

## CONTENTS

Participants.....	v
Abbreviations.....	ix
Introduction .....	xiii
 <u>The monographs<sup>1</sup></u>	
Abamectin .....	1
Acephate .....	3
Aldicarb ** .....	19
Benomyl .....	119
Bentazone .....	137
Captan .....	157
Carbendazim .....	231
Chlormequat ** .....	253
Chlorpyrifos-methyl .....	319
Clethodim * .....	323
DDT .....	363
Diazinon .....	365
Dicofol .....	369
Dimethoate ** .....	383
Diquat ** .....	397
Disulfoton .....	469
Ethephon ** .....	511
Ethion ** .....	571
Fentin .....	615
Folpet .....	619
Glufosinate-ammonium .....	625
Glyphosate .....	673
Heptachlor .....	685
Hexythiazox .....	687
Imazalil .....	697
Iprodione ** .....	701
Methamidophos .....	815
Methidathion .....	857
Monocrotophos .....	863
Parathion-methyl .....	867
Phosalone ** .....	937
Pirimiphos-methyl .....	1021
Profenofos .....	1025
Propiconazole .....	1043
Propylenethiourea (PTU) .....	1053

---

<sup>1</sup> \* first evaluation; \*\* re-evaluation in CCPR periodic review programme

	Tebuconazole * ,.....	1055
	Tecnazene , .....	1199
	Thiophanate-methyl .....	1221
	Tolclofos-methyl * .....	1237
ANNEX I	ADIs, MRLs and GLs .....	1291
ANNEX II	Previous FAO and WHO documents .....	1309

**1994 JOINT MEETING OF THE FAO PANEL OF EXPERTS ON  
PESTICIDE RESIDUES IN FOOD AND THE ENVIRONMENT  
AND THE WHO EXPERT GROUP ON PESTICIDE RESIDUES**

Rome, 19-28 September 1994

**PARTICIPANTS**

WHO Expert Group on Pesticide Residues

Dr A.L. Black  
Medical Services Adviser in Toxicology  
Department of Human Services and Health  
Canberra, Australia

Professor J.F. Borzelleca      *Vice-Chairman*  
Pharmacology, Toxicology  
Medical College of Virginia  
Virginia Commonwealth University  
Richmond, Virginia, USA

Dr P. Fenner-Crisp      *Rapporteur*  
Acting Deputy Director  
Office of Pesticide Programs (H7501C)  
US Environmental Protection Agency  
Washington, D.C., USA

Professor O. Pelkonen  
Professor of Pharmacology  
Department of Pharmacology and Toxicology  
University of Oulu,  
Oulu, Finland

Professor A. Rico  
Biochemistry-Toxicology  
Physiopathology and Experimental Toxicology Laboratory (INRA)  
Ecole Nationale Vétérinaire, Toulouse, France

Dr Peipei Yao  
Professor of Toxicology  
Institute of Occupational Medicine, CAPM  
Ministry of Public Health  
Beijing, China

FAO Panel of Experts on Pesticide Residues in Food and the Environment<sup>9</sup>

Dr D.C. Abbott  
Ashted, Surrey, UK

Dr A. Ambrus *Rapporteur*  
Budapest Plant Health and Soil Conservation Station  
Budapest, Hungary

Dr Ursula Banasiak  
Federal Biological Research Centre for Agriculture and Forestry  
Kleinmachnow, Germany

Mr D.J. Hamilton  
Department of Primary Industries  
Indooroopilly, Brisbane, Queensland,  
Australia

Mr N.F. Ives *Chairman*  
Health Effects Division (H7509C)  
US Environmental Protection Agency  
Washington, D.C., USA

Ms Elena Masoller  
Servicios de Laboratorios  
Ministerio de Ganadería, Agricultura y Pesca  
Montevideo, Uruguay

Mr T. Sakamoto  
Assistant Director  
Plant Protection Division

Ministry of Agriculture, Forestry and Fisheries  
Chiyoda-ku, Tokyo, Japan

Dr B. Worobey  
Chemical Evaluation Division  
Bureau of Chemical Safety  
Health Canada,  
Ottawa, Ontario, Canada

Secretariat

Mrs P.H. van Hoeven-Arentzen (WHO Temporary Adviser)  
National Institute of Public Health and Environmental Protection  
Bilthoven, The Netherlands

Dr Elisabeth Bosshard (WHO Temporary Adviser)  
Federal Office of Public Health  
Division of Food Science  
Institute of Toxicology  
Schwerzenbach, Switzerland

Mrs M. Caris (WHO Temporary Adviser)  
Bureau of Chemical Hazards  
Environmental Health Centre  
Health Canada  
Ottawa, Ontario, Canada

Dr P. Chamberlain (WHO Consultant)  
Veterinary Medical Officer  
Center for Veterinary Medicine  
Food and Drug Administration  
Rockville, MD, USA

Dr W.H. van Eck  
Chairman, Codex Committee on Pesticide Residues  
Food and Product Safety Division  
Ministry of Health, Welfare and Sport  
Rijswijk, The Netherlands

Dr K. Fujimori (WHO Temporary Adviser)  
Division of Pharmacology  
Biological Safety Research Center  
National Institute of Health Sciences  
Ministry of Health and Welfare  
Tokyo, Japan

Dr J.L. Herrman *WHO Joint Secretary*  
International Programme on Chemical Safety  
World Health Organization  
Geneva, Switzerland

Mrs E. Heseltine  
Communication in Science  
Lajarthe  
Saint-Léon-sur Vézère, France

Dr Jens-Jørgen Larsen (WHO Temporary Adviser)  
Head, Department of General Toxicology  
Institute of Toxicology  
National Food Agency of Denmark  
Søborg, Denmark

Mr A.F. Machin  
London, UK

Dr D. McGregor  
Unit of Carcinogen Identification and Evaluation  
International Agency for Research on Cancer  
Lyon, France

Dr A. Moretto (WHO Temporary Adviser)  
Università di Padova  
Istituto di Medicina del Lavoro  
Padova, Italy

Dr G. Moy  
Food Safety Unit  
Division of Food and Nutrition  
World Health Organization  
Geneva, Switzerland

Mr W. Murray *FAO Joint Secretary*  
Plant Protection Service  
Plant Production & Protection Division  
Food and Agriculture Organization of the United Nations (FAO)  
Rome, Italy

Dr. B. Röstel-Peters  
Detached National Expert  
Pharmaceuticals  
Commission of the European Communities  
Brussels, Belgium

Dr G. Vettorazzi (WHO Temporary Adviser)  
International Toxicology Information Centre (ITIC)  
San Sebastian, Spain

Mr M. Walsh  
Principal Administrator EEC  
Commission of the European Communities  
Législation des produits végétaux et de nutrition animale  
Brussels, Belgium

Mr M. Watson (WHO Temporary Adviser)  
 Head, Risk Evaluation Branch  
 Pesticides Safety Directorate  
 Ministry of Agriculture, Fisheries and Food  
 York, UK

Dr Y. Yamada  
 Food Standards Officer  
 Joint FAO/WHO Food Standards Programme  
 Food and Agriculture Organization of the United Nations (FAO)  
 Rome, Italy

### ABBREVIATIONS WHICH MAY BE USED

Ache	acetylcholinesterase
ADI	acceptable daily intake
AFI(D)	alkali flame-ionization (detector)
ai	active ingredient
ALAT	alanine aminotransferase
approx.	approximate
ASAT	aspartate aminotransferase
BBA	Biologische Bundesanstalt für Land- und Forstwirtschaft
bw	body weight
(not b.w.)	
c	centi- ( $\times 10^{-2}$ )
CA	Chemical Abstracts
CAS	Chemical Abstracts Services
CCPR	Codex Committee on Pesticide Residues
ChE	cholinesterase
CNS	central nervous system
cv	coefficient of variation
CXL	Codex Maximum Residue Limit (Codex MRL). See MRL.
DFG	Deutsche Forschungsgemeinschaft
DL	racemic (optical configuration, a mixture of dextro- and laevo-)
DP	dustable powder
DS	powder for dry seed treatment
EBDC	ethylenebis(dithiocarbamate)
EC	(1) emulsifiable concentrate (2) electron-capture [chromatographic detector]
ECD	electron-capture detector
EMDI	estimated maximum daily intake
EPA	Environmental Protection Agency
ERL	extraneous residue limit
ETU	ethylenethiourea
F <sub>1</sub>	filial generation, first

F <sub>2</sub>	filial generation, second
f.p.	freezing point
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
FID	flame-ionization detector
FPD	flame-photometric detector
g (not gm)	gram
µg	microgram
GAP	good agricultural practice(s)
GC-MS	gas chromatography - mass spectrometry
G.I.	gastrointestinal
GL	guideline level
GLC	gas-liquid chromatography
GLP	Good Laboratory Practice
GPC	gel-permeation chromatography
GSH	glutathione
h (not hr)	hour(s)
ha	hectare
Hb	haemoglobin
hl	hectolitre
HPLC	high-performance liquid chromatography
HPLC-MS	high-performance liquid chromatography - mass spectrometry
IBT	Industrial Bio-Test Laboratories
i.d.	internal diameter
i.m.	intramuscular
i.p.	intraperitoneal
IPCS	International Programme on Chemical Safety
IR	infrared
IRDC	International Research and Development Corporation (Mattawan, Michigan, USA)
i.v.	intravenous
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)
LC	liquid chromatography
LC <sub>50</sub>	lethal concentration, 50%
LC-MS	liquid chromatography - mass spectrometry
LD <sub>50</sub>	lethal dose, median
LOAEL	lowest observed adverse effect level
LOD	limit of determination (see also "*" at the end of the Table)
LSC	liquid scintillation counting or counter
MFO	mixed function oxidase
µm	micrometre (micron)
min	minute(s)
(not min.)	
MLD	minimum lethal dose



M	molar
mo (not mth.)	month(s)
MRL	Maximum Residue Limit. MRLs include <u>draft</u> MRLs and <u>Codex</u> MRLs (CXLs). The MRLs recommended by the JMPR on the basis of its estimates of maximum residue levels enter the Codex procedure as draft MRLs. They become Codex MRLs when they have passed through the procedure and have been adopted by the Codex Alimentarius Commission.
MS	mass spectrometry
MTD	maximum tolerated dose
n	normal (defining isomeric configuration)
NCI	National Cancer Institute (United States)
NMR	nuclear magnetic resonance
NOAEL	no-observed-adverse-effect level
NOEL	no-observed-effect level
NP(D)	nitrogen-phosphorus (detector)
NTE	neuropathy target esterase
OP	organophosphorus pesticide
PHI	pre-harvest interval
ppm	parts per million. (Used only with reference to the concentration of a pesticide in an experimental diet. In all other contexts the terms mg/kg or mg/l are used).
PT	prothrombin time
PTT	partial thromboplastin time
PTU	propylenethiourea
RBC	red blood cell
s.c.	subcutaneous
SC	suspension concentrate (= flowable concentrate)
SD	standard deviation
SE	standard error
SG	water-soluble granule
SL	soluble concentrate
SP	water-soluble powder
sp./spp.	species (only after a generic name)
sp gr (not sp. gr.)	specific gravity
t	tonne (metric ton)
T <sub>3</sub>	tri-iodothyronine
T <sub>4</sub>	thyroxine
TADI	Temporary Acceptable Daily Intake
<i>tert</i>	tertiary (in a chemical name)
TLC	thin-layer chromatography
TMDI	theoretical maximum daily intake
TMRL	Temporary Maximum Residue Limit
TPTA	triphenyltin acetate
TPTH	triphenyltin hydroxide

TSH	thyroid-stimulating hormone (thyrotropin)
UDMH	1,1-dimethylhydrazine (unsymmetrical dimethylhydrazine)
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration
UV	ultraviolet
v/v	volume ratio (volume per volume)
WG	water-dispersible granule
WHO	World Health Organization
WP	wettable powder
wt/vol	weight per volume
w/w	weight ratio (weight per weight)
<	less than
≤	less than or equal to
>	greater than
≥	greater than or equal to
*	(following residue levels, e.g. 0.01* mg/kg): level at or about the limit of determination





## INTRODUCTION

The report of the Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues, held in Rome, 19-28 September 1994, contains a summary of the evaluations of residues in foods of the various pesticides considered as well as information on the general principles followed by the Meeting. The present document contains summaries of the residues data considered, together with the recommendations made.

The Evaluations are issued in two parts:

Part I: Residues (by FAO)

Part II: Toxicology (by WHO)

For those interested in both aspects of pesticide evaluation, not only both parts but also the reports containing summaries of residue and toxicological considerations will be available. Special attention is drawn to Annex I containing updated ADIs, MRLs, temporary ADIs and MRLs, and GLs, which also appears in full as part of the report of the Meeting.

Some of the compounds considered at this Meeting have been previously evaluated and reported on in earlier publications. In general only new information is summarized in the relevant monographs and reference is made to previously published evaluations, which should also be consulted. In the case of older compounds which are re-evaluated as part of the periodic review programme of the Codex Committee on Pesticide Residues (CCPR) however a comprehensive review of all available data, including data which may have previously been submitted, is carried out. Compounds evaluated for the first time are indicated by a single asterisk and those evaluated in the CCPR periodic review programme by a double asterisk in the Table of Contents.

The name of the compound appearing as the title of each monograph is followed by its Codex Classification Number in parentheses.

References to previous Reports and Evaluations of Joint Meetings are listed in Annex II.

### Acknowledgements

The monographs in these Evaluations were prepared by the following participants in the 1994 JMPR for the FAO Panel of Experts on Pesticide Residues in Food and the Environment:

Dr. D.C. Abbott, Dr. A. Ambrus, Dr. U. Banasiak, Mr. D.J. Hamilton, Mr. N.F. Ives, Mr. A.F. Machin, Ms. E. Masoller, Mr B. Murray, Mr. T. Sakomoto and Dr. B. Worobey.

**Note:** Any comments on residues in food and their evaluation should be addressed to the:

Pesticide Residue Specialist  
Plant Protection Service  
Plant Production and Protection Division  
Food and Agriculture Organization  
Viale delle Terme di Caracalla  
00100 Rome, Italy

