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PESTICIDE RESIDUES IN FOOD

**Report of the 1975 Joint Meeting of the FAO
Working Party of Experts on Pesticide Residues
and the WHO Expert Committee on
Pesticide Residues**



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1975 JOINT MEETING OF THE FAO WORKING PARTY OF EXPERTS
ON PESTICIDE RESIDUES AND THE
WHO EXPERT COMMITTEE ON PESTICIDE RESIDUES

Geneva, 24 November–3 December 1975

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PESTICIDE RESIDUES IN FOOD

Report of the 1975 Joint FAO/WHO Meeting

A Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues was held in Geneva from 24 November to 3 December 1975. The Meeting was opened by Dr B. H. Dieterich, Director of the Environmental Health Division of the World Health Organization, on behalf of the Directors-General of the Food and Agriculture Organization of the United Nations and of the World Health Organization. The FAO Working Party had already met in Geneva from 19 to 22 November 1975 in preparation for the Joint Meeting.

Dr Dieterich stated that to meet the increasing need for food there has been a worldwide increase of the use of pesticides in agriculture. However, pesticides, even when applied in accordance with good agricultural practice, sometimes leave residues in food. Man is therefore exposed to them. The tasks of the Meeting were to provide toxicological evaluations aimed at establishing acceptable daily intakes for man, and to recommend limits of certain pesticide residues in specific foods. Dr Dieterich pointed out that the recommendations of the Joint Meeting would provide guidance to countries attempting to control the agricultural use of pesticides and to the Codex Alimentarius Commission and its subsidiary body, the Codex Committee on Pesticide Residues, when recommending international tolerances. Moreover, evaluation of the hazards of pesticides would contribute to the health protection of man from the pollution of the general environment by chemicals.

1. INTRODUCTION

The Joint Meeting was held in pursuance of the recommendations made in 1961, at a meeting of a WHO Expert Committee on Pesticide Residues held jointly with the FAO Panel of Experts on the Use of Pesticides in Agriculture, that studies be undertaken to evaluate possible hazards to man arising from the occurrence of residues of pesticides in foods.

The reports of previous Joint Meetings (FAO/WHO, 1965a, 1967a, 1968a, 1969a, 1970a, 1971a, 1972a, 1973a, 1974a, 1975a) contain infor-

mation on acceptable daily intakes (ADIs), residue limits, and methods of analysis for the various pesticides considered. The supporting documents (FAO/WHO, 1965b, 1965c, 1967b, 1968b, 1969b, 1970b, 1971b, 1972b, 1973b, 1974b, 1975b) contain detailed monographs on these pesticides and include comments on analytical methods.

The present Meeting was convened to consider a further number of pesticides, together with requests of both a general and specific nature contained in the report of the Eighth Session of the Codex Committee on Pesticide Residues held from 3 to 8 May 1975.

During the present Joint Meeting the FAO Working Party was primarily responsible for :

- (a) reviewing data on certain pesticides and their residues ;
- (b) proposing pesticide residue limits and recommending methods of analysis.

The WHO Expert Committee was primarily responsible for :

- (a) reviewing toxicological and other data on certain pesticides and their residues ;
- (b) establishing, where possible, ADIs for man for those pesticides.

Furthermore, each of these groups of experts made recommendations designed to indicate, stimulate, and coordinate research.

2. GENERAL CONSIDERATIONS

2.1 Principles and scope

The Meeting took account of the principles enumerated in previous reports.^a In relation to the substances considered at the present Meeting, members felt that some of those principles should be clarified, rephrased, extended, or reaffirmed.

2.2 Toxicological evaluation and margin of safety

The Meeting adhered to the principles laid down previously in allocating ADIs or temporary ADIs for pesticides.

^a FAO/WHO 1958, 1961, 1967a, 1969a, 1970a, 1971a, 1972, 1972a, 1973a, 1974a, 1975a ; WHO 1967.

Each pesticide is toxicologically evaluated on the basis of all the available data on that compound and taking into account relevant data on related compounds and on compounds that give identical or similar metabolites.

It is an essential part of the evaluation to determine the dose levels where no significant toxicological effect is found. These "no-effect" levels in the relevant animal species and when possible in man are specified in the comments on each pesticide in the published monographs.

A margin of safety is necessary to allow for differences in sensitivity between the animal species and man, the wide variations in sensitivity among human beings, and the fewness of the experimental animals in comparison with the human population that might be exposed.

A thorough discussion of the question of the margin of safety was made by the WHO Scientific Group on Procedures for Investigating Intentional and Unintentional Food Additives (WHO 1967, pp. 19-22). The Meeting reaffirmed the conclusions of that Scientific Group especially with respect to increasing or decreasing the margin of safety. For the pesticides evaluated or re-evaluated at this Meeting, the comments stated in the monographs give an indication of the rationale behind each action taken.

It should be emphasized that the magnitude of the margin of safety applied in each individual case is based on the evaluation of all available data. In consideration of any information that gives rise to particular concern, the magnitude of the margin of safety will be increased.

Where the data provide an assurance of safety, the magnitude may be decreased. Therefore it is impossible to recommend fixed rules for the margin of safety to be applied in all instances.

2.3 Availability of data for consideration

The Meeting reaffirmed that it could not allocate ADIs or residue limits on the basis of abstracts or brief summaries of experimental data. To allocate ADIs or residue limits a full review of all data is necessary.

The Meeting appreciated the large volume of information furnished for its consideration by government agencies, industry, the International Union of Pure and Applied Chemistry, etc. In past years the Meeting had agreed to accept and to consider relevant information from all sources whether published or proprietary. The Meeting reaffirmed the previously

stated policy (FAO/WHO, 1970a) to review unpublished but not confidential information, which is available to scientists requesting information or challenging statements made by the Meeting.

The Meeting also reaffirmed the previous policy that on the request of the Secretariat all data should be made available to it in time for the preparation of working papers. The data must be sent to the Secretariat and/or their designated expert and must also be available to the Meeting. The Meeting further reaffirmed its inability to review pesticide chemicals unless these procedures were adhered to.

2.4 Definitions

A glossary of definitions accepted by successive Joint Meetings was added as Appendix IV to the report of the 1969 Joint Meeting (FAO/WHO, 1970a). Additions and amendments to the glossary were given in Annex 3 of the report of the Joint Meeting in 1971 (FAO/WHO, 1972a). The 1971 Joint Meeting noted (para. 2.10) that inconsistencies remained and that attention should be given to the subject at a future meeting. In the light of further developments within the Joint Meeting as well as in the Codex Committee on Pesticide Residues it was considered desirable to publish a revised list of definitions as Annex 3 to the present report. In the revision, attention was given to remarks made during the eighth session of the Codex Committee on Pesticide Residues that the definitions in use by the Joint Meeting and the Codex Committee on Pesticide Residues should agree as far as possible.

The Meeting agreed to the following changes.

(1) A separate definition for "pesticide" in line with the definition given by the Codex Committee on Pesticide Residues is introduced.

(2) The definition of "pesticide residue" is extended to include residues in animal feed and to limit the conversion products included in the definition to those considered to be of toxicological significance.

(3) The expression "negligible residue" has not been used by the Joint Meeting and is deleted.

(4) The use of the expression "unintentional residue" is no longer necessary in view of the new definitions of "maximum residue limit" and "extraneous residue level".

(5) In order to facilitate the work of the Codex Committee on Pesticide Residues and to ensure that recommendations are made on a similar

basis, the definition of "good agricultural practice in the use of pesticides" of the Codex Committee on Pesticide Residues is adopted.

(6) The definition of "temporary acceptable daily intake" now includes the fact that a period of validity must be specified.

(7) The definition of "tentative negligible daily intake" was withdrawn by the 1973 Joint Meeting and is deleted.

(8) The expression "tolerance" has been replaced by "maximum residue limit" in accordance with recent practice. "Temporary tolerance" has been replaced by "temporary maximum residue limit". The limits are expressed as milligrams per kilogram instead of parts per million—a practice that was initiated by the 1972 Joint Meeting.

(9) The term "extraneous residue limit" replaces "practical residue limit" defined in the report of the 1969 Joint Meeting. The latter has caused confusion owing to its similarity to "maximum residue limit" and to inconsistencies in its application to recommendations for residue limits in foods of animal origin.

(10) A definition of "guideline level", introduced by the 1972 Joint Meeting, is included in the glossary.

(11) The definition of "referee methods" is deleted, as proposed by the 1972 Joint Meeting.

(12) Minor changes have been made in some other definitions.

In addition it is proposed to include the definition of a "conditional acceptable daily intake" as a subject for discussion in the agenda of a future Meeting.

3. SPECIFIC PROBLEMS

3.1 Delayed neurotoxicity

A major toxicological problem long recognized to be associated with such organophosphate esters as tri-*o*-cresylphosphate (TOCP) and more recently brought to the attention of the Meeting in the evaluation of leptophos (see section 4) is that known commonly as "delayed neurotoxicity". This term refers to the observations made on patients suffering from acute poisoning with TOCP (and certain other organophosphorus compounds) of an apparent recovery from the acute parasympathomimetic signs of poisoning followed by the onset after 8–14 days of clinical signs of ataxia

muscle weakness and loss of appetite. Extensive reviews on the chemical structure/activity relationship, biochemistry, and histological factors relating to this syndrome have been published.

The delayed neurotoxicity syndrome affects only certain animal species, including man. The most susceptible animal for laboratory bioassay procedures, the adult hen, is not susceptible before 3-4 months of age. While the adult hen is the animal of choice for laboratory testing, cats, dogs, calves and sheep have been shown to be susceptible. Some sub-human primates and rodents are resistant to both the clinical and the histological lesions. In contrast, man has been shown to be highly susceptible to the syndrome, as suggested by studies where occurrences of paralysis have been reported. Although no definite data are available, man may well be the most sensitive species exhibiting delayed neurotoxicity.

There are no known antidotes to delayed neurotoxicity, and recovery from ataxia is predominantly through development of collateral nerve pathways and physical therapy to develop muscles not served by affected nerves. Reference has been made in the literature^a to the induction of neurotoxicity by certain organophosphorus compounds used as pesticides and drugs. The dose in most experimental cases is high, and atropine has been used to protect the animal from acute signs of poisoning to allow time for the neurotoxicity syndrome to develop. While atropine protects against the short-term acute parasympathomimetic signs of poisoning, it is ineffective against delayed neurotoxicity occurring 8-14 days after treatment.

The potential hazards associated with delayed neurotoxicity are two-fold :

- (1) exposure of occupationally or accidentally exposed individuals who would be affected by high doses for short periods ; and
- (2) long-term low-level exposure and possible build-up of the toxicant to threshold levels leading to ataxia.

Although the first aspect does not fall into the direct terms of reference of the Meeting, the toxicological hazard associated with such exposure

^a CAVANAGH, J. B. Peripheral neuropathy caused by toxic agents, *CRC critical reviews in toxicology*, 2 : 365 (1973) ; JOHNSON, M. K. The delayed neuropathy caused by some organophosphorus esters : mechanism and challenge, *CRC critical reviews in toxicology*, 3 : 289-316 (1975) ; DAVIES, D. R. Neurotoxicity of organophosphorus compounds, in : Koelle, G. B., ed. *Handbuch der Experimentellen Pharmakologie* [Handbook of experimental pharmacology], Supplement 15, Berlin, Springer Verlag, 1963, pp.860-882.

must be considered, not least because it may throw light on the evaluation of the hazards from residues in food.

A key factor in the problem of delayed neurotoxicity discussed by the Meeting is the dose response. The Meeting concluded that delayed neurotoxicity appears to follow a dose-response relationship and that it is therefore possible to estimate a no-effect level following acute or chronic exposure in a susceptible species. With an adequate margin of safety an ADI for man can be allocated with a sufficient degree of assurance as far as pesticide residues in food are concerned.

The toxicological evaluation and possible prevention and treatment of delayed neurotoxicity would benefit considerably from a better understanding of this toxic phenomenon. Further work should be encouraged concerning the possible mechanisms of neurotoxicity, such as the effects on the myelin sheath nerve conduction, motor end-plate function, muscular contraction and spasticity. Studies are also desirable of the mechanisms of the delayed response, including the kinetics of metabolism and tissue distribution.

3.2 Pharmacokinetic studies

It is now well appreciated that the tissue distribution, the mode and rate of metabolism, and the rate of excretion of a chemical may profoundly affect its toxicity. Furthermore, the rate of metabolic degradation of a pesticide in the environment influences its persistence. It has become the accepted practice in toxicological evaluation of pesticides to undertake studies of the biotransformation of the chemical and of its tissue distribution and excretion kinetics, generally after single dose administration.

Many pesticides and their metabolites, in addition to being excreted from the body in the urine, are also excreted in substantial amounts in the bile, as a consequence of which they may undergo enterohepatic recirculation. In addition, certain highly lipophilic substances may be distributed and stored in fat depot after absorption from the gut. On repeated dosage these processes of absorption, metabolism, excretion and reabsorption become kinetically complex and may lead to the progressive tissue accumulation of a pesticide or one of its metabolites. This is especially likely where these chemicals are highly lipophilic, extensively biliary excreted and only slowly metabolized.

The Meeting considered that studies of the pharmacokinetics of a pesticide during repeated low dosage are very desirable since they provide

valuable information concerning possible accumulation or depletion and the probable maximum tissue concentration attainable. Such studies contribute to the safety evaluation of long-term exposure to pesticides at the low concentrations that are likely to be present in food.

3.3 Testing of pesticides for mutagenicity

The Joint Meeting discussed the need for mutagenicity tests in the evaluation of a pesticide when estimating an ADI for man. The possible mutagenic action of chemicals has already been discussed by several WHO Scientific Groups (WHO 1967, pp. 16-17; WHO 1971). It was also discussed by the 1973 Joint Meeting (FAO/WHO 1974, pp. 15-16) and by the WHO Scientific Group on the Assessment of the Carcinogenicity and Mutagenicity of Chemicals (WHO 1974). The Meeting reconfirmed the views expressed earlier (WHO 1974a, b).

The Meeting emphasized the importance of protecting the human population from exposure to mutagens in food. The methodology for predicting the mutagenic hazard to man is undergoing rapid development and therefore the Meeting could not recommend any particular test.

It was felt that doses of the chemicals that bear some relationship to the concentrations likely to be encountered in food and the environment should be included in the range of doses used in mutagenicity tests.

The Meeting noted the work of WHO and other agencies and national and international scientific societies concerning testing methods and their evaluation. It hoped that research now in progress would lead to the development of mutagenicity tests relevant to the prediction of mutagenic potential for man.

More weight should be attached to the results of mutagenic tests in mammals than to those obtained from microbial or other non-mammalian systems or isolated cell systems. The significance of positive results from microbial tests, unsupported by information from tests of other kinds, would be regarded as uninterpretable for the purposes of establishing an ADI.

For many of the pesticides evaluated or re-evaluated at the Meeting, results from one or more tests for mutagenicity were available. Most of them were negative.

In spite of this, it was agreed that because of the uncertainties of potential mutagenic hazards such tests are desirable. Tests for mutagenicity are especially desirable in certain cases—e.g., for substances that yield metabolites with stable carbonium ions or strong electrophilic

reactivity. The Meeting recommended that the results of mutagenicity tests should be evaluated together with other toxicological data.

3.4 Antibiotics used as pesticides

The Meeting discussed the current use of antibiotics in plant protection, predominantly as fungicides or bactericides. Such antibiotics are in reality pesticides and should be subjected to tests similar to those carried out on other pesticides.

However, the problem of possible induction of microbial resistance, the phenomenon of cross-resistance in disease organisms affecting animals and man, and the possibility of sensitization in man from the use of such antibiotics were of concern to the Meeting and warrant further discussion. The methods for residue analysis of antibiotics are usually based on bioassay and the sensitivity is low. There is need for more sensitive methods for residue analysis of such antibiotics (see section 8.4).

4. EVALUATION OF DATA FOR ACCEPTABLE DAILY INTAKE

4.1 Pesticides evaluated for the first time

4.1.1 Organophosphorus pesticides

Chlorpyrifos-methyl.^a Short- and long-term studies in rats and dogs have revealed no unusual effects, apart from cholinesterase depression. Sufficient data were available to allocate an ADI.

Cyanofenphos.^b A long-term study in the rat and 12-month study in the dog showed cholinesterase to be the most sensitive parameter of effect and formed the basis for allocating a temporary ADI. The lack of metabolic data was pointed out by the Meeting as a significant deficiency in the data base.

Ethephon.^c Sufficient data were not available to allocate an ADI. Data are expected to be available within two years, when experiments in progress are completed.

^a *O*, *O*-dimethyl *O*-(3,5,6-trichloro-2-pyridinyl) phosphorothioate.

^b *O*-(4-cyanophenyl) *O*-ethyl phenylphosphonothionate.

^c (2-chloroethyl)-phosphonic acid.

4.1.2 Carbamate pesticides

Carbofuran.^a Sufficient data were not available to allocate an ADI. Data are expected to be provided for the next Meeting.

Methomyl.^b The data for toxicological evaluation were not made available to the Meeting and an ADI could not be allocated. Questions raised in reference to proprietary data are discussed in section 2.3.

4.1.3 Other pesticides

Sec-butylamine. Short-term and long-term studies were available, on the basis of which a temporary ADI was allocated. Lack of certain specific toxicological tests and the occurrence of residues in milk was a matter of concern and permitted only a temporary ADI to be allocated.

Bioresmethrin. Data were not made available in sufficient time to allow an ADI to be allocated, and consideration of this pesticide was postponed.

4.2 Pesticides previously evaluated

4.2.1 Organophosphorus pesticides

Bromophos-ethyl. Short-term studies in two rodent species did not show an increased urinary excretion of ascorbic acid and dehydroascorbic acid. The Meeting considered the rodent studies to be complete and an ADI was allocated based on no-effect levels in 2-year rat and dog studies.

Coumaphos. The Meeting was informed that the required studies were in progress. The temporary ADI was therefore extended.

Disulfoton. Based on short-term studies, a temporary ADI had been allocated at a previous meeting. New data confirming the metabolic fate in mammals and 2-year studies in rat and dog were sufficient to allow the Meeting to allocate a new ADI.

Fenthion. The studies required by a previous meeting to support the estimated temporary ADI were not all available, but sufficient were available to allow the Meeting to extend the temporary ADI until long-term studies are completed.

^a Methylcarbamate 2,3-dihydro-2,2-dimethyl-7-benzofuranol.

^b Methyl N-[[[(methylamino)carbonyl]-oxy]-ethanimidothioate.

Leptophos.^a The existence of a considerable amount of information, including studies on reproduction, carcinogenicity, neurotoxicity, mutagenicity, teratogenicity, and long- and short-term studies in rat and dog, allowed the Meeting to allocate a temporary ADI. The problem of delayed neurotoxicity, as evidenced by a positive dose-dependent response in adult hens, was of concern. However, the Meeting considered that delayed neurotoxicity should be considered as another toxicological parameter showing a dose-response relationship which permits an evaluation to be made of a no-effect level (see section 3.1).

Methidathion. Concern expressed by a previous Meeting over hepatic lesions was alleviated by a reinterpretation of the histopathology data from a 2-year dog study. The reassurance of this new interpretation and the data on observations in man enabled the Meeting to allocate an ADI.

Monocrotophos. Additional data submitted with respect to mutagenicity testing, biotransformation, and observations on man allowed the Meeting to re-evaluate the compound and increase the ADI.

Omethoate. Further data considered on neurotoxicity and on several reproduction parameters allowed the Meeting to extend the temporary ADI until the results of the long-term studies understood to be in progress become available.

Parathion-methyl. Although teratogenicity and reproduction studies were not forthcoming as requested by a previous Meeting, the availability of further observations in man allowed the Meeting to extend the temporary ADI. Required and desirable information specified by previous Meetings was again requested.

Trichlorfon. Previous meetings expressed concern over the carcinogenic potential as demonstrated by several studies. Although reconsideration to these studies relieved some of the concern, reports of new work reflecting hepatic involvement caused the Meeting to reduce the temporary ADI. It was understood that new long-term carcinogenicity tests are in progress.

4.2.2 Benzimidazole fungicides

Benomyl.^b Sufficient data were not available to estimate a no-effect level or to allocate an ADI.

^a *O*-(4-bromo-2,5-dichlorophenyl) *O*-methyl phenylphosphonothioate.

^b Methyl [1-[(butylamino)carbonyl]-1*H*-benzimidazol-2-yl]-carbamate.

Thiophanate-methyl. New data on metabolism and on effects on the male reproductive system were incorporated into the monograph addendum. The previously allocated ADI was confirmed.

Carbendazim.^a Consideration of this pesticide was postponed because the required studies were still in progress and the data would not be available until a later date.

4.2.3 Other pesticides

Chlordimeform.^b Further data reported on short-term rat studies did not provide information on the problems of liver and bile duct effects noted in a previous evaluation. The short-term studies and studies on the mode of action were, however, sufficient to allow the temporary ADI to be extended.

Quintozene. Long-term studies in the rat and mouse were sufficient to allocate an ADI.

5. EVALUATION OF DATA FOR RESIDUE LIMITS

The Meeting evaluated five pesticides that had not been considered previously. Recommendations made by previous Meetings on other pesticides were reviewed and, in certain cases, amended.

5.1 Pesticides not previously considered for establishment of maximum residue limits

Recommendations for maximum residue limits were made for chlorpyrifos-methyl, cyanofenphos and *sec*-butylamine.

In the absence of ADIs it was not possible to recommend maximum residue limits for bioresmethrin and methomyl, but guideline levels indicating the level of residues resulting from recommended uses of these insecticides were published for the information of regulatory and other interested authorities.

Full details of the evaluation of these compounds are contained in the monographs (FAO/WHO 1976b) and summarized in Annex 1.

^a Methyl 1*H*-benzimidazol-2-ylcarbamate.

^b *N'*-(4-chloro-2-methylphenyl)-*N,N*-dimethyl-methanimidamide.

5.2 Pesticides reviewed in the light of new information

The following pesticides were reviewed in the light of information received since the previous Meeting : benomyl, bromophos-ethyl, chlor-dimeform, coumaphos, 2,4-D, demeton, disulfoton, fenthion, leptophos, methidathion, monocrotophos, omethoate, parathion-methyl, quinto-zene, thiophanate-methyl, and trichlorfon. In the case of quintozene, the carry-over of the impurities hexachlorobenzene and pentachlorobenzene were recognized, and recommendations that should lead to the reduction of these impurities are included in the monographs.

In addition, a number of questions concerning the following compounds, referred from the eighth session of the Codex Committee on Pesticide Residues (FAO/WHO, 1975c), were considered in the light of available information and such information as was supplied by governments : aldrin/dieldrin, bromophos, bromophos-ethyl, carbaryl, chlorobenzilate, chlorpyrifos^a, cyhexatin^b, 2,4-D, diazinon, endosulfan, endrin, ethion, heptachlor, lindane, malathion, monocrotophos, omethoate, parathion-methyl, 2-phenylphenol^c, phosalone, thiabendazole and trichlorfon. Certain additions, amendments, and clarifications appear in Annex 1 in the relevant monographs.

5.3 Compounds not considered

Carbendazim, carbofuran, ethephon, piperonyl butoxide, and the pyrethrins were scheduled for evaluation or re-evaluation at the Meeting. However, insufficient data were received on which to base recommendations. Additional effort should be made to obtain necessary information so that these compounds can be considered at a future meeting.

Questions on captafol, captan, diquat, fenchlorfos and parathion were referred from the Codex Committee on Pesticide Residues in 1975 (FAO/WHO 1975c) but were not dealt with by the Meeting owing to lack of information. Consideration was postponed to a future meeting.

^a *O,O*-diethyl *O*-(3,5,6-trichloro-2-pyridinyl) phosphorothioate.

^b Tricyclohexylhydroxy-stannane.

^c [1,1'-biphenol]-2-ol.

6. COMPARISON OF POTENTIAL DAILY INTAKES OF PESTICIDE RESIDUES WITH THEIR ACCEPTABLE DAILY INTAKES

The Meeting considered results of calculations made on the potential daily intakes of pesticide residues of most of the compounds toxicologically evaluated. It was possible to undertake these calculations only for compounds for which the proposed residue limits were available early in the Meeting. Such calculations were made using food intake figures from five countries in three regions of the world for 14 pesticides for which food consumption data were submitted to WHO.

The calculations were based on the assumption that the concentrations of pesticide residues in food at the time of consumption were always at the level of the limits recommended by the Joint Meeting and that all food in each class bore these residues at the limit.

The results of this study indicated that with good agricultural practice there was theoretically no possibility that the acceptable daily intakes for the following pesticides might be exceeded: bromophos-ethyl, chlor-dimeform, chlorpyrifos-methyl, cyanofenphos, 2,4-D, demeton, methidathion, *sec*-butylamine and trichlorfon. Further work on the reduction of residue levels during storage, processing and cooking is therefore not essential, and there is no special need to include these pesticides in monitoring studies as long as the residue limits and the acceptable daily intakes remain unchanged.

For several compounds, on the basis of the above assumptions, the ADI could be exceeded up to four times in one or more of the countries considered. These are: disulfoton, leptophos, monocrotophos, and parathion-methyl. For one compound, fenthion, the calculations indicated that the ADI could be exceeded by 6-15 times in the five countries studied.

The Meeting considered that exceeding the ADI in these calculations does not necessarily represent a toxicological problem in view of the assumptions on which the calculations are based. However, the Meeting felt that further work on the occurrence and fate of the residues would be desirable in these cases. If after taking the new data into account the ADI still appears to be exceeded, these pesticides and especially fenthion should be included in total diet studies. If the total diet studies show that the ADI is exceeded, further evaluations must be undertaken and recommendations made.

7. FUTURE WORK

The following items should be considered by future Joint Meetings :

(1) Pesticides postponed from the present Meeting : benomyl, bioresmethrin, captafol, captan, carbendazim, carbofuran, diquat, ethephon, fenclorfos, methomyl, parathion, piperonyl butoxide and the pyrethrins.

(2) Pesticides evaluated at previous Meetings and scheduled for re-evaluation in 1976 : captafol, carbophenothion, dodine, paraquat, pirimiphos-methyl, thiometon.

(3) Codex priority list No. 2 (FAO/WHO 1975c, p. 77) : acephate^a, cartap^b, dialifos^c, edifenphos^d, formetanate, maleic hydrazide, methamidophos^e, phosmet, pirimicarb, and propargite.

(4) Compounds that have been listed for re-evaluation in previous reports and monographs, without dates having been specified : aldrin/dieldrin, azinphos-ethyl, technical BHC, camphechlor, chloropicrin, DDT, dichlofluanid, DNOC, lead arsenate, propham/chlorpropham, 2,4,5-T, trichloronat, vamidothion. Compounds listed for re-evaluation include the following fumigants : bromoethane, bromomethane, carbon disulfide, carbon tetrachloride, 1,2-dibromoethane, 1,2-dichloroethane, and ethylene oxide. The Meeting noted that the 1975 session of the Codex Committee on Pesticide Residues suggested that the following compounds did not merit priority consideration : acrylonitrile, allethrin, chloropropylate, Chlorthion^f, dimethrin, MGK 264^g.

8. RECOMMENDATIONS

1. In certain instances additional information was not sufficient for evaluation in spite of requests made at previous meetings. A concerted effort should be made to solicit support from international organizations,

^a *O,S*-dimethyl acetyl-phosphoramidothioate.

^b *S,S'*-[2-(dimethylamino)-1,3-propanediyl] carbamothioate.

^c *S*-[2-chloro-1-(1,3-dihydro-1,3-dioxo-2*H*-isoindol-2-yl)ethyl] *O,O*-diethyl phosphorodithioate.

^d *O*-ethyl *S,S*-diphenyl phosphorodithioate.

^e *O,S*-dimethyl phosphoramidothioate.

^f *O*-(3-chloro-4-nitrophenyl) *O,O*-dimethyl phosphorothioate.

^g 2-(2-ethylhexyl)-3a,4,7,7a-tetrahydro-4,7-methano-1*H*-isoindole-1,3-(2*H*)-dione.

government agencies and other interested parties, including manufacturers' associations, to provide the data for the Meeting.

2. WHO should consider convening a special meeting to evaluate existing tests for mutagenicity with a view to predicting potential mutagenicity hazards to man and to recommend appropriate test procedures. In addition, this meeting should consider the possibility of establishing threshold intakes in relation to mutagenic action (see section 3.3).

3. Further work should be encouraged in the area of delayed neurotoxicity especially with respect to certain areas of concern such as occupational exposure (see section 3.1).

4. Studies of potential daily intake should be continued and expanded by WHO to include countries not currently represented. In addition, food commodities representing newer trends in food consumption (e.g., bran) should be incorporated into the programme. The study should take into consideration information now available on the occurrence and disappearance of residues during marketing, storage and processing prior to consumption. Action should be taken to encourage research to develop such data. In addition, where appropriate, total diet residues and/or monitoring studies should be encouraged to compare the theoretical intake with actual average dietary consumption.

5. There is an increasing use of biological plant protection agents such as bacteria, viruses, and hormones. The agricultural and public health aspects associated with their use should be kept under close consideration by FAO and WHO.

6. It is highly desirable that the toxicological evaluation of pesticide residues in food be supplemented by information on occupational exposure and health effects. For this reason, such information should be published and made available to the Joint Meeting.

REFERENCES

- FAO/WHO (1958) *Procedures for the testing of intentional food additives to establish their safety for use. Second report of the Joint FAO/WHO Expert Committee on Food Additives.* FAO Nutrition Meetings Report Series, No. 17 ; WHO Technical Report Series, No. 144
- FAO/WHO (1961) *Evaluation of the carcinogenic hazards of food additives. Fifth report of the Joint FAO/WHO Expert Committee on Food Additives.* FAO Nutrition Meetings Report Series, No. 29 ; WHO Technical Report Series, No. 220
- FAO/WHO (1962) *Principles governing consumer safety in relation to pesticide residues. Report of a meeting of a WHO Expert Committee on Pesticide Residues held jointly*

- with the *FAO Panel of Experts on the Use of Pesticides in Agriculture*. FAO Plant Production and Protection Division Report, No. PL:1961/11 ; WHO Technical Report Series, No. 240
- FAO/WHO (1964) *Evaluation of the toxicity of pesticide residues in food; report of a Joint Meeting of the FAO Committee on Pesticides in Agriculture and the WHO Expert Committee on Pesticide Residues*. FAO Meeting Report, No. PL:1963/13 ; WHO/Food Add./23 (1964)
- FAO/WHO (1965a) *Evaluation of the toxicity of pesticide residues in food. Report of the Second Joint Meeting of the FAO Committee on Pesticides in Agriculture and the WHO Expert Committee on Pesticide Residues*. FAO Meeting Report, No. PL:1965/10 ; WHO/Food Add./26.65
- FAO/WHO (1965b) *Evaluation of the toxicity of pesticide residues in food*. FAO Meeting Report, No. PL:1965/10/1 ; WHO/Food Add./27.65
- FAO/WHO (1965c) *Evaluation of the hazards to consumers resulting from the use of fumigants in the protection of food*. FAO Meeting Report, No. PL:1965/10/2 ; WHO/Food Add./28.65
- FAO/WHO (1967a) *Pesticide residues in food. Joint report of the FAO Working Party on Pesticide Residues and the WHO Expert Committee on Pesticide Residues*. FAO Agricultural Studies, No. 73 ; WHO Technical Report Series, No. 370
- FAO/WHO (1967b) *Evaluation of some pesticide residues in food*. FAO : PL/CP/15 ; WHO/Food Add./67.32
- FAO/WHO (1968a) *Pesticide residues. Report of the 1967 Joint Meeting of the FAO Working Party and the WHO Expert Committee*. FAO Meeting Report, No. PL:1967/M/11 ; WHO Technical Report Series, No. 391
- FAO/WHO (1968b) *1967 evaluation of some pesticide residues in food*. FAO/PL:1967/M/11/1 ; WHO/Food Add./68.30
- FAO/WHO (1969a) *Pesticide residues in food. Report of the 1968 Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues*. FAO Agricultural Studies, No. 78 ; WHO Technical Report Series, No. 417
- FAO/WHO (1969b) *1968 evaluations of some pesticide residues in food*. FAO/PL:1968/M/9/1 ; WHO/Food Add./69.35
- FAO/WHO (1970a) *Pesticide residues in food. Report of the 1969 Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Group on Pesticide Residues*. FAO Agricultural Studies, No. 84 ; WHO Technical Report Series, No. 458
- FAO/WHO (1970b) *1969 evaluations of some pesticide residues in food*. FAO/PL:1969/M/17/1 ; WHO/Food Add./70.38
- FAO/WHO (1971a) *Pesticide residues in food. Report of the 1970 Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Group on Pesticide Residues*. FAO Agricultural Studies, No. 87 ; WHO Technical Report Series, No. 474
- FAO/WHO (1971b) *1970 evaluations of some pesticide residues in food*. AGP:1970/M/12/1 ; WHO/Food Add./71.42
- FAO/WHO (1972) *Toxicological evaluation of certain food additives with a review of general principles and of specifications. Seventeenth report of the Joint FAO/WHO*

- Expert Committee on Food Additives*. FAO Meeting Series No. 52; WHO Technical Report Series, No. 539.
- FAO/WHO (1972a) *Pesticide residues in food. Report of the 1971 Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues*. FAO Agricultural Studies, No. 88; WHO Technical Report Series, No. 502
- FAO/WHO (1972b) *1971 evaluations of some pesticide residues in food*. AGP:1971/M/9/1; WHO Pesticide Residues Series, No. 1
- FAO/WHO (1973a) *Pesticide residues in food. Report of the 1972 Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and of the WHO Expert Committee on Pesticide Residues*. FAO Agricultural Studies, No. 90; WHO Technical Report Series, No. 525
- FAO/WHO (1973b) *1972 evaluations of some pesticide residues in food*. AGP:1972/M/9/1; WHO Pesticide Residues Series, No. 2
- FAO/WHO (1974a) *Pesticide residues in food. Report of the 1973 Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues*. FAO Agricultural Studies, No. 93; WHO Technical Report Series, No. 545
- FAO/WHO (1974b) *1973 evaluations of some pesticide residues in food*. AGP:1973/M/9/1; WHO Pesticide Residues Series, No. 3
- FAO/WHO (1974c) *Report of the seventh session of the Codex Committee on Pesticide Residues* (document ALINORM 74/24)
- FAO/WHO (1974d) *Toxicological evaluation of certain food additives with a review of general principles and of specifications*. FAO Nutrition Meetings Report Series, No. 53; WHO Technical Report Series, No. 539
- FAO/WHO (1974e) *The use of mercury and alternative compounds as seed dressings. Report of a Joint FAO/WHO meeting*. FAO Agricultural Studies, No. 95; WHO Technical Report Series, No. 555
- FAO/WHO (1975a) *Pesticide residues in food. Report of the 1974 Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues*. FAO Agricultural Studies, No. 97; WHO Technical Report Series, No. 574
- FAO/WHO (1975b) *1974 evaluations of some pesticide residues in food*. AGP:1974/M/11; WHO Pesticide Residues Series, No. 4
- FAO/WHO (1975c) *Report of the eighth session of the Codex Committee on Pesticide Residues* (document ALINORM 76/24)
- WHO (1967) *Procedures for investigating intentional and unintentional food additives. Report of a WHO Scientific Group*. WHO Technical Report Series, No. 348
- WHO (1974) *Assessment of the carcinogenicity and mutagenicity of chemicals. Report of a WHO Scientific Group*. WHO Technical Report Series, No. 546

Annex 1

RECOMMENDATIONS CONCERNING ACCEPTABLE DAILY INTAKES AND RESIDUE LIMITS
MADE AT THE 1975 MEETING

These recommendations are additional to, or amend, those recorded in Annex 1 of the reports of the 1972, 1973 and 1974 Meetings (FAO/WHO 1973a; 1974a; 1975a).

Certain ADIs and residue limits are only temporary, and in these instances the year is specified in which further data are required.

The references are to FAO/WHO publications as listed on pp. 22-24. Where a monograph has been completely revised, mention is not necessarily made of any earlier ones.

Pesticide and references to previous evaluations	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits		Remarks
			Maximum residue limit (mg/kg)	Guideline level (mg/kg)	
aldrin, dieldrin 1967b, 1968b, 1969b, 1970b, 1971b, 1975b	0.0001	Fruit.	0.05		Applicable to aldrin or dieldrin separately or to the sum if both are involved.
benomyl 1974b	no ADI	Lettuce. Rice straw, wheat straw. Raw cereals (wheat, barley, rye, rice). Meat of poultry, eggs.		5 2 0.5 0.1*	Guidelines are for total residues of benomyl, carbendazim and 2-amino-benzimidazole, expressed as carbendazim. Re-evaluation for 1976 proposed.
bioresmethrin	no ADI	Raw grain, milled products from grain. Cooked cereal products including bread.		5 0.05*	Re-evaluation for 1976 proposed.

Annex 1 (continued)

Pesticide and references to previous evaluations	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits		Remarks
			Maximum residue limit (mg/kg)	Guideline level (mg/kg)	
bromophos 1973b	0.006 (1977)	Bran.	20		
		Raw grain (wheat, maize and sorghum).	10	(1977)	
		White flour, wholemeal bread.	2		
		Brussels sprouts, white bread, Broad beans (without pods).	0.5 0.1		
bromophos-ethyl 1973b	0.003	Fat of sheep.	3		
		Milk and milk products (fat basis) Maize (kernels and fodder).	0.2 0.05		
sec-butylamine	0.2 (1978)	Dried citrus pulp, citrus molasses.	50		ADI and residue limits expressed as the base.
		Citrus fruits.	30	(1978)	
		Citrus juice.	0.5		
carbaryl 1967b, 1968b, 1969b, 1971b, 1973b, 1974b	0.01	Milk, milk products.	0.1 *		
chlordimeform 1973b	0.01 (1978)	Pears.	10		Limits are for the sum of chlordimeform and its metabolites determined as 4-chloro- <i>o</i> -foluidine and expressed as chlordimeform.
		Tomatoes.	1	(1978)	
		Rice (hulled).	0.1		
chlorobenzilate 1969b, 1973b	0.02	Apples.	5		
chlorpyrifos 1973b, 1975b	0.0015	Fat and skin of turkey.	0.2		
		Fat of chicken, milk and milk products (fat basis)	0.1		
		Eggs (whole).	0.01 *		
chlorpyrifos-methyl	0.01	Bran.	20		
		Raw grains (wheat, maize, sorghum).	10		
		Flour, wholemeal bread.	2		
		Apples, peaches, tomatoes.	0.5		
		Artichoke, beans, cabbage, Chinese cabbage, eggplant, lettuce (outdoor), peppers, radish, tea (green), rice (pre-harvest).	0.1		
		Milk.	0.01 *		

coumaphos 1969b, 1973b	0.0005 (1978)				
cyanofenphos	0.005 (1978)	Cabbage. Peaches. Soybean (fresh without pods), soybean (dry). Radishes (roots), rice (hulled). Cucumbers, ginger, onions.	2	(1978)	
			1		
2,4-D 1971b, 1972b, 1975b	0.3	Vaccinium berries (e.g., lingon- berries, bilberries), blackberries, raspberries. Raw grain. Milk and milk products, meat, eggs.	5		
			0.2		
demeton 1965b, 1968b	0.005	Apricots, grapes, peaches. Apples, citrus fruit, pears. Plums. Melons, strawberries.	1		Residue limits refer to the total resi- due of demeton, demeton sulfoxide and demeton sulfone determined as demeton sulfone and expressed as disulfoton. See also disulfoton.
			0.5		
diazinon 1965b, 1967b, 1968b, 1969b, 1971b	0.002	Milk, milk products (fat basis).	0.05 *		
			0.1		
disulfoton 1974b	0.002	Alfalfa (hay), clover (hay). Forage crops (green). Vegetables including beans, broccoli, Brussels sprouts, cabbage, caulif- lower, celery, lettuce, maize, pota- toes, peanut shells, peas (including pods), rice (in husks), spinach, sugar beets (roots), tomatoes. Raw grain (except rice and maize). Coffee beans, pecans, peanuts (ker- nels), pineapple, soybeans.	10		Residue limits refer to the total resi- dues of disulfoton, disulfoton sulfoxide, demeton sulfoxide and demeton sul- fone expressed as disulfoton. Pre- viously recommended limits were for residues determined as disulfoton sulfone and demeton-s sulfone ex- pressed as disulfoton. The pre- viously recommended limits are re- peated in this annex.
			5		
ethion 1968b, 1970b, 1973b	0.005	Melons.	0.2		Residue limit is for ethion and its oxygen analogue expressed as ethion.
			0.0005		
fenthion 1972b	0.0005	Apples, pears, broccoli, Brussels sprouts, cabbage, lettuce, tomatoes. Cottonseed, oil (crude). Raw cereals (wheat, oats barley), rice (hulled), sugar beet tops. Cottonseed, cottonseed meal, carrots. Potatoes. Maize, fieldcorn (kernels), sweet corn (kernels and cobs, husks and silk removed), sunflower seed, sugar beet (roots).	2	(1978)	Residue limits refer to the sum of leptophos, its oxygen analogue and desbromoleptophos, expressed as leptophos.
			1		
leptophos 1975b	0.001 (1978)		0.5		
			0.2		
			0.1		
			0.05		

Annex 1 (continued)

Pesticide and references to previous evaluations	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits		Remarks	
			Maximum residue limit (mg/kg)	Guideline level (mg/kg)		
lindane 1967b, 1968b, 1970b, 1974b, 1975b	0.01 (1977)	Lettuce, endive.	2			
		Cocoa beans, kohlrabi, radish.	1			
		Apples, cherries, grapes, pears, plums, red-currants, Brussels sprouts, cabbage (including red cabbage), savoy, cauliflower.	0.5		(1977)	
		Peas, sugar beet (roots), sugar beet (leaves)	0.1			
		Potatoes, rape seed	0.05*			
methidathion 1973b	0.005				With the allocation of an ADI the temporary tolerances recommended by the 1972 Meeting are confirmed as maximum residue limits.	
methomyl	no ADI	Alfalfa, peas, sorghum and soybean forage, barley, oat and wheat straw.		10		
		Cabbage, lettuce, peanut forage, spinach.		5		
		Celery.		3		
		Apples, citrus (oranges, lemons, grapefruit, tangelos), mint hay.		2		
		Cauliflower, grapes, hops (dried), nectarines, peppers, snap beans, tobacco (flue cured), tomatoes.		1		
		Cucumbers, eggplant, onions (green).		0.5		
		Asparagus, barley, cantaloupes, melons, onions (dry), peas (green), pineapples, sorghum, summer squash, watermelons.		0.2		
		Beans (dry), cottonseed, oats, peanuts, peanut hulls, potatoes, soybeans, sugar beets, wheat, sweet-corn.		0.1		
		Meat, milk.		0.02*		
		Apples, pears, tomatoes.		1		
		monocrotophos 1973b	0.0006			

omethoate 1972b	0.0005 (1978)	Hops (dry). Grapes. Sugar beet (leaves). Sugar beet (roots), potatoes.	3 2 1 0.05	(1978)	Residue limits are for omethoate arising from treatment with dimethoate or omethoate, expressed as dimethoate. The limits previously recommended for dimethoate apply also to omethoate.
parathion-methyl 1969b, 1973b	0.001 (1978)	Tea (fermented and dried), tomatoes. Sugar beet, hops (dry cones).	0.2 0.05*	(1978)	Residue limits are for parathion-methyl and its oxygen analogue.
2-phenylphenol (and sodium salt) 1970b	1	Apples.	25		Referred to as o-phenylphenol in FAO/WHO 1969a.
phosalone 1973b	0.006	Fat of sheep. Meat of sheep.	0.5 0.05 *		
quintozene 1970b, 1974b, 1975b	0.007	Peanuts (whole). Bananas (whole). Lettuce, peanuts (kernels). Beans (navy), potatoes. Tomatoes. Cottonseed. Broccoli, cabbage. Bananas (pulp), beans (other than navy), peppers (bell).	5 1 0.3 0.2 0.1 0.03 0.02 0.01		With the allocation of an ADI, the temporary tolerances previously recommended are confirmed as maximum residue limits.
thiabendazole 1971b, 1972b, 1973b	0.05	Potatoes (unwashed). Potatoes (washed). Milk. Meat and meat products of cattle goats, horses, pigs and sheep.	10 3 0.1 * 0.1 *		Residue limits are for thiabendazole and 5-hydroxy-thiabendazole expressed as thiabendazole.
thiophanate-methyl 1974b	0.08	Meat and fat of chickens.	0.02 *		Residue limits are for total residue of thiophanate-methyl and carbendazim, expressed as carbendazim. Recommendation is additional to 1973 recommendations, which are no longer temporary.
trichlorfon 1972b	0.005 (1978)	Lettuce, spinach. Tomatoes. Raw cereals including maize.	0.5 0.2 0.1	(1978)	

* Level at or about the limit of determination.

Annex 2

**FURTHER WORK OR INFORMATION REQUIRED
(OR DESIRABLE)**

If a compound has been considered at earlier meetings the requirements listed below replace those stated in earlier reports, unless otherwise indicated.

ALDRIN/DIELDRIN

Required

1. Information on current use patterns and residue monitoring to indicate the level and incidence of aldrin/dieldrin residues in food.

BENOMYL

Required (before an acceptable daily intake can be allocated)

1. Long-term studies in at least one mammalian species.
2. Short-term studies in several animal species including a non-rodent mammalian species.
3. Acute oral studies in several animal species.

Desirable

1. A supplementary carcinogenic study.
2. Observations in man.
3. Further development of analytical methods for the separate determination of benomyl and carbendazim.
4. Further information on residues in food in commerce.

BIORESMETHRIN

Required (before an acceptable daily intake can be allocated)

1. Full toxicological data.

Desirable

1. Further information on the level and fate of bioresmethrin on different classes of raw grains.
2. Residue data from supervised trials on other stored commodities, including nuts, peanuts, lentils, dried fruit and dried vegetables.
3. Information on residues in fruit and vegetables following approved uses.
4. Further information on the level and fate of residues in food at the point of consumption following the use of bioresmethrin for the control of various stored-product pests.
5. Improved procedures for the determination of bioresmethrin residues in fruit and vegetables as well as stored products.

BROMOPHOS

Required (by 30 June 1977, in addition to the information listed in FAO/WHO 1973a, p. 42, and before additional maximum residue limits can be recommended)

1. Residue data on fat of meat of domestic animals other than sheep (including residues in milk products, poultry, and eggs) and on peanuts, for which recommendations have not been made.

Desirable (in addition to the information listed in FAO/WHO 1973a, p. 42)

1. Further information on residues in stored wheat and on rice following storage and processing under full-scale commercial conditions.

BROMOPHOS-ETHYL

Desirable (in addition to the information as listed in FAO/WHO 1973a, p. 43)

1. Residue data from supervised trials on cereals other than maize, on cotton and on fruit and vegetables after repeated application where this forms a part of good agricultural practice.

2. Further information on use patterns including data on rates, frequencies of application, and pre-harvest intervals, especially on black and red currants, peaches, strawberries, blackberries or raspberries, Brussels sprouts, cauliflower, kale, sugar beets and sugar beet tops, together with residue data where appropriate.

3. Further information on the fate of residues in vegetables after cooking, especially carrots and spinach.

sec-BUTYLAMINE

Required (before 30 June 1978)

1. Fate of residues especially after processing of meat and milk.
2. Quantitative metabolic studies in animals.
3. Information on the fate of *sec*-butylamine residues in livestock when citrus pulp and citrus molasses containing *sec*-butylamine are used as components in the ration of livestock.
4. Information on the use of *sec*-butylamine for the control of post-harvest rot on fruits other than citrus and on residues resulting from such uses.

Desirable

1. Mutagenicity studies with techniques currently available.
2. Clinical observations in man.

CHLORDIMEFORM

Required (before 30 June 1978)

1. Long-term study to consider the occurrence of changes in liver and bile duct of rats.
2. Further metabolic studies in several animal species including observations in man.
3. Further studies to elucidate the mode of action.
4. Continued observations on the possible occurrence of haemorrhagic cystitis in people exposed to chlordimeform.

5. Information to justify the short pre-harvest interval on pears in the USA.

CHLORPYRIFOS-METHYL

Required (before additional maximum residue limits can be recommended)

1. Information on residues in animal tissues, fat and eggs following feeding of chlorpyrifos-methyl residues in animal feeds.

Desirable

1. Appropriate mutagenicity study.
2. Neurotoxicity study with histological examination of nervous tissues.
3. Information on evidence of residues in commerce.
4. Further information on residue disappearance in practical grain storage at low temperatures and low humidities.

COUMAPHOS

Required (by 30 June 1978)

See FAO/WHO 1973a, p. 44.

CYANOFENPHOS

Required (by 30 June 1978)

1. Data on absorption, metabolism and excretion in at least one mammalian species.
2. Studies to identify and investigate toxicity of plant metabolites.
3. Distribution of residues in rice and their fate during processing and cooking.
4. Information on residues in dry green and dry manufactured (fermented) tea.
5. Studies on residues in sheep following dipping and spraying.

6. Results of ongoing studies on the feeding of poultry to determine the fate of residues in tissues and eggs.

7. Further information on the fate of residues in cabbage during processing and cooking.

Desirable

1. Observations in man including cholinesterase studies.
2. Appropriate mutagenicity study.
3. A further long-term study.
4. Information from trials in countries other than Japan.
5. Studies to determine whether cyanofenphos residues can be determined by current multi-residue methods.

DEMETON

Desirable

1. Validation of residue analytical method for regulatory purposes.
2. Residue data from supervised trials for commodities not mentioned above or under disulfoton, but included in national tolerance lists.
3. Data on residues in commodities moving in commerce.

DISULFOTON

Desirable

1. Residue data from supervised trials for commodities not mentioned above, but included in national tolerance lists.
2. Results from studies now in progress (expected in the spring of 1976) on residues in meat, milk and eggs after feeding animals on fodder treated with disulfoton in order to determine residue limits in food of animal origin.
3. Information on residues in food moving in commerce.

ENDOSULFAN

Desirable

The request for further work (FAO/WHO 1975a, p. 35) is reaffirmed.

FENTHION

Required (by 30 June 1978, in addition to the information listed in FAO/WHO 1972a, p. 43 and before additional maximum residue limits can be recommended)

1. Residue data from supervised trials in accordance with good agricultural practice on other citrus fruits (especially lemons), coffee, cucurbits, onions and potatoes, and additional residue data on sugar beet roots and tops.

Desirable

See FAO/WHO 1972a, p. 43.

LEPTOPHOS

Required (before 30 June 1978)

1. Studies on the kinetics of accumulation of leptophos in storage depots of two species, preferably non-rodent to investigate the potential build-up in man to ultimate threshold levels.

2. Studies on the species variation for delayed neurotoxicity with leptophos to assess its ultimate effect on man.

3. Epidemiological studies on people in exposed occupations in agriculture or industry.

4. Further long-term low-level feeding studies in a species susceptible to the delayed neurotoxicity syndrome.

5. Residue data on the major crops for which national tolerances or use recommendations exist, e.g., tea, vegetables not included in the recommendations, and citrus fruits.

6. Residues in those parts of agricultural commodities which are used either as such or as agricultural waste for animal feed.

Desirable

1. Improved methodology for assessing the delayed neurotoxicity syndrome.

2. Studies on the mechanism of neurotoxic action of leptophos. Further investigations into mechanism of action of tri-*o*-cresyl phosphate and other neurotoxic agents as compared to leptophos.

3. Data on current use patterns in countries outside the USA and Canada and on residue levels resulting from those uses.

LINDANE

Required (by 30 June 1978)

See FAO/WHO 1975a, p. 39.

MALATHION

Desirable

1. Further information on residues in stored grains resulting from good storage practice including storage at relatively low temperature and humidity and the effect of milling, cooking and baking on these residues.
2. Residue data from supervised trials in countries where malathion is used.

METHIDATHION

Desirable

As FAO/WHO 1973a, p. 45, excluding item 1.

METHOMYL

Required

1. Full toxicological data (before an acceptable daily intake can be recommended).
2. Modification or refinement of available methods of residue analysis to make them suitable for regulatory purposes.

Desirable

1. Further data on the disappearance of residues during storage and processing.
2. Further residue data from countries other than the USA.

MONOCROTOPHOS

Desirable

As FAO/WHO 1973a, p. 45, excluding item 2.

OMETHOATE

Required (by 30 June 1978)

1. Long-term studies in at least one species.

Desirable

1. Information on residues occurring in food in commerce.

PARATHION-METHYL

Required (by 30 June 1978)

1. Oral studies on teratogenesis and on reproduction in species appropriate to such tests.

Desirable

1. Adequate long-term studies in at least one mammalian species.
2. Information on current use patterns in various countries on crops for which no recommendations are made and on residue levels resulting from such uses.

QUINTOZENE

Required (before additional maximum residue limits can be recommended)

1. Information on the occurrence of hexachlorobenzene and pentachlorobenzene in plant and animal products, including animal feeds, resulting from the use of quintozene as well as from other sources, as a basis for making recommendations for practical residue limits for both hexachlorobenzene and pentachlorobenzene.

2. Further studies on the nature and levels of residues on animal products following feeding of plant materials containing residues typical of those resulting from the use of quintozene in agriculture.

Desirable

1. Further research to elucidate the formation of subcutaneous fibrosarcomas in female mice.

THIABENDAZOLE

Desirable

1. Data on current use patterns in various countries, especially on pre-harvest uses, and on resulting residue levels including those on grain crops, strawberries and tomatoes.

THIOPHANATE-METHYL

No information required or desirable other than items listed in FAO/WHO 1974a, p. 41, with the exception of items 1 and 2 of desirable information.

TRICHLORFON

Required (before 30 June 1978)

1. Long-term carcinogenicity study.

Desirable

1. Further studies on the spontaneous conversion of trichlorfon to dichlorvos *in vitro* and *in vivo* and on the possible intermediates involved.

GLOSSARY ^a

Pesticide

A pesticide is any substance or mixture of substances intended for preventing or controlling any unwanted species of plants and animals and also includes any substances or mixture of substances intended for use as a plant-growth regulator, defoliant or desiccant.

Explanatory note. The term "pesticide" includes any substance used for the control of pests during the production, storage, transport, marketing or processing of food for man or animals or which may be administered to animals for the control of insects or arachnids in or on their bodies. It does not apply to antibiotics or other chemicals administered to animals for other purposes, such as to stimulate their growth or to modify their reproductive behaviour; nor does it apply to fertilizers.

Pesticide residue

A pesticide residue is any substance or mixture of substances in food for man or animals resulting from the use of a pesticide and includes any specified derivatives, such as degradation and conversion products, metabolites, reaction products and impurities which are considered to be of toxicological significance.

Explanatory note. The term "pesticide residue" includes residues from unknown sources (i.e., background residues) as well as those from known uses or the chemical in question.

Good agricultural practice in the use of pesticides

Good agricultural practice in the use of pesticides is the officially recommended or authorized usage of pesticides under practical conditions at any stage of production, storage, transport, distribution and processing of food and other agricultural commodities, bearing in mind the variations in requirements within and between regions and taking into account the minimum quantities necessary to achieve adequate control,

^a The definitions given in this glossary are those adopted for use in Joint FAO/WHO Meetings on Pesticide Residues and are not necessarily of universal validity.

the pesticides being applied in such a manner as to leave residues that are the smallest amounts practicable and that are toxicologically acceptable.

Explanatory note. The "officially recommended or authorized" usage is that which complies with the procedures, including formulation, dosage rates, frequency of application and pre-harvest intervals, approved by the relevant authorities.

Acceptable daily intake

The acceptable daily intake of a chemical is the daily intake which, during an entire lifetime, appears to be without appreciable risk on the basis of all the known facts at the time. It is expressed in milligrams of the chemical per kilogram of body weight.

Explanatory note. For this purpose "without appreciable risk" is taken to mean the practical certainty that injury will not result even after a lifetime of exposure. Furthermore, for a pesticide residue, the acceptable daily intake is intended to give a guide to the maximum amount that can be taken daily in the food "without appreciable risk" to the consumer. Accordingly, the figure is derived as far as possible from feeding studies in animals and/or man. The studies are usually conducted with the pesticide chemical itself. However, if the residues of a pesticide are known to consist of more than one chemical that may influence the toxicology of the residue (see definition of "pesticide residue"), information on the toxicology of the residual chemicals and, where appropriate, their acceptable daily intakes have to be taken into account when assessing the risks (see section 2.3 of the report of the 1969 Joint Meeting for further information concerning the inclusion of metabolites). Acceptable daily intakes are always subject to revision at any time in the light of new information.

Temporary acceptable daily intake

A temporary acceptable daily intake is an acceptable daily intake established for a specified, limited period.

Explanatory note. A specified period is provided to enable additional biochemical, toxicological or other data to be obtained, as may be required for establishing an acceptable daily intake (see definition of "further work required"). In such cases any recommendation will normally involve the application of a safety factor, the size of which will depend on the nature of the toxicity of the compound but which will be larger

than that normally used in estimating acceptable daily intakes. In all cases the position will be reviewed not later than the first meeting following the specified date.

Conditional acceptable daily intake

A conditional acceptable daily intake is one that is established for a pesticide in order to limit its use to those situations where no satisfactory substitutes are available.

Potential daily intake

The potential daily intake of a pesticide is the theoretical intake calculated on the basis of the maximum residue limits and/or extraneous residue limits and the *per caput* consumption of the relevant food commodities per day.

Maximum residue limit

A maximum residue limit is the maximum concentration of a pesticide residue resulting from the use of a pesticide according to good agricultural practice directly or indirectly for the production and/or protection of the commodity for which the limit is recommended. The maximum residue limit should be legally recognized. It is expressed in milligrams of the residue per kilogram of the commodity.

Explanatory note. The expression "maximum residue limit" replaces the formerly used "tolerance" in accordance with the practice initiated by the 1972 Joint Meeting.

Temporary maximum residue limit

A temporary maximum residue limit is a maximum residue limit established for a specified, limited period.

Explanatory note. The expression "temporary maximum residue limit" replaces the formerly used "temporary tolerance" in accordance with the practice initiated by the 1972 Joint Meeting.

A temporary maximum residue limit is proposed under either of the following conditions :

(i) when only a temporary or conditional acceptable daily intake has been established for the pesticide concerned ; or

(ii) when, although an acceptable daily intake has been established, the residue data are inadequate for firm maximum residue recommendations.

Residues for which data are inadequate include those for which information on losses of residue during storage, handling and preparation is inadequate and for which calculations based on the inadequate figures indicate that the potential daily intake could be exceeded. In cases of this kind temporary maximum residue limits are recommended only after the Joint Meeting has considered information on the actual occurrence of residues in food, obtained from total diet and similar studies, and after it is satisfied that the potential daily intake is not likely to be exceeded. The information considered includes the results from subjective and/or objective sampling, including total diet studies, in various countries and particularly in places where pesticides are most widely used. Temporary maximum residue limits will be reviewed no later than the first meeting following the specified date.

Extraneous residue limit

An extraneous residue limit is, for a particular commodity, the maximum toxicologically acceptable concentration of a residue unavoidably arising from sources other than the use of a pesticide directly or indirectly for the production of that commodity. The extraneous residue limit should be legally recognized.

Explanatory note. Residues in food of animal origin arising from residues in animal feed derived from activities that are controllable by farming practices are covered by "maximum residue limits". The term "practical residue limits" which has led to much confusion has been abandoned.

Guideline level

A guideline level is the maximum concentration of a pesticide residue that might occur after the officially recommended or authorized use of a pesticide for which no acceptable daily intake or temporary acceptable daily intake is established and that need not be exceeded if good practices are followed. It is expressed in milligrams of the residue per kilogram of the food.

Total diet study

A total diet study is a study designed to establish the pattern of pesticide residue intake by a person consuming a defined diet.

Explanatory note. To make total diet studies, random samples of food are usually purchased in representative population centres in the country or district concerned and weighed out in the proportions in which they are consumed in the total diet. The weighed portions are then washed, cooked or otherwise prepared in the normal way for table presentation and then mixed to give a number of predetermined food group samples comprising, for example, cereals, green vegetables, root crops, fruits and preserves, fats, meats and milk. These groups are chosen with the intention of minimizing the subsequent analytical problems; they also serve to identify the areas of the diet which contribute most to total residues present. The foods are purchased and prepared under expert supervision with the requirements of the studies in mind, but otherwise they resemble as far as possible the normal character of the total diet. Water and beverages are included. Each food group sample, prepared as above, is analysed for various residues. This may involve several different analyses for each group. The exact analytical procedure may vary from group to group. In addition, from experience, it may become possible to omit certain analyses for some groups. Thus, the different groups will not necessarily be subject to exactly the same analytical procedure. Similar studies have also been described as "market basket" studies.

Subjective sample

A subjective sample is a sample of a food or other agricultural commodity taken after a known or suspected use of a pesticide thereon.

Explanatory note. Subjective samples include those taken during the early stages of the introduction of a pesticide into practical application, when it is desirable to ascertain the residues occurring after known methods of application in the field, as well as those taken in circumstances where there are reasons to suspect that good agricultural practices have not been followed. Such samples may relate to crops from specific sites or from districts or countries where the use of particular pesticides is known or suspected. Subjective sampling, rather than total diet studies, is sometimes used to assess the actual danger to consumers, particularly where the sampling and analytical facilities are limited; it enables the facilities to be concentrated on those categories of food intake considered to offer the greatest risks. Subjective sampling also enables certain of the analytical difficulties encountered in total diet studies to be avoided.

Objective sample

An objective sample is a sample of a food or other agricultural commodity taken at random.

Explanatory note. The samples taken during total diet intake studies fall into this category.

Regulatory method of analysis

A regulatory method of analysis is a method suitable for the determination of a pesticide residue in connexion with the enforcement of legislation.

Explanatory note. For this purpose, it is often necessary to identify the nature of the residue as well as to determine its concentration. Subject to any expression of requirements in the particular legislation, the accuracy, precision and limit of determination of a regulatory method need be sufficient only to demonstrate clearly whether or not a maximum residue limit has been exceeded. Usually, regulatory methods are not specified in pesticide residues legislation, and at any given time there may be a number of methods suitable for a particular purpose.

Further work required

Further work required is work that must be done, properly reported and made available to the Joint Meeting within a specified period before acceptable daily intakes and/or maximum residue limits can be recommended or confirmed.

Explanatory note. In certain instances, although acceptable daily intakes have been established, further work has been considered to be essential to remove doubts about the toxicological significance of some experimental observations. Results of the further work required should be made available not later than the specified date, after which the compound will be re-evaluated. The re-evaluation may be done at an earlier Meeting if relevant information should become available.

Further work desirable

Further work desirable is work which, when properly reported and made available to the Joint Meeting, would be expected to provide additional assurance that acceptable daily intakes and recommended

maximum residue limits are adequate for the protection of the health of the consumer.

Limit of determination

The limit of determination of a method of analysis is the lowest concentration of a pesticide residue that can be quantitatively measured in the specified commodity with an acceptable degree of certainty.

Limit of detection

The limit of detection of a method of analysis is the lowest concentration of a pesticide residue that can be qualitatively detected in a specified commodity.

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