

OPERATION OF THE PRIOR INFORMED  
CONSENT PROCEDURE FOR BANNED  
OR SEVERELY RESTRICTED CHEMICALS  
IN INTERNATIONAL TRADE

# DECISION GUIDANCE DOCUMENTS

**Methamidophos**

JOINT FAO/UNEP PROGRAMME  
FOR THE OPERATION OF  
PRIOR INFORMED CONSENT

United Nations Environment Programme

**UNEP**



Food and Agriculture Organization  
of the United Nations

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Food and Agriculture Organization of the United Nations  
United Nations Environment Programme  
Rome - Geneva 1991; amended 1996

## DISCLAIMER

The inclusion of these chemicals in the Prior Informed Consent Procedure is based on reports of control action submitted to the United Nations Environment Programme (UNEP) by participating countries, and which are presently listed in the UNEP-International Register of Potentially Toxic Chemicals (IRPTC) database on Prior Informed Consent. While recognizing that these reports from countries are subject to confirmation, the FAO/UNEP Joint Working Group of Experts on Prior Informed Consent has recommended that these chemicals be included in the Procedure. The status of these chemicals will be reconsidered on the basis of such new notifications as may be made by participating countries from time to time.

The use of trade names in this document is primarily intended to facilitate the correct identification of the chemical. It is not intended to imply approval or disapproval of any particular company. As it is not possible to include all trade names presently in use, only a number of commonly used and published trade names have been included here.

This document is intended to serve as a guide and to assist authorities in making a sound decision on whether to continue to import, or to prohibit import, of these chemicals because of health or environmental reasons. While the information provided is believed to be accurate according to data available at the time of preparation of this Decision Guidance Document, FAO and UNEP disclaim any responsibility for omissions or any consequences that may flow therefrom. Neither FAO or UNEP, nor any member of the FAO/UNEP Joint Group of Experts shall be liable for any injury, loss, damage or prejudice of any kind that may be suffered as a result of importing or prohibiting the import of these chemicals.

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## ABBREVIATIONS WHICH MAY BE USED IN THIS DOCUMENT

(N.B. : chemical elements and pesticides are not included in this list)

ADI	acceptable daily intake
ai	active ingredient
b.p.	boiling point

bw	body weight
°C	degree Celsius (centigrade)
CCPR	Codex Committee on Pesticide Residues
DNA	Designated National Authority
EC	emulsion concentrate
EEC	European Economic Community
EPA	U.S. Environmental Protection Agency
ERL	extraneous residue limit
FAO	Food and Agriculture Organization of the United Nations
g	gram
µg	microgram
GAP	good agricultural practice
GL	guideline level
ha	hectare
IARC	International Agency for Research on Cancer
i.m.	intramuscular
i.p.	intraperitoneal
IPCS	International Programme on Chemical Safety
IRPTC	International Register of Potentially Toxic Chemicals
JMPR	Joint FAO/WHO Meeting on Pesticide Residues (Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and a WHO Expert Group on Pesticide Residues)
k	kilo- (x 10 <sup>3</sup> )
kg	kilogram
l	litre
LC <sub>50</sub>	lethal concentration, 50%
LD <sub>50</sub>	lethal dose, median
m	metre
mg	milligram
ml	millilitre

m.p.	melting point
MRL	Maximum Residue Limit
MTD	maximum tolerated dose
ng	nanogram
NOEL	no-observed-effect level
NOAEL	no-observed-adverse-effect level
NS	Not Stated
OP	organophosphorus pesticide
PHI	pre-harvest interval
ppb	parts per billion
ppm	parts per million (Used only in reference to the concentration of a pesticide in an experimental diet. In all other contexts the terms mg/kg or mg/l are used).
ppt	parts per trillion
sp gr	specific gravity
STEL	Short Term Exposure Limit
TADI	Temporary Acceptable Daily Intake
TLV	Threshold Limit Value
TMDI	theoretical maximum daily intake
TMRL	Temporary Maximum Residue Limit
TWA	Time Weighted Average
UNEP	United Nations Environment Programme
WHO	World Health Organization
WP	wettable powder
wt	weight
<	less than
<<	much less than
≤	less than or equal to
>	greater than
≥	greater than or equal to

**PIC Decision Guidance Document for acutely hazardous pesticides  
of concern to human health under conditions of use in developing countries**

# Methamidophos

Published: September 07

<b>Common Name</b>	Methamidophos
<b>Other names/ Synonyms</b>	Metamidophos
<b>CAS-No.</b>	10265-92-6
<b>Use</b>	Systemic insecticide with contact and stomach action to control chewing and sucking insects
<b>Trade Names</b>	Monitor, Tamaron, Filitox, Tamanox, Tam, Patrole, Metamidofos Estrella; Methamidophos 60 WSC: Methedrin 60; Morithion; Red Star Alloran
<b>Formulation Types</b>	Soluble and emulsifiable concentrates in various concentrations of active ingredient.
<b>Basic Manufacturers</b>	Bayer, Chevron Chemical Co., Cia-Shen Co., Crystal Chemical Inter- America, Fufong Agro-Chems Mfg., Jiangmen, Jin Hung Fine Chemical Co., Linghu P.F., Mobay Corp., Productos OSA, Quimica Estrella S.A.C.I.e.I., Sanonda, Suzhou P.F., Taiwan Tainan Giant Industrial Co

## Reasons for Inclusion in the PIC Procedure

*Formulations of the substance which exceed 600 g a.i./l are included because of their acute hazard classification and concern as to their impact on human health under conditions of use in developing countries (Fifth meeting of the Joint Expert Group).*

There are several reports that the agricultural use of methamidophos causes health problems (China, Hong Kong, Korea). In the USA, methamidophos ranked second in percentage of cases displaying signs of life-threatening symptoms among occupational Poison Control Center cases. (see Annex 1).

In a study conducted by US-EPA regarding acute worker exposure risk assessment under conditions of use in Indonesia for chemicals of concern, a MOE-value (NOEL/Anticipated Exposure Level) of <1 was estimated for methamidophos. EPA generally considers a MOE of lower than 100 to present an unacceptable risk. (FAO Jakarta, 1996)

*Registrars need to carefully consider the formulations actually used in each country when determining the risks of continued use of this pesticide. The toxicity of the active ingredient is high, but many formulations will fall into a much lower category of hazard.*

## Hazard Classification by International Organisms

<b>WHO</b>  (WHO, 1996)	Technical product.: lb (highly hazardous), classification based on oral toxicity				
	<b>Classification of formulations</b>				
		oral toxicity		dermal toxicity	
		LD <sub>50</sub> : 30 mg/kg bw (see Ann. 1)		LD <sub>50</sub> : 50 mg/kg bw (see Ann. 1)	
	formulation	a.i. (%)	Hazard class	a.i. (%)	Hazard class
	liquid	>10 >1	lb II	>10 >1	lb II
	solid	There are no solid formulations of methamidophos			
<b>EPA</b>	Category 1 (highly toxic)				
<b>EU</b>	T+ (very toxic)				
<b>IARC</b>	not classified				

## Protective Measures That Have Been Applied Concerning the Chemical

### Measures to Reduce Exposures

- Personal** WHO recommends that for the health and welfare of workers and the general population, the handling and application of methamidophos should be entrusted only to competently supervised and well-trained applicators who must follow adequate safety measures and use the chemical according to good application practices. Regularly exposed workers should receive appropriate monitoring and health evaluations. (IPCS, 1993)
- Protection** Protective clothing as indicated in the *FAO Guidelines for Personal Protection when Working with Pesticides in Tropical Climates* (FAO, 1990) is required; a respirator should also be worn by mixers and when spraying tall crops. The use of flaggers should be avoided; if used, they require full protective clothing, including a respirator. All equipment and protective clothing should be washed thoroughly after use; clothing should be laundered separately from family clothing.
- Unprotected workers should be kept out of treated areas for 48 hours. (FAO 1990)
- Application** The manufacture, formulation, agricultural use and disposal of methamidophos should be carefully managed to minimize contamination of the environment. To minimize risks for all individuals, a 48-hour interval between spraying and re-entry into any sprayed area is recommended. Pre-harvest intervals have been set in many countries. These intervals vary from 3 to 90 days (most falling within 14-21 days), depending on the crop, harvesting technique and the country.
- In view of the high toxicity of methamidophos, this agent should not be considered in hand-applied ULV spraying practices. (IPCS, 1993; FAO, 1995)

## Regulatory measures

*Although the chemical has been included in the PIC procedure because it is a highly toxic pesticide that is likely to cause problems under conditions of storage, transportation and use in developing countries, some countries have reported control actions that may be of interest when considering its use as a pesticide (see below).*

Control Actions regarding methamidophos have been reported by Indonesia, Samoa and Sri Lanka (see Annex 2).

Liquid formulations with 40% or more methamidophos are restricted in the United States to use by certified applicators.

*Not all of the reports have been determined to be of control actions which conform with the FAO/UNEP definitions of banned or severely restricted for health or environmental reasons. However, all reports are provided here since the FAO/UNEP Joint Expert Group on Prior Informed Consent decided that the substance should be included in the PIC procedure due to its potential to cause problems under conditions of use in developing countries regardless of the number of qualifying actions.*

*For further information on the control actions provided in Annex 2, contact the Designated National Authorities (Annex 3) in the country reporting the control action.*

## Alternatives

Indonesia and Samoa have indicated alternatives to methamidophos (see Annex 2). Alternatives have been reported in literature. (Gips, 1990)

*It is essential that before a country considers substituting any of the reported alternatives, it ensures that the use is relevant to its national needs. A first step may be to contact the DNA in the country where the alternative has been reported (see addresses of DNAs in Annex 3). It will then be necessary to determine the compatibility with national crop protection practices.*

## Packaging and Labelling

Follow *FAO Revised Guidelines on Good Labelling Practice for Pesticides (FAO, 1995)*.

The United Nations Committee of Experts on the Transportation of Dangerous Goods (*IPCS, 1993*) classifies the chemical in:

<b>Hazard Class 6.1</b>	poisonous substance
<b>Packing Group 2:</b>	substances and preparations presenting a serious risk of poisoning (formulations containing 15 - 100 % active material)
<b>Packing Group 3:</b>	harmful substances and preparations presenting a relatively low risk of poisoning (solid formulations containing 3-15% active material and liquid formulations containing 1.5-15 % active material)

## Waste Disposal

All waste and contaminated material associated with this chemical should be considered hazardous waste. The material should be destroyed by incineration in a special, high temperature chemical incinerator facility.

See *FAO Guidelines on Prevention of Accumulation of Obsolete Pesticide Stocks* and *The Pesticide Storage and Stock Control Manual*. (FAO,1996)

***It should be noted that the methods recommended in literature are often not suitable in a specific country. High temperature incinerators or secure landfills may not be available.***

## Exposure Limits

	Type of limit	Value
Food	MRL's (Maximum residue limits in mg/kg) in specified products ( <i>FAO/WHO, 1996</i> )	0.01-5
	JMPR_ADI (acceptable daily intake) in mg/kg diet ( <i>JMPR, 1995</i> )	0.004

## First Aid

Early symptoms of poisoning may include excessive sweating, headache, weakness, giddiness, nausea, vomiting, hypersalivation, stomach pains, blurred vision and slurred speech. If these symptoms occur, the person should remove contaminated clothes, wash affected skin with soap and water, and flush with large quantities of water. If in the event of collapse artificial resuscitation is used, vomit may contain toxic amounts of the substance. In case of ingestion, the stomach should be emptied as soon as possible by careful gastric lavage. Do not induce vomiting if the formulation contained hydrocarbon solvents.

Persons who have been poisoned (accidentally or otherwise) must be transported immediately to a hospital and put under the surveillance of properly trained medical staff.

Antidotes are atropine sulphate and pralidoxime chloride.

General surveillance and cardiac monitoring must be maintained for at least 14 days. (*IPCS, 1986*)

## Annexes

Annex 1 **Further Information on the Substance**

Annex 2 **Details on Reported Control Actions**

Annex 3 **List of Designated National Authorities**

Annex 4 **References**

## Annex 1 - Further Information on the Substance

### 1 Chemical and Physical Properties

1.1	<b>Identity</b>	Colourless crystals with a melting point 44.5 °C (pure material); Technical methamidophos (about 73%) is in the form of yellowish to colourless crystals with melting point below 40 °C.
1.2	<b>Formula</b>	C <sub>2</sub> H <sub>8</sub> NO <sub>2</sub> PS
	<b>Chemical Name</b>	O,S-dimethyl phosphoramidothioate (IUPAC; CAS)
	<b>Chemical Type</b>	Organophosphate
1.3	<b>Solubility</b>	In water > 200 g/l at 20°C, highly soluble in alcohols and ketones, sparingly soluble in ether and petroleum ether
	<b>logP<sub>ow</sub></b>	-0.8
1.4	<b>Vapour Pressure</b>	4.7 mPa (25°C)
1.5	<b>Reactivity</b>	Decomposes on heating without boiling; stable at pH 3-8. The technical grade and concentrates are corrosive to steel and copper containing alloys. Incompatible with alkaline pesticides.  Further information in <i>Tomlin, 1994</i> and <i>IPCS, 1993</i> )

### 2 Toxicity

#### 2.1 General

2.1.1	<b>Mode of action</b>	Methamidophos affects the nervous system by inhibiting acetylcholinesterase, an enzyme essential for normal nerve impulse transmission.
2.1.2	<b>Uptake</b>	Methamidophos can be absorbed following ingestion, inhalation and skin contact
2.1.3	<b>Metabolism</b>	Biotransformation in mammals results in the formation of metabolites that are toxicologically insignificant ( <i>IPCS, 1986; IPCS, 1993</i> )

#### 2.2 Known Effects on Human Health

##### 2.2.1 Acute Toxicity

Symptoms of poisoning The organophosphate insecticides are cholinesterase-inhibitors. They are highly toxic by all routes of exposure. When inhaled, the first effects are usually respiratory and may include bloody or runny nose, coughing, chest discomfort, difficult or short breath and wheezing due to constriction or excess fluid in the bronchial tubes. Skin contact with organophosphates may cause localized sweating and involuntary muscle contractions. Eye contact will cause pain, bleeding, tears, pupil constriction and blurred vision. Following exposure by any route, other systemic effects may begin within a few minutes or be delayed for up to 12 hours. These may include pallor, nausea, vomiting, diarrhoea, abdominal cramps, headache, dizziness, eye pain, blurred vision, constriction or dilation of the pupils, tears, salivation, sweating and confusion. Severe poisoning will affect the central nervous system, producing incoordination, slurred speech, loss of reflexes, weakness, fatigue, involuntary muscle contractions, twitching, tremors of

the tongue or eyelids, and eventually paralysis of the body extremities and the respiratory muscles. In severe cases there may also be involuntary defecation or urination, psychosis, irregular heart beat, unconsciousness, convulsions and coma. Respiratory failure or cardiac arrest may cause death.

- 2.2.2 **Short and long term exposure** *Some organophosphates may cause delayed symptoms beginning 1 to 4 weeks after an acute exposure that may or may not have produced immediate symptoms. In such cases, numbness, tingling, weakness and cramping may appear in the lower limbs and progress to incoordination and paralysis. Improvement may occur over months or years, but some residual impairment will remain.*

Repeated exposure through inhalation, ingestion or through skin may gradually lead to signs and symptoms of inhibition of cholinesterase activity.

Excessive human exposure to methamidophos may cause delayed neuropathy. (IPCS, 1993)

- 2.2.3 **Epidemiological studies** no data available

### 2.3 Toxicity studies with laboratory animals and *in vitro* systems

- 2.3.1 **Acute Toxicity** (Tomlin, 1994; IPCS, 1993; FAO/WHO, 1993)
- oral** LD<sub>50</sub> (a.i.; mg/kg b.w.): 10-50; in different test species
- dermal** LD<sub>50</sub> (a.i.; mg/kg b.w.): 50-110 ; in different test species.
- inhalation** LC<sub>50</sub> (a.i.; mg/m<sup>3</sup> air- exposure 4 hrs) 162 ; (rat)
- irritation** Moderate erythema and oedema were observed in skin tests on the rabbit ear. The chemical is also irritating to the eye.
- 2.3.2 **Short and long term exposure** The following levels were published as not to cause any toxicological effect; rat: 0.1 mg/kg bw/day; dog: 0.06 mg/kg bw/day; chicken 0.3 mg/kg bw/day. (IPCS, 1993)
- A long-term study (500 days) on the effects of low doses of methamidophos on mice was conducted. Mice given 0.03 mg methamidophos/kg body weight still showed significant effects (reduced number of muscarinic receptors in the brain), which can be valued as an important influence on the central nervous system. (Tigges, 1994)
- 2.3.4 **Effects on reproduction** In reproductive studies, several parameters were affected at relatively low levels. (IPCS, 1993)
- 2.3.5 **Mutagenicity** Methamidophos was found to be non -mutagenic in bacterial and *in vivo* assays. (IPCS, 1993)
- 2.3.6 **Carcinogenicity** There were no indications of oncogenicity in a mouse oncogenicity study or in a long-term toxicity/oncogenicity study on rats.

## 3 Exposure

- 3.1 **Food** Use of methamidophos may result in low level residues; but there should be no health hazards if preharvest intervals are observed. (IPCS, 1993)
- Since 1987 in Hong Kong, there have been numerous cases of acute poisoning following the consumption of green leafy vegetables imported from China. In

Shenzen, where the bulk of these vegetables originates, it is strongly suspected that methamidophos has been used by some farmers and that the sprayed vegetables have been harvested too early before the residue levels have fallen to safe levels. (Chan, 1994)

In the US, methamidophos was found at unacceptable levels in preschoolers diets in a 1989 study. The average intake as a percentage of the ADI was 5.763%. Between 63%-97.6% of 1-5 year olds were estimated to be receiving average daily exposures above the ADI (NRDC, 1989).

- 3.2 **Occupational** Higher occupational exposure (mainly through inhalation and dermal absorption) may occur in the case of accidents or as a result of incorrect handling.
- There are several reports on methamidophos indicating it may cause health problems during occupational use. In the US, methamidophos was judged third-highest among 28 pesticides on measures of occupational hazard. Methamidophos had the third-highest ratio of handler poisonings per 1,000 applications in California when exposures in mixtures were included, and the second-highest overall for field workers. Methamidophos ranked second in percentage of cases displaying symptoms or life-threatening symptoms among occupational Poison Control Center cases. (US-EPA, 1996)
- In China, 27 provinces reported a total of 48,377 poisoning cases, including 3,204 fatalities in 1995. 15,300 of these cases were caused by normal agricultural use and not by accidents or improper use. More than 50 % of these 15,000 cases were attributed to parathion, methamidophos and omethoate (Shuyang Chen, Peipei Yao, 1996; Chan, 1996).*
- 3.3 **Environment** The population is not generally exposed to methamidophos in air or water.
- 3.4 **Accidental Poisoning** Accidental poisoning with methamidophos may occur due to incorrect handling.

## 4 Effects on the Environment

### 4.1 Fate

- 4.1.1 **Persistence** The half-life in soil is a few days. Degradation products are CO<sub>2</sub>, mercaptan, dimethyl disulfide and dimethyl sulfide.
- 4.1.2 **Bioconcentration** On the basis of data on the solubility of methamidophos, bioaccumulation would not be expected to occur.
- (Tomlin, 1994; IPCS, 1993)

### 4.2 Ecotoxicity

- 4.2.1 **Fish** LC<sub>50</sub> 96 h: 25 - 100 mg/l (rainbow trout, goldfish, carp)
- 4.2.2 **Aquatic invertebrates** EC<sub>50</sub> 48 h : 0.27 mg/l (Daphnia)
- 4.2.3 **Birds** Oral LD<sub>50</sub>: 8 - 50 mg/kg bw (mallard duck, Japanese quail, hen)
- 4.2.4 **Bees** Toxic to bees (Tomlin, 1994; IPCS, 1993)

## Annex 2 - Details on reported control actions

INDONESIA

Effective:	1996
Control Action:	Registration no longer permitted. Stocks can be used only until 12/10/1999.
Uses still allowed:	None.
Reasons:	Induces harmful effects on human beings and the environment.

**KUWAIT**

Effective:	1980
Control Action:	The substance is banned for use.
Uses still allowed:	No remaining uses are allowed.
Reasons:	

**SAMOA**

Effective:	1995
Control Action:	Registration declined 84/1992. Review declined 26/5/1994; Notification PIC 27/7/1995.
Uses still allowed:	None.
Reasons:	Significant health hazard to users.

**SRI LANKA**

Effective:	1995
Control Action:	Severely restricted. The import of methamidophos formulations higher than 600g/l has been prohibited since July 1995.
Uses still allowed:	
Reasons:	

## Annex 3 - List of Designated National Authorities

### INDONESIA

<b>P</b>	<b>Phone</b>	62 (21) 7805652
Chairman		7806213
Direktorat Bina Perlindungan Tanaman Pesticide Committee, Jln. AUP. Pasar Minggu 12520 Jakarta	<b>Fax</b>	62 (21)
	<b>Telex</b>	
	<b>e-mail</b>	
<b>CP</b>	<b>Phone</b>	021 583918
Bapedal Offices , Ms. Masnellyarti Hilman	<b>Fax</b>	021 5703365
Arthaloka Building, 11th Floor, Jl. Jend Sudirman No. 2 Jakarta Pusat	<b>Telex</b>	62 21 583918
	<b>e-mail</b>	

### KUWAIT

<b>P</b>	<b>Phone</b>	(965) 2427161
Public Authority for Agriculture Affairs & Fish Resources Plant Wealth Department,  Safat 13075 Kuwait P.O. Box 21422	<b>Fax</b>	
	<b>Telex</b>	
	<b>e-mail</b>	
<b>CP</b>	<b>Phone</b>	(965) 2452790
The Secretary General		2456835/36
Environment Protection Council , Safat 13104 Kuwait P.O. Box 24395	<b>Fax</b>	(965) 2421993
	<b>Telex</b>	46408 EP CNCL KT
	<b>e-mail</b>	

### SAMOA

<b>P</b>	<b>Phone</b>	(685) 22561
Director	<b>Fax</b>	(685) 22565
Ministry of Agriculture, Forests, Fisheries and Meteorology , Apia P.O. Box 1874	<b>e-mail</b>	

### SRI LANKA

<b>P</b>	<b>Phone</b>	94 (08) 88135
Registrar of Pesticides	<b>Fax</b>	94 (08) 88206
Pesticides Registration Office , Getambe Peradeniya P.O. BOX 49	<b>Telex</b>	
	<b>e-mail</b>	

## Annex 4 - References

*The information on methamidophos given in this DGD is mainly based on documents published by WHO, FAO and the International Programme on Chemical Safety (IPCS). If important information from other sources has been used, these references are noted in the text. The following list also includes other publications containing useful information.*

**Shuyang Chen, Peipei Yao, 1996.** Heavy OP poisoning toll in China. Pesticide News 32, June 1996, published by The Pesticides Trust

**Asian Development Bank, 1987.** Handbook on the use of pesticides in the Asia-Pacific region. ADB, Manila.

**Chan, TYK and Critchley, JAJH, 1994.** The Spectrum of Poisonings in HongKong: An Overview. Vet Human Toxicol 36 (2) 135-136 April 1994.

**CIRAD, 1990.** Agricultural Requisites Scheme for Asia and the Pacific & International Cooperation Centre of Agricultural Research for Development. The ARSAP/CIRAD regional agro-pesticide index Asia.

**Codex Alimentarius Commission 1987.** Codex Alimentarius. Guide to Codex Recommendations Concerning Pesticide Residues, part 2. Maximum Limits for Pesticide Residues, 3rd prelim. issue, Rome.

**FAO - Regional Office for Asia and the Pacific (RAPA), 1989.** Pesticide Use by Vegetable Farmers: Case Study in a Multiple Cropping System in Sri Lanka. Quarterly Newsletters, Asia and Pacific Plant Protection

**FAO, 1995.** Revised guidelines on good labelling practices for pesticides. Food and Agriculture Organization, Rome.

**FAO, 1996.** Technical guidelines on disposal of bulk quantities of obsolete pesticides in developing countries. Food and Agriculture Organization, Rome.

**FAO, 1996.** Pesticide storage and stock control manual. Food and Agriculture Organization, Rome.

**FAO, 1990.** Guidelines for personal protection when working with pesticides in tropical countries. Food and Agriculture Organization, Rome.

**FAO/WHO, 1993.** Pesticide Residues in Food - Evaluations. Methamidophos. Joint Meeting on Pesticide Residues (JMPPR);

**Farm Chemicals Handbook 1994.** Meister Publishing, Willoughby, Ohio, USA.

**Hayes, W.J. and E.R. Laws (ed.), 1991.** Handbook of Pesticide Toxicology. Academic Press, Inc., New York,

**Hayes, W.J. and E.R. Laws (ed.), 1990.** Handbook of Pesticide Toxicology, Vol. 3, Classes of Pesticides. Academic Press, Inc., NY.

**IPCS, 1993.** Health and Safety Guide No. 79: Methamidophos. International Programme on Chemical Safety, IPCS/ World Health Organization, Geneva.

**IPCS, 1986.** Environmental health criteria No. 63: Organophosphorous insecticides: a general introduction. International Programme on Chemical Safety, IPCS/ World Health Organization, Geneva.

**Natural Resources Defense Council (NRDC) 1989.** Intolerable Risk: Pesticides in Our Children's Food. 27 February 1989

**Pesticide Trust, 1989.** The FAO Code: missing ingredients. Pesticides Trust, London N1 2UN, United Kingdom.

**Schulze-Rosario and Loosli, R., 1994.** Reviews of Environmental Contamination and Toxicology. Vol. 139.

**Tigges, Bernhard 1994.** Studies on the effect of the organophosphate methamidophos in mice: Effects of long-term low-level exposition on muscarinic receptors and cholinesterase in vivo and on muscarinic receptors and membrane characteristics in vitro. 121 S, Berlin, Freie Univ., Diss., 1994

**Tomlin, Clive 1994.** The Pesticide Manual: A World Compendium. (10th ed.), British Crop Protection Council, Surrey, (United Kingdom)

**US-EPA, 1996.** Memorandum: Review of Poison Control Center Data Call in. Internal Communication.

**WHO, 1996.** Recommended classification of pesticides by hazard and guidelines to classification 1996-1997. WHO/PCS/96.3. World Health Organization, IPCS, Geneva.