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## 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

Geneva, 22-29 November 1971



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**1971 JOINT MEETING OF THE FAO WORKING PARTY OF EXPERTS  
ON PESTICIDE RESIDUES AND THE  
WHO EXPERT COMMITTEE ON PESTICIDE RESIDUES**

*Geneva, 22-29 November 1971*

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# **PESTICIDE RESIDUES IN FOOD**

## **Report of the 1971 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 22 to 29 November 1971. The Meeting was opened by Dr V. Fattorusso, Director of the Division of Pharmacology and Toxicology of the World Health 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 of Experts on Pesticide Residues had already met from 16 to 20 November 1971 in Geneva in preparation for the Joint Meeting.

Dr Fattorusso recalled the increasing concern about the overall problem of contamination of man's environment as reflected in the convening of the United Nations Conference on the Human Environment to be held in Stockholm next year. Food is one of the main sources of intake of chemical contaminants, particularly pesticides. However, in all countries the use of pesticides is still essential to ensure an adequate food supply. Consequently, the possible hazards associated with their use require the most careful study. The toxicological evaluation of pesticides, the estimation of acceptable daily intakes for man, and the recommendation of tolerances in various food items provide guidance to countries attempting to control the agricultural use of pesticides. They are also useful to the Codex Alimentarius Commission and its subsidiary body the Codex Committee on Pesticide Residues when recommending international tolerances.

### **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 (FAO/WHO, 1962), that studies be undertaken to evaluate possible hazards to man arising from the occurrence of residues of pesticides in foods. Following this recommendation, Joint Meetings of the FAO Committee on Pesticides in Agriculture and the WHO Expert Committee on Pesticide Residues were held in 1963 and 1965. The reports of these meetings (FAO/WHO, 1964; 1965a), which were concerned primarily with establishing acceptable daily intakes (ADIs), and the supporting

documents (FAO/WHO, 1965b, 1965c) were then considered by the FAO Working Party on Pesticide Residues with a view to recommending tolerances and appropriate methods of analysis for certain pesticides used on cereals (FAO, 1966).

Joint Meetings of the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues (referred to hereafter as "Joint Meetings") were held in 1966, 1967, 1968, 1969 and 1970. The reports of these meetings (FAO/WHO, 1967a, 1968a, 1969a, 1970a, 1971a) contain information on ADIs established, the tolerances recommended, and the methods of analysis suggested for the various pesticides considered. The supporting documents (FAO/WHO, 1967b, 1968b, 1969b, 1970b, 1971b) 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 Fifth Session of the Codex Committee on Pesticide Residues held in October 1970 (FAO/WHO, 1970c). The Meeting also received the report of the *Ad Hoc* Working Group of the Codex Committee on Pesticide Residues held in Copenhagen, 11-16 October 1971 (FAO/WHO, 1971c).

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

- (a) reviewing relevant data on certain pesticides and their residues ;
- (b) proposing, where appropriate, pesticide residue limits ;
- (c) recommending, where appropriate, methods of analysis for pesticide residues.

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 co-ordinate necessary research.

## 2. GENERAL CONSIDERATIONS

### 2.1 Principles adopted

Like its predecessors, this meeting took account of the principles enumerated in the first and second reports of the Joint Meetings of the FAO Committee on Pesticides in Agriculture and the WHO Expert Committee on Pesticide Residues (FAO/WHO, 1964, 1965a), in the second,

fifth, eleventh and twelfth reports of the Joint FAO/WHO Expert Committee on Food Additives (FAO/WHO, 1958, 1961, 1968c, 1969c), in the report of the WHO Scientific Group on Procedures for Investigating Intentional and Unintentional Food Additives (WHO, 1967), and in reports of previous Joint Meetings (FAO/WHO, 1967a, 1968a, 1969a, 1970a, 1971a).

## 2.2 Establishment of acceptable daily intakes

In the past, ADIs have occasionally been established for pesticides for which the results of long-term studies in animals were not available. The general scientific literature contains an increasing number of examples of substances that have been presumed to be safe solely on the basis of chemical, metabolic, and short-term toxicological information, but that have subsequently been shown to exhibit toxic effects in long-term studies in laboratory animals. The Meeting therefore agreed that only in exceptional circumstances should ADIs be established in the absence of satisfactory data from long-term animal studies. For some organophosphorus pesticides it may still be logical to base ADIs on data from adequate short-term *in vivo* studies of anticholinesterase activity, since such activity is the most sensitive criterion of effect for these compounds. Nevertheless, data from long-term experiments are usually required to provide assurance of the safety of moieties of molecules other than those responsible for the anticholinesterase activity.

## 2.3 Nature and availability of data considered

The Meeting reaffirmed the principles (FAO/WHO, 1971a) that the establishment of ADIs and residue limits should be based on all relevant data available at the time of evaluation and that the data used for these purposes should be available to *bona fide* scientists on request. It was further agreed that all data that fulfilled these requirements, irrespective of their source, would be considered by the Meeting in the establishment of ADIs and residue limits and that any data used for this purpose might be quoted in the evaluations and in the report of the Meeting.

It was noted that some of the matters on which insufficient chemical or toxicological data were available related to items on which information had been requested at previous meetings. It was also noted that some of the deficiencies related to pesticides that had been in use for a long time and that they were compounds in which no commercial companies had exclusive rights. Furthermore, certain of these substances were cheap and readily available and were currently used in many developing countries. In the above circumstances the Meeting endorsed the recommendation of the 1969 Joint Meeting (FAO/WHO, 1970a) that urgent attention be given

to the possibility of providing international support for research on these subjects.

#### **2.4 Good agricultural practice**

The Meeting considered part of the report of the *Ad Hoc* Working Group of the Codex Committee on Pesticide Residues (FAO/WHO, 1971c) dealing with the concept of good agricultural practice in the use of pesticides as a means of minimizing the occurrence of residues. It was agreed that the concept outlined in that report was consistent with the principles followed by the Joint Meeting in relation to the information considered when making recommendations for tolerances.

As far as possible agricultural practices in all countries from which data have been received and the pesticide residues likely to result from these practices are considered by the Joint Meeting when making recommendations for residue limits.

The definition of good agricultural practice in the use of pesticides proposed in Appendix II to the report of the *Ad Hoc* Working Group covers important aspects considered by the Joint Meeting, as stated in the definition and explanatory note in the Glossary appended to the report of the 1969 Meeting (FAO/WHO, 1970a). However the Group's definition does not specifically refer to some other requirements that are normally taken into account by national authorities in regulating usage of pesticides. For example, the officially recommended or authorized usage normally specifies the formulation, dosage rate, frequency of application, pre-harvest interval, and other directions to be included on the label.

The Meeting therefore decided that, for the time being at least, the definition approved at the 1969 Joint Meeting (FAO/WHO, 1970a) should not be altered.

In some instances the recommendations of the Joint Meeting are conditioned by the composition or quality of the pesticide used in supervised trials; in such cases the recommendations are to be interpreted as applying to such compositions or qualities as are specified in the corresponding monograph.

Similarly, some procedures for handling the raw agricultural produce after treatment, e.g., after fumigation, may be regarded as usual and necessary conditions to apply to agricultural practice. In this connexion, guidelines were recommended for fixing the residue levels of unchanged fumigant that, if good practices are adopted, need not be exceeded in milled cereal products and in bread and other cooked cereal products

#### **2.5 Residues in milk and milk products**

The Meeting discussed the problem of residues in milk arising from the use of selected pesticides for the control of various parasites of dairy

cows. It was stressed that, as far as possible, milk should be free from such residues. However, it was noted that in many areas parasites such as lice, horn flies, ticks, and warble flies seriously affect the health of animals and the production of food. Furthermore, in such areas, and particularly in semitropical countries where cattle ticks are endemic, it is difficult if not impossible to avoid the use of pesticides on lactating cattle and such use is acceptable to the regulating authorities.

In some instances treatment can be confined to the non-lactating periods. Where this is not possible and trials have shown that residues occur in milk from cows known to have been treated individually, it is possible to insist that milk be discarded for a period following treatment. However, where treatment has to be repeated at regular intervals, as in the case of tick control, or where all members of a herd have to be treated at one time, it is not always practical to continue discarding milk until the residues in the milk from each cow have fallen below the level of detection.

The Meeting felt that it was improbable that the level of residues reaching the consumer would be as high as the maximum values observed in supervised trials on individual cows, for the following reasons :

(a) It is the practice for regulatory authorities to set limitations on the use of such pesticides, including type of formulation, route and time of application, dosage, condition of the animal, and interval between treatment and use of milk for human consumption.

(b) Milk of the first milking after treatment is usually mixed with that of subsequent milkings.

(c) It is usual for milk from many cows to be mixed before processing and before distribution to consumers, either as milk or as milk products.

(d) Even in areas where treatments have to be repeated frequently it would be highly unlikely for more than a small proportion of the milk delivered on a particular day to have come from recently treated cows.

It was recognized that chlordimeform, chlorfenvinphos, fenthion, and trichlorfon and their metabolites were not secreted in the milk for appreciable periods. On this basis, recommendations for tolerances for residues of these pesticides in milk and milk products were made.

## 2.6 Sampling and analysis

From the report of the Meeting of the *Ad Hoc* Working Group (FAO/WHO, 1971c) it was noted that the Codex Committee on Pesticide Residues was studying the possible adoption of standard methods for sampling some important food commodities for use in the course of enforcing pesticide residue limits. The meeting recognized that the results of individual analyses

are dependent on the method of sampling; it also reaffirmed that the numerical values for residue limits and figures included in the recommendations related to representative samples of the commodities to which they referred. It was agreed that the recommendations for residue limits should in future mention any special technical requirements for sampling (e.g., mixing or timing) where this seemed to be necessary to define the conditions for application of the proposed tolerance levels.

In general, the tolerances are deemed to apply to the commodity on an "as received" basis, but two main exceptions are made to this condition. In the case of vegetable crops that have edible parts developed underground the tolerances apply to the "soil-free" commodity (i. e., after removal by brushing of all loosely adhering soil). As discussed in the report of the 1970 Joint Meeting (FAO/WHO, 1971a) the tolerances for preferentially fat-soluble pesticide residues are sometimes more conveniently expressed "on a fat basis" or "in the fat of" the product in question. The former implies that the commodity is analysed on an "as received" basis but that a determination of its fat content is also made, the result then being expressed in terms of this. In such cases it is desirable to use a method for the determination of fat content that is recommended for use on the commodity in question; where the tolerance is expressed as "in the fat of meat of", this is deemed to apply to body fat, irrespective of its anatomical site on an "as received" basis.

## 2.7 Methods of residue analysis

In discussing methods for the analysis of pesticide residues the Meeting reaffirmed its policy of advising, wherever possible, on the types of method to be preferred for regulatory purposes. The minutes of the Sixth Meeting of the IUPAC Commission on the Development, Improvement and Standardization of Methods of Pesticide Residue Analysis<sup>1</sup> were reviewed. The Meeting endorsed the view of the Commission that, in addition to the multiresidue gas chromatographic procedures at present considered to be the methods of choice for the determination of residues of organochlorine and organophosphorus pesticides, there was a continuing need for "special" methods for individual compounds, particularly for those that could provide evidence of positive identification of the observed residue (e.g., micro-infrared and mass spectroscopic methods). It also accepted the recommendation of the Commission that gas chromatographic multiresidue procedures were now acceptable for the detection and determination of volatile fumigant residues.

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<sup>1</sup> The proceedings of this meeting are to be published in the *Comptes rendus* of the XXVIth IUPAC Conference, 1971 and, in summary, in the *Journal of the Association of Official Analytical Chemists*.

The Meeting considered some of the definitions contained in the Glossary attached as Appendix IV to the report of the 1969 Joint Meeting (FAO/WHO, 1970a) relating to methods of residue analysis and decided that definitions of "limit of determination" and "limit of detection" should be added to the Glossary (see section 2.10 and Annex 3).

The need for a definition of "referee method of analysis" was considered at some length. It was the view of the Meeting that referee methods of analysis would demand special emphasis on accuracy and precision, possibly requiring apparatus and experience not normally available in laboratories undertaking routine regulatory work. Procedures for the positive identification of the residue under consideration are also likely to be required for referee purposes. Furthermore, since it is necessary to ensure that the samples examined by the parties to the dispute and those examined by the referee analyst are all equally representative of the commodity under examination, close specification of the sampling procedure may be essential. Because the methods of pesticide residue analysis are undergoing continual revision and alteration to take advantage of the latest developments in analytical techniques, established "referee methods" are apt to become quickly outdated. In addition interference from natural materials or from traces of other chemicals (whether or not derived from other pesticides) renders the adequate description of a "referee" method with the required degree of specificity a matter of extreme difficulty. For these reasons the Meeting concluded that it was impractical to attempt to specify any analytical procedure for the determination of pesticide residues as a "referee method of analysis"; however, it also became clear that there may be a greater need to specify "referee procedures of action". A slightly amended definition of "referee method of analysis" has been included in the *Additions and amendments to the glossary* (Annex 3) for information purposes. But, as it is proposed not to continue to use the term, the Meeting was of the opinion that it might be deleted from future editions.

## 2.8 National tolerances

Monographs on individual pesticides arising from various Joint FAO/WHO Meetings on Pesticide Residues list some national tolerances for residues of the particular chemical in specified foods. Such lists are included for information and to facilitate comparison of legislation in various countries. The lists of tolerances are known to be incomplete and not necessarily up to date at the time of publication. The omission of any country or of any tolerance should not be construed as indicating that such tolerances do not exist in those countries. The tolerance recommendations of the Joint Meeting are based on extensive scientific data obtained from supervised field trials in many countries and are not influenced by national tolerances from any country.

### 2.9 Tolerance definition

The Meeting considered the definition of "Codex Tolerance or Codex Maximum Residue Limit" contained in Appendix II to the Report of the *Ad Hoc* Working Group of the Codex Committee on Pesticide Residues (FAO/WHO, 1971c).

While the wording of this definition is not identical with that used in the Glossary appended to the report of the 1969 Joint Meeting (FAO/WHO, 1970a) the concepts are identical. It was noted from the explanatory note attached to the definition of Codex tolerance that the higher values found to occur in some countries when food commodities are produced or treated with pesticides under good agricultural practices are normally accommodated by Codex maximum residue limits. The recommendations of the Joint Meeting are also normally designed to accommodate the highest acceptable levels of residues in raw agricultural commodities resulting from good agricultural practices in countries with special pest problems and special reasons for applying pesticides.

### 2.10 Additions and amendments to glossary

The Meeting considered the definitions contained in the Glossary appended to the report of the 1969 Joint Meeting (FAO/WHO, 1970a, Appendix IV). Definitions for "limit of determination" and "limit of detection" were accepted by the Meeting. The definitions for "pesticide residue", "regulatory method of analysis" and "reference method of analysis" were modified. The new definitions and those amended by the present Meeting are listed in Annex 3.

The Meeting was aware that there remained a number of inconsistencies in certain other definitions and explanatory notes, in particular "unintentional residue", "practical residue limit", "acceptable daily intake" and "total diet studies", and recommended that special attention be paid to these at a future meeting.

## 3. FUMIGANTS

The 1969 Joint Meeting (FAO/WHO, 1970a) noted reports of the occurrence of residues of methyl bromide and 1,2-dibromoethane (ethylene dibromide) in unchanged form in certain foods and decided that the residues of these two fumigants together with those from carbon disulfide, carbon tetrachloride, 1,2-dichloroethane (ethylene dichloride) and ethylene oxide should be reviewed at a future meeting.

The 1970 Joint Meeting (FAO/WHO, 1971a) suggested that chloropicrin and hydrogen phosphide should be added to the list of fumigants to be reviewed.

The present Meeting reviewed the pattern of use and the information on residues in food for each of these fumigants, except chloropicrin. This compound was not reviewed since its use as a fumigant on foods is small and no new information was available. The Meeting did not review the toxicological information but recommended that such a review be undertaken at a future meeting in the light of the new evaluations of the information on residues of these fumigants.

As part of the present review, special consideration was given to the problem of residues of the bromide ion, which can arise in food from a number of sources, including the bromine-containing fumigants.

### 3.1 Residues of unchanged fumigant

The fumigants are characterized by their high volatility relative to most other types of pesticide. The total residue at the end of the fumigation period consists of "physically held" (sorbed) unchanged fumigant and also the products of any chemical reaction between sorbed fumigant and the food. The process of physical uptake is reversible and during subsequent storage, handling, and processing of the food the physically sorbed fumigant tends to disappear by volatilization and diffusion away from the food, and possibly also by further chemical reaction with the food. The problem of the residual unchanged fumigant is referred to in this section of the report. The important problems of residual reaction products and the effects, if any, on the nutritive properties of the treated food were not discussed by the Meeting. They are referred to where appropriate in the separate monographs.

It has previously been generally accepted that after use in accordance with good practice no significant residue of the unchanged fumigant reaches the consumer and some countries setting national tolerances for pesticide residues have exempted a number of these fumigant compounds from the requirement for establishment of a tolerance.

More sensitive and more selective methods of fumigant residue analysis have recently been developed and these have been used to follow changes in the amounts of unchanged fumigant in certain foods after fumigation. The results confirm that the amount of the residual unchanged fumigant continues to decline during storage, handling, or processing, but indicate that in some circumstances small amounts may still be detectable in food when offered for consumption.

The Meeting stressed the desirability of reducing to a minimum such residues in food by the adoption of good practice in handling the food after fumigation.

The Meeting considered the 5 fumigants carbon disulfide, carbon tetrachloride, 1,2-dibromoethane (ethylene dibromide), 1,2-dichloroethane (ethylene dichloride) and methyl bromide and indicated for each of them resi-

due levels (parts per million) in raw cereals, in milled cereal products, and in bread and other cooked cereal products that need not be exceeded if good practices are followed. These levels are listed below :

|                                                                                           | carbon disulfide | carbon tetrachloride | 1,2-dibromo-ethane | 1,2-dichloro-ethane | methyl bromide |
|-------------------------------------------------------------------------------------------|------------------|----------------------|--------------------|---------------------|----------------|
| In raw cereals at point of entry into a country or when supplied for milling <sup>a</sup> | 10               | 50                   | 20                 | 50                  | 50             |
| In milled cereal products that will be subjected to baking or cooking                     | 2                | 10                   | 5                  | 10                  | 10             |
| In bread and other cooked cereal products <sup>b</sup>                                    | 0.5              | 0.05                 | 0.1                | 0.1                 | 0.5            |

<sup>a</sup> Provided that the commodity is freely exposed to the air for a period of at least 24 hours after the end of treatment before sampling.

<sup>b</sup> The levels for these commodities are at or about the present limit of determination.

For the above 5 compounds the residue of unchanged fumigant in the food as offered for consumption was not expected to exceed an amount close to the limit of determination by present analytical methods.

A special difficulty arises in the application of tolerances at the point of entry of a commodity into a country. Since fumigation is frequently undertaken immediately before shipping, or even during transit, in ships' holds or containers, the amounts of volatile or reactive residues will be changing rapidly at the time of discharge. It has therefore been specified that such produce should not be sampled for analysis until the commodity has been discharged, ventilated, or freely exposed to the air for a period of at least 24 hours after the end of treatment.

For methyl bromide consideration was also given to residue levels in dried fruits, cocoa beans, nuts, and peanuts at the point of entry into a country and as offered for consumption.

Pending a discussion in depth of the new situation created by the detection of residues of the unchanged fumigants in food, the Meeting recommended that all the foregoing residue levels be used as guidelines.

For hydrogen phosphide derived from preparations containing aluminium phosphide existing tolerances were confirmed and extended.

For ethylene oxide the residue pattern is especially complex and the Meeting recommended that further consideration should be given to this compound at a future meeting.

### 3.2 Residues of bromide ion

Inorganic bromide may occur in foods (*a*) as a result of the uptake of bromine from the soil, predominantly in water-soluble, ionic form ; (*b*) as

a result of the breakdown of methyl bromide or other bromine-containing fumigants applied after harvest ; or (c) as a result of the use of other bromine-containing pesticides or food additives. The bromide ion in the soil may be present "naturally" or may result from the breakdown of bromine-containing chemicals including insecticides, herbicides, and soil fumigants such as methyl bromide, 1,2-dibromoethane (ethylene dibromide) and 1,2-dibromo-3-chloropropane.

Some countries have established multiple residue tolerances for the bromide ion in a particular food; these differ according to specific pesticide uses. The Meeting concluded that the establishment of tolerances for the bromide ion derived from any particular source is of very limited value. The increase in bromide ion content resulting from a particular treatment can be determined only in supervised trials in which the bromide content is determined before and after treatment or, alternatively, in which an isotopically labelled compound is used for the treatment. However, when a food, the history of which is unknown or is incompletely known, is examined for regulatory purposes there is no means of judging from the determination of bromide ion what proportion arises from natural sources or from any one form of treatment. Furthermore, as far as is known, the source of the bromide ion does not affect its behaviour on ingestion.

A considerable amount of information has been published from laboratory studies and from supervised trials on the amounts of bromide found in food after soil or post-harvest treatment with bromine-containing fumigants, including methyl bromide and 1,2-dibromoethane. Some limited information is available on the amounts of background bromide present in untreated food, but it is clear that, for some foods, this "background" can be extremely variable. In particular, the amount of bromide ion "naturally" present in the soil is very variable and its uptake by plants, particularly the amount passing into green leaves, can produce an amount in the harvested crop that is large relative to that resulting from the direct use of fumigants on the crop.

Tolerances for total bromide ion in foods have previously been proposed primarily to prevent the excessive use of certain bromine-containing pesticides rather than as a means of limiting the intake of bromide ion in the diet. However, where a large addition to the bromide ion content of a food results from the post-harvest use of a bromine-containing fumigant such as methyl bromide, this addition provides an indication of the extent of the reaction of the fumigant with the food and an indirect measure of methylated or other organic reaction products that may be present. Where it is possible, regulation against the excessive formation of these residues may be as important as, and might possibly be more important than, the regulation of the bromide ion content *per se*.

For these reasons, the Meeting concluded that where there is clear evidence that the amount of "background" bromide ion is only a small part of the

tolerance figure, the establishment of the tolerance does provide a means of controlling the use of bromine-containing pesticides, whereas if the "background" is large or variable then such a tolerance is of limited value for regulatory purposes.

The Meeting decided that since adequate data exist showing that the level of "background" bromide ion in raw cereals is usually well below 10 ppm, the existing recommended tolerance (50 ppm) may be used effectively for raw cereals and wholemeal flour for the regulatory control of the use of fumigants such as methyl bromide. It further agreed that, for other foods, additional and more reliable data are required before decisions can be taken on the practicability of establishing tolerances in terms of bromide ion. The Meeting therefore recommended that the existing temporary tolerances for bromide ion in foods other than raw cereals be held in abeyance until the required information is assembled and assessed.

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

##### 4.1 Organophosphorus insecticides

Five organophosphorus compounds were considered for the first time: chlorfenvinphos, fenthion, omethoate, trichlorfon, and trichloronat.

The quantity and quality of the data from studies in laboratory animals concerning chlorfenvinphos were considered adequate for the purposes of establishing an ADI for man. It was felt, however, that an explanation was needed of the wide variation between species in sensitivity to the acute toxic effects of this compound.

The Meeting noted that signs of organophosphorus intoxication with fenthion developed slowly and persisted for a considerable time, following both oral and intraperitoneal administration. The effects on the spleen noted in several studies were, in the light of present knowledge, considered to be of no toxicological significance. The one-year rat study was not accepted as fulfilling the need for a long-term study. Despite the above considerations, a temporary ADI for fenthion was established in the light of the availability of data from human exposure.

Taking into account the availability of toxicological data on dimethoate, the Meeting established a temporary ADI for omethoate based on the 90-day study in the rat. However, it was agreed that there is an urgent need for long-term toxicological studies on omethoate.

The Meeting expressed concern about the finding, in two of three long-term feeding studies with trichlorfon in the rat, of an increased inci-

dence of hyperplastic and/or neoplastic lesions in the mammary glands. Although this and other reported evidence was not regarded as necessarily indicative of carcinogenic activity, it was taken into account and only a temporary ADI was established for the compound.

The Meeting was assured that polychlorinated dibenzo-*p*-dioxins were not present in technical trichloronat above the level of detection (0.1 ppm). However, neither an ADI nor a temporary ADI could be established for trichloronat because of a complete lack of information on the fate of this relatively stable compound after ingestion by animals and because of a shortage of information on both the gross pathological and the histopathological appearances in animals exposed to the compound in the diet, particularly in long-term studies.

#### 4.2 Herbicides

Since the last evaluation of 2,4-D (FAO/WHO, 1971a) the results of two-year studies in the rat and the dog and an adequate reproduction study in the rat have become available. The Meeting agreed that, despite certain statistical calculations on tumour incidence in rats fed on 2,4-D for up to two years, consideration of all the data from this study do not substantiate the view that 2,4-D is carcinogenic. In this connexion, it was noted that after long-term exposure to the substance mice exhibited no increase in the incidence of neoplasms of any site or type. The Meeting drew attention to the fact that 2,4-D or its esters only displays embryotoxic activity at very high levels of exposure and that polychlorinated dibenzo-*p*-dioxins were below the level of detection in the currently manufactured technical material. An acceptable daily intake for man was therefore established based on the two-year feeding study in the rat.

#### 4.3 Miscellaneous

In the case of chlordimeform, the Meeting established a temporary ADI on the basis of two-year feeding studies in rats and dogs. Explanations of organ weight and body-weight changes and elucidation of the nature of liver lesions in both species were deemed necessary.

The Meeting was unable to establish an ADI for chlormequat because the non-confidential toxicity data submitted for its consideration were grossly insufficient (see section 2.3).

The Meeting was informed of the progress of the long-term toxicity studies initiated by WHO and IARC on DDT in rodents and considered that the new information did not provide grounds for recommending any change in the present ADI or tolerance levels.

## 5. EVALUATION OF DATA FOR RESIDUE LIMITS

The Meeting reviewed and, in certain cases, amended recommendations made previously. Some pesticides that had not been previously considered were also reviewed.

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

The reports of the Fourth and Fifth Sessions of the Codex Committee on Pesticide Residues (FAO/WHO, 1969d, 1970c) cover a number of questions not dealt with at the 1970 Joint Meeting on Pesticide Residues. These concern the following substances: carbaryl, chlordane, DDT, hydrogen phosphide, inorganic bromide, and lindane. 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, 1972b).

In the absence of any new data it was not possible to propose a practical residue limit for chlordane in carrots or to propose tolerances for residues resulting from pre-harvest treatment in the case of carbaryl in raw cereals and carbaryl, DDT or lindane in cocoa beans and derived products. The Meeting considered all questions concerning inorganic bromide and made the recommendations presented in section 3.2 of this report. The existing tolerance for residues of hydrogen phosphide on breakfast cereals was confirmed subject to the conditions specified in the column "Remarks" in Annex 1 to this report and in the relevant monograph.

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

The following pesticides were reconsidered in the light of information received since the previous meeting: 2,4-D, endosulfan, thiabendazole, and the fumigants carbon disulfide, carbon tetrachloride, 1,2-dibromoethane (ethylene dibromide), 1,2-dichloroethane (ethylene dichloride), ethylene oxide, hydrogen phosphide, and methyl bromide. Certain additions, amendments, or clarifications that were made appear in Annex 1 to this report and in the relevant monographs (FAO/WHO, 1972b).

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

Recommendations for tolerances were made for chlordimeform, chlorfenvinphos, fenthion, phosphamidon, omethoate, and trichlorfon. In the absence of an ADI, it was not possible to make recommendations for trichloronat. Full details of their evaluation are contained in the mono-

graphs and a summary of the recommended values and remarks is provided in Annex 1.

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

The Meeting considered the position of those compounds for which ADIs had been established but only temporary tolerances had been proposed. In this category "bromide ion" and "endosulfan" were fully dealt with and recommendations were made. The other compounds in this category—azinphos-methyl, chlorobenzilate, crufomate, dioxathion, ethion, fenchlorphos, and phosphamidon—are those for which certain data had previously been specified as required before 30 June 1972. Since these data were not available at the time of the Meeting, it was decided to defer consideration of these materials until the next Joint Meeting.

### 6. COMPARISON OF POTENTIAL INTAKES OF PESTICIDES IN DIETS WITH THEIR ACCEPTABLE DAILY INTAKES

The Meeting considered the results of a study undertaken in accordance with the recommendations of previous meetings (FAO/WHO, 1970a, 1971a); this was an extension of the pilot study discussed by the 1969 Joint Meeting, and the details have been previously reported. Calculations were made of *theoretical* intakes of 35 pesticides in 4 countries from 3 regions of the world for which average food consumption data had been compiled by FAO. The total of 35 includes 6 pesticides for which ADIs and tolerances were recommended by the present Meeting.

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

The results of this study indicated that there was not even a theoretical possibility that the acceptable daily intakes for the following pesticides might be exceeded: binapacryl, bromide ion, captafol, captan, chlordimeform, chlorfenvinphos, 2,4-D, diphenylamine, diquat, ethoxyquin, fenitrothion, folpet, formothion, mancozeb, paraquat, 2-phenylphenol, pyrethrins, thiabendazole, trichlorfon, and tricyclohexyltin hydroxide. 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 tolerance figures and the acceptable daily intakes for them remain unchanged.

Several compounds are borderline cases and warrant further studies at this stage. These include chlordane, dichlorvos, endrin, fentin compounds,

heptachlor, malathion, carbaryl, diazinon, hexachlorobenzene, and quinozene. In addition, there was a significant theoretical possibility that the acceptable daily intakes of DDT, dieldrin, fenthion, omethoate, and piperonyl butoxide might be exceeded.

Available information on the disappearance of residues during processing and cooking before consumption was used in the case of 3 pesticides—carbaryl, DDT, and malathion. In all instances, when the effects of processing were taken into account in recalculating the data, the potential intakes of these pesticides were considerably reduced. In this study, the effects of processing indicated that malathion could be considered to be in that group of compounds for which no further data need be developed because the quantity of residue reaching the consumer after processing would not exceed the ADI.

The results obtained in this study indicate that it is useful to calculate the potential daily intakes of pesticide residues using average food consumption figures for individual countries. In future studies information on the extent of use and on the effects of processing, storage, and cooking before consumption should be considered when making evaluations of pesticides. Where adequate information is not available for this purpose, work should be initiated to obtain the necessary data on disappearance of residues before consumption. If for some pesticides there remains a possibility that the ADI may be exceeded, residue determinations on the total diet and other monitoring studies should be undertaken to assess the levels of those compounds in the food. In the absence of total diet studies, relevant data from monitoring studies should be used in future.

These intake studies should be undertaken and expanded on a continuing basis to check that the ADI is not being exceeded even on a theoretical basis. They should also be extended to countries with dietary habits different from those at present under consideration.

## 7. FUTURE WORK

It was suggested that the following items should be considered at future joint meetings :

1. The compounds in Priority List VII in Appendix IX to the report of the Fifth Session of the Codex Committee on Pesticide Residues (FAO/WHO, 1970c) ; i.e., benomyl, bromophos, bromophos ethyl, carbophenothion, chlorpyrifos, fensulfothion, methidathion, mevinphos, monocrotophos, and phosalone.

It may be advantageous to add the fungicide thiophanate methyl to this list and to consider it in connexion with benomyl since the residue in plants from both materials consists essentially of the same metabolite.

2. Matters referred to the Joint Meeting by the Fourth and the Fifth Sessions of the Codex Committee on Pesticide Residues (FAO/WHO, 1969d, 1970c).

3. Evaluation of the relevant toxicological and other related data on the following fumigants: carbon disulfide, carbon tetrachloride, 1,2-dibromoethane (ethylene dibromide), 1,2-dichloroethane (ethylene dichloride), ethylene oxide, hydrogen phosphide, and methyl bromide.

4. Consideration of the following pesticides for which the temporary ADIs and/or temporary tolerances are due to expire in 1972: azinphos-methyl, chlorobenzilate, chloropropylate, coumaphos, crufomate, dioxathion, ethion, fenchlorfos, parathion-methyl, piperonyl butoxide, phosphamidon, and pyrethrins.

5. A review of the definitions given in Annex IV to the report of the 1969 Joint Meeting (FAO/WHO, 1970a).

6. Any other matters mentioned under the item Future Work in the reports of earlier Joint Meetings, in so far as these matters have not yet been dealt with and still need consideration.

## 8. RECOMMENDATIONS TO FAO AND WHO

1. In the interests of public health and agriculture and in accordance with the recommendations of previous Joint Meetings on Pesticide Residues, it is desirable that further Joint Meetings should be convened annually.

2. The study proposed by the 1969 Joint Meeting (FAO/WHO, 1970a) of the relationship between intake, tolerance, and ADI should be continued in respect of those pesticides for which the pilot study showed that there was a theoretical possibility that the ADI might be exceeded. Furthermore, the study should be extended to include all pesticides for which ADIs, tolerances, and practical residue limits have been established.

3. In certain instances insufficient information was available in spite of requests made at previous meetings. This situation was foreseen in 1969 when the Joint Meeting recommended that research on certain subjects, particularly on certain long-established pesticides, should be initiated by official bodies and supported by public funds. The Meeting therefore endorsed the previous recommendation and urged that high priority be given to research in these areas.

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Annex 1

INDEX TO DOCUMENTATION AND SUMMARY OF RECOMMENDATIONS  
 CONCERNING ACCEPTABLE DAILY INTAKES, TOLERANCES, AND  
 PRACTICAL RESIDUE LIMITS, AS OF NOVEMBER 1971 \*

| Pesticide                                                                             | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                              | Practical limits <sup>2</sup> (ppm) | Remarks                                                                                                                                                       |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made                                         |                                                                            |                                                     |                                                                                                                              |                                     |                                                                                                                                                               |
| acrylonitrile                                                                         | 1965c                                                                      |                                                     |                                                                                                                              |                                     |                                                                                                                                                               |
| aldrin                                                                                | 1967b, 1968b                                                               | 0.0001                                              |                                                                                                                              |                                     | See also dieldrin.                                                                                                                                            |
| allethrin                                                                             | 1965b                                                                      |                                                     |                                                                                                                              |                                     |                                                                                                                                                               |
| arsenic (as calcium or lead arsenate)                                                 | 1969b                                                                      |                                                     |                                                                                                                              |                                     |                                                                                                                                                               |
| azinphos-methyl                                                                       | 1969b                                                                      | 0.0025                                              | Apricots, grapes . . . . . 4 <sup>a</sup><br>Other fruit . . . . . 1 <sup>a</sup><br>● Vegetables . . . . . 0.5 <sup>a</sup> |                                     | Residues for "vegetables" for review in 1972, not 1973 as in Annex 1 of Ref. 1971 a.                                                                          |
| BHC (mixture of isomers)                                                              | 1969b                                                                      |                                                     |                                                                                                                              |                                     |                                                                                                                                                               |
| binapacryl                                                                            | 1970b                                                                      | 0.0025                                              | Peaches, cherries . . . . . 1<br>Apples, pears, grapes . . . 0.5<br>Plums . . . . . 0.3<br>Nectarines . . . . . 0.2          |                                     |                                                                                                                                                               |
| bromide (inorganic form, derived from bromine-containing fumigants and other sources) | 1969b, 1970b, 1972a, b                                                     | 1                                                   | Raw cereals, wholemeal flour . . . . . 50                                                                                    |                                     | Recommendations relate exclusively to inorganic bromide, not to bromine present as unchanged fumigant.<br>● Other recommendations from previous meetings held |



Annex 1 (continued)

| Pesticide                                     | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Practical limits <sup>2</sup> (ppm)                                                                                                            | Remarks                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made |                                                                            |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                |                                                                                                                                                                                                                                                                                            |
| carbon disulfide                              | 1965c, 1968b, 1970a, 1972a, b                                              |                                                     | <ul style="list-style-type: none"> <li>● Raw cereals . . . . . 50 e</li> <li>● Milled cereal products . . . . . 10 f</li> <li>● Bread and other cooked cereal products . . . . . 0.05 g</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                | Guideline levels (see footnote 3 and report on 1971 meeting).                                                                                                                                                                                                                              |
| carbon tetrachloride                          | 1965c, 1968b, 1970a, 1972b                                                 |                                                     | <ul style="list-style-type: none"> <li>● Raw cereals . . . . . 50 e</li> <li>● Milled cereal products . . . . . 10 f</li> <li>● Bread and other cooked cereal products . . . . . 0.05 g</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                | Guideline levels (see footnote 3 and report on 1971 meeting).                                                                                                                                                                                                                              |
| chlorbenside                                  | 1965b                                                                      | 0.01                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                |                                                                                                                                                                                                                                                                                            |
| chlordane                                     | 1968b, 1970b, 1971b                                                        | 0.001                                               | <p>Potatoes, sweet potatoes, rutabagas, turnips, parsnips, sugar beet, radishes . . . . . 0.3</p> <p>Asparagus, broccoli, Brussels sprouts, cabbage, celery, cauliflower, mustard greens, spinach, Swiss chard, lettuce . . . . . 0.2</p> <p>Beans, peas, egg plant, tomatoes, collards (= coleworts) . . . . . 0.02</p> <p>Wheat, rye, oats, rice (polished), maize, popcorn, sorghum . . . . . 0.05</p> <p>Cantaloupes, cucumbers, pumpkins, squash, watermelons . . . . . 0.1</p> <p>Almonds, bananas, figs, filberts, guavas, mangoes, olives, passion fruit, papayas, pecans, pomegranates, pineapples, strawberries, walnuts . . . . . 0.1</p> | <p>Milk and milk products (fat basis) . . . . . 0.05</p> <p>Fat of meat and poultry . . . . . 0.05</p> <p>Eggs (shell free) . . . . . 0.02</p> | Expressed as the sum of the <i>cis</i> - and <i>trans</i> -isomers in plant products and as the sum of <i>cis</i> - and <i>trans</i> -isomers and oxychlordane in animal products. Tolerances apply to residues resulting from soil or seed treatments apart from that for cottonseed oil. |



Annex 1 (continued)

| Pesticide                                     | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                                                                                                                                                                                | Practical limits <sup>2</sup> (ppm)                                                                      | Remarks                                                                                                                                                             |
|-----------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made |                                                                            |                                                     |                                                                                                                                                                                                                                                                                |                                                                                                          |                                                                                                                                                                     |
| chlorobenzilate                               | 1969b                                                                      | 0.02                                                | Apples, pears (whole fruit) . . . . . 5 <i>a</i><br>Citrus fruit (whole) . . . . . 1 <i>a</i><br>Almonds, walnuts (without shells) . . . . . 0.2 <i>a</i><br>Melons, cantaloupes . . . . . 1 <i>a</i>                                                                          |                                                                                                          |                                                                                                                                                                     |
| chloropicrin                                  | 1965c                                                                      |                                                     |                                                                                                                                                                                                                                                                                |                                                                                                          |                                                                                                                                                                     |
| chloropropylate                               | 1969b                                                                      | 0.01 <i>a</i> (see remarks)                         | Apples, pears, citrus fruit (whole) . . . . . 3 <i>a</i><br>Tomatoes, cantaloupes . . . . . 1 <i>a</i>                                                                                                                                                                         |                                                                                                          | ADI is temporary; this fact was erroneously omitted from Annex 2 of Ref. 1969a and from Appendix I of Ref. 1970a. See monograph, Ref. 1969b, p. 62.                 |
| chlorpropham                                  | 1965b                                                                      |                                                     |                                                                                                                                                                                                                                                                                |                                                                                                          |                                                                                                                                                                     |
| chlorthion                                    | 1965b                                                                      |                                                     |                                                                                                                                                                                                                                                                                |                                                                                                          |                                                                                                                                                                     |
| coumaphos                                     | 1969b                                                                      | 0.0005 <i>a</i>                                     | Eggs (shell-free) . . . . . 0.05 <i>a</i><br>Meat (including poultry (on fat basis) ) . . . . . 0.5 <i>a</i>                                                                                                                                                                   |                                                                                                          | To be determined as coumaphos and oxygen analogue and expressed as coumaphos.                                                                                       |
| crufomate                                     | 1969b                                                                      | 0.1                                                 | Whole milk . . . . . 0.05 <i>a</i><br>Meat (fat basis) . . . . . 1 <i>a</i>                                                                                                                                                                                                    |                                                                                                          |                                                                                                                                                                     |
| 2, 4-D                                        | 1971b, 1972b                                                               | 0.3                                                 | ● Barley, oats, rye, wheat . . . . . 0.2                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                                                                                     |
| DDT                                           | 1967b, 1968b, 1969b, 1970b                                                 | 0.005 (see remarks)                                 | Apples, pears, peaches, apricots, small fruit (except strawberries), vegetables (except root vegetables), meat and poultry (on fat basis) . . . . . 7<br>Nuts (shelled), strawberries, root vegetables . . . . . 1<br>Cherries, plums, citrus and tropical fruit . . . . . 3.5 | Whole milk . . . . . 0.05<br>Milk products (fat basis) . . . . . 1.25<br>Eggs (shell-free) . . . . . 0.5 | 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,<br>1968b                               | 0.0025 |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                     |
| diazinon           | 1965b,<br>1967b,<br>1968b,<br>1969b,<br>1971b | 0.002  |  | Peaches, citrus fruit,<br>cherries . . . . . 0.7<br>Other fruits . . . . . 0.5<br>Leafy vegetables . . . . . 0.7<br>Other vegetables . . . . . 0.5<br>Wheat, barley, rice<br>(polished) . . . . . 0.1<br>Almonds, walnuts, filberts,<br>pecans, peanuts (shelled) . . . . . 0.5<br>Cottonseed, safflower seed,<br>sunflower seed . . . . . 0.5<br>Sweet corn (kernels and<br>cob with husks removed) . . . . . 0.7<br>Olives and olive oil . . . . . 2<br>Fat of meat of cattle, sheep<br>and hogs . . . . . 0.7<br>● Raw cereals . . . . . 20 <i>e</i><br>● Milled cereal products . . . . . 5 <i>f</i><br>● Bread and other cooked cereal<br>products . . . . . 0.1 <i>g</i> | Residues to be determined and expressed as the parent compound. Residues decline rapidly during storage and shipment; the tolerances are based on residues likely to be found at harvest or slaughter (see monograph).                                                                                                                                                                                              |
| 1,2-dibromoethane  | 1967b,<br>1968b,<br>1970a,<br>1972            |        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Analytical method must identify residue, because guideline level refers to original fumigant. Previously listed as ethylene dibromide.                                                                                                                                                                                                                                                                              |
| dichlofluanid      | 1970b                                         |        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 1,2-dichloroethane | 1965c,<br>1968b,<br>1970a,<br>1972            |        |  | ● Raw cereals . . . . . 50 <i>e</i><br>● Milled cereal products . . . . . 10 <i>f</i><br>● Bread and other cooked cereal<br>products . . . . . 0.1 <i>g</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Previously listed as ethylene dichloride.                                                                                                                                                                                                                                                                                                                                                                           |
| dichlorvos         | 1967b,<br>1968b,<br>1970b,<br>1971b           | 0.004  |  | Cocoa beans . . . . . 5<br>Raw grain (wheat, rice, rye,<br>oats, barley, maize,<br>sorghum, etc.) . . . . . 2<br>Milled products from raw<br>grain . . . . . 0.5<br>Coffee beans, soya beans,<br>lentils, peanuts . . . . . 2<br>Mushrooms . . . . . 0.5<br>Fresh vegetables (except<br>lettuce) . . . . . 0.5<br>Lettuce . . . . . 1<br>Tomatoes . . . . . 0.5<br>Fresh fruit (apples, pears,<br>peaches, strawberries, etc.) . . . . . 0.1<br>Meat of cattle, sheep,<br>goats, pigs, and poultry . . . . . 0.05<br>Eggs (shell-free) . . . . . 0.05<br>Milk (whole) . . . . . 0.02<br>Miscellaneous food items<br>not otherwise specified . . . . . 0.1                      | The tolerances are based on residues likely to be found at harvest or slaughter. Residues decline rapidly during storage or shipment (see monograph). 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. |

Annex 1 (continued)

| Pesticide                                     | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                                                                                                                                                                                                       | Practical limits <sup>2</sup> (ppm)                                                                                                                             | Remarks                                                                                                                          |
|-----------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made |                                                                            |                                                     |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 |                                                                                                                                  |
| dicofol                                       | 1969b, 1971b                                                               | 0.025                                               | Fruit, hops, vegetables, tea. 5                                                                                                                                                                                                                                                                       |                                                                                                                                                                 | ● "Tea" refers to dry manufactured tea.                                                                                          |
| dieldrin                                      | 1967b, 1968b, 1969b, 1970b, 1971b                                          | 0.0001                                              | Asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, cucumber, eggplant, horseradish, onions, parsnips, peppers, pimentos, radishes, radish tops . . . . . 0.1<br>Fruit (other than citrus) . . . 0.1<br>Citrus fruit . . . . . 0.05<br>Rice (rough) . . . . . 0.02<br>Potatoes . . . . . 0.2 | Carrots, lettuce, fat of meat . 0.2<br>Milk and milk products (fat basis) . 0.15<br>Raw cereals (other than rice) . . . . 0.02<br>Eggs (shell-free) . . . . 0.1 |                                                                                                                                  |
| difolatan (see captafol)                      |                                                                            |                                                     |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 |                                                                                                                                  |
| dimethoate                                    | 1968b, 1971b                                                               | 0.02                                                | Tree fruit (including citrus). 2<br>Tomatoes and peppers . . . 1<br>Other vegetables . . . . . 2                                                                                                                                                                                                      |                                                                                                                                                                 | Residues to be determined as dimethoate and its oxygen analogue and expressed as dimethoate.                                     |
| dimethrin                                     | 1965b                                                                      |                                                     |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 |                                                                                                                                  |
| dinocap                                       | 1970b                                                                      |                                                     |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 |                                                                                                                                  |
| dioxathion                                    | 1969b                                                                      | 0.0015                                              | Pome fruit . . . . . 5 <sup>a</sup><br>Grapes . . . . . 2 <sup>a</sup><br>Citrus fruit . . . . . 3 <sup>a</sup><br>Meat, excluding poultry (fat basis) . . . . . 1 <sup>a</sup>                                                                                                                       |                                                                                                                                                                 | Residues of <i>cis</i> - and <i>trans</i> -isomers of principal active ingredient to be determined and expressed as sum of both. |
| diphenyl                                      | 1967b, 1968b                                                               | 0.125                                               | Citrus fruit . . . . . 110                                                                                                                                                                                                                                                                            |                                                                                                                                                                 |                                                                                                                                  |
| diphenylamine                                 | 1970b                                                                      | 0.025                                               | Apples . . . . . 10                                                                                                                                                                                                                                                                                   |                                                                                                                                                                 |                                                                                                                                  |
| diquat (cation)                               | 1971b                                                                      | 0.002 <sup>a</sup>                                  | Rice (in husk) . . . . . 5 <sup>a</sup><br>Rape seed, sorghum . . . . 2 <sup>a</sup>                                                                                                                                                                                                                  |                                                                                                                                                                 | ● To be reviewed in 1972, not 1973 as listed on p. 40 of Ref. 1971a.                                                             |

|                                                                                                                   |                     |         |                                                                                                                                                                      |                                     |                                                                                                         |                  |                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------|---------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                   |                     |         | Peas, beans, sunflower seed . . . . .                                                                                                                                | 0.1 c                               |                                                                                                         |                  |                                                                                                                                                                           |
|                                                                                                                   |                     |         | Onions, potatoes, maize, rice (polished) . . . . .                                                                                                                   | 0.1 c                               |                                                                                                         |                  |                                                                                                                                                                           |
|                                                                                                                   |                     |         | Edible oils (sesame seed, sunflower seed, rape seed, cottonseed) . . . . .                                                                                           | 0.1 c                               |                                                                                                         |                  |                                                                                                                                                                           |
| dithiocarbamates, dimethyl (ferbam, thiram, and ziram)                                                            | 1965b, 1968b, 1971b | 0.025 b |                                                                                                                                                                      |                                     |                                                                                                         |                  | ADI applies to parent compound or to sum of residues of all compounds present.<br>● To be reviewed in 1973, not 1972 as recorded in Annex I of Ref. 1971a.                |
| dithiocarbamates, ethylene bis (mancozeb, maneb, and zineb, including zineb derived from nabam plus zinc sulfate) | 1965b, 1968b, 1971b | 0.025 b |                                                                                                                                                                      |                                     |                                                                                                         |                  | ADI applies to parent compound or to sum of residues of all compounds present (see mancozeb).<br>● To be reviewed in 1973, not 1972 as recorded in Annex I of Ref. 1971a. |
| DNOC                                                                                                              | 1965b               |         |                                                                                                                                                                      |                                     |                                                                                                         |                  |                                                                                                                                                                           |
| endosulfan                                                                                                        | 1968b, 1969b, 1972b | 0.0075  | ● Tea (dry, manufactured) . . . . .<br>Fruit, vegetables . . . . .<br>● Cottonseed . . . . .<br>● Cottonseed oil (crude) . . . . .<br>● Rice (unpolished) . . . . .  | 30<br>2<br>0.5<br>0.2<br>0.1        |                                                                                                         |                  | To be measured and reported as total endosulfan A and B and endosulfan sulfate.                                                                                           |
| endrin                                                                                                            | 1965b, 1971b        | 0.0002  | Cottonseed, cottonseed oil (crude) . . . . .<br>Edible cottonseed and maize oil . . . . .<br>Apples, wheat, barley, sorghum, rice (husked and/or polished) . . . . . | 0.1<br>0.02<br>0.02                 | Milk and milk products (fat basis) . . . . .<br>Fat of poultry . . . . .<br>Eggs (shell-free) . . . . . | 0.02<br>1<br>0.2 | All recommendations are total figures for endrin plus delta-keto-endrin.                                                                                                  |
| ethion                                                                                                            | 1969b, 1970b        | 0.00125 | Grapes . . . . .<br>Other fruit . . . . .<br>Vegetables . . . . .<br>Tea . . . . .<br>Meat (fat basis) . . . . .                                                     | 2 a<br>1 a<br>0.5 a<br>7 a<br>2.5 a |                                                                                                         |                  | The proviso "at slaughter" made for meat at 1968 Meeting withdrawn. Distinction between blended and straight tea withdrawn.                                               |

Annex 1 (continued)

| Pesticide                                     | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                                                                                                                                                                                                                                       | Practical limits <sup>2</sup> (ppm) | Remarks                                                                                                                                                                                                                   |
|-----------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made |                                                                            |                                                     |                                                                                                                                                                                                                                                                                                                                       |                                     |                                                                                                                                                                                                                           |
| ethoxyquin                                    | 1970b                                                                      | 0.06                                                | Apples, pears . . . . . 3                                                                                                                                                                                                                                                                                                             |                                     | ADI and tolerances erroneously designated as temporary in Appendix I of Ref. 1970a.                                                                                                                                       |
| ethylene dibromide                            |                                                                            |                                                     |                                                                                                                                                                                                                                                                                                                                       |                                     | See 1,2-dibromoethane.                                                                                                                                                                                                    |
| ethylene dichloride                           |                                                                            |                                                     |                                                                                                                                                                                                                                                                                                                                       |                                     | See 1,2-dichloroethane.                                                                                                                                                                                                   |
| ethylene oxide                                | 1965c, 1969b, 1970a, 1972                                                  |                                                     |                                                                                                                                                                                                                                                                                                                                       |                                     |                                                                                                                                                                                                                           |
| fenchlorfos                                   | 1969b                                                                      | 0.01                                                | Whole milk . . . . . 0.04 <i>a</i><br>Egg yolk . . . . . 0.05 <i>a</i><br>Meat (fat basis) . . . . . 7.5 <i>a</i>                                                                                                                                                                                                                     |                                     | Residues of fenchlorfos and oxygen analogues to be determined and expressed as fenchlorfos.                                                                                                                               |
| fenthion                                      | 1972b                                                                      | 0.0005 <i>d</i>                                     | Apples, peaches, cherries, lettuce, fat of meat . . . . . 2 <i>d</i><br>Cabbage, cauliflower,, olives, olive oil . . . . . 1 <i>d</i><br>Grapes, oranges, peas, meat . . . . . 0.5 <i>d</i><br>Squash . . . . . 0.2 <i>d</i><br>Wheat, rice, milk products (fat basis) . . . . . 0.1 <i>d</i><br>Milk (whole) . . . . . 0.05 <i>d</i> |                                     | Tolerances for fenthion and its major metabolites, determined separately or together and expressed as fenthion.                                                                                                           |
| fentin compounds                              | 1971b                                                                      | 0.0005                                              | Celery . . . . . 1<br>Sugarbeet, carrots . . . . . } see remarks 0.2<br>Potatoes, celeriac . . . . . } 0.1<br>Peanuts (shelled) . . . . . 0.05                                                                                                                                                                                        |                                     | Triphenyl tin considered 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 |

|              |                                   |                |                                                                     |              |                                                                                        |                |                                                                                                                                                                                                                           |
|--------------|-----------------------------------|----------------|---------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| fenitrothion | 1970b                             | 0.001 <i>c</i> | Apples, cherries, grapes, lettuce . . . . .                         | 0.5 <i>c</i> | Milk products (fat basis) . . . . .                                                    | 0.05 <i>c</i>  | ● Date for review postponed to 1974 to provide longer period for experiments.                                                                                                                                             |
|              |                                   |                | Red cabbage, tea (green at harvest) . . . . .                       | 0.3 <i>c</i> |                                                                                        |                |                                                                                                                                                                                                                           |
| ferbam       | 1965b, 1968b                      | 0.025 <i>b</i> | Tomatoes . . . . .                                                  | 0.2 <i>c</i> | Milk (whole) . . . . .                                                                 | 0.002 <i>c</i> | See dithiocarbamates.                                                                                                                                                                                                     |
|              |                                   |                | Cocoa . . . . .                                                     | 0.1 <i>c</i> |                                                                                        |                |                                                                                                                                                                                                                           |
| folpet       | 1970b                             | 0.16 <i>b</i>  | Currants (fresh) . . . . .                                          | 30 <i>b</i>  | Strawberries . . . . .                                                                 | 0.3            | Residues present as dimethoate to be covered by recommendations for dimethoate.                                                                                                                                           |
|              |                                   |                | Grapes, blueberries . . . . .                                       | 25 <i>b</i>  |                                                                                        |                |                                                                                                                                                                                                                           |
| formothion   | 1970b                             | 0.16 <i>b</i>  | Cherries, raspberries . . . . .                                     | 15 <i>b</i>  | Pineapple (edible portions) . . . . .                                                  | 0.01           | 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. |
|              |                                   |                | Apples, citrus fruit . . . . .                                      | 10 <i>b</i>  |                                                                                        |                |                                                                                                                                                                                                                           |
| heptachlor   | 1967b, 1968b, 1969b, 1970b, 1971b | 0.0005         | Tomatoes, strawberries . . . . .                                    | 5 <i>b</i>   | Fat of meat and poultry . . . . .                                                      | 0.2            | ● Sugar beet erroneously omitted from Ref. 1971a.                                                                                                                                                                         |
|              |                                   |                | Cucumber, cantaloupe (whole), water melon (whole), onions . . . . . | 2 <i>b</i>   |                                                                                        |                |                                                                                                                                                                                                                           |
|              |                                   |                |                                                                     |              | Vegetables (except where otherwise specified), sugar beet, eggs (shell-free) . . . . . | 0.05           |                                                                                                                                                                                                                           |
|              |                                   |                |                                                                     |              | Carrots . . . . .                                                                      | 0.2            |                                                                                                                                                                                                                           |
|              |                                   |                |                                                                     |              | Crude soya bean oil . . . . .                                                          | 0.5            |                                                                                                                                                                                                                           |
|              |                                   |                |                                                                     |              | Citrus fruit . . . . .                                                                 | 0.01           |                                                                                                                                                                                                                           |

Annex 1 (continued)

| Pesticide                                     | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                                                                                                         | Practical limits <sup>2</sup> (ppm)                                                                                                                                                                                                                  | Remarks                                                                                                                                                               |
|-----------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made |                                                                            |                                                     |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                      |                                                                                                                                                                       |
| hexachlorobenzene                             | 1970b                                                                      | (see remarks)                                       |                                                                                                                                                                                                         | Fat of cattle, sheep, goats, and poultry . . . 1 <sup>b</sup><br>Eggs (shell-free) . . . . . 1 <sup>b</sup><br>Milk products . . . 0.3 <sup>b</sup><br>Raw wheat . 0.05 <sup>b</sup><br>Cereal products (from wheat), milk (whole) 0.01 <sup>b</sup> | Tentative negligible daily intake of 0.0006 mg/kg established. (To be reviewed in 1973. See monograph.)                                                               |
| hydrogen cyanide                              | 1965c, 1969b                                                               | 0.05                                                | Raw cereals . . . . . 75<br>Flour . . . . . 6                                                                                                                                                           |                                                                                                                                                                                                                                                      |                                                                                                                                                                       |
| hydrogen phosphide                            | 1967b, 1968b, 1970b, 1972                                                  | Not necessary (see remarks)                         | Flour and other milled cereal products, breakfast cereals, dried vegetables, spices, nuts, peanuts, dried fruit, cocoa beans, other dried foods . . . . . 0.01<br>Raw cereals . . . . . 0.1             |                                                                                                                                                                                                                                                      | 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                                                                      |                                                     |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                      |                                                                                                                                                                       |
| lindane                                       | 1967b, 1968b, 1969b, 1971b                                                 | 0.0125                                              | Vegetables . . . . . 3<br>Cranberries, cherries, grapes, plums, and strawberries . . . . . 3<br>Fat of meat (cattle, pigs, sheep) . . . . . 2<br>Beans (dried) . . . . . 1<br>Raw cereals . . . . . 0.5 | Eggs (yolk) . 0.2<br>Milk and milk products (fat basis) . 0.1<br>Poultry (fat basis) . . . 0.7                                                                                                                                                       | Referred to as "gamma" BHC prior to 1967.                                                                                                                             |

|                              |                                     |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                      |
|------------------------------|-------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| malathion                    | 1967b,<br>1968b,<br>1969b,<br>1971b | 0.02            | Raw cereals, nuts, dried<br>fruits . . . . . 8<br>Whole meal and flour from<br>rye and wheat . . . . . 2<br>Citrus fruit . . . . . 4<br>Blackberries, raspberries,<br>lettuce, endive, cabbage,<br>spinach . . . . . 8<br>Cherries, peaches, plums . 6<br>Broccoli . . . . . 5<br>Tomatoes, kale, turnips . . 3<br>Beans (green), apples . . . 2<br>Strawberries, celery . . . . 1<br>Pears, blueberries, peas (in<br>pod), cauliflower, peppers,<br>eggplant, kohlrabi, roots<br>(except turnips), Swiss<br>chard, collards . . . . . 0.5 | The tolerances are based on<br>residues likely to be found at<br>harvest. Residues decline<br>rapidly during storage or<br>shipment (see monograph). |
| mancozeb                     | 1968b,<br>1971b                     | 0.025 <i>b</i>  | Potatoes . . . . . 1 <i>b</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Temporary tolerance applies<br>to parent compound or to<br>sum of all dithiocarbamates<br>present.<br><br>See dithiocarbamates.                      |
| maneb                        | 1965b,<br>1968b                     | 0.025 <i>b</i>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                      |
| methoxychlor                 | 1965b                               | 0.1             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                      |
| methyl bromide               | 1967b,<br>1968b,<br>1972            |                 | ● Nuts, peanuts . . . . . 100 <i>e</i><br>● Raw cereals, cocoa beans . . 50 <i>e</i><br>● Dried fruits . . . . . 20 <i>e</i><br>● Milled cereal products . . . 10 <i>f</i><br>● Bread, other cooked cereal<br>products, cocoa products,<br>dried fruits, nuts, peanuts . . 0.5 <i>g</i>                                                                                                                                                                                                                                                    | Guideline figures relate only<br>to unchanged fumigant.<br>(See also "bromide".)                                                                     |
| mevinphos                    | 1965b                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                      |
| MGK 264                      | 1968b                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                      |
| nabam                        | 1965b,<br>1968b                     | 0.025 <i>b</i>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | See entries for "dithiocarba-<br>mates" and "zineb".                                                                                                 |
| omethoate                    | 1972b                               | 0.0005 <i>d</i> | Apples, apricots, cherries,<br>grapes, peaches, pears,<br>plums . . . . . 2 <i>d</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | See also dimethoate and<br>formothion.                                                                                                               |
| organomercurial<br>compounds | 1967b,<br>1968b                     |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Monograph in Ref. 1967b is<br>entitled "phenylmercury<br>acetate".                                                                                   |

Possible figures are  
suggested in Ref.  
1968b, p. 208.

Annex 1 (continued)

| Pesticide                                                  | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                                                                        | Practical limits <sup>2</sup> (ppm) | Remarks                                                                                                                                            |
|------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made              |                                                                            |                                                     |                                                                                                                                                                        |                                     |                                                                                                                                                    |
| orthophenylphenol                                          |                                                                            |                                                     |                                                                                                                                                                        |                                     | See 2-phenylphenol.                                                                                                                                |
| oxydemeton-methyl                                          | 1968b, 1969b                                                               | Withdrawn at Joint Meeting in 1968 (Ref. 1969a)     |                                                                                                                                                                        |                                     | Referred to as demeton-S-methylsulfoxide in publications prior to Ref. 1968b.                                                                      |
| oxythioquinox                                              | 1969b                                                                      |                                                     |                                                                                                                                                                        |                                     | Renamed quinomethionate.                                                                                                                           |
| paraquat (cation)                                          | 1971b                                                                      | 0.0007 <sup>a</sup>                                 | Cottonseed . . . . . 0.2 <sup>a</sup><br>Potatoes . . . . . 0.1 <sup>a</sup><br>Cottonseed meal, cottonseed oil (edible), sugar cane juice . . . . . 0.05 <sup>a</sup> |                                     | To be reviewed in 1972, not 1973 as listed on p. 42 of Ref. 1971a.                                                                                 |
| parathion                                                  | 1965b, 1968b, 1970b, 1971b                                                 | 0.005                                               | Vegetables (except carrots) 0.7<br>Peaches, apricots, citrus fruit . . . . . 1<br>Other fresh fruit . . . . . 0.5                                                      |                                     | Reexamination of data at 1969 Meeting showed that tolerance recommendations for two groups of fruit had been recorded wrongly in previous reports. |
| parathion-methyl                                           | 1969b                                                                      | 0.001 <sup>a</sup>                                  | Fruit, cole crops, cucurbits . . . . . 0.2 <sup>a</sup><br>Other vegetables . . . . . 1 <sup>a</sup><br>Cottonseed oil . . . . . 0.05 <sup>a</sup>                     |                                     | Cucurbits include cantaloupes, melons and cucumbers.                                                                                               |
| phenyl mercury acetate<br>2-phenylphenol (and sodium salt) |                                                                            | 1                                                   | Cantaloupes (whole) . . . 120<br>Pears . . . . . 25<br>Carrots, peaches . . . . . 20<br>Sweet potatoes, apples,                                                        |                                     | See organomercurial compounds.<br>Residues expressed as 2-phenylphenol.<br>Referred to as orthophenylphenol on p. 18 of Ref. 1969a.                |

|                    |                                     |                    |                                                                                                |                   |                                                                            |
|--------------------|-------------------------------------|--------------------|------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------|
| phosphamidon       | 1965b,<br>1967b,<br>1969b,<br>1972b | 0.001              | plums (including fresh prunes) . . . . .                                                       | 15                | Expressed as the sum of phosphamidon and its des-ethyl derivative.         |
|                    |                                     |                    | Citrus fruit, cucumbers, peppers, cantaloupes (edible portions), pineapple, tomatoes . . . . . | 10                |                                                                            |
| phosphine          | 1967b,<br>1968b,<br>1970b           | 0.03 <sup>a</sup>  | Cherries, nectarines . . . . .                                                                 | 3                 | See hydrogen phosphide.<br>Only data for codfish examined at 1969 Meeting. |
|                    |                                     |                    | Raw cereals . . . . .                                                                          | 0.1 <sup>a</sup>  |                                                                            |
|                    |                                     |                    | Apples, pears . . . . .                                                                        | 0.5 <sup>a</sup>  |                                                                            |
|                    |                                     |                    | Citrus fruit . . . . .                                                                         | 0.4 <sup>a</sup>  |                                                                            |
|                    |                                     |                    | Other fruit, cole crops . . . . .                                                              | 0.2 <sup>a</sup>  |                                                                            |
|                    |                                     |                    | Tomatoes, lettuce, cucumbers, water-melons . . . . .                                           | 0.1 <sup>a</sup>  |                                                                            |
|                    |                                     |                    | Other vegetables (except root vegetables, for which a tolerance is not required) . . . . .     | 0.2 <sup>a</sup>  |                                                                            |
| piperonyl butoxide | 1967b,<br>1968b,<br>1970b           | 0.03 <sup>a</sup>  | Raw cereals . . . . .                                                                          | 20 <sup>a</sup>   | Only data for codfish examined at 1969 Meeting.                            |
|                    |                                     |                    | Fresh fruit and vegetables, dried fruit and vegetables, oil-seeds, tree nuts . . . . .         | 8 <sup>a</sup>    |                                                                            |
| propham            | 1965b                               | 0.04 <sup>a</sup>  | Dried codfish . . . . .                                                                        | 1 <sup>a</sup>    | Only data for codfish examined at 1969 Meeting.                            |
|                    |                                     |                    | Raw cereals . . . . .                                                                          | 3 <sup>a</sup>    |                                                                            |
| pyrethrins         | 1967b,<br>1968b,<br>1970b           | 0.04 <sup>a</sup>  | Fresh fruit and vegetables, dried fruit and vegetables, oil-seeds, tree nuts . . . . .         | 1 <sup>a</sup>    | Only data for codfish examined at 1969 Meeting.                            |
|                    |                                     |                    | Dried codfish . . . . .                                                                        | 0.1 <sup>a</sup>  |                                                                            |
|                    |                                     |                    | Raw cereals . . . . .                                                                          | 3 <sup>a</sup>    |                                                                            |
| quinomethionate    | 1969b                               |                    |                                                                                                |                   | Listed in Ref. 1969b as oxythioquinox, subsequently re-named.              |
| quintozene         | 1970b                               | 0.001 <sup>b</sup> | Mushrooms . . . . .                                                                            | 10 <sup>b</sup>   |                                                                            |
|                    |                                     |                    | Peanuts (whole) . . . . .                                                                      | 5 <sup>b</sup>    |                                                                            |
|                    |                                     |                    | Bananas (whole) . . . . .                                                                      | 1 <sup>b</sup>    |                                                                            |
|                    |                                     |                    | Lettuce, peanuts (kernels) . . . . .                                                           | 0.3 <sup>b</sup>  |                                                                            |
|                    |                                     |                    | Beans (navy), potatoes . . . . .                                                               | 0.2 <sup>b</sup>  |                                                                            |
|                    |                                     |                    | Tomatoes . . . . .                                                                             | 0.1 <sup>b</sup>  |                                                                            |
|                    |                                     |                    | Cottonseed . . . . .                                                                           | 0.03 <sup>b</sup> |                                                                            |
|                    |                                     |                    | Broccoli, cabbage . . . . .                                                                    | 0.02 <sup>b</sup> |                                                                            |
|                    |                                     |                    | Bananas (pulp), beans (other than navy), peppers (bell) . . . . .                              | 0.01 <sup>b</sup> |                                                                            |
|                    |                                     |                    |                                                                                                |                   |                                                                            |

Annex 1 (continued)

| Pesticide                                     | FAO/WHO publication dates (see list of references on page 22) <sup>1</sup> | Maximum acceptable daily intake (mg/kg body weight) | Tolerances <sup>2</sup> and guideline levels <sup>3</sup> (ppm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Practical limits <sup>2</sup> (ppm) | Remarks                                                                |
|-----------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------|
| Blank spaces indicate no recommendations made |                                                                            |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     |                                                                        |
| 2,4,5-T                                       | 1971b                                                                      |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     |                                                                        |
| thiabendazole                                 | 1971b, 1972b                                                               | 0.05                                                | ● Apples, pears . . . . . 10<br>Citrus fruit . . . . . 6<br>Bananas . . . . . 3<br>Bananas (pulp) . . . . . 0.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     |                                                                        |
| thiometon                                     | 1970b                                                                      |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     |                                                                        |
| thiram                                        | 1965b, 1968b                                                               | 0.025 <i>b</i>                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     | See dithiocarbamates.                                                  |
| toxaphene                                     | 1969b                                                                      |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     |                                                                        |
| trichlorfon                                   | 1972b                                                                      | 0.01 <i>d</i>                                       | Peppers . . . . . 1 <i>d</i><br>Bananas (pulp), peaches, Brussels sprouts, cauliflower, kale, sweet corn (kernels and cobs), celery, beet, wheat . . . . . 0.2 <i>d</i><br>Barley, maize, apples, cherries, oranges, strawberries, artichokes, cabbage, cowpeas, beans (blackeyed, green and lima), mustard greens, pumpkins, tomatoes, turnips, cottonseed, linseed, rape seed, safflower seed, soya beans, peanuts (shelled) . . . . . 0.1 <i>d</i><br>Meat, fat byproducts and offal of cattle and pigs . . . . . 0.1 <i>d</i><br>Milk (whole) . . . . . 0.05 <i>d</i><br>Sugar beet . . . . . 0.05 <i>d</i> |                                     |                                                                        |
| trichloroethylene                             | 1969b                                                                      |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     | 1969 Meeting decided not necessary to continue to study this compound. |

|                            |                 |                 |                         |            |                                                                                  |
|----------------------------|-----------------|-----------------|-------------------------|------------|----------------------------------------------------------------------------------|
| trichloronat               | 1972b           |                 |                         |            |                                                                                  |
| tricyclohexyltin hydroxide | 1971b           | 0.0075 <i>c</i> | Apples, pears . . . . . | 2 <i>c</i> | Expressed as the parent compound.                                                |
| triphenyltin               | 1965b           |                 |                         |            | Also see fentin compounds.                                                       |
| zineb                      | 1965b,<br>1968b |                 |                         |            | (Including zineb derived from nabam plus zinc sulfate.)<br>See dithiocarbamates. |
| ziram                      | 1965b,<br>1968b | 0.025 <i>b</i>  |                         |            | See dithiocarbamates.                                                            |

● Indicates additions or modifications made by the 1971 Joint Meeting concerning compounds considered at previous meetings.

<sup>1</sup> The dates of publication refer to the first complete or completely revised monograph. Where more than one date is given, later dates refer to addenda to the monograph in the first reference. Where a monograph has been completely revised no mention is made of any earlier obsolete ones. Where the only date given is 1972, the compound was considered at the 1971 Joint Meeting for the first time.

<sup>2</sup> Unless otherwise indicated, the tolerance and practical residue 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 or samples representative of individual consignments or lots.

*a* Temporary: results of work to be made available not later than 30 June 1972.

*b* Temporary: results of work to be made available not later than 30 June 1973.

*c* Temporary: results of work to be made available not later than 30 June 1974.

*d* Temporary: results of work to be made available not later than 30 June 1975.

<sup>3</sup> Guideline levels are printed in italics. They are included to assist administering authorities, even though ADIs have not been established for the individual fumigants. The levels recorded are those that need not be exceeded if good practices are followed. They are intended to be applied at one of the stages indicated below and in the knowledge that when so applied residues of unchanged fumigants in food as offered for consumption would not exceed an amount close to the limit of determination by present analytical methods:

*e* 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.

*f* To apply to milled cereal products to be subjected to baking or cooking.

*g* To apply to commodity 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 except where the name of the compound is marked with an asterisk, in which case the requirements previously stated are still valid.

**CARBON DISULFIDE \*****Desirable**

1. Additional data on residues of unchanged carbon disulfide occurring in food in commercial practice.
2. Studies on the nature of the reaction products, if any, of carbon disulfide with foodstuffs.

**CARBON TETRACHLORIDE \*****Desirable**

Further information from supervised trials and commercial treatments on the amount of residues of unchanged carbon tetrachloride occurring after fumigation of raw cereals, with an indication of the rate of disappearance during subsequent storage or processing.

**CHLORDIMEFORM****Required before 30 June 1975**

1. A further long-term feeding study in rats to obtain precise information on the incidence and nature of the histopathological changes in the liver and bile ducts of rats exposed to levels above and below 100 ppm in the diet. An effort should be made to explain the changes in organ-to-body-weight ratios noted in the previous long-term rat study.
2. Further investigation of the nature of the hepatic lesions observed in the dog.
3. Metabolic studies in several animal species, preferably including man.
4. Further data on the nature and levels of residues in animal tissues after use in cattle sprays and dips.

5. Further data on residues in milk after use in cattle sprays and dips, especially information on the nature of the residues and their distribution between aqueous and lipid phases.

6. Data on the residue levels in commercial butter and cheese.

#### **Desirable**

1. Further studies on the haematological effects.
2. Elucidation of the pharmacodynamic activity on the heart, including the potentiation of the effects of pressor amines.
3. Further data on the disappearance of residues during storage, processing, and cooking.
4. Data on residue levels in raw agricultural commodities moving in commerce.

### CHLORFENVINPHOS

#### **Desirable**

1. Clarification of differences in acute toxicity between species.
2. Further information on the depression of red blood cell cholinesterase levels in dogs.
3. Information on residues occurring in food in commerce.
4. Information on the effects of storage and processing in meat and other commodities when no adequate data are available.

### CHLORMEQUAT

**Required** (before an acceptable daily intake for man can be established)

Full reports on the biochemical and toxicological studies conducted on chlormequat.

#### **Desirable**

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

### 2,4-D

#### **Desirable**

1. Further life-time studies in the rat and in a non-rodent species.
2. Information on the extent of increased nitrate formation in plants treated with 2,4-D.

3. Information on the metabolism and excretion of 2,4-D in animal species other than the rat, particularly in non-rodent species and in man.

4. Information on the occurrence of 2,4-D residues in crops following uses other than on cereals.

#### 1,2-DIBROMOETHANE \*

(Ethylene dibromide)

##### **Desirable**

1. Further data on residues of unchanged 1,2-dibromoethane occurring in foods in commercial practice, including data for fresh fruits and vegetables.

2. Further information on the nature and amount of the reaction products of 1,2-dibromoethane in cereals and in a selection of other foods.

#### 1,2-DICHLOROETHANE \*

(Ethylene dichloride)

##### **Desirable**

Additional data on residues of unchanged 1,2-dichloroethane occurring in food in commercial practice.

#### ENDOSULFAN

##### **Desirable**

1. Metabolic studies in man, with particular reference to storage of the original compound and metabolites.

2. Further data on residue levels in rice.

3. Information on the latest use patterns of endosulfan, especially on the specific fruits and vegetables to which it is applied in various countries.

#### ETHYLENE OXIDE \*

##### **Desirable**

1. Data on the nature and amounts of alkylated and hydroxyethylated derivatives of food constituents arising from the use of ethylene oxide.

2. Additional data on residues in food resulting from the use of ethylene oxide in commercial practice.

3. An appraisal of the toxicological importance of the various residual compounds in food resulting from the use of ethylene oxide.

## FENTHION

**Required before 30 June 1975**

1. Adequate two-year feeding studies in the dog and in one rodent species.
2. Establishment of the sequence of metabolic changes in man and laboratory animals in order to elucidate the mechanism of long-lasting cholinesterase inhibition.

**Desirable**

Information on the frequency and level of fenthion residues in food commodities in commerce.

## HYDROGEN PHOSPHIDE

**Desirable**

1. Further elucidation of the nature of the reaction or breakdown products of hydrogen phosphide in grain.
2. Further data on the residues, if any, determined and expressed as hydrogen phosphide, in products known to be fumigated commercially with hydrogen phosphide.

## METHYL BROMIDE \*

**Desirable**

1. Additional data on residues of unchanged methyl bromide occurring in food in commercial practice, including data for fresh fruits and vegetables.
2. Information on the nature of the reaction products of methyl bromide with foods other than cereals and cereal products.
3. Additional data on amounts of "background" bromide ion occurring in foods before post-harvest fumigation.

## OMETHOATE

**Required before 30 June 1975**

A long-term feeding study in at least one species of animal.

**Desirable**

1. Relevant observations in man.
2. More information on the quantitative aspect of the metabolism of omethoate as compared with that of dimethoate.
3. Reproduction study in a non-rodent species.

4. Studies on the fate of the compound during storage, processing, and preparation of food for consumption.
5. Further data on residues occurring in use on lettuce, potatoes, sugar beet, and hops.
6. Information on residues occurring in food in commerce and in total diet studies.

#### TRICHLORFON

##### **Required before 30 June 1975**

1. A two-generation carcinogenicity study to elucidate the possible increase in the incidence of tumours, including those of the mammary gland.
2. More information on residues on oats.
3. More information on residues on lettuce and spinach under various conditions (including greenhouses).

##### **Desirable**

1. Elucidation of the effect on spermatogenesis.
2. Information on residues occurring in food in commerce and in total diet studies.

#### TRICHLORONAT

##### **Required** (before an acceptable daily intake can be established or tolerances recommended)

1. Information on the absorption, distribution, excretion, and general metabolism of trichloronat in at least one mammalian species.
  2. Comprehensive information on the gross and histopathological findings, particularly after long-term administration of this compound.
  3. Relevant data for the evaluation of trichloronat in the feed of domestic animals e.g., fodder crops.
-

**Annex 3****ADDITIONS AND AMENDMENTS TO THE GLOSSARY****Limit of determination**

The limit of determination of a method of analysis is the least 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 least concentration of a pesticide residue at which its qualitative presence in a specified commodity can be reliably indicated.

**Pesticide residue**

A pesticide residue is a residue in or on a food of any chemicals used for the control of pests. The term also includes derivatives of such chemicals. The amounts are expressed in parts by weight of the chemical and/or derivative per million parts by weight of the food (ppm).

*Explanatory note*

It is proposed that, in interpreting this definition consideration also be given to any substance that may, at a given time, be known to be derived from the product and that may be held to influence the toxicology of the residue. Residues from unknown sources (i.e., "background" residues) will be considered as well as those from known uses of the chemical in question. The term pesticide will be held to include any constituent of a pesticide used for the control of pests during the production, distribution, or processing of food or that may be administered to animals for the control of insects or arachnids in or on their bodies; fungicides, herbicides, and plant growth regulators are included. It will 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 will it apply to fertilizers.

**Regulatory method of analysis**

A regulatory method of analysis is one used for the determination of a pesticide residue in the course of the administration of legislation relating to the subject.

*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 tolerance level 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.

**Referee method of analysis** (see section 2.7 of this report)

A referee method of analysis is one that has been specified, or agreed upon by the parties concerned, for use in the event of a dispute, e.g., concerning the level or nature of a pesticide residue.

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