced.

### Alternative Methods

Because of the significant worldwide concern about the health and environmental risk of chemical pesticide use, some organizations are seeking chemical-free ways to manage pest problems. Some of the methods already discussed are alternatives to chemical pesticide use. A few other examples of alternative methods follow:<sup>1</sup>

1. Before contraceptive products are shipped from the U.S. to recipient countries, packaging and shipping cartons can be treated to prevent the infestation of pests during shipment. For example, cartons could be injected with carbon dioxide or nontoxic dehydrating substances.
2. For the control of structural pests, examples of alternative methods would be the construction of sand barriers (preventive), nontoxic heat treatments, and liquid nitrogen treatments.
3. As a means to attract and trap male insects, there are “pheromone traps.” These traps are scented with the pheromones of a female insect in attempts to lure the male insects inside the trap.
4. One method for getting rid of insects is simply physically removing them. Cartons containing insects should be opened and the insects manually removed. Depending on the species of insects, sometimes it is a good idea to take the contaminated cartons out into the sunlight (some insects will run from the sun). Damaged products (those infested with insect nests and feces) should also be physically removed from storage and properly destroyed. As part of this process, insects’ building access should be identified and corrected.
5. For reptile management, local methods can be used. Most snake species are innocuous and can be managed either through noise makers or by using available local materials to construct mesh L-shaped barriers under the soil. These methods are contingent upon whether the snakes coil, burrow, climb, etc. To prevent snakes and other lizards from invading cartons, preventive measures (such as shrink-wrap) in packaging should be employed.

---

<sup>1</sup> These methods are provided by the Bio-Integral Research Center (BIRC) in Berkeley, California. This organization specializes in least-toxic and non-toxic methods for managing pests. Some of the procedures described here may not be feasible in some settings for reasons of cost or material accessibility, but they may be adapted. BIRC’s contact information is provided in appendix C.

## 6. Planning Ahead

Warehouses should have written procedures for (1) the prevention of pests (i.e., sanitary measures) and (2) the use of suitable pest management methods, including the use of chemical pesticides.

Local resources for pest management should be tapped for proper and effective treatment of pest problems by identifying local, regional, and worldwide professional resources for dealing with specific pest problems.

The future of pest management is moving toward preventive measures in packaging. When pests move in cartons and containers of international commerce, they may thrive in a new environment where they have no natural enemies. These problems can be eliminated through packaging. When considering a new or different source of a product, the type of packaging and preventive measures employed in packaging contraceptive products should be taken into consideration.





## **Appendix A**

# **Most Hazardous Pesticides**



## Some of the Most Hazardous Pesticides<sup>2</sup>

Aldicarb (Temik)

Aldrin

Camphechlor (Toxaphene)

Chlordane

Chlordimeform

DBCP

DDT

Dieldrin

Endrin

Ethylene dibromide (EDB)

HCH/BHC

Heptachlor

Lindane

Methyl Parathion

Paraquat

Parathion

Pentachlorophenol (PCP)

2,4,5-T

---

<sup>2</sup> Source: Pesticide Action Network (PAN). Demise of the dirty dozen chart. 1993.



## **Appendix B**

# **Toxicity**



## Toxicity

Acute toxicity is defined as the ability of a pesticide to produce adverse health effects from a single exposure of relatively short duration. Toxicity is measured in terms of median lethal dose, or LD<sub>50</sub>, which is defined as the amount of a substance in milligrams of product per kilogram of body weight (mg/kg) which will kill half of the test animals to which it is administered. LD<sub>50</sub> stands for “lethal dose at the 50th percentile.” The lower the median lethal dose, or LD<sub>50</sub>, the more toxic the compound is. Oral, dermal, or inhalation measurements can determine toxicity. Table 1 provides a general scale for converting LD<sub>50</sub>s to approximate lethal doses for humans<sup>4</sup> (it is important to note that these measurements do not address the duration of toxicity):

**Table 1. Converting LD<sub>50</sub>s to Lethal Doses for Humans**

Toxicity Rating	Oral LD <sub>50</sub> (mg/kg)	Amount That Will Kill an Average Adult
Supertoxic	5	A few drops
Extremely toxic	5–50	Up to 1 teaspoon
Very toxic	50–500	1 teaspoon–2 tablespoons
Moderately toxic	500–5,000	1 ounce–12 ounces
Slightly toxic	5,000–15,000	12 ounces–1/2 gallon

Information about toxicity of pesticides may be available but varies by manufacturer and also by country, depending on the regulations. In the United States, for example, the U.S. Environmental Protection Agency (EPA) requires that toxicity information be located on material safety data sheets (MSDS) for each product. Also, regulations by the EPA state that signal words denoting a product’s level of toxicity must be included on product labels; table 2 lists categories of toxicity and associated signal words. Although this regulation is specific to the United States, other countries may have similar types of guidelines:

**Table 2. Categories of Toxicity and Signal Words**

Risk category	Signal word	Oral LD <sub>50</sub> (mg/kg)
I	DANGER—Poison	0–50
II	WARNING	50–500
III	CAUTION	500–5,000
IV	CAUTION	>5,000

Although all countries may not have regulations requiring MSDS when importing pesticides, shipping companies require MSDS to handle these toxic products. Therefore, it can be assumed that all pesticide manufacturers must have MSDS if they expect to ship their products internationally.





## **Appendix C**

### **Contacts**



Sheila Daar, M.S.H., Executive Director  
Dr. William Olkowski, Technical Director  
The Bio-Integral Resource Center  
P.O. Box 7414  
Berkeley, California 94707  
U.S.A.  
Phone: (510) 524-2567  
Fax: (510) 524-1758

Cooperative Extension Liaison to EPA  
Environmental Protection Agency  
Region 10  
1200 Sixth Avenue  
Seattle, Washington 98101  
U.S.A.  
Phone: (206) 553-2960

Don Gilbert Industries  
5611 Krueger Drive  
Jonesboro, Arkansas 72401-9102  
U.S.A.  
Phone: (800) 643-0400, (501) 932-6070  
(for information on industrial study of insects,  
particularly insect light traps)

Pesticide Action Network (PAN) Regional  
Centers:  
North America  
PAN North America Regional Center  
116 New Montgomery #810  
San Francisco, California 94105  
U.S.A.  
Phone: (415) 541-9140  
Fax: (415) 541-9253  
Telex: 156283472 PANNA

Africa (Anglophone)  
Environment Liaison Centre International  
P.O. Box 72461  
Nairobi  
KENYA  
Phone: (254-2) 562-015  
Fax: (254-2) 562-175  
Telex: 23240 ELC KE

Africa (Francophone)  
Environment and Development Action in the  
Third World  
BP 3370  
Dakar  
SENEGAL  
Phone: (221) 224229  
Fax: (221) 222695  
Telex: 51456 ENDA TM SG

Asia Pacific  
PAN Asia and the Pacific  
P.O. Box 1170  
10850 Penang  
MALAYSIA  
Phone: (60-4) 870-271  
Fax: (60-4) 877-445

Europe  
PAN Europe c/o The Pesticides Trust  
23 Beehive Place  
Brixton, London SW9 70R  
UNITED KINGDOM  
Phone: (44-71) 274-9086  
Fax: (44-71) 274-9084

Latin America  
RAPALMIRA  
Calle 30 Cra 30  
Edificio Cooperadores  
Office #301  
Palmira (Valle)  
COLOMBIA  
Phone: (57-227) 22463  
Fax: (57-227) 35252



# References

- Collman, S. United States Environmental Protection Agency, Region 10. Personal communication. August 1993.
- Daar, S. Bio-Integral Research Center (BIRC). Personal communication. August 1993.
- Federal insecticide, fungicide, and rodenticide act, subchapter II environmental pesticide control (Title 7 U.S. Code 136).
- Gage, K. Centers for Disease Control and Prevention (CDC). Plague transmission. Personal communication. Atlanta: CDC. February 1994.
- Georgiou, G. IN: National Research Council. *Pesticide resistance: Strategies and tactics for management*; National Academy of Science. Washington, D.C. pp. 14–43. 1986.
- Gilbert, D. *Industrial insectecology*. N.p.: N.p. 1980.
- Management Sciences for Health (MSH). *Managing Drug Supply: The Selection, Procurement, Distribution, and Use of Pharmaceuticals in Primary Health Care*. Boston: MSH. 1984.
- Metrocenter YMCA. Earth-friendly ways to have a healthy lawn or garden. Seattle: N.p. September 1992.
- Office of the Federal Register. Code of federal regulations, food and drugs. 211.50-211.58 and 820.40-820.56. revised April 1, 1987.
- Pesticide Action Network (PAN). Dirty dozen pesticide fact sheets. 1990.
- Pesticide Action Network (PAN). Demise of the dirty dozen chart. 1993.
- Pest Control. Tests confirm ILTs work; pp. 58, 62, 63. October 1988.
- United Nations, Department of International Economic and Social Affairs. *Consolidated list of products whose consumption and/or sale have been banned, withdrawn, severely restricted or not approved by governments*; fourth edition; New York. 1991.
- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. *Morbidity and Mortality Weekly Report*. “Hantavirus infection—southwestern.”
- United States Centers for Disease Control and Prevention (CDC). Interim Recommendations for Risk Reduction; volume 42; Atlanta: CDC. July 30, 1993.
- Terminix International. Personal communication. August 1993.
- Werner, D. Where there is no doctor. N.p.: N.p. pp. 412–413. 1992.

## **Pest Management for Warehouses Storing Contraceptive Products in Developing Countries**

---

Williard's Pest Control. personal communication. August 1993.

Product brochures:

- Dursban SOW, insecticide in water soluble packets
- Pest Chaser (Sonic Technology Products), ultrasonic rodent management products
- Knox Out 2FM, flowable microencapsulated insecticide

### **Additional information:**

Van Alebeek, F.A.N. Integrated pest management: A catalog of training and extension materials. Wageningen Agricultural University. Netherlands. 1989.

Hansen, M. K. *Escape from the pesticide treadmill: Alternatives to pesticides in developing countries*. Institute for Consumer Policy Research. 1988 (available from PAN).