S INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

Health and Safety Guide No. 22

CYPERMETHRIN HEALTH AND SAFETY GUIDE

UNITED NATIONS
ENVIRONMENT PROGRAMME

INTERNATIONAL
LABOUR ORGANISATION

WORLD HEALTH
ORGANIZATION

WORLD HEALTH ORGANIZATION, GENEVA

Other HEALTH AND SAFETY GUIDES available:

Acrylonitrile
Kelevan
Methylene Chloride
Tetrachloroethylene
1-Butanol
2-Butanol
tert-Butanol
Isobutanol
2,4-D
Epichlorohydrin
Tetradifon
12. Tecnazene
13. Chlordane
14. Heptachlor
15. Propylene Oxide
16. Ethylene Oxide
17. Endosulfan
18. Dichlorvos
19. Pentachlorophenol
20. Dimethoate
21. Aldrin and Dieldrin

IPCS

Health and Safety Guide No. 22

CYPERMETHRIN HEALTH AND SAFETY GUIDE

This is a companion volume to
Environmental Health Criteria 82: Cypermethrin

Published by the World Health Organization for the International Programme on Chemical Safety
(a collaborative programme of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization)

WORLD HEALTH ORGANIZATION, GENEVA 1989

ISBN 92 4 154344 2
ISSN 0259 - 7268

Computer typesetting by HEADS, Oxford OX7 2NY, England
Printed by Wissenschaftliche Verlagsgesellschaft mbH - D-7000 Stuttgart 10

CONTENTS

CONTENTS

INTRODUCTION

The Environmental Health Criteria (EHC) documents produced by the International Programme on Chemical Safety include an assessment of the effects on the environment and on human health of exposure to a chemical or combination of chemicals, or physical or biological agents. They also provide guidelines for setting exposure limits.

The purpose of a Health and Safety Guide is to facilitate the application of these guidelines in national chemical safety programmes. The first three sections of a Health and Safety Guide highlight the relevant technical information in the corresponding EHC. Section 4 includes advice on preventive and protective measures and emergency action; health workers should be thoroughly familiar with the medical information to ensure that they can act efficiently in an emergency. Within the Guide is an International Chemical Safety Card which should be readily available, and should be clearly explained, to all who could come into contact with the chemical. The section on regulatory information has been extracted from the legal file of the International Register of Potentially Toxic Chemicals (IRPTC) and from other United Nations sources.

The target readership includes occupational health services, those in ministries, governmental agencies, industry, and trade unions who are involved in the safe use of chemicals and the avoidance of environmental health hazards, and those wanting more information on this topic. An attempt has been made to use only terms that will be familiar to the intended user. However, sections 1 and 2 inevitably contain some technical terms. A bibliography has been included for readers who require further background information.

Revision of the information in this Guide will take place in due course, and the eventual aim is to use standardized terminology. Comments on any difficulties encountered in using the Guide would be very helpful and should be addressed to:

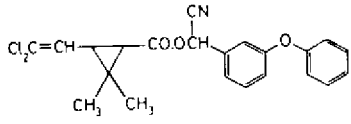
The Manager
International Programme on Chemical Safety
Division of Environmental Health
World Health Organization
1211 Geneva 27
Switzerland

INTRODUCTION

THE INFORMATION IN THIS GUIDE SHOULD BE CONSIDERED AS A STARTING POINT TO A COMPREHENSIVE HEALTH AND SAFETY PROGRAMME

1. PRODUCT IDENTITY AND USES

1.1 Identity

Common name:	Cypermethrin
Chemical structure:	
Molecular formula:	$C_{22}H_{19}O_3NCl_2$
Chemical name: (IUPAC)	(RS9-alpha-cyano-3-phenoxybenzyl (1RS) *cis-trans*-3-(2,2-dichlorovinyl)-2,2-dimethyl-cyclopropane carboxylate
Chemical name: (CAS)	(RS)-cyano(3-phenoxyphenyl)methyl (1RS)-*cis-trans*-3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropane carboxylate
CAS registry number:	52315-07-8 (formerly 69865-47-0)
RTECS registry number:	GZ1250000
Synonyms:	NRDC 149, WL43467, PP 383, CG-A 55186
Common trade names:	Ammo, Avicade, Barricade, CCN 52, Cymbush, Folcord, Imperator, Kafil super, Polytrin, Ripcord, Stockade.
Relative molecular mass:	416.3

Cypermethrin is the ISO name for the pure racemic compound, consisting of 8 stereo isomers. The technical products commonly available contain more than 90% cypermethrin and the ratio of *cis* to *trans* isomers varies from 50:50 to 40:60.

1.2 Physical and Chemical Properties

Technical cypermethrin varies from a viscous, yellow liquid to a semi-solid crystalline mass at ambient temperatures.

Some physical and chemical properties are listed in the International Chemical Safety Card on pages 20–23.

Cypermethrin is highly stable to light and at temperatures below 220 °C. It is resistant to acidic rather than alkaline media with an optimum stability at pH 4. Cypermethrin hydrolyses under alkaline conditions in a similar way to simple aliphatic esters. Dilute aqueous solutions are subject to photolysis, which occurs at a moderate rate.

1.3 Analytical Methods

The most widely adopted procedures for the determination of cypermethrin residues in crops, soil, animal tissues and products, and environmental samples are based on extraction of the residue with an organic solvent, clean-up of the extract, as necessary, by solvent–solvent partition and adsorption-column chromatography, followed by determination of the residue using gas chromatography with electron capture detector (GC/ECD). The identity of residues can be confirmed by GC with mass selective detection (GC-MSD) or by thin-layer chromatography (TLC) followed by GC/ECD.

1.4 Production and Uses

Cypermethrin was first synthesized in 1974 and first marketed in 1977 as a highly active synthetic pyrethroid insecticide effective against a wide range of pests in agriculture, public health, and animal husbandry. In agriculture, its main use is against foliage pests and certain surface soil pests, such as cutworms, but, because of its physical and chemical properties, it is not recommended against soil-borne pests below the surface.

In 1980, 92.5% of all the cypermethrin produced in the world was used on cotton; in 1982, world production was 340 tonnes of the active material. It is used primarily in the form of an emulsifiable concentrate, but ultra-low-volume concentrates, wettable powders, and joint formulations with other pesticides are available.

2. SUMMARY AND EVALUATION

2.1 Human Exposure

The levels of cypermethrin residues in food commodities after good agricultural practice are generally low. The residue levels will be further reduced during food processing. In food of animal origin, residues may range between 0.01 and 0.2 mg/kg product. Residue levels found in non-food commodities are generally higher, up to 20 mg/kg product. Total-diet studies are not available, but the available residue information indicates that the oral intake by the general population is well below the ADI, and expected to be negligible.

2.2 Effects on Animals and Human Health

The absorption and elimination of cypermethrin was rapid in the different mammalian species tested. The major metabolic reaction is cleavage of the ester bond followed by hydroxylation and conjugation of the cyclopropane and phenoxybenzyl moieties. The highest levels of cypermethrin are found in body fat, which is consistent with the lipophilic nature of the compound. The half-life in the fat of rats is about 12–9 days for the *cis*-isomer and 3–4 days for the *trans*-isomer.

The acute toxicity of cypermethrin for mammals is of a moderate order. The oral LD_{50} for the rat ranged from 200–4000 mg/kg body weight. Short-term and long-term toxicity studies on rats, mice, and dogs have shown effects on growth, the liver and kidneys, the nervous system, and the blood. A no-observed-adverse-effect level of 7.5 mg/kg body weight has been adopted by the Task Group.

Cypermethrin was not carcinogenic in mice or rats fed diets containing the compound over a 2-year period. Cypermethrin was not teratogenic in either rats at 70 mg/kg body weight or rabbits at 30 mg/kg body weight. No effects on reproductive performance were seen in a 3-generation reproduction study on rats administered 10 mg cypermethrin/kg diet. In a variety of mutagenicity studies, cypermethrin was shown to be mainly without mutagenic activity.

The mechanism of the action of cypermethrin on the nervous system has been extensively studied. From these studies and the available

occupational studies, it seems that the skin sensation seen in workers handling cypermethrin generally lasts only a few hours and does not persist for more than one day after exposure. Other neurological signs have not been observed. These skin sensations may be considered as an early warning that exposure has occurred and that work practice should be reviewed. Cypermethrin may cause eye irritation and may be a sensitizer for certain persons.

No cases of accidental poisoning have been reported as a result of occupational exposure.

2.3 Evaluation of Effects on the Environment

When cypermethrin is applied to crops, residues may occur in soils and surface waters, but biological degradation is fairly rapid and residues do not accumulate in the environment. Photodegradation is unlikely to play an important role. The main route of degradation is cleavage of the ester linkage to give two main degradation products containing the cyclopropane, and the phenoxybenzyl moieties. The half-life in the soil is determined by many factors, but is in the range of 2–4 weeks. Breakdown products in plants are bound as glucosides. Because of its rather fast breakdown forming less toxic breakdown products, and the low dose rates used in good agricultural practice, it is unlikely that cypermethrin will reach significant levels in the environment.

Cypermethrin at high dose levels may exert transient effects on the soil microflora. Earthworms and other soil organisms are generally resistant to cypermethrin. Because of strong adsorption to soil, only low levels of cypermethrin may leak into surface water. These may have transient effects, mainly on surface-breathing insects.

Cypermethrin is very toxic for fish and aquatic invertebrates. The presence of suspended solids decreases the toxicity by a factor of at least 2, because of the adsorption of cypermethrin on the solids.

Accumulation studies have shown that cypermethrin is rapidly taken up by fish (accumulation factor approximately 1000). The half-life of residues in the rainbow trout was 8 days. In view of the low concentrations of cypermethrin that are likely to arise in water bodies and their rapid decline,

it is concluded that, under practical conditions, residues in fish will not reach measurable levels.

The toxicity of cypermethrin for birds is low. However, bees appeared to be very sensitive in laboratory tests. Under field conditions, the effect on bees is minimal, because cypermethrin seems to have a repellent effect on them.

3. CONCLUSIONS

General population exposure: Under recommended conditions of use the exposure of the general population to cypermethrin is negligible and is unlikely to present a hazard.

Occupational exposure: With reasonable work practices, hygiene measures, and safety precautions, the use of cypermethrin is unlikely to present a hazard to those occupationally exposed to it. The occurrence of "facial sensations" is an indication of exposure. Under these circumstances work practices should be reviewed.

Environment: With recommended application rates, it is unlikely that cypermethrin or its degradation products will attain levels of environmental significance. The fact that cypermethrin is highly toxic for fish and honey bees is only likely to cause a problem in the case of spillage or overspraying.

4. HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

4.1 Main Human Health Hazards, Prevention and Protection, First Aid

Cypermethrin is a synthetic pyrethroid insecticide. Only one case of poisoning has been described in the general population and none during occupational exposure. The results of experimental animal studies suggest that, following massive overexposure or accidental ingestion, neurological signs and symptoms, e.g., ataxia, convulsions, could occur.

The human health hazards associated with certain types of exposure to cypermethrin, together with preventive and protective measures and first aid recommendations, are listed on the International Chemical Safety Card on pages 20–23.

4.1.1 *Advice to Physicians*

No specific antidote is known. If indicated, empty stomach. Treat symptomatically. The main hazard with liquid formulations is aspiration of the solvent into the lungs, resulting in chemical pneumonitis.

4.1.2 *Health Surveillance Advice*

Occurrence of "facial sensations" is an indication of skin exposure. Under these circumstances, work practices should be reviewed.

4.2 Explosion and Fire Hazards

Some solvents in pyrethroid formulations are highly flammable. Use dry powder, carbon dioxide, alcohol-resistant foam, sand, or earth for dealing with fires. **Do not use water**. Cool nearby drums with water spray.

If pyrethroid products are involved in a major fire or in a fire involving other products, advise the fire service that protective clothing and breathing apparatus should be worn. Also, warn the authorities that pyrethroids are highly toxic for fish, and that the use of water should be confined to the cooling of unaffected stock, thus avoiding the accumulation of polluted run-off from the site.

4.3 Storage

Store technical material and formulations away from heat, under lock and key, and out of the reach of children, animals, and unauthorized personnel. Store in an area designated for insecticide storage, preferably without drains.

Store away from other chemicals, foodstuffs, and animal feed.

4.4 Transport

Pyrethroids are classified as "harmful" or "low hazard" for transport purposes. Formulations based on flammable solvents may be subject to local transport controls. Ensure that containers are sound and that labels are securely fixed and undamaged before dispatch. Comply with local transport regulations.

Do not load together with food and animal feed.

Accident procedures:

(*a*) Avoid exposure – if possible by the use of appropriate protective clothing and masks. Keep spectators away from leaking or spilled product and prevent smoking or the use of naked flames in the immediate vicinity.

(*b*) Extinguish fires with dry powder, carbon dioxide, alcohol-resistant foam, sand, or earth.

(*c*) Prevent liquid from spreading to other cargo, vegetation, or waterways by containing it with the most readily available barrier material, e.g., earth or sand.

(*d*) Absorb spilled liquid and cover contaminated areas with earth, lime, sand, or other absorbent material. Sweep up and place in a secure container for subsequent safe disposal.

4.5 Spillage and Disposal

4.5.1 *Spillage*

Avoid exposure, if possible by the use of appropriate protective clothing and masks.

Empty any product remaining in damaged or leaking containers into a clean empty drum and label.

Absorb spillage with lime, damp sawdust, sand, or earth and dispose of safely (see below). If spillage is large, contain it by building a barrier of earth or sandbags.

Decontaminate empty, damaged, or leaking containers with a 10% sodium carbonate solution added at the rate of at least 1 litre per 20-litre drum. Puncture containers to prevent reuse.

4.5.2 *Disposal*

Waste containing cypermethrin should be burnt in a proper high temperature incinerator with effluent scrubbing. Where no incinerator is available, contaminated absorbents or surplus products should be decomposed by hydrolysis at pH 12 or above. Contact with a suitable hydrolysing agent is required to ensure degradation of the active ingredient to a safe level.

(*a*) *For emulsifiable material*: 5% sodium hydroxide (caustic soda) solution or saturated (7–10%) sodium carbonate (washing soda) solution can be used.

(*b*) *For non-emulsifiable material*: a 1:1 mixture (by volume) can be used of either of the above solutions and a water/oil soluble solvent, such as denatured alcohol, monoethylene glycol, hexylene glycol, or isopropanol.

The material should be covered with hydrolysing agent and put aside to stand for 7 days. Before disposal of the resultant waste, the material must

be analysed to ensure that the active ingredient has been degraded to a safe level.

Never pour untreated waste or surplus products into public sewers or where there is any danger of run-off or seepage into streams, water-courses, open waterways, ditches, fields with drainage systems, or the catchment areas of boreholes, wells, springs, or ponds.

Puncture empty containers in order to avoid reuse.

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

With recommended applications rates, it is unlikely that cypermethrin and its degradation products will reach levels of environmental significance. Cypermethrin is very toxic for fish and honey bees, but, because of the very low exposure levels that normally occur, this may only cause a problem in the case of spillage or overspraying.

Avoid spraying over bodies of water. Do not contaminate ponds, waterways, or ditches with the product or with used containers.

6. INTERNATIONAL CHEMICAL SAFETY CARD

This card should be easily available to all health workers concerned with, and users of, cypermethrin. It should be displayed at, or near, entrances to areas where there is potential exposure to cypermethrin, and on processing equipment and containers. The card should be translated into the appropriate language(s). All persons potentially exposed to the chemical should also have the instructions on the chemical safety card clearly explained.

Space is available on the card for insertion of the National Occupational Exposure Limit, the address and telephone number of the National Poison Control Centre, and for local trade names.

INTERNATIONAL CHEMICAL SAFETY CARD

CYPERMETHRIN

CAS chemical name: (RS)-cyano(3-phenoxyphenyl)methyl(1RS)-*cis-trans*-3-(2,2-dichloro-ethenyl)-2,2-dimethyl-cyclopropane carboxylate

CAS registry no. 52315-07-8; RTECS registry no. GZ1250000

$C_{22}H_{19}O_3NCl_2$

Physical properties		Other characteristics
Relative molecular mass	416.3	Technical cypermethrin is a yellowish-brown liquid to semi-solid, with a mild chemical odour. It is stable to light and more stable in an acidic than in an alkaline medium. It decomposes on heating above 220 °C. Readily absorbed via ingestion and inhalation and to a lesser extent via the skin. It is a highly active synthetic pyrethroid used as a stomach and contact insecticide. The technical product is a mixture of eight steroisomers
Melting point	up to 80 °C (depending on purity and *cis* or *trans* form)	
Water solubility	0.01 mg/litre (20 °C)	
Solubility in organic solvents (at 20 °C)		
xylene	> 450 g/litre	
hexane	103 g/litre	
Log *n*-octanol/water partition coefficient	6.3	
Density	1.12 (20 °C)	
Vapour pressure	1.4×10^{-9} mmHg (20 °C)	

Hazards/symptoms	Prevention and protection	First aid
SKIN: tingling or burning sensation, or numbness	Decrease exposure by using proper application technique, proper skin protection, face shield; wear protective clothing when handling the concentrate	Remove contaminated clothing, wash skin with water and soap
EYES: splashing may cause severe irritation	Wear face shield or goggles	Flush immediately with clean water for at least 15 minutes
INHALATION: irritant to respiratory system	Avoid inhalation of fine dust and mist	Fresh air

INTERNATIONAL CHEMICAL SAFETY CARD (*continued*)

Hazards/symptoms	Prevention and protection	First aid
INGESTION: unlikely occupational hazard	Do not eat, drink, or smoke during work, wash hands	
Accidental or deliberate ingestion could lead to neurological signs and symptoms, such as ataxia and convulsions; main hazard of ingested liquid formulations is aspiration into lungs	Do not induce vomiting	Obtain medical attention immediately; if breathing has stopped, apply artificial respiration Do not induce vomiting
ENVIRONMENT: very toxic for fish and honey bees	Avoid the spraying of water; do not contaminate ponds, waterways, or ditches with the product or used containers	

Spillage	Storage	Fire and Explosion
Absorb spillage with lime, damp sawdust, sand or earth; sweep up and place in closed container and dispose of safely; avoid contamination of personnel, ponds, and waterways	Store in locked, well ventilated storeroom, away from feed and foodstuffs, children and unauthorized personnel	Some liquid formulations may be highly flammable; use dry powder, carbon dioxide, or alcohol-resistant foam; cool nearby drums with water spray

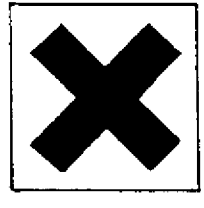
Waste disposal

Burn in high-temperature incinerator with effluent scrubbing; alternatively, treat with 5% caustic soda as a hydrolysing agent; comply with local regulations

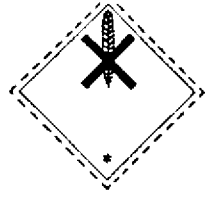
National Occupational Exposure Limit:

National Poison Control Centre:

Local trade names:



Sundhedsskadelig
Gesundheitsschädlich
Επιβλαβές
Harmful
Nocif
Nocivo
Schadelijk



7. CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

The information given in this paragraph has been extracted from the International Register of Potentially Toxic Chemicals (IRPTC) legal file and other UN sources. Its intention is to give the reader a representative but non-exhaustive overview of current regulations, guidelines, and standards.

The reader should be aware that regulatory decisions about chemicals taken in a certain country can only be fully understood in the framework of the legislation of that country.[a]

7.1 Previous Evaluations by International Bodies

Cypermethrin has been discussed several times by the Joint FAO/WHO Meeting on Pesticide Residues (JMPR). In 1981, the JMPR established an acceptable daily intake (ADI) for cypermethrin of 0–0.05 mg/kg body weight.

WHO has classified cypermethrin as "irritant to eyes and sensitizer of skin" in the list of "technical products unlikely to present an acute hazard in normal use" (WHO, 1986). WHO has also issued a data sheet on cypermethrin (WHO/FAO, 1975–85).

7.2 Exposure Limit Values

Some exposure limit values are given in the table on page 25.

7.3 Specific Restrictions

Cypermethrin is officially approved for use as a pesticide in many countries, in each of which specific uses are defined, as well as limitations and precautions. Its toxicity classification is also determined according to the country or region concerned.

[a] The regulations and guidelines of all countries are subject to change and should always be verified with appropriate regulatory authorities before application.

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

EXPOSURE LIMIT VALUES

Medium	Country/ Organization	Exposure limit description	Value	Effective date
FOOD	FAO/WHO	Acceptable daily intake (ADI)	0.05 mg/kg body weight	1985
	FAO/WHO	Maximum residue limits (MRL) (in specified products)	0.02–2.0 mg/kg	1982
	Brazil	Acceptable limit	0.01–0.5 mg/kg	1985
	Sweden	Maximum tolerable concentration (provisional limit)	2 mg/kg	1985
	USA	Acceptable residue limit (in specified products)	0.05–0.5 mg/kg	1985

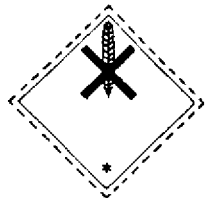
7.4 Labelling, Packaging, and Transport

The United Nations Committee of Experts on the Transportation of Dangerous Goods classifies pyrethroids in:

– Hazard Class 6.1: poisonous substance

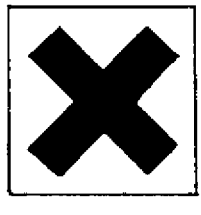
– Packing Group III: a substance presenting a relatively low risk of poisoning in transport.

The following label should be used:



St Andrew's Cross over an ear of wheat (black). Background: white.
The bottom half of the label should bear the inscription:
harmful, stow away from foodstuff.

The European Community legislation requires labelling as a dangerous substance using the symbol:



Sundhedsskadelig
Gesundheitsschädlich
Επιβλαβες
Harmful
Nocif
Nocivo
Schadelijk

The label must read:

Harmful by inhalation, in contact with skin and if swallowed; keep out of reach of children; keep away from food, drink, and animal feeding stuff.

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

7.5 Waste Disposal

In the USA, permits are required for discharge of pyrethroids from any point source into national waters.

BIBLIOGRAPHY

FAO (1985a) *Guidelines for the packaging and storage of pesticides.* Rome, Food and Agriculture Organization of the United Nations.

FAO (1985b) *Guidelines for the disposal of waste pesticides and pesticide containers on the farm.* Rome, Food and Agriculture Organization of the United Nations.

FAO (1985c) *Guidelines on good labelling practice for pesticides.* Rome, Food and Agriculture Organization of the United Nations.

FAO (1986) *International code of conduct on the distribution and use of pesticides.* Rome, Food and Agriculture Organization of the United Nations.

FAO/WHO (1986) *Guide to Codex recommendations concerning pesticide residues.* Part 8. *Recommendations for methods of analysis of pesticide residues*, 3rd ed., Rome, Codex Committee on Pesticide Residues.

GIFAP (1982) *Guidelines for the safe handling of pesticides during their formulation, packing, storage and transport.* Brussels, Groupement International des Associations Nationales des Fabricants de Produits Agrochimiques.

GIFAP (1983) *Guidelines for the safe and effective use of pesticides.* Brussels, Groupement International des Associations Nationales des Fabricants de Produits Agrochimiques.

GIFAP (1984) *Guidelines for emergency measures in cases of pesticide poisoning.* Brussels, Groupement International des Associations Nationales des Fabricants de Produits Agrochimiques.

GIFAP (1987) *Guidelines for the safe transport of pesticides.* Brussels, Groupement International des Associations Nationales des Fabricants de Produits Agrochimiques.

IARC (1972–present) *IARC Monographs on the evaluation of carcinogenic risk of chemicals to man.* Lyons, International Agency for Research on Cancer.

BIBLIOGRAPHY

IRPTC (1985) *IRPTC file on treatment and disposal methods for waste chemicals*. Geneva, International Register for Potentially Toxic Chemicals, United Nations Environment Programme.

IRPTC (1987) *IRPTC legal file 1983*. Geneva, International Register of Potentially Toxic Chemicals, United Nations Environment Programme.

PLESTINA, R. (1984) *Prevention, diagnosis, and treatment of insecticide poisoning*. Geneva, World Health Organization (Unpublished WHO document VBC/84.889).

SAX, N.I. (1984) *Dangerous properties of industrial materials*. New York, Van Nostrand Reinhold Company, Inc.

UNITED NATIONS (1986) *Recommendations on the transport of dangerous goods*. 4th ed. New York, United Nations.

US NIOSH/OSHA (1981) *Occupational health guidelines for chemical hazards*. 3 Vols., Washington DC, US Department of Health and Human Services, US Departmnent of Labor (Publication No. DHSS(NIOSH) 01-123).

WHO (1989) *EHC No. 82: Cypermethrin*. Geneva, World Health Organization.

WHO (1986) *The WHO recommended classification of pesticides by hazard and guidelines to classification 1986–87*. Geneva, World Health Organization (Unpublished WHO document VBC/86.1).

WHO/FAO (1975–87) *Data sheets on pesticides*. (Unpublished WHO documents).

WORTHING, C.R. & WALKER, S.B. (1983) *The pesticide manual*. 7th ed. Lavenham, Lavenham Press Limited, British Crop Protection Council.

WHO publications may be obtained, direct or through booksellers, from:

ALGERIA: Enterprise nationale du Livre (ENAL), 3 bd Zirout Youcef, ALGIERS

ARGENTINA: Carlos Hirsch, SRL, Florida 165, Galerías Güemes, Escritorio 453/465, BUENOS AIRES

AUSTRALIA: Hunter Publications, 58A Gipps Street, COLLINGWOOD, VIC 3066 — Australian Government Publishing Service *(Mail order sales)*, P.O. Box 84, CANBERRA A.C.T. 2601; *or over the counter from:* Australian Government Publishing Service Bookshops *at:* 70 Alinga Street, CANBERRA CITY A.C.T. 2600; 294 Adelaide Street, BRISBANE, Queensland 4000; 347 Swanston Street, MELBOURNE, VIC 3000; 309 Pitt Street, SYDNEY, N.S.W. 2000; Mt Newman House, 200 St. George's Terrace, PERTH, WA 6000; Industry House, 12 Pirie Street, ADELAIDE, SA 5000; 156–162 Macquarie Street, HOBART, TAS 7000 — R. Hill & Son Ltd., 608 St. Kilda Road, MELBOURNE, VIC 3004; Lawson House, 10–12 Clark Street, CROW'S NEST, NSW 2065

AUSTRIA: Gerold & Co., Graben 31, 1011 VIENNA I

BANGLADESH: The WHO Representative, G.P.O. Box 250, DHAKA 5

BELGIUM: *For books:* Office International de Librairie s.a., avenue Marnix 30, 1050 BRUSSELS. *For periodicals and subscriptions:* Office International des Périodiques, avenue Louise 485, 1050 BRUSSELS — *Subscriptions to World Health only:* Jean de Lannoy, 202 avenue du Roi, 1060 BRUSSELS

BHUTAN: *see* India, WHO Regional Office

BOTSWANA: Botsalo Books (Pty) Ltd., P.O. Box 1532, GABORONE

BRAZIL: Biblioteca Regional de Medicina OMS/OPS, Sector de Publicações, Caixa Postal 20.381, Vila Clementino, 04023 SÃO PAULO, S.P.

BURMA: *see* India, WHO Regional Office

CANADA: Canadian Public Health Association, 1335 Carling Avenue, Suite 210, OTTAWA, Ont. K1Z 8N8

CHINA: China National Publications Import & Export Corporation, P.O. Box 88, BEIJING (PEKING)

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA: *see* India, WHO Regional Office

DENMARK: Munksgaard Export and Subscriptions Service, Norre Søgade 35, 1370 COPENHAGEN K

FIJI: The WHO Representative, P.O. Box 113, SUVA

FINLAND: Akateeminen Kirjakauppa, Keskuskatu 2, 00101 HELSINKI 10

FRANCE: Librairie Arnette, 2 rue Casimir-Delavigne, 75006 PARIS

GERMAN DEMOCRATIC REPUBLIC: Buchhaus Leipzig, Postfach 140, 701 LEIPZIG

GERMANY, FEDERAL REPUBLIC OF: Govi-Verlag GmbH, Ginnheimer Straße 20, Postfach 5360, 6236 ESCHBORN
Buchhandlung Alexander Horn, Friedrichstraße 3, Postfach 3340, 6200 WIESBADEN

GHANA: Fides Enterprises, P.O. Box 1628, ACCRA

GREECE: G. C. Eleftheroudakis S.A., Librairie internationale, rue Nikis 4, ATHENS (T. 126)

HONG KONG: Hong Kong Government Information Services, Beaconsfield House, 6th Floor, Queen's Road, Central, VICTORIA

HUNGARY: Kultura, P.O. Box 149, BUDAPEST 62

INDIA: WHO Regional Office for South-East Asia, World Health House, Indraprastha Estate, Mahatma Gandhi Road, NEW DELHI 110002

INDONESIA: P.T. Kalman Media Pusaka, Pusat Perdagangan Senen, Block I, 4th Floor, P.O. Box 3433/Jkt, JAKARTA

IRAN (ISLAMIC REPUBLIC OF): Iran University Press, 85 Park Avenue, P.O. Box 54/551, TEHERAN

IRELAND: TDC Publishers, 12 North Frederick Street, DUBLIN

ISRAEL: Heiliger & Co., 3 Nathan Strauss Street, JERUSALEM 94227

ITALY: Edizioni Minerva Medica, Corso Bramante 83-85, 10126 TURIN; Via Lamarmora 3, 20100 MILAN; Via Spallanzani 9, 00161 ROME

JAPAN: Maruzen Co. Ltd., P.O. Box 5050, TOKYO International, 100-31

JORDAN: Jordan Book Centre Co. Ltd., University Street, P.O. Box 301 (Al-Jubeiha), AMMAN

KUWAIT: The Kuwait Bookshops Co. Ltd., Thunayan Al-Ghanem Bldg., P.O. Box 2942, KUWAIT

LAO PEOPLE'S DEMOCRATIC REPUBLIC: The WHO Representative, P.O. Box 343, VIENTIANE

LUXEMBOURG: Librairie du Centre, 49 bd Royal, LUXEMBOURG

MALAWI: Malawi Book Service, P.O. Box 300-4, Chichiri, BLANTYRE 3

MALAYSIA: The WHO Representative, Room 1004, 10th Floor, Wisma Lim Foo Yong (formerly Fitzpatrick's Building), Jalan Raja Chulan, KUALA LUMPUR 05-10; P.O. Box 2550, KUALA LUMPUR 01-02; Parry's Book Center, 124-I Jalan Tun Sambanthan, P.O. Box 10960, 50730 KUALA LUMPUR

MALDIVES: *see* India, WHO Regional Office

MEXICO: Libreria Internacional, S.A. de C.V., Av. Sonora 206, 06100-MEXICO, D.F.

MONGOLIA: *see* India, WHO Regional Office

MOROCCO: Editions La Porte, 281 avenue Mohammed V, RABAT

NEPAL: *see* India, WHO Regional Office

NETHERLANDS: Medical Books Europe BV, Noorderwal 38, 7241 BL LOCHEM

NEW ZEALAND: New Zealand Government Printing Office, Publishing Administration, Private Bag, WELLINGTON; Walter Street, WELLINGTON, World Trade Building, Cubacade, Cuba Street, WELLINGTON, *Government Bookshops at:* Hannaford Burton Building, Rutland Street, Private Bag, AUCKLAND; 159 Hereford Street, Private Bag, CHRISTCHURCH; Alexandra Street, P.O. Box 857, HAMILTON; T & G Building, Prince Street, P.O. Box 1104, DUNEDIN — R. Hill & Son Ltd., Ideal House, Cnr Gillies Avenue & Eden Street, Newmarket, AUCKLAND 1

NORWAY: Tanum – Karl Johan A.S., P.O. Box 1177, Sentrum, N-0107 OSLO 1

PAKISTAN: Mirza Book Agency, 65 Shahrah-E-Quaid-E-Azam, P.O. Box 729, LAHORE 3

PAPUA NEW GUINEA: The WHO Representative, P.O. Box 646, KONEDOBU

PHILIPPINES: World Health Organization, Regional Office for the Western Pacific, P.O. Box 2932, MANILA

PORTUGAL: Livraria Rodrigues, 186 Rua do Ouro, LISBON 2

REPUBLIC OF KOREA: The WHO Representative, Central P.O. Box 540, SEOUL

SINGAPORE: The WHO Representative, 144 Moulmein Road, SINGAPORE 1130; Newton P.O. Box 31, SINGAPORE 9122

SOUTH AFRICA: *Contact major book stores*

SPAIN: Ministerio de Sanidad y Consumo, Centro publicaciones, Documentación y Biblioteca, Paseo del Prado 18, 28014 MADRID — Comercial Atheneum S.A., Consejo de Ciento 130-136, 08015 BARCELONA; General Moscardó 29, MADRID 20 — Libreria Díaz de Santos, P.O. Box 6050, 28006 MADRID; Balmes 417 y 419, 08022 BARCELONA

SRI LANKA: *see* India, WHO Regional Office

SWEDEN: *For books:* Aktiebolaget C.E. Fritzes Kungl. Hovbokhandel, Regeringsgatan 12, 103 27 STOCKHOLM. *For periodicals:* Wennergren-Williams AB, Box 30004, 104 25 STOCKHOLM

SWITZERLAND: Medizinischer Verlag Hans Huber, Länggassstrasse 76, 3012 BERN 9

THAILAND: *see* India, WHO Regional Office

UNITED KINGDOM: H.M. Stationery Office: 49 High Holborn, LONDON WC1V 6HB; 13a Castle Street, EDINBURGH EH2 3AR; 80 Chichester Street, BELFAST BT1 4JY; Brazennose Street, MANCHESTER M60 8AS; 258 Broad Street, BIRMINGHAM B1 2HE; Southey House, Wine Street, BRISTOL BS1 2BQ. *All mail orders should be sent to:* HMSO Publications Centre, 51 Nine Elms Lane, LONDON SW8 5DR

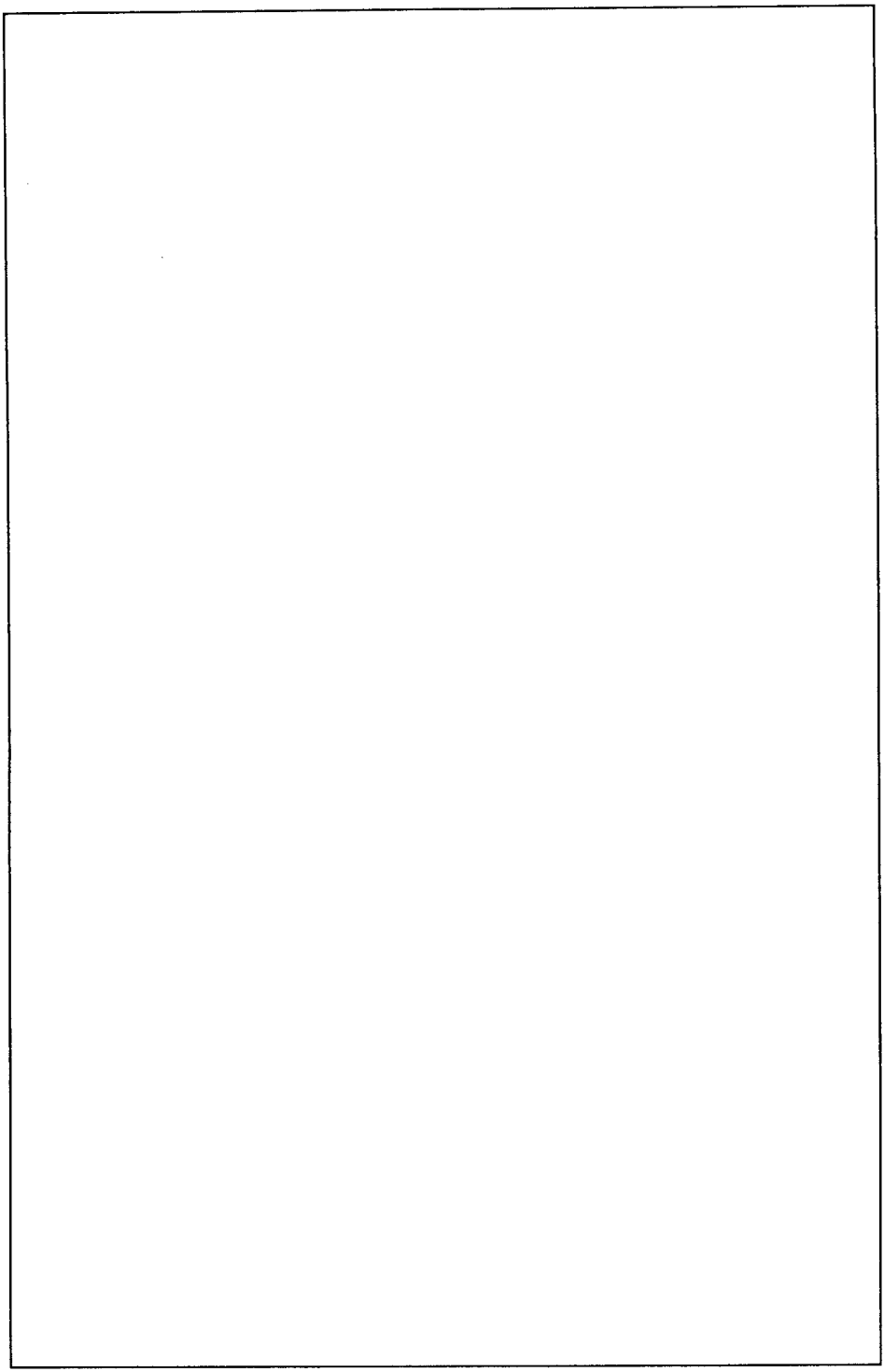
UNITED STATES OF AMERICA: *Copies of individual publications (not subscriptions):* WHO Publications Center USA, 49 Sheridan Avenue, ALBANY, NY 12210. *Subscription orders and correspondence concerning subscriptions should be addressed to the* World Health Organization, Distribution and Sales, 1211 GENEVA 27, Switzerland. *Publications are also available from the* United Nations Bookshops, NEW YORK, NY 10017 *(retail only)*

USSR: *For readers in the USSR requiring Russian editions:* Komsomolskij prospekt 18, Medicinskaja Kniga, MOSCOW — *For readers outside the USSR requiring Russian editions:* Kuzneckij most 18, Meždunarodnaja Kniga, MOSCOW G-200

VENEZUELA: Libreria Medica Paris, Apartado 60.681, CARACAS 106

YUGOSLAVIA: Jugoslovenska Knjiga, Terazije 27/II, 11000 BELGRADE

Special terms for developing countries are obtainable on application to the WHO Representatives or WHO Regional Offices listed above or the World Health Organization, Distribution and Sales Service, 1211 Geneva 27, Switzerland. Orders from countries where sales agents have not yet been appointed may also be sent to the Geneva address, but must be paid for in pounds sterling, US dollars, or Swiss francs. UNESCO book coupons may also be used. Prices are subject to change without notice.



Price: Sw. fr. 5.–

ISBN 92 4 154344 2