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# **PESTICIDE RESIDUES IN FOOD**

**Report of the 1972 Joint Meeting of the FAO  
Working Party of Experts on Pesticide Residues  
and the WHO Expert Committee on  
Pesticide Residues**

Rome, 20-28 November 1972



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1972 JOINT MEETING OF THE FAO WORKING PARTY OF EXPERTS  
ON PESTICIDE RESIDUES AND THE  
WHO EXPERT COMMITTEE ON PESTICIDE RESIDUES

Rome, 20-28 November 1972

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# PESTICIDE RESIDUES IN FOOD

## Report of the 1972 Joint FAO/WHO Meeting

The Joint Meeting of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues was held in Rome from 20 to 28 November 1972. The Meeting was opened by Mr F. Albani, Director of the Plant Production and Protection Division of the Food and Agriculture Organization, on behalf of the Directors-General of the Food and Agriculture Organization of the United Nations and the World Health Organization. The FAO Working Party had already met in Rome from 14 to 18 November.

Mr Albani drew attention to the great increase in public interest in residues in food during the 11 years since FAO and WHO experts first met jointly to discuss the subject. Governments are also involved and in taking their decisions they need appraisals of the true facts on aspects that are sometimes controversial in nature. With UNDP funds, the two Agencies are cooperating in assisting developing countries to supervise the use of pesticides and to measure residues. Many countries now make use of the recommendations of the Joint Meeting, and many more are planning to do so.

### 1. INTRODUCTION

This annual Joint Meeting was held in pursuance of the recommendation 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 meetings contain information on acceptable daily intakes (ADIs) established, the tolerances recommended, and the methods of analysis suggested for the various pesticides considered. The supporting documents contain detailed monographs on these pesticides and include comments on analytical methods.

The present Joint Meeting was convened to consider a further number of pesticides, together with requests of both a general and a specific nature contained in the report of the Sixth Session of the Codex Committee on Pesticide Residues held from 16 to 23 October 1972.

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 methods of analysis for their determination.

The WHO Expert Committee was primarily responsible for :

(a) reviewing toxicological and other relevant 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 initiate, stimulate, and coordinate necessary research.

## 2. GENERAL CONSIDERATIONS

### 2.1 Principles adopted

Like its predecessors, this Meeting took account of the principles enumerated in the previous meetings and outlined in the report of the 1971 Joint FAO/WHO Meeting (FAO/WHO, 1972a). This and other documents arising from the meetings of FAO/WHO on pesticide residues are listed in the reference section (see p. 21).

### 2.2 Clarification of the term " Temporary ADI "

Until 1966 the Joint Meeting of the FAO Committee on Pesticides in Agriculture and the WHO Expert Committee on Pesticide Residues recommended ADIs that were defined (FAO/WHO 1965b) as :

The daily dosage of a chemical that, during an entire lifetime, appears to be without appreciable risk on the basis of all the facts known at the time. " Without appreciable risk " is taken to mean the practical certainty that injury will not result even after a lifetime of exposure.<sup>1</sup>

In 1966, the Joint Meeting adopted the concept of a *temporary ADI* established by a WHO Scientific Group on Procedures for Investigating Intentional and Unintentional Food Additives (WHO, 1967). The Scientific Group had recommended that temporary ADIs be used as a basis for the establishment of temporary tolerances only if the following specific conditions were rigidly adhered to :

(1) Each chemical additive must be considered on its merits.

(2) The temporary ADI must be established only for a specific and definite period, namely, 3-5 years.

(3) In setting a temporary ADI, the additional biochemical and toxicological data required for the eventual establishment of an ADI must be

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<sup>1</sup> A slightly revised version of this definition was published in *Wld Hlth Org. techn. Rep. Ser.*, 1970, No. 458, Appendix IV.

clearly stated. The additional requirements must be justified as being essential for the protection of the consumer.

(4) A review of the original and new data must be carried out before the expiration of the provisional period.

No alternatives or consequences were clearly specified in the event that the requested information was not forthcoming.

The present Joint Meeting discussed the procedures to be adopted in cases where temporary ADIs (and hence temporary tolerances) have been established, with specific requirements set out in an effort to establish an ADI, and where no data have been forthcoming before the specified date. In the light of the 4 recommendations of the Scientific Group, this Meeting decided that where a temporary ADI is established with requirements for toxicological data before a certain date and where such data are not forthcoming or are not being generated the temporary ADI (and hence the temporary tolerances) must be withdrawn until such time as data are available to allow reconsideration of the recommendations.

The Meeting emphasized that such a withdrawal of a temporary ADI does not necessarily indicate a potential health hazard but only that insufficient information is available at the time of review to permit the Meeting to state with reasonable certainty that there is no likelihood of adverse effects on health resulting from ingestion over a prolonged period. It is recognized that in some such cases there may be a need to inform regulatory authorities about the residue levels to be expected in food items when these pesticides are used in accordance with good agricultural practice. Where this is felt to be necessary, these will be presented as "guideline levels" in the report and monographs of the Joint Meeting. These figures must not be confused with tolerances or temporary tolerances, which are fully supported by ADIs or temporary ADIs.

The Meeting recognized that there is often a lack of adequate toxicological data on pesticides for which no commercial company has exclusive rights but that are readily available and currently used in many countries. The Meeting endorsed the recommendation of the previous Committee that urgent attention be given to the possibility that international organizations, governments, or interested parties provide support for the research required in these cases.

### **2.3 Future work proposed for studies on cholinesterase-inhibiting compounds**

The attention of the Meeting was drawn to recent work published in Japan<sup>1</sup> suggesting that certain ophthalmological effects may have been

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<sup>1</sup> Imaizumi, K. & Atsumi, K. (1971) *Ganka*, 13, 717-724; Ishikawa, S. (1972) *Nippon Ganka Kyo*, 23, 569-583.

induced by exposure to organophosphorus insecticides. Studies were also reported in the USA<sup>1</sup> on the modification of electroencephalographic patterns in certain experimental animals following long-term exposure to low levels of cholinesterase-inhibiting compounds. Insufficient information was available to permit any conclusion to be reached on the relationship of these studies to the toxicological assessment of cholinesterase-inhibiting compounds. The Meeting felt, however, that attention should be drawn to these possible effects in the hope that future work to determine their significance will be forthcoming.

The significance of potentiation studies was also considered. It was recognized that data from acute potentiation studies on cholinesterase-inhibiting insecticides are of little direct value in assessing the acceptable daily intake for man. However, they are of value in assessing potential hazards to persons applying insecticides. The Joint Meeting in 1967 noted that no evidence of potentiation was detected when several acutely synergistic pairs of compounds were administered in short-term tests on experimental animals at low dietary levels. That meeting, however, suggested that consideration be given to the usefulness of inhibition of carboxylesterases ("aliesterases") as a criterion for assessing a no-effect level of these compounds, which inhibit carboxylesterases at lower concentrations than those that inhibit cholinesterases. Recent short-term feeding studies<sup>2, 3</sup> have demonstrated that a large number of organophosphorus insecticides are more potent inhibitors of liver and serum carboxylesterases than of cholinesterases. Although there is strong evidence that inhibition of carboxylesterases is a factor in the potentiation of the acute toxicity of insecticides and other chemicals that depend upon these enzymes for their detoxification, the physiological significance of carboxylesterase inhibition is still unknown. The present Meeting noted that potentiation of acute toxicity occurred when several of the compounds reviewed were tested with other anticholinesterase insecticides. The Meeting was of the opinion that it is desirable to investigate further the mechanisms of these interactions and to determine the part played by carboxylesterases. When further pairs of pesticides that potentiate one another strongly in acute tests are evaluated, it would be desirable to determine, with regard to both cholinesterase inhibition and other toxicological parameters, whether this potentiation persists at low dietary levels (of the order of the no-effect level of cholinesterase depression or multiples of this).

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<sup>1</sup> Santolucito, J. A. & Morrison, G. (1971) *Toxicol. appl. Pharmacol.*, **19**, 147-154.

<sup>2</sup> Su, M., Kinoshita, F. K., Frawley, J. P. & DuBois, K. P. (1971) *Toxicol. appl. Pharmacol.*, **20**, 241-249.

<sup>3</sup> Murphy, S. D. & Cheever, K. L. (1968) *Arch. environm. Hlth*, **17**, 749-758.

## 2.4 DDT

Following the publication of a report<sup>1</sup> indicating that long-term exposure of several generations of mice to DDT resulted in an increasing incidence of tumours at various sites in later generations, the ADI of DDT was changed to a "conditional ADI" and lowered from 0.01 mg per kg of body weight to 0.005 mg/kg by the Joint Meeting in 1969 (FAO/WHO, 1970a). Having reviewed an interim publication from the authors of the report, the Joint Meeting in 1967 had already recommended that the IARC initiate extensive testing of the possible carcinogenicity of DDT. Results of these studies, carried out in parallel at the IARC laboratory in Lyon and the National Institute for the Study and Therapy of Tumours in Milan, showed that exposure of two strains of mice to the highest dose level of DDT used (250 mg of DDT per kg of animal diet, equivalent to a daily intake of 37.5 mg per kg of body weight) resulted in an increased incidence of parenchymal liver cell tumours, some of which were malignant. At this high level of exposure, the tumour incidence was increased in both sexes and there was a significant shortening of the life span. At the lowest dose level (2 mg of DDT per kg of animal diet, equivalent to a daily intake of 0.3 mg per kg of body weight) an increased incidence of liver tumours was observed in the males of one strain only. Results from tests on these two strains of mice did not confirm the occurrence of tumours at multiple sites, nor was there any increase in incidence of tumours at any site from the first generation to the second. The Meeting noted that the lowest dose tested in the mice was more than 100 times the average daily intake for man.

After examining the new information, the Meeting felt that it was not yet in a position to evaluate the nature and implication of all the data available. It considered, however, that the "conditional ADI" of 0.005 mg per kg of body weight as defined and established at the 1969 Joint Meeting should be maintained, and that this conditional ADI should be reconsidered when further results from current and additional studies, in particular comparative metabolic and epidemiological studies, become available. Moreover, the Meeting recognized that there are particular circumstances where the benefits to man arising from the proper use of DDT outweigh the possible risk from exposure and, in this respect, agreed with the views of the 1969 Joint Meeting.

## 2.5 Organomercury fungicides

Attention was drawn to the statement of the FAO/WHO Expert Committee on Food Additives (FAO/WHO, 1972d) that "the use of alkyl or aryl mercury fungicides as seed-treating agents should be discouraged and the Committee recommends that the use of mercury compounds in

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<sup>1</sup> Tarján, R. & Kemény, T. (1969) *Food Cosmet. Toxicol.*, **7**, 215-222.

agriculture be reviewed, in the light of this report, by the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues". As the report was seen for the first time at the meeting it was not possible to carry out a full review. However, the subject was considered on the basis of the personal knowledge of the Experts present and in the light of the discussion of the subject at previous Joint Meetings.

As recorded in earlier monographs (FAO/WHO, 1967b and 1968b), a wide range of organomercury compounds are used in agriculture. These fall into three main classes: alkyl, alkoxy-alkyl, and aryl compounds. In 1967, the main usage of these compounds was for the treatment of cereal and other seeds before sowing. Other applications included the treatment of rice plants at early stages of growth and of fruit trees before flowering. The latter have since become less frequent and at present seed dressings are the only significant agricultural usage.

Although it was not possible at the present meeting to conduct a detailed enquiry into the various reasons for treating seeds with fungicides or into the efficacy of possible replacements, it is known that mercury dressings are needed in certain situations and against particular plant diseases. Satisfactory alternatives are not currently available. It is recognized that at least a small proportion of the more volatile alkylmercury compounds are needed in the formulation to obtain effective results from dressings. The fungicidal activity of alkylmercury compounds is much greater than that of arylmercury ones and treatment levels increase very considerably according to whether alkylmercury, alkoxy-alkylmercury, or arylmercury compounds are used.

The Meeting noted that organomercury fungicides, particularly the alkylmercury compounds, have been implicated in incidents of poisoning, including fatal poisoning in man. The most serious incidents have been due to the consumption of treated seed accidentally or improperly diverted from its intended use for sowing. Some evidence was also examined concerning the extent to which seed dressings contribute to the amount of mercury in the environment. Bearing in mind that arylmercury and other forms of mercury can be transformed into alkylmercury (principally methylmercury) compounds by certain organisms in nature, the evidence did not clearly differentiate between the potential contributions of arylmercury and alkylmercury compounds and that of naturally occurring inorganic mercury.

However, it is clear that the amount of mercury used in agriculture represents only a small proportion of the total released into the environment from all sources, e.g., in the USA, agricultural uses account for only some 2% of the release of mercury.<sup>1</sup> The amount of mercury added to soil

<sup>1</sup> Nobbs, C. L. (1972) *Mercury use and social choice*. OECD Report 84810, Paris.

by seed dressings is usually small in comparison with the normal levels of mercury in the soil. There is very little likelihood of mercury from treated seeds finding its way into streams or other water, except as a result of gross carelessness.

The Meeting confirmed the view of the 1967 Meeting (FAO/WHO, 1968b) that the uptake of mercury into crops from dressed seed was insignificant as a potential source of food contamination. However, in view of serious cases of human poisoning by mercury fungicides and the difficulty of preventing dressed seed from being diverted for consumption by man or animals, especially in certain countries, the Meeting recommended that further study should be given to the question of replacing them, wherever possible, by compounds less likely to produce such poisoning incidents.

## **2.6 Methods of pesticide residue analysis**

Recognizing the need for guidance on methods of residue analysis, the Meeting reaffirmed the view of the 1969 Joint Meeting (FAO/WHO, 1970a) that an effort would be made to provide advice on the most suitable methods for regulatory purposes in connexion with each compound. The Meeting drew attention to the fact that methods that are adequate for the determination of residues from supervised trials of known pesticides are not necessarily satisfactory for regulatory purposes when samples with an unknown history of pesticide treatment are being examined. A method suitable for assessing whether a specified commodity complies with a recommended tolerance for one pesticide is unlikely to indicate whether that commodity also complies with limits for residues of other pesticides.

In view of variations in the analytical results due to experimental conditions, the presence of other pesticides or their metabolites, or the presence of other contaminating compounds of either natural or synthetic origin, it is also impossible to specify any procedure that will always satisfactorily determine a residue of a particular pesticide in any substrate. It is usually necessary to adapt a generally acceptable procedure to the particular circumstances involved, i.e., the reason for the analysis, the nature of the sample, the nature of the residue, and the type of interference likely to be met. In addition, some form of positive identification of the residue is highly desirable, particularly if the tolerance appears to be exceeded.

The Pesticide Residue Analysis Commission of the Pesticides Section of IUPAC has made several general recommendations to previous Joint Meetings relating to the multiresidue methods of analysis available for organochlorine (FAO/WHO, 1970a; FAO/WHO, 1971a), organophosphorus (FAO/WHO, 1971a), and fumigant (FAO/WHO, 1972a) compounds, and also on procedures for organic and inorganic mercury compounds (FAO/WHO, 1972a). The Meeting reaffirmed that these procedures provide a sound basis for regulatory methods. It again stressed the importance of expertise and experience on the part of the residue analyst (FAO/

WHO, 1970a). The section of the draft report of the Sixth Session of the Codex Committee on Pesticide Residues (FAO/WHO, 1972c) referring to methods of residue analysis was also considered. The Meeting agreed with the view expressed by the Codex Committee that when considering the relative merits of several published methods preference be given to multi-residue methods that have been subjected to collaborative check sample procedures. When such collaborative procedures are lacking the best methods available should be chosen.

### **2.7 Residue limits "at or about the limit of determination"**

Many approved uses for pesticides do not give rise to detectable residues in food commodities at harvest or at any stage thereafter. Such situations represent the ideal of "good agricultural practice". Examples of such cases have come to the notice of the Joint Meeting in the past and reference has been made in the corresponding monographs, but it has been usual to assume that no recommendation for a residue limit was required and generally none has been made. The absence of a recommendation can, however, indicate either that no residue occurs or that the question has never been considered by the Meeting, and this distinction needs to be made clear in the report.

Any reference to "nil" or "zero" (in respect to residues) is scientifically unsound and unenforceable; inspecting authorities need to know how close traces are to zero when determined by recommended methods. The Meeting therefore decided to recommend residue limits "at or about the limit of determination" in those cases where data indicate that there is little likelihood that significant residues would result from approved uses of the specific pesticide concerned.

The magnitude of such limits depends upon the pesticide, the food, and the method of determination. In certain instances it would be possible to propose a somewhat lower figure than that recommended but the validity of such low figures would often be questionable. At these low levels experience with the method and considerable care are required to eliminate interference from a variety of artifacts and contaminants. The identity of such traces is often difficult to prove.

Examples of tolerances recommended by the Meeting on this basis are to be found in Annex 1 and in the corresponding monographs relating to: bromophos, bromophos-ethyl, carbophenothion, chlormequat, chlorpyrifos, dioxathion, diquat, ethion, fensulfothion, fentin compounds, methidathion, monocrotophos, and paraquat.

### **2.8 Classification of residues in foods of animal origin**

Uptake of pesticides by animals, leading to residues in animal products, can occur following either direct application of the pesticide to the animal or its housing or ingestion of feed carrying residues of pesticides. In the

first of these situations the application of the pesticide is deliberate and can therefore be controlled by the farmer. Limits for residues in animal products (meat, milk, eggs) following such treatments should therefore normally be considered as tolerances, rather than as practical residue limits.

In recognition of the fact that residues in animal products can result from residues in feed and that such animal feeds enter into commerce, the Meeting felt it would be appropriate to consider data and to make recommendations on residues in such animal feeds. The residues in the products (meat, milk, eggs), resulting from the ingestion of feeds containing pesticides, would be considered for tolerances or for practical residue limits. These limits would be designated tolerances or practical residue limits, depending upon whether or not it was known at the time of application of the pesticide that the crop was to be fed to animals. For example, in the following cases (a) and (b) would normally be considered as practical residue limits, (c) and (d) as tolerances.

(a) where unintentional residues (see definition FAO/WHO, 1970a, Appendix IV) occur in animal feeds that have not themselves been treated e.g., drift from other areas, carry over of pesticide persisting in the soil from application to an earlier crop ;

(b) where waste such as skins, pulp, offal, stems, stubble, and trash from crops grown primarily for human food may sometimes be fed to animals ;

(c) where crops produced mainly for human food (e.g., cereal grains) are also fed to animals ;

(d) where pesticides are applied to crops produced mainly for animal feed (pasture, straw, forage, etc.).

The Meeting considered a number of examples of residues in meat, milk, and eggs, resulting from the feeding of rations or the grazing of pasture that had been treated with approved pesticides, and recommended appropriate tolerances. Generally these residue levels were low, even when the animals only received rations treated with pesticide.

Examples of tolerances for residues in animal products may be found in the recommendations for chlormequat, chlorobenzilate, diquat, fen-sulfothion, methidathion, monocrotophos, and paraquat.

In many instances the feeding of treated plant products did not produce a detectable residue in animal products and in these instances the limits recommended are "at or about the limit of determination by the recommended method" (see section 2.7).

## 2.9 Response to requests for information

Over the past years it has become evident that certain compounds have been readily available from many manufacturers, so that there is no single manufacturer or organization that might provide a source of residue or

toxicological information required by the Meeting. It is unlikely that any single manufacturer would sponsor the additional studies or collect information requested by the Meeting.

Manufacturers' associations should be asked to solicit information from their Members and to consider the possibility of a collaborative effort to collect or generate the required data.

The Meeting acknowledged the assistance received from the Pesticides Section of IUPAC in initiating and maintaining work to satisfy the requirements of the Joint Meeting for information on the nature of terminal residues and on methods of analysis suitable for regulatory purposes. The hope was expressed that a suitably qualified organization would take up the task of collecting and collating the toxicological data required by the Meeting on those compounds not sponsored by single manufacturers.

### **2.10 Procedure for determining tolerance level**

The Meeting was informed of the difficulties arising in the Codex Committee on Pesticide Residues and the Codex Alimentarius Commission where a number of countries, while accepting the concept of good agricultural practices in the use of pesticides, found it difficult to accept into their legislation the numerical value of the tolerance necessary to accommodate the residues resulting from good agricultural practices in other regions. The impression appears to have been created that the residue limits recommended by the Joint Meeting are based on high figures that occur in exceptional circumstances. In the light of these difficulties the Meeting agreed to summarize the basic principles used by the Joint Meeting in arriving at its decisions.

#### *Data considered*

The Meeting considers published literature, government legislation submissions from manufacturers, and reports on research from various sources, including manufacturers, universities, and agricultural research stations. Generally the bulk of the information comes from manufacturers as submitted to regulatory authorities. Information from government agencies concerning permitted uses, results of residue surveys and analyses made on commodities moving in commerce, and the need to use a particular pesticide is valuable but rarely available.

#### *Good agricultural practice*

Only residue data from trials carried out in conformity with registered or approved use patterns are employed as a basis for recommendations. Attention is however paid to the effect on residue levels of the number of applications, application rates, and the interval between final application and harvest.

The uses of any compound against a pest on a particular crop vary considerably from region to region, owing to differences in ecology, climate, and cultural practices. The residue levels at harvest consequently vary over a range.

The Meeting considers the available information on agricultural practices and makes an effort to base recommendations only on normal conditions in the regions where there is a need to use the pesticide. If, in the opinion of the experts at the Meeting, the requirements of certain regions justify multiple applications or applications shortly before harvest, consideration is given to these needs. It would not be possible to recommend significantly lower levels without seriously interfering with pest control practices.

#### *Withholding periods or pre-harvest intervals*

The minimum interval permitted between the last application and harvest varies considerably from country to country. This does not necessarily mean that the residue level at harvest varies to the same degree. The practice of the Joint Meeting is to select results reflecting the most generally approved interval, unless there are special circumstances that indicate that some other interval should be considered.

#### *Nature and fate of residues*

Considerable attention is paid to the question of metabolites, degradation products, and impurities that might appear as residues in plant or animal products and the significance of each is considered. Where such substances appear as significant residues at or after harvest, appropriate mention is made in the recommendations.

Where available, data on disappearance during storage, processing, and cooking, are considered and reference is made in the monographs. However, since it is necessary to base the proposals on levels to be found in raw agricultural products, the tolerance levels normally recommended are much higher than those of the residues actually present in the prepared food eaten by the consumer.

To guide regulatory authorities in their examination of commodities moving in trade at some stage later than harvest, information on the rate of reduction during storage is provided, where this has been determined.

Likewise, information that indicates the location of the residue on or in the commodity (on skin, shell, leaves, husks, or in fat, meat, juice, pulp, etc.) is provided when available.

#### *Exceptional conditions*

Residue data resulting from an exceptional need to use high application rates immediately before harvest are not generally used as a basis for recommendations.

### 3. EVALUATION OF DATA FOR ACCEPTABLE DAILY INTAKES

#### 3.1 Organophosphorus insecticides

Eight organophosphorus compounds were considered for the first time : bromophos, bromophos-ethyl, carbophenothion, chlorpyrifos, fensulfothion, methidathion, monocrotophos, and phosalone. The Meeting established ADIs for chlorpyrifos, fensulfothion, monocrotophos, and phosalone, and temporary ADIs for the remainder.

Although the studies on bromophos were not up to present-day standards, the Meeting decided that the data were sufficient to permit recommendation of a temporary ADI. The design of the experiment and the low number of survivors in the long-term study in the rat raised doubts about the validity of the carcinogenicity study.

A temporary ADI was also established for bromophos-ethyl. A no-effect level for the cholinesterase-depressing activity of this compound was established in the rat and the dog. However, a true no-effect level was not demonstrated in the rat because urinary excretion of ascorbic and dehydroascorbic acid increased following ingestion of the substance. The implication of these findings should be clarified.

Effects of carbophenothion on reproduction were observed in the rat, but only at dosages known to cause maternal cholinesterase depression. Although human tests indicate that man may be less sensitive than the rat and the dog, the ADI was classified as temporary until the marked interspecies difference observed following subacute exposure has been further substantiated.

The ADI for methidathion was also classified as temporary, since the Meeting was concerned about the signs of hepatic impairment that occurred in a 2-year feeding study in the dog. Information was therefore required on the nature of the liver lesions, and the nature and origin of a pigment noted to be deposited in liver macrophages and hepatocytes. However, information on other species, including man, was adequate.

Four organophosphorus insecticides—ethion, mevinphos, coumaphos, and parathion-methyl—were re-evaluated. Considerable additional data were available for ethion enabling the Meeting to increase the ADI established by previous Joint Meetings (FAO/WHO 1968a).

On the basis of the additional data made available since the last review, it was possible to establish an ADI for mevinphos. The temporary ADIs were extended for coumaphos and parathion-methyl (see section 3.3).

### 3.2 Bipyridilium herbicides

The additional information required by the 1970 Joint Meeting having become available, it was possible to establish ADIs for the bipyridilium herbicides diquat and paraquat.

Man appears to be more susceptible than most laboratory animals to lung lesions following acute oral exposure to paraquat. The Meeting recognized, however, that there is usually only a tenuous relationship between the effects of acute and chronic exposure and therefore felt able to recommend an ADI. Nevertheless, the Meeting requested WHO to keep this compound under review and to try to obtain results of any further toxicological investigations.

### 3.3 Coumaphos and parathion-methyl

The present Meeting noted that no new data have become available on these two compounds, which are still extensively used. Since the 1966 Joint Meeting did not specify the action to be taken if the additional toxicological data required to confirm a temporary ADI had not been received within the stipulated time (see section 2.2), the present Meeting decided to re-evaluate coumaphos and parathion-methyl on the basis of the data on which the temporary ADIs were established. This resulted in a decision to extend the present temporary ADI for both compounds for a further 3-year period. While this decision is at variance with present recommendations (section 2.2) it was taken because the policy was not clearly established prior to this Meeting.

### 3.4 Chloropropylate

In the case of chloropropylate, the Meeting was informed that interest in this compound is negligible. Accordingly, in conformity with the statement of the 1966 Joint Meeting and since no further toxicological data had been presented, the temporary ADI was withdrawn.

### 3.5 Chlormequat

Chlormequat was evaluated by the Meeting for the first time. The available data were such that an ADI was established.

### 3.6 Piperonyl butoxide and pyrethrins

Piperonyl butoxide and pyrethrins were re-evaluated in the light of additional data presented to the Meeting. Although not all the data required by the earlier Joint Meetings were available, the Meeting determined that sufficient information existed to permit the establishment of ADIs for these compounds. It was noted that the further data required by previous Joint Meetings were still desired.

#### 4. EVALUATION OF DATA FOR TOLERANCES AND PRACTICAL RESIDUE LIMITS

##### 4.1 Matters referred to the Joint Meeting by the Codex Committee on Pesticide Residues

The draft report of the Sixth Session of the Codex Committee on Pesticide Residues (FAO/WHO, 1972c) contains certain matters that were referred to the Joint Meeting for clarification and advice, in particular the questions raised in paragraphs 52, 124, and 142.

It was possible to review the following compounds in the light of new data or to clarify questions from data filed with FAO: chlorobenzilate, coumaphos, crufomate, dicofol, dioxathion, ethion, fenchlorphos, formothion, and pyrethrins. The amendments, additions, or clarifications made at this Meeting are given in Annex 1 to the present report and in the relevant monographs (FAO/WHO, 1973b).

In the absence of adequate new data and while awaiting certain information from government agencies, it was not possible to provide further recommendations on: aldrin and dieldrin, azinphos-methyl, captafol, captan, carbaryl, DDT, fenitrothion, folpet, heptachlor, or quintozone.

The question of dichlorvos residues on vegetables was reviewed, especially in the light of the information in the 1970 monograph and the knowledge that the use of trichlorfon had given rise to significant residues of dichlorvos on vegetables. It was concluded that the recommendation made in 1970 should not be changed.

In the case of phosphamidon, a specific analytical method suitable for regulatory purposes is available and details are given in the monograph of the 1969 meeting (FAO/WHO, 1970b). Reference to the bioassay method was deleted from the table of recommendations in Annex 1 of the 1971 report (FAO/WHO, 1972b).

##### 4.2 Pesticides reviewed in the light of new information

The following pesticides were reconsidered in the light of information received since the previous meeting: azinphos-methyl, chlordane, chloromequat, chlorobenzilate, chloropropylate, coumaphos, crufomate, dioxathion, diquat, ethion, fenchlorphos, fentin compounds, paraquat, parathion-methyl, phosphamidon, piperonyl butoxide, pyrethrins, and thiabendazole. Certain additions, amendments, and/or clarifications appear in Annex 1 to this report and in the relevant monographs (FAO/WHO, 1973b). Annex 2 lists those items on which further information is still required or desirable.

#### 4.3 Pesticides not previously considered for tolerances or practical residue limits

Recommendations for tolerances and/or practical residue limits were made for bromophos, bromophos-ethyl, carbophenothion, chlorpyrifos, fensulfothion, methidathion, mevinphos, monocrotophos, and phosalone, and these appear in Annex 1 to this report and in the relevant monographs (FAO/WHO, 1973b).

A preliminary assessment of the data on residues resulting from the use of benomyl on a range of food commodities was made. In view of the fact that these residues are similar to residues of other compounds of a similar nature and are likely to be confused with them, no recommendations were made at this stage. Further information is expected to be available for consideration at an early meeting, when other compounds giving similar residues should also be covered.

#### 4.4 Pesticides with ADIs but with only temporary tolerances

The Meeting considered the position of those compounds for which ADIs had been established but for which only temporary tolerances had been proposed. In this category chlorobenzilate, crufomate, dioxathion, diquat, ethion, fenchlorphos, and phosphamidon were considered and the temporary tolerances were converted into tolerances. In many instances, additional recommendations were made, details of which appear in Annex 1 and in the corresponding monographs (FAO/WHO, 1973b).

Further consideration was also given to azinphos-methyl but the data were not adequate to allow any changes to be made in the status of the temporary tolerance.

### 5. FUTURE WORK

It was suggested that the following items be considered at future Joint Meetings :

(a) The compounds included in Priority List VIII and recorded in order of priority in the report of the Sixth Session of the Codex Committee on Pesticide Residues (FAO/WHO, 1972c); i.e., lindane, technical BHC (including all isomers), camphechlor (FAO Specification AGP: CP/43, Toxaphene), azinphos-ethyl, propoxur, demeton-methyl and related products (e.g., thiometon), vamidothion, isopropyl 4,4'-dibrombenzilate disulfoton, prometryn, and tetradifon (to be considered together with tetrasul and chlorfensulphide).

(b) Benomyl, consideration of which was deferred from the current Meeting, should be considered together with thiophanate-methyl and carbomethoxyaminobenzimidazole.

(c) Compounds considered at previous meetings and scheduled for re-evaluation in 1973, with the exception of those listed under (d), i.e., captafol, captan, carbaryl, hexachlorobenzene, folpet, and quintoxene.

(d) Dithiocarbamates and tricyclohexyl hydroxystannate<sup>1</sup> are listed for re-evaluation in 1973, but the Meeting was aware that the results of investigations essential to this re-evaluation would not be available in 1973. It was recommended that evaluation of these compounds be postponed until 1974.

(e) DDT, in the light of the evaluations already undertaken and the changing patterns of use. A special effort should be made to collect and collate information on current use patterns and on levels in foods. This should be done with a view to making fresh recommendations for tolerances or practical residue limits.

## 6. RECOMMENDATIONS

1. In the interests of public health and agriculture and in view of the large number of pesticides that require evaluation or re-evaluation, it is desirable that further Joint Meetings should continue to be convened annually. It is recommended that the duration of each meeting should be extended.

2. In certain instances, insufficient information was available in spite of requests made at previous meetings. The situation is particularly acute with pesticides for which only temporary ADIs have been established (see section 2.2). It is therefore recommended that an effort be made to solicit support for the required research from international organizations, governments, and interested parties, including manufacturers' associations.

3. In view of the occurrence of serious cases of human poisoning by mercury fungicides and in view of the difficulty of preventing dressed seed from being improperly or accidentally diverted for consumption by man or animals, it is recommended that a meeting be convened to study the possibility of replacing them by compounds less likely to produce such poisoning incidents.

4. It is recommended that a request be forwarded to all government agencies and interested international organizations advising on the type

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<sup>1</sup> Previously listed as tricyclohexyltin hydroxide.

of information required by the Joint Meeting. This should include information on toxicity, use patterns, residues from supervised trials, fate of residues after harvesting, and residue levels found in food commodities moving in commerce.

## REFERENCES

- 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 ; *Wld Hlth Org. techn. Rep. Ser.*, 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 ; *Wld Hlth Org. techn. Rep. Ser.*, 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 ; *Wld Hlth Org. techn. Rep. Ser.*, No. 417
- FAO/WHO (1969b) *1969 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 ; reports 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 ; *Wld Hlth Org. techn. Rep. Ser.*, 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 ; *Wld Hlth Org. techn. Rep. Ser.*, No. 474
- FAO/WHO (1971b) *1970 evaluation of some pesticide residues in food. FAO/AGP/1970/M/12/1 ; WHO/Food Add./71.42*

- 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 ; Wld Hlth Org. techn. Rep. Ser., No. 502*
- FAO/WHO (1972b) *1971 evaluations of some pesticide residues in food. FAO/AGP/1971/M/9/1 ; WHO Pesticide Residues Series, No. 1*
- FAO/WHO (1972c) *Report of the Sixth Session of the Codex Committee on Pesticide Residues. Alinorm 73/24*
- FAO/WHO (1972d) *Evaluation of certain food additives and the contaminants mercury, lead, and cadmium. Sixteenth report of the Joint FAO/WHO Expert Committee on Food Additives. FAO Nutrition Meetings Report Series, No. 51 ; Wld Hlth Org. techn. Rep. Ser., No. 505*
- FAO/WHO (1973b) *1972 evaluations of some pesticide residues in food. FAO/AGP/1972/M/9/1 ; WHO Pesticide Residues Series, No. 2 (in press)*
- WHO (1967) *Procedures for investigating intentional and unintentional food additives ; report of a WHO Scientific Group. Wld Hlth Org. techn. Rep. Ser., No. 348*

**Annex 1**  
**INDEX TO DOCUMENTATION AND SUMMARY OF RECOMMENDATIONS**  
**CONCERNING ACCEPTABLE DAILY INTAKES, TOLERANCES, PRACTICAL RESIDUE LIMITS,**  
**AND GUIDELINE LEVELS AS OF NOVEMBER 1972**

Further details concerning the recommendations will be found in the original documents referred to in the second column. Explanatory notes are given at the end of this table (see p. 41).

Pesticide	Ref. 1	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
acrylonitrile	1965c						
aldrin	1967b, 1968b	0.0001					See also dieldrin.
allethrin	1965b						
arsenic (as calcium or lead arsenate)	1969b						
azinphos-methyl	1969b, 1973b	0.0025	Apricots, grapes Other fruit Vegetables	4 <sup>a</sup> 1 <sup>a</sup> 0.5 <sup>a</sup>			Date for review postponed to 1973 to provide more time for experiment.
benomyl	1973a						
BHC (mixture of isomers)	1969b						
binapacryl	1970b	0.0025	Peaches, cherries Apples, pears, grapes Plums Nectarines	1 0.5 0.3 0.2			See diphenyl. See 2-phenylphenol.
biphenyl 2-biphenylol							

Annex 1 (continued)

Pesticide	Ref. 1	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances 2 (mg/kg)	Practical limits 2 (mg/kg)	Guideline levels 3 (mg/kg)	
bromide (inorganic form, derived from bromine-containing fumigants and other sources)	1969b, 1970b, 1972a, b	1	Raw cereals, wholemeal flour	50	Blank spaces indicate no recommendations made		Recommendations relate exclusively to inorganic bromide, not to bromine present as unchanged fumigant. Other recommendations from previous meetings held in abeyance pending further data on normal background bromide levels and on residues from supervised trials (see FAO/WHO 1972a and 1972b).
			Nuts, peanuts Raw cereals, cocoa beans Dried fruit Milled cereal products Bread, other cooked cereal products, cocoa products, dried fruit, nuts, peanuts		100 <i>f</i> 50 <i>f</i> 20 <i>f</i> 10 <i>g</i>	Figures relate only to unchanged fumigant (see also bromide). See also FAO/WHO 1972a pp. 12-16. Previously listed as methyl bromide.	
bromomethane	1967b, 1968b, 1972a, b	0.006 <i>e</i>	Olives, olive oil	5 <i>e</i>		The tolerance for wheat is based on residues likely to be found at harvest.	
			Apples, lamb's lettuce, leeks, radishes	2 <i>e</i>			
bromophos	1973b	0.006 <i>e</i>	Pears, plums, red currants, carrots, celery, French beans, savoy cabbage, spinach	1 <i>e</i>			
			Blackberries, black currants, cherries, gooseberries, peaches, strawberries, lettuce, sugarbeet (roots)				
			Rape seed, rape seed oil, wheat	0.5 <i>e</i> 0.5 <i>e</i>			
			Broccoli, red cabbage, cabbage, cauliflower, cucumbers, kohlrabi, onions, peas	0.2 <i>e</i>			
			Milk (whole)	0.1 <i>e</i> 0.02 *			

bromophos-ethyl	1973b	0.003 c	<ul style="list-style-type: none"> <li>● Apples, pears, plums, carrots, spinach</li> <li>● Fat of meat of cattle</li> <li>● Red currants, Brussels sprouts</li> <li>● Cherries (sweet), gooseberries, peaches, celery, rape seed oil</li> <li>● Black currants, lettuce</li> <li>● Strawberries, rape seed, cabbage</li> <li>● Kohlrabi, French beans</li> <li>● Beans (without pod), cauliflower, onions, sugarbeet</li> <li>● Milk (whole)</li> </ul>	<p>2 c</p> <p>2 c</p> <p>1 c</p> <p>0.5 c</p> <p>0.2 c</p> <p>0.1 c</p> <p>0.05 c</p> <p>0.02 *</p> <p>0.02 *</p>		
calcium arsenate	1969b				See lead arsenate 1969b.	
camphechlor	1970b	0.05 "	<ul style="list-style-type: none"> <li>● Peaches</li> <li>● Cherries (sour)</li> <li>● Cherries (sweet)</li> <li>● Tomatoes</li> <li>● Melons (whole)</li> <li>● Cucumbers (whole)</li> <li>● Apricots</li> <li>● Plums</li> </ul>	<p>15 a</p> <p>10 a</p> <p>2 a</p> <p>5 a</p> <p>2 a</p> <p>1 a</p> <p>0.5 a</p> <p>0.2 a</p>	Listed as toxaphene, 1969b.	
captan	1970b	0.125 "	<ul style="list-style-type: none"> <li>● Apples, cherries</li> <li>● Pears</li> <li>● Apricots</li> <li>● Citrus fruit, peaches, plums, rhubarb, tomatoes</li> <li>● Strawberries, raspberries, cranberries, cucumbers, lettuce, green beans, peppers</li> <li>● Raisins</li> </ul>	<p>40 a</p> <p>30 a</p> <p>20 a</p> <p>15 a</p> <p>10 a</p> <p>5 a</p>	Recommendations relate only to parent substance. Referred to as difolatan in FAO/WHO 1969a, p. 18.	
carbaryl	1967b, 1968b, 1969b, 1970b, 1971b	0.01 "	<ul style="list-style-type: none"> <li>● Apricots</li> <li>● Blackberries, boysenberries, nectarines, peaches, raspberries, asparagus, okra, leafy vegetables (except brassicas), nuts (whole), olives (fresh)</li> <li>● Blueberries, citrus fruit, strawberries</li> <li>● Apples, bananas (pulp), grapes, beans, peas (including pod), brassicas, tomatoes, peppers, aubergines, poultry (skin)</li> </ul>	<p>10 a</p> <p>10 a</p> <p>10 a</p> <p>7 a</p> <p>5 a</p>	Earlier tolerances reviewed at 1969 Meeting in light of Codex comments. Tolerance on whole milk temporarily withdrawn (see FAO/WHO 1970b). Apricots unintentionally omitted from Annex 1 of FAO/WHO 1971a and FAO/WHO 1972a.	

Annex 1 (continued)

Pesticide	Ref. <sup>1</sup>	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
carbaryl (cont)			Poultry (total) (edible portions) Cucurbits (including melons) Rice Cottonseed (whole), sweet corn (kernels), nuts (shelled), olives (processed), meat of cattle, goats, and sheep Potatoes	0.5 <sup>a</sup> 3 <sup>a</sup> 2.5 <sup>a</sup>  1 <sup>a</sup> 0.2 <sup>a</sup>			
carbon disulfide	1965c, 1968b, 1970a, 1972a, b		<ul style="list-style-type: none"> <li>● Raw cereals</li> <li>● Milled cereal products</li> <li>● Bread and other cooked cereal products</li> </ul>			Blank spaces indicate no recommendations made	See also FAO/WHO 1972a, pp. 12-16. Errata carbon disulfide figures, FAO/WHO 1972a, p. 26. See also <i>ibid.</i> , p. 14 and FAO/WHO 1972b.
carbon tetrachloride	1965c, 1968b, 1970a, 1972b		Raw cereals Milled cereal products Bread and other cooked cereal products				See also FAO/WHO 1972a, pp. 12-16.
carbophenothion	1973b	0.005 <sup>d</sup>	<ul style="list-style-type: none"> <li>● Lemons</li> <li>● Spinach</li> <li>● Fat of meat of cattle and sheep</li> <li>● Apricots, nectarines, peaches, prunes, grapefruit, limes, oranges</li> <li>● Apples, pears, broccoli, Brussels sprouts, cauliflower</li> <li>● Olive oil</li> <li>● Olives (fresh), sugarbeet</li> <li>● Milk and milk products (fat basis)</li> <li>● Potatoes, rape seed</li> <li>● Walnuts and pecans (shelled)</li> </ul>	5 <sup>d</sup> 2 <sup>d</sup> 1 <sup>d</sup> 1 <sup>d</sup>  0.5 <sup>d</sup> 0.2 <sup>d</sup> 0.1 <sup>d</sup> 0.1 <sup>d</sup> 0.02 <sup>*</sup> 0.02 <sup>*</sup>		Tolerances apply to the total residue, comprising carbophenothion, its sulfoxide and sulfone, together with their corresponding oxygen analogues, if present, expressed as carbophenothion.	



Annex 1 (continued)

Pesticide	Ref. <sup>1</sup>	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
chlorfenvinphos (cont.)							
chloromequat	1971b, 1973b	0.05	Brussels sprouts, cabbage, broccoli, swedes, turnips, potatoes, sweet potatoes, onions, leeks, aubergines, mushrooms, peanuts (shelled), maize, wheat (grain), cottonseed, rice (raw and polished)	0.05			Residue levels in FAO/WHO 1972b now changed to tolerances.
			<ul style="list-style-type: none"> <li>● Oats, rye</li> <li>● Wheat, pears</li> <li>● Grapes, raisins, and other dried vine fruit</li> <li>● Milk and milk products</li> <li>● Apples, pears, grapes</li> <li>● Citrus fruit, cantaloupes, melons</li> <li>Almonds and walnuts (shelled)</li> <li>● Tomatoes</li> <li>● Milk (whole)</li> </ul>	5 3 1 0.1*			
chlorobenzilate	1969b, 1973b	0.02	<ul style="list-style-type: none"> <li>● Citrus fruit, cantaloupes, melons</li> <li>Almonds and walnuts (shelled)</li> <li>● Tomatoes</li> <li>● Milk (whole)</li> </ul>	2 1			
chlorodimeform	1972b	0.01 <sup>c</sup>	<ul style="list-style-type: none"> <li>● Pears, peaches, prunes</li> <li>● Apples, grapes, plums, strawberries</li> <li>Cherries, citrus fruit, brassicas, cottonseed oil (crude and refined), cottonseed</li> <li>Beans</li> <li>Fat, meat, and meat products of cattle</li> <li>Milk (whole)</li> <li>Milk products</li> </ul>	0.05* 5 3 <sup>c</sup>		Expressed as the sum of chlorodimeform and its metabolites determined as 4-chloro-o-toluidine and expressed as chlorodimeform.	
chloropicrin	1965c			2 <sup>c</sup> 0.5 <sup>c</sup>			
chloropropylate	1969b, 1973b		<ul style="list-style-type: none"> <li>● Apples, pears, citrus fruit</li> <li>● Tomatoes, cantaloupes</li> </ul>	0.5 <sup>c</sup> 0.05 <sup>c</sup> 0.5 <sup>c</sup>			The temporary ADI established at the 1968 meeting withdrawn (see section 3.4 of FAO/WHO 1973a). See also section 2.2 of FAO/WHO 1973a).
chlorpropham	1965b						3 1

chlorpyrifos	1973b	0.0015	<ul style="list-style-type: none"> <li>● Fat of meat of cattle</li> <li>● Apples, chinese cabbage, grapes, kale</li> <li>● Pears, carrots, tomatoes</li> <li>● Beans, aubergines, peppers, raspberries</li> <li>● Fat of meat of sheep and of poultry</li> <li>● Lettuce, sugarbeet, rice (in husk)</li> <li>● Celery, cottonseed, cottonseed oil (crude), mushrooms, onions</li> <li>● Cauliflower, red cabbage, potatoes</li> <li>● Milk (fat basis)</li> </ul>	2 1 0.5 0.2 0.2 0.1  0.05 0.01 * 0.01 *		
Chlorthion coumaphos	1965b 1969b, 1973b	0.0005 <sup>c</sup>	<ul style="list-style-type: none"> <li>● Fat of meat of cattle</li> <li>● Poultry</li> <li>● Fat of meat of sheep, pigs, and goats</li> <li>● Milk and milk products (fat basis)</li> <li>● Eggs (shell-free)</li> </ul>	1 <sup>c</sup> 1 <sup>c</sup> 0.5 <sup>c</sup> 0.5 <sup>c</sup> 0.05 <sup>c</sup>		To be determined as coumaphos and oxygen analogue and expressed as coumaphos.
crufomate	1969b, 1973b	0.1	<ul style="list-style-type: none"> <li>● Meat</li> <li>● Milk (whole)</li> </ul>	1 0.05		Qualification "(fat basis)" in previous recommendation for meat now deleted.
2,4-D	1971b, 1972b	0.3	<ul style="list-style-type: none"> <li>● Barley, oats, rye, wheat</li> </ul>	0.02		Erratum FAO/WHO 1972a, p. 26.
DDT	1967b, 1968b, 1969b, 1970b, 1973a	0.005 (see remarks)	<ul style="list-style-type: none"> <li>● Apples, apricots, pears, peaches, small fruits (except strawberries), vegetables (except root vegetables), fat of meat and poultry</li> <li>● Cherries, plums, citrus fruit, tropical fruit</li> <li>● Strawberries, nuts (shelled), root vegetables</li> <li>● Milk and milk products (fat basis)</li> <li>● Eggs (shell-free)</li> </ul>	7 3.5 1		ADI is "conditional". Tolerance on fish withdrawn at 1969 Meeting. Limits apply to DDT, DDD, and DDE singly or in combination. Tolerances subject to regular review.
demeton	1965b, 1968b	0.0025			1.25 0.5	
diazinon	1965b, 1967b, 1968b, 1969b, 1971b	0.002	<ul style="list-style-type: none"> <li>● Olives and olive oil</li> <li>● Cherries, citrus fruit, peaches</li> <li>● Other fruit</li> <li>● Leafy vegetables</li> </ul>	2 0.7 0.5 0.7		Residues to be determined and expressed as the parent compound. Residues decline rapidly during storage and shipment; the tolerances are based

Annex 1 (continued)

Pesticide	Ref. <sup>1</sup>	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
diazinon (cont.)			Other vegetables Sweet corn (kernels and cob with husks removed) Cottonseed, safflower seed, sunflower seed Almonds, filberts, pecans, peanuts, walnuts (shelled) Rice (polished), barley, wheat Fat of meat of cattle, sheep, and pigs	0.5 0.7 0.5 0.5 0.1 0.7			on residues likely to be found at harvest or slaughter (see FAO/WHO 1971b).
1,2-dibromoethane	1967b, 1968b, 1970a, 1972b		Raw cereals Milled cereal products Bread and other cooked cereal products			20 <i>f</i> 5 <i>g</i> 0.1 <i>h</i>	See also FAO/WHO 1972a, pp. 12-16. Analytical method must identify residue, because guideline level refers to original fumigant. Previously listed as ethylene dibromide.
dichlofluanid	1970b		Raw cereals Milled cereal products Bread and other cooked cereal products			50 <i>f</i> 10 <i>g</i> 0.1 <i>h</i>	See also FAO/WHO 1972a, pp. 12-16. Previously listed as ethylene dichloride.
1,2-dichloroethane	1965c, 1968b, 1970a, 1972b		Cocoa beans Coffee beans, soybeans, lentils, peanuts Raw grain (barley, maize, oats, rice, rye, sorghum, wheat, etc.) Milled products from raw grain Lettuce Fresh vegetables (except lettuce) Tomatoes, mushrooms Fresh fruit (apples, pears, peaches, strawberries, etc.)			5 2 2 1 0.5 0.5 0.5 0.1	The tolerances are based on residues likely to be found at harvest or slaughter. Residues decline rapidly during storage or shipment (see FAO/WHO 1968b, 1971b). The tolerance for "miscellaneous food items, not otherwise specified", for example bread, cakes, cheese, cooked meats, etc., is intended to cover residues resulting from usage of dichlorvos for pest control purposes in storage, in warehouses, shops, etc.
dichlorvos	1967b, 1968b, 1970b, 1971b	0.004					

dicofof	1969b, 1971b	0.025	Meat of cattle, sheep, goats, pigs, and poultry Eggs (shell-free) Milk (whole) Miscellaneous food items not otherwise specified	0.05 0.05 0.02 0.1	5 5	Practical residue limit for shell-free eggs is equivalent to 0.25 mg/kg in egg yolk. Limits apply to aldrin and dieldrin singly or together and expressed as dieldrin.
dieldrin	1967b, 1968b, 1969b, 1970b, 1971b	0.0001	Asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, cucumbers, aubergines, horseradish, onions, parsnips, peppers, pimientos, radishes, radish tops Fruit (other than citrus) Citrus fruit Rice (in husk) Potatoes Carrots, lettuce, fat of meat Milk and milk products (fat basis) Raw cereals (other than rice) Eggs (shell-free)	0.1 0.1 0.05 0.02 0.2 0.2 0.15 0.02 0.1		
dimethoate	1968b, 1971b	0.02	Tree fruit (including citrus) Tomatoes, peppers Other vegetables	2 1 2		Residues to be determined as dimethoate and its oxygen analogue and expressed as dimethoate.
dimethrin	1965b					
dinocap	1970b					
dioxathion	1969b, 1973b	0.0015	● Pome fruit, (apples, pears, and quinces) ● Citrus fruit ● Grapes ● Fat of meat of cattle, sheep, goats, and pigs ● Milk and milk products (fat basis) ● Stone fruit (apricots, cherries, peaches, prunes, and plums)	5 3 2 1 0.2		Residues of <i>cis</i> - and <i>trans</i> -isomers of principal active ingredient to be determined and expressed as sum of both. Tolerances no longer temporary.
diphenyl	1967b, 1968b	0.125	Citrus fruit	110		
diphenylamine	1970b	0.025	Apples	10		

Annex 1 (continued)

Pesticide	Ref. <sup>1</sup>	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
diquat	1971b, 1973b	0.005	<ul style="list-style-type: none"> <li>● Barley, poppy seed, rice (in husk)</li> <li>● Rape seed, sorghum, wheat</li> <li>● Cottonseed</li> <li>● Beans, sunflower seed</li> <li>● Rice (polished), potatoes, wheat flour</li> <li>● Onions, maize, sugarbeet, peas</li> <li>● Cottonseed oil</li> <li>● Rape, sesame, and sunflower oils</li> <li>● Other vegetable crops</li> <li>● Milk (whole)</li> <li>● Meat and meat products</li> </ul>	5 2 1 0.5 0.2 0.1 0.1 0.1 0.05 * 0.01 * 0.05 *	Blank spaces indicate no recommendations made	Tolerances no longer temporary. ADI equivalent to 0.0036 expressed as diquat ion.	
dithiocarbamates, dimethyl (ferbam, thiram, and ziram)	1965b, 1968b, 1971b	0.025 <sup>b</sup>				ADI applies to parent compound or to sum of residues of all compounds present. To be reviewed in 1974, not 1972 as recorded in Annex 1, FAO/WHO 1971a.	
dithiocarbamates, ethylenebis (mancozeb, maneb, and zineb) including zineb derived from nabam plus zinc sulfate	1965b, 1968b, 1971b	0.025 <sup>b</sup>				ADI applies to parent compound or to sum of residues of all compounds present (see mancozeb). To be reviewed in 1974, not 1972 as recorded in Annex 1, FAO/WHO 1971a.	
DNOC	1965b						
endosulfan	1968b, 1969b, 1972b	0.0075	Tea (dry, manufactured) Fruit, vegetables Cottonseed Cottonseed oil (crude) Rice (in husk)	30 2 0.5 0.2 0.1		To be measured and reported as total endosulfan A and B and endosulfan sulfate.	

endrin	1965b, 1971b	0.0002	<ul style="list-style-type: none"> <li>● Cottonseed, cottonseed oil (crude)</li> <li>● Corn (sweet)</li> <li>● Apples, barley, rice (husked and/or polished), sorghum, wheat</li> <li>● Edible cottonseed oil</li> <li>● Milk and milk products (fat basis)</li> <li>● Fat of poultry</li> <li>● Eggs (shell-free)</li> </ul>	0.1 0.02  0.02 0.02  1 0.2	<p>All recommendations are total figures for endrin plus delta-keto-endrin. Erratum p. 31 FAO/WHO 1971a. A tolerance of 0.02 was established for sweet corn (see FAO/WHO 1971b) but not for maize oil, which is deleted.</p>
ethion	1969b, 1970b, 1973b	0.005	<ul style="list-style-type: none"> <li>● Tea (dry, manufactured)</li> <li>● Apples, grapes, lemons, limes, oranges, plums, prunes, strawberries</li> <li>● Nectarines, peaches, pears</li> <li>● Apricots, cherries</li> <li>● Almonds, chestnuts, filberts, pecans, walnuts (shelled)</li> <li>● Beans, melons, tomatoes</li> <li>● Aubergines, garlic, onions, pimientos, peppers</li> <li>● Cucumbers, squash</li> <li>● Cottonseed</li> <li>● Maize (grain)</li> <li>● Fat of meat of cattle</li> <li>● Edible offal of cattle</li> <li>● Fat of meat and edible offal of goats, horses, pigs, poultry, and sheep</li> <li>● Milk and milk products</li> <li>● Eggs (shell-free)</li> <li>● Apples, pears</li> </ul>	7 2 1 0.1 *  0.1 * 2 1 0.5 0.05 * 2.5 0.75  0.2 * 0.5 * 0.2 *	<p>Residues to be determined as ethion and its oxygen analogue and expressed as ethion. Tolerances no longer temporary. General recommendations for fruit and vegetables withdrawn.</p>
ethoxyquin	1970b	0.06	<ul style="list-style-type: none"> <li>● Apples, pears</li> </ul>	3	<p>ADI and tolerances erroneously designated as temporary in Appendix 1, FAO/WHO 1970a.</p>
ethylene dibromide					See 1,2-dibromoothane.
ethylene dichloride					See 1,2-dichloroethane.
ethylene oxide	1965c, 1969b, 1970a, 1972b				
fenchlorphos	1969b, 1973b	0.01	<ul style="list-style-type: none"> <li>● Fat of meat of cattle, goats, and sheep</li> <li>● Fat of meat of pigs</li> <li>● Milk and milk products (fat basis)</li> <li>● Eggs (shell-free)</li> <li>● Poultry</li> </ul>	10 2 2 0.05 * 0.01 *	<p>Residues of fenchlorphos and oxygen analogues to be expressed as fenchlorphos. Tolerances no longer temporary.</p>

Annex 1 (continued)

Pesticide	Ref. 1	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
fenitrothion	1970b	0.001 <i>b</i>	Apples, cherries, grapes, lettuce Red cabbage, tea (green at harvest) Tomatoes Cocoa Milk products (fat basis) Meat or fat of meat Milk (whole)	0.5 <i>b</i> 0.3 <i>b</i> 0.2 <i>b</i> 0.1 <i>b</i>			Date for review postponed to 1974 to provide longer period for experiments.
fensulfotthion	1973b	0.0003	● Maize (grain), including kernels of field corn and popcorn ● Onions, potatoes, rutabagas (roots), tomatoes ● Peanuts (shelled), pineapple, sugarbeet ● Bananas (whole fruit) ● Fat of meat and edible offal of cattle, goats, and sheep	0.1 0.1 0.05 <i>b</i> * 0.03 <i>b</i> * 0.002 <i>b</i> *			Residues of fensulfotthion, its oxygen analogue, the oxygen analogue sulfone, and the sulfone to be determined and expressed as fensulfotthion.
fenthion	1972b	0.0005 <i>c</i>	Apples, peaches, cherries, lettuce, fat of meat Cabbage, cauliflower, olives, olive oil Grapes, oranges, peas, meat Squash Wheat, rice, milk products (fat basis) Milk (whole)	2 <i>c</i> 1 <i>c</i> 0.5 <i>c</i> 0.2 <i>c</i> 0.1 <i>c</i> 0.05 <i>c</i>			Tolerances for fenthion and its major metabolites to be determined separately or together and expressed as fenthion.
fentin compounds	1965b, 1971b, 1973b	0.0005	Celery Sugarbeet, carrots Potatoes, celeriac ● Cocoa beans, coffee (raw beans), rice (in husk) ● Peanuts and pecans (shelled)	1 0.2 0.1 0.1 * 0.05 *			Referred to as triphenyltin in FAO/WHO 1965b. Tolerances on root crops expressed on "soil free" basis. Tolerances to refer to the total amount of fentin compounds present, expressed as fentin hydroxide. (Inorganic tin is not included in these tolerances.)

Blank spaces indicate no recommendations made

} see remarks

ferbam	1965b, 1968b	0.025 <sup>b</sup>			See dithiocarbamates.
folpet	1970b	0.16 <sup>a</sup>	30 <sup>a</sup> 25 <sup>a</sup> 15 <sup>a</sup> 10 <sup>a</sup> 5 <sup>a</sup>	Currents (fresh) Grapes, blueberries Cherries, raspberries Apples, citrus fruit Tomatoes, strawberries Cucumbers, cantaloupes (whole), watermelons (whole), onions	Recommendations apply only to parent compound.
formothion	1970b, 1973b		0.3 2	Strawberries Black currants	Residues determined as dimethoate and omethoate and expressed as dimethoate.
heptachlor	1967b, 1968b, 1969b, 1970b, 1971b	0.0005	0.01	Pineapple (edible portions) Milk and milk products (fat basis) Fat of meat and of poultry Raw cereals, tomatoes, cottonseed, soybeans, edible soybean oil Vegetables (except carrots, soybeans, tomatoes) Sugarbeet Eggs (shell-free) Carrots Crudo soya bean oil Citrus fruit	Residues of heptachlor and its epoxide to be determined separately and the sum to be expressed as heptachlor. Certain of these practical residue limits may include residues resulting from applications to soil or seed.
hexachlorobenzene	1970b	(see remarks)	1 <sup>a</sup> 1 <sup>a</sup> 1 <sup>a</sup> 0.3 <sup>a</sup> 0.05 <sup>a</sup> 0.01 <sup>a</sup>	● Fat of meat of pigs poultry, and sheep Eggs (shell-free) Milk and milk products (fat basis) Raw wheat Cereal products (from wheat)	Tentative negligible daily intake of 0.0006 mg/kg established. (To be reviewed in 1973. See FAO/WHO 1970b.) Fat of pigs omitted from Annex 1, FAO/WHO 1972a.
hydrogen cyanide	1965c,	0.05	75 6	Raw cereals Flour	
hydrogen phosphide	1967b, 1968b, 1970b, 1972b	Not necessary (see remarks)		Flour and other milled cereal products, breakfast cereals, dried vegetables, spices, nuts, peanuts, dried fruit, cocoa beans, other dried foods Raw cereals	Hydrogen phosphide present as such or derived from any phosphide present. Good usage practices should ensure that residues are not detectable at time of consumption.
lead (as lead arsenate)	1969b		0.01 0.1		

Annex 1 (continued)

Pesticide	Ref. <sup>1</sup>	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
lindane	1967b, 1968b, 1969b, 1970b	0.0125	Vegetables Cranberries, cherries, grapes, plums, strawberries ● Fat of meat of cattle, pigs, and sheep Beans (dried) Raw cereals Eggs (yolk) Milk and milk products (fat basis) Poultry (fat basis)	3			Referred to as gamma-BHC prior to 1967.
			● Grapes Raw cereals, nuts, dried fruit Whole meal and flour from rye and wheat Citrus fruit Blackberries, raspberries, lettuce, endive, cabbage, spinach Cherries, peaches, plums Broccoli Tomatoes, kale, turnips Beans (green), apples Strawberries, celery Pears, blueberries, peas (in pod), cauliflower, peppers, aubergines, kohlrabi, root vegetables (except turnips), Swiss chard, collards	3	2		
malathion	1967b, 1968b, 1969b, 1971b	0.02	Potatoes	8			Recommendations for grapes previously omitted.
mancozeb	1968b, 1971b	0.025 <sup>b</sup>		8			Temporary tolerance applies to parent compound or to sum of all dithiocarbamates present. See dithiocarbamates.
maneb	1965b, 1968b	0.025 <sup>b</sup>		1 <sup>a</sup>			

Blank spaces indicate no  
recommendations made

mercury compounds methidathion	1973b	0.005 c	<ul style="list-style-type: none"> <li>● Citrus fruit</li> <li>● Apples, pears</li> <li>● Apricots, cherries, nectarines, peaches, plums, prunes, grapes</li> <li>● Cabbage, cauliflower, leafy vegetables</li> <li>● Beans, peas, tomatoes</li> <li>● Maize, sorghum (grain)</li> <li>● Cottonseed oil (crude)</li> <li>● Cottonseed</li> <li>● Hops (dried)</li> <li>● Tea (dry, manufactured)</li> <li>● Potatoes</li> <li>● Meat, fat, and edible offal of cattle, sheep, goats, pigs, and poultry</li> <li>● Milk and milk products (fat basis)</li> <li>● Eggs (shell-free)</li> </ul>	<p>2 c 0.5 c</p> <p>0.2 c 0.2 c 0.1 c 0.1 c 1 c 0.2 c 3 c 0.1 c 0.02 *</p> <p>0.02 *</p> <p>0.02 *</p> <p>0.02 *</p>	See organomercurials.
methoxychlor	1965b	0.1			Residues in animal products from feeding on treated forage and plant products.
methyl bromide	1965b, 1973b	0.0015	<ul style="list-style-type: none"> <li>● Broccoli, Brussels sprouts, cabbage, cauliflower, collards</li> <li>● Cherries, strawberries</li> <li>● Apples, grapes, peaches, lettuce, spinach</li> <li>● Cucumbers, tomatoes, apricots, citrus fruit, pears</li> <li>● Carrots, beans, onions, peas, potatoes, turnips</li> <li>● Melons</li> </ul>	<p>1 1</p> <p>0.5</p> <p>0.2</p> <p>0.1 0.05</p>	See bromomethane. Residues of cis- and trans-isomers to be determined and expressed as the sum of both.
MGK 264	1968b	0.0003	<ul style="list-style-type: none"> <li>● Apples, pears</li> <li>● Hops (dried)</li> <li>● Citrus fruit</li> <li>● Tomatoes</li> <li>● Beans, Brussels sprouts, cabbage, cauliflower</li> <li>● Onions, peas, coffee (raw beans)</li> <li>● Cottonseed</li> <li>● Carrots, maize (grain), potatoes, turnips, sugarbeet</li> <li>● Cottonseed oil, soybeans</li> </ul>	<p>1 c 1 0.2 0.5</p> <p>0.2</p> <p>0.1 0.1</p> <p>0.05 * 0.05 *</p>	
monocrotophos	1973b				

Annex 1 (continued)

Pesticide	Ref. <sup>1</sup>	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
monocrotophos (cont.)							
nabam	1965b, 1968b	0.025 <sup>b</sup>	<ul style="list-style-type: none"> <li>● Meat and edible offal of cattle, goats, pigs, poultry, and sheep</li> <li>● Milk</li> <li>● Milk products</li> <li>● Eggs (shell-free)</li> </ul>	0.02 * 0.002 * 0.02 * 0.02 *			Residues in products of animal origin arising from feeding treated plant products.
omethoate	1972b	0.0005 <sup>c</sup>	Apples, apricots, cherries, grapes, peaches, pears, plums	2 <sup>c</sup>			See also dithiocarbamates and zineb. See also dimethoate and for-mothion.
organomercurials	1967b, 1968b						Referred to as phenylmercury acetate in FAO/WHO 1967b.
oxydemeton-methyl	1968b, 1969b						ADI withdrawn at 1968 Meeting (see FAO/WHO 1969b).
oxythioquinox	1969b						See chinomethionate.
paraquat	1971b, 1973b	0.002	<ul style="list-style-type: none"> <li>● Rice (in husk)</li> <li>● Olives (fresh)</li> <li>● Rice (polished), sorghum</li> <li>● Cottonseed, potatoes</li> <li>● Maize, soybeans</li> <li>● Cottonseed oil (refined)</li> <li>● Other vegetables</li> <li>● Milk (whole)</li> </ul>	10 1 0.5 0.2 0.1 0.05 0.05 * 0.01 *			Tolerances no longer temporary. ADI equivalent to 0.0014 expressed as paraquat ion.
parathion	1965b, 1968b, 1970b, 1971b	0.005	<ul style="list-style-type: none"> <li>● Apricots, citrus fruit, peaches</li> <li>● Other fresh fruit</li> <li>● Vegetables (except carrots)</li> </ul>	1 0.5 0.7			

Blank spaces indicate no recommendations made

Possible figures are suggested in FAO/WHO 1968b, p. 208.

parathion-methyl	1969b, 1973b	0.001 <sup>c</sup>	Fruit, cole crops, cucurbits Other vegetables Cottonseed oil	0.2 <sup>c</sup> 1 <sup>c</sup> 0.05 <sup>c</sup>	Cucurbits include cantaloupes, melons, and cucumbers. Temporary tolerances are for parathion-methyl plus its oxy- gen analogue.
2-phenylphenol (and sodium salt)	1970b	1	Cantaloupes (whole) Pears Carrots, peaches Apples, sweet potatoes, plums (including fresh prunes) Cantaloupes (edible portions), citrus fruit, cucumbers, peppers, pineapple, tomatoes Cherries, nectarines	120 25 20 15 10 3	Residues expressed as 2-phenylphenol. Referred to as o-phenylphenol in FAO/WHO 1969a, p. 18.
o-phenylphenol					See 2-phenylphenol.
phosalone	1973b	0.006	● Apples, grapes, peaches, plums ● Cherries, pears, beetroots ● Hops (dried) ● Citrus fruit, strawberries, broccoli, Brussels sprouts, cabbage, cucumbers, lettuce, peas, tomatoes ● Chestnuts and pecans (shelled), potatoes, rape seed	5 2 2 1 0.1 *	
phosphamidon	1965b, 1967b, 1969b, 1972b, 1973b	0.001	● Apples, pears ● Citrus fruit ● Other fruit, cole crops ● Tomatoes, lettuce, cucumbers, watermelons ● Other vegetables (except root vegetables) ● Raw cereals ● Root vegetables, potatoes	0.5 0.4 0.2 0.1 0.2 0.1 0.05 *	Expressed as the sum of phosphamidon and its desethyl derivative.
phosphine	1965c				See hydrogen phosphide.
piperonyl butoxide	1967b, 1968b, 1973b	0.03	Raw cereals Fresh fruit and vegetables, dried fruit and vegetables ● Peanuts (whole), tree nuts, oil seeds ● Fish (dried)	20 <sup>d</sup> 8 <sup>a</sup> 8 <sup>a</sup> 20	Peanuts omitted from Annex 1, FAO/WHO 1972a and from earlier tables. See FAO/WHO 1967b.
propham	1965b				

Annex 1 (continued)

Pesticide	Ref. <sup>1</sup>	Maximum acceptable daily intake (mg/kg body weight)	Commodity	Residue limits			Remarks
				Tolerances <sup>2</sup> (mg/kg)	Practical limits <sup>2</sup> (mg/kg)	Guideline levels <sup>3</sup> (mg/kg)	
pyrethrins	1967b, 1968b, 1970b, 1973b	0.04	Raw cereals Fresh fruit and vegetables, dried fruit and vegetables, oil seeds, tree nuts ● Fish (dried)	3 <sup>a</sup>			
quintozene	1970b	0.001 <sup>a</sup>	Mushrooms Peanuts (whole) Bananas (whole) Lettuce, peanuts (kernels) Beans (navy), potatoes Tomatoes Cottonseed Broccoli, cabbage Bananas (pulp) beans (other than navy), peppers (bell)	10 <sup>a</sup> 5 <sup>a</sup> 1 <sup>a</sup> 0.3 <sup>a</sup> 0.2 <sup>a</sup> 0.1 <sup>a</sup> 0.03 <sup>a</sup> 0.02 <sup>a</sup> 0.01 <sup>a</sup>			
2,4,5-T thiabendazole	1971b 1971b, 1972b, 1973b	0.05	Apples, pears ● Citrus fruit Bananas Bananas (pulp)	10 10 3 0.4			
thiometon thiram	1970b 1965b, 1968b	0.025 <sup>b</sup>					
toxaphene	1969b	0.01 <sup>c</sup>	Peppers Bananas, peaches, Brussels sprouts, cauliflower, kale, sweet corn (kernels and cobs), celery, beet, wheat Apples, cherries, oranges, strawberries, artichokes, beans (blackeyed, green, and lima), cabbage, cowpeas, mustard greens, pumpkins, tomatoes, turnips	1 <sup>c</sup>			See dithiocarbamates. Subsequently listed as camphe- chlor.
trichlorfon	1972b			0.2 <sup>c</sup>			
				0.1 <sup>c</sup>			

trichloroethylene	1969b		Barley, maize Cottonseed, linseed, rape seed, safflower seed, soybeans, peanuts (shelled)	0.1 <sup>c</sup>		
trichloronat	1972b		Meat, fat, and edible offal of cattle and pigs	0.1 <sup>c</sup>		
tricyclohexyl hydroxystannate	1971b	0.0075 <sup>b</sup>	Milk (whole)	0.05 <sup>c</sup>		Expressed as the parent com- pound.
tricyclohexyltin hydroxide			Sugarbeet	0.05 <sup>e</sup>		See tricyclohexyl hydroxystan- nate.
triphenyltin						See fentin compounds.
zinob	1965b, 1968b	0.025 <sup>b</sup>				(Including zineb derived from nabam plus zinc sulfate.)
ziram	1965b, 1968b	0.025 <sup>b</sup>	Apples, pears	2 <sup>b</sup>		See also dithiocarbamates.

● Indicates additions or modifications made by the 1972 Joint Meeting.

<sup>1</sup> References are to FAO/WHO publications (see list of references on p. 21). Dates of publication refer to the first complete or completely revised monograph or to important mentions of the compound in a report. Where a monograph has been completely revised mention is not necessarily made of any earlier ones. Where the only date given is 1973, the compound was considered at the 1972 Joint Meeting for the first time.

<sup>2</sup> Unless otherwise indicated, the tolerances and practical limits should apply as soon as practicable after harvest to the raw agricultural products moving in commerce and prior to processing. For commodities entering international trade, tolerances are applicable, unless otherwise indicated, at the point of entry into a country or as soon as practicable thereafter. All levels refer to contents of samples representative of individual consignments or lots.

<sup>3</sup> Guideline levels are included to assist administering authorities, even though ADIs have not been established for the individual products, or temporary ADIs established at an earlier date have been withdrawn. The levels recommended are those that need not be exceeded if good practices are followed. With regard to fumigants, they are intended to be applied at one of the stages indicated by *f*, *g*, *h*, or *i* in the knowledge that, when so applied, residues of unchanged fumigants in foods as offered for consumption would not exceed an amount close to the limit of determination by present analytical methods.

\* Level at or about the limit of determination.

<sup>a</sup> Temporary : results of work to be made available not later than 30 June 1973.

<sup>b</sup> Temporary : results of work to be made available not later than 30 June 1974.

<sup>c</sup> Temporary : results of work to be made available not later than 30 June 1975.

<sup>d</sup> Temporary : results of work to be made available not later than 30 June 1976.

<sup>e</sup> Temporary : results of work to be made available not later than 30 June 1977.

<sup>f</sup> To apply at point of entry into a country and, in the case of cereal for milling, if product has been freely exposed to air for a period of at least 24 hours after fumigation and before sampling.

<sup>g</sup> To apply to milled cereal products to be subjected to baking or cooking.

<sup>h</sup> To apply at point of retail sale or when offered for consumption.

## 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.

## AZINPHOS-METHYL

**Required by 30 June 1973**

1. Information on the nature of terminal residues in plants.
2. Further data on supervised trials in various areas, including the currently recommended rates of application and preharvest intervals on those crops for which insufficient information is available.
3. Data on disappearance of residues during storage and processing.

**Desirable**

1. Further data on residue levels in food commodities moving in commerce.
2. Data on the possible carry-over of residues into wine as a result of the treatment of grapes.

## BROMOPHOS

**Required** (before tolerances can be recommended)

1. Residue data from supervised trials for meat of domestic animals other than sheep, poultry, eggs, and any fruit or vegetables not listed.
2. Further information on good agricultural practices for use on stored grain and the effects of moisture and temperature on residues in stored grain.

**Required by 30 June 1977**

1. A study in dogs using animals of similar weight, age, and origin in control and test groups, with particular attention to renal function and testicular pathology. The dosage levels should be set to demonstrate the no-effect level.
2. An adequate study to assess carcinogenic potential of bromophos.

**Desirable**

1. A study to determine dose levels causing no carboxylesterase (aliesterase) activity depression.

**BROMOPHOS-ETHYL****Required** (before tolerances can be recommended)

1. Residue data from supervised trials on maize, rice and other cereals, cotton, domestic animals other than cattle, and milk products.

**Required by 30 June 1975**

1. Further studies evaluating the significance of urinary excretion of ascorbic and dehydroascorbic acids and its relevance to man.

**Desirable**

1. A study to determine dose levels causing no carboxylesterase (aliesterase) activity depression.

**CARBOPHENOTHION****Required by 30 June 1976**

1. Further studies to substantiate the marked species difference in sensitivity to plasma cholinesterase depression.
2. An adequate reproduction study.

**CHLORMEQUAT****Desirable**

1. Information on other registered uses for chlormequat.
2. Further information on residues of chlormequat in raw agricultural commodities from a number of different countries.
3. Information on chlormequat residues in commodities moving in international trade.

**CHLOROBENZILATE****Desirable**

1. Data on the possible carry-over of residues into wine as a result of the treatment of grapes.
2. Further data on the disappearance of residues in soils.
3. Further data on residues occurring from usage on tea.

## CHLORPYRIFOS

**Required** (before tolerances can be recommended)

1. Residue data from supervised trials for rape seed, cereal grains, and any vegetables not listed.

**Desirable**

1. Further information on residues in milk and milk products arising from the dipping of dairy cattle.
2. Elucidation of possible increased sensitivity to plasma cholinesterase depression after withdrawal from an initial dose regime.

## COUMAPHOS

**Required by 30 June 1975**

1. Short-term studies (including histopathology) on the toxicologically significant metabolites.
2. A study examining the effect on blood coagulation.

**Desirable**

1. Investigations relating to the observation of lens opacities in rats.

## CRUFOMATE

**Required** (if tolerance is to be recommended)

1. Data on residues in milk products and partition into milk fat.

**Desirable**

1. Further information on residues in milk from treated animals using modern gas chromatographic methods of analysis.

## DIQUAT

**Desirable**

1. If treated cereals are to be used for human consumption, further data will be required on residues occurring in barley, wheat, rye, and oats and their products (flour, bread, beer, etc.).
2. Further studies on the mechanism of cataractogenic activity.
3. Identification of the toxicologically active substance (i.e., parent compound or metabolite).

## ETHION

**Desirable**

1. Determination of the metabolic fate in animals.

## FENSULFOTHION

**Desirable**

1. Teratogenicity studies at higher dose levels.
2. Studies on human exposure.

## METHIDATHION

**Required by 30 June 1975**

1. A study to elucidate the formation of pigment and the nature of the liver lesions that lead to increased serum transaminase levels in dogs.

**Desirable**

1. Further information on the fate of residues in storage and processing.
2. Metabolic studies in man to determine comparative degradation in man and other species.
3. A study to determine dose levels causing no carboxylesterase (aliesterase) activity depression.

## MONOCROTOPHOS

**Desirable**

1. Studies on human exposure.
2. Information on incidence of residues in apples and pears.

## PARAQUAT

**Desirable**

1. Detailed comparative toxicity and metabolism studies in order to elucidate the reason for the comparatively high sensitivity of man to this compound.
2. Comparative studies on the relationship between lung concentration and toxicity.

## PARATHION-METHYL

**Required by 30 June 1975**

1. Oral studies on teratogenesis and on reproduction in species appropriate to such tests.
2. Data on supervised trials in various areas, including the currently recommended rates of application and preharvest intervals on those crops for which insufficient information is available.
3. Data on residues in food commodities moving in commerce.

**Desirable**

1. A 2-year feeding study in a mammalian species.

## PHOSALONE

**Desirable**

1. Effect on food storage and processing on residues.
2. Data on residues occurring in food commodities moving in commerce.
3. Nature and concentration of impurities in the technical product.
4. Information on the use pattern of phosalone against ectoparasites of domestic animals and data on residues in animal products resulting from this use.
5. Studies on human exposure.
6. A study to determine dose levels causing no carboxylesterase (aliesterase) activity depression.

## PIPERONYL BUTOXIDE

**Required by 30 June 1975**

1. Further data on residues in dried fish from supervised trials and from commercial usage.

**Desirable**

1. Studies on the effect of piperonyl butoxide on the liver of dogs.<sup>1</sup>
2. Effects on reproduction in at least one more species.

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<sup>1</sup> For details see *Wld Hlth Org. techn. Rep. Ser.*, 1967, No. 348.

## PYRETHRINS

**Required by 30 June 1975**

1. Further data on residues in dried fish from supervised trials and from commercial usage.

**Desirable**

1. Toxicity studies in a nonrodent mammalian species with special emphasis on the effects on the liver.

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