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 Animal Feed Contamination*

REPORT

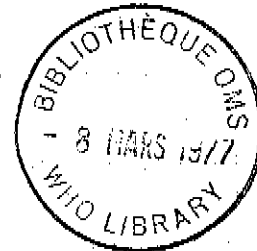
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MEETING TO PLAN PHASE II

of the

JOINT FAO/WHO FOOD AND ANIMAL FEED
 CONTAMINATION MONITORING PROGRAMME

Geneva, 13-16 December, 1976



UNITED NATIONS ENVIRONMENT PROGRAMME

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JOINT FAO/WHO FOOD AND ANIMAL FEED CONTAMINATION MONITORING PROGRAMME -
TECHNICAL CONSULTATIONS

with

The Food and Agriculture Organization of the United Nations and
the World Health Organization as cooperating agencies

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MEETING TO PLAN PHASE II OF THE JOINT FAO/WHO FOOD AND
ANIMAL FEED CONTAMINATION MONITORING PROGRAMME

Geneva, 13-16 December 1976

List of Participants

Participants

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Institut für Strahlentechnologie, Karlsruhe, Federal Republic of Germany
- Dr G.J. van Esch, Head, Laboratory for Toxicology, National Institute of Public Health,
Bilthoven, Netherlands
- Professor Peter Marquardt, Freiburg, Federal Republic of Germany
- Dr S.A. Storach, Food Research Department, National Food Administration, Uppsala,
Sweden (Chairman)

FAO Representatives

- Mr G.O. Kermode, Acting Director, Food Policy and Nutrition Division, FAO, Rome, Italy
- Mr R.K. Malik, Senior Officer, Food Policy and Nutrition Division, FAO, Rome, Italy

WHO Representatives

- Dr C. Agthe, Chief, Food Additives Unit, WHO
- Dr D.G. Chapman, Scientist, Food Additives Unit, WHO (Secretary)
- Dr L. Reinius, Food Hygienist, Veterinary Public Health Unit, WHO

1. INTRODUCTION

In welcoming the participants to the Meeting to Plan Phase II of the Joint FAO/WHO Food and Animal Feed Contamination Monitoring Programme, Dr C. Agthe, Chief, Food Additives Unit, WHO, made reference to the short- and long-term objectives of the Programme as contained in the United Nations Environment Programme Project Document (FP-1301-76-03). Dr Agthe also indicated that the major purpose of the meeting was to suggest a plan of operation for this international programme orientated towards possible health effects of food contamination, for approval, possibly after some amendment, by a meeting of representatives of the Collaborating Centres and other experts to be held in June 1977. He further stated that priority should be given to those food contaminants which have a potential health effect on the consumer.

Mr G.O. Kermodé, Acting Director, Food Policy and Nutrition Division, FAO, in his opening remarks indicated that within the health priorities, primary consideration should be given to those contaminants which are of economic significance such as the question of the mycotoxin content of nuts and other products.

Dr S.A. Slorach, Food Research Department, National Food Administration, Uppsala, Sweden, was named Chairman of the Meeting. In accepting the Chairmanship, Dr Slorach asked that the participants of the Meeting should (i) be mindful of the need to keep to a minimum the number of contaminants and the number of foods to be examined in Stage I (Pilot Study), (ii) have a clear motivation for the collection of data on a specific food contaminant, and (iii) consider the final use to which the data is to be put.

This Report outlines suggestions for Phase II of the Joint FAO/WHO Food and Animal Feed Contamination Monitoring Programme. These proposals are subject to the approval, possibly after some amendment, by a meeting of the representatives of the Collaborating Centres and other experts to be held in June 1977, and subsequently by the Technical Advisory Committees.

2. DESIGNATION OF INTERNATIONAL REFERENCE CENTRES

The Meeting noted that the Project Document made reference to the designation of several laboratories both from developed and developing countries to serve as International Reference Centres to assist in the collection, quality control, and processing of data. The participants expressed the fear that not all countries would be willing to submit data to a Reference Centre in another country and also that such an arrangement, by spreading the work over a number of places, might delay the processing of data. However, it was agreed that the Programme could draw consultants to scrutinize the data at WHO from institutions which may have the potential to serve as Reference Centres. If, at a later stage of the Programme, it were found necessary to involve the laboratory facilities, further consideration could be given to designating such institutions as Reference Centres, e.g., to check the analytical methods or to organize a check-sample study.

3. PURPOSES OF FOOD CONTAMINATION MONITORING

The Meeting gave consideration to the major objectives for conducting a food contamination monitoring programme, and listed the following reasons together with examples.

3.1 To determine global trends in food contamination

The Meeting concluded that it would be useful to determine trends in food contamination in order to take appropriate prevention and control measures. Examples of contaminants which could be used for this purpose are aflatoxins, cadmium, lead, mercury, arsenic, organochlorine pesticides and polychlorinated biphenyls.

3.2 To identify groups within a population that may be at high risk

The Meeting agreed that the identification of groups which may be at high risk was desirable in order to facilitate subsequently planned epidemiological studies and/or preventive measures. Contaminants which could be studied for this purpose are lead in foods consumed by infants and young children, mercury in fish among populations consuming large quantities of this food item and mycotoxins in nut and nut products in warm, humid areas.

3.3 To determine the geographical spread of certain specific highly toxic contaminants

Although there was no intention to investigate contaminants for this purpose in Phase II of the Project, the following could be considered to be examples in this category - the polychlorinated biphenyls, persistent pesticides and dioxins.

3.4 To determine the total intake via food of substances having the same toxic effect (target organs)

Various organochlorine pesticides and polychlorinated biphenyls (liver injury) and organophosphorus pesticides (choline esterase inhibition) are examples of this category.

3.5 To determine the total exposure to a contaminant through air, water and food

The Meeting was aware of activities currently underway, or planned, for the monitoring of air and water for pollutants. The proposed monitoring of foods for contaminants would complete the picture and permit the calculation of the total exposure to specific pollutants. For this purpose, it was felt desirable, wherever relevant, to carry out food contamination monitoring in the same location as for air and water.

3.6 To determine the extent and trends in the contamination of foods by biological agents

Salmonellae and certain parasites were considered suitable examples of biological contaminants with which the programme should concern itself in its initial phase.

3.7 To provide information to those responsible for the development of international food standards containing a contaminant component

A major aspect of the Joint FAO/WHO Food Standards Programme is the development of food standards which may be accepted internationally. In some of these standards, it is desirable to set limits on the levels of certain contaminants, but information is lacking as to the levels which are attainable under good manufacturing practice. The heavy metals are examples of contaminants falling into this category.

4. PHASE II OF JOINT FAO/WHO FOOD AND ANIMAL FEED CONTAMINATION MONITORING PROGRAMME

The Meeting then turned its attention to a consideration of the specific contaminants which might be examined in Phase II of the Joint FAO/WHO Food and Animal Feed Contamination Monitoring Programme. The Programme was divided into three parts: Stage I (Pilot Study) - 1977, Stage II - 1978 and Stage III - 1979.

The Meeting was aware of, and in its deliberations took into account, the proposals to be found in (i) the Report of the Expert Consultation on the Joint FAO/WHO Food Contamination Monitoring Programme, Rome, 7-11 October 1974 (FAO-ESN:MON/74.21, WHO-FAD/FCM/74.21) and (ii) the Report of the Expert Consultation on the Joint FAO/WHO Food Contamination Monitoring Programme, Geneva, 17-21 March 1975 (WHO-FAD/FCM/75.1, FAO-ESN:MON/75.1).

In the latter Report, it was proposed that data on the following contaminants and foods be collected in a pilot study: (a) DDT, DDT and metabolites, and (b) lead in (i) milk and milk products, (ii) cereals (to include milled products used in the first production steps for the manufacture of cereal products), and (iii) canned foods (for lead only).

After some considerable discussion of this matter the Meeting concluded that it would be desirable to collect data as follows: (For the convenience of the reader, this information is summarized in Table 1).

4.1 Stage I (Pilot Study) - 1977

The Meeting stressed that the Pilot Study was designed primarily to test the operation of the system including the collection, quality control and processing of the data. (This has to some extent, influenced the choice of the food commodities and contaminants selected.)

(a) Organochlorine pesticides and polychlorinated biphenyls (as determined by the multi-residue technique) in whole fluid milk, whole dried milk, butter and human milk. With regard to human milk, the Meeting noted that the Nutrition Division at WHO had an ongoing programme dealing with the determination of heavy metals in human milk obtained from certain tropical countries and asked the Secretariat to investigate the possibility of collaboration between the two programmes.

(b) Lead in the following fresh or frozen vegetables, potatoes, carrots, beetroots, lettuce, cabbage, Brussels sprouts and peas, and in molluscs and crustaceans.

It was further suggested that this information be collected, on an annual basis, for the period 1971 - 1975.

The Stage I (Pilot Study) proposals would be sent to the Collaborating Centres early in 1977 in order to permit these Centres to begin the collection of data which are to be submitted to WHO later in 1977.

4.2 Stage II - 1978

In considering the work to be carried out in Stages II and III, the Meeting felt that some aspects of the work of Stage I (Pilot Study) should be continued or extended while at the same time, data on additional contaminants should be collected.

(a) Continue with the collection of data on the organochlorine pesticides and polychlorinated biphenyls in whole fluid milk, whole dried milk, butter and human milk (for the previous one-year period), and in addition, provide data on these contaminants in edible fats and oils (for the preceding five-year period on an annual basis).

(b) Cadmium in cereals and cereal products, potatoes and shellfish (for the preceding five-year period).

(c) Mercury in fish and canned fish which are important food items in the particular country. The results should be on an annual basis for the preceding five-year period, should be expressed in terms of the edible portion of the fish and should include figures for the fish in the general food supply and from major fishing grounds.

(d) Organophosphorus pesticides. Review the methodology (including choline esterase inhibition methods) for the determination of these compounds as a group, as well as other aspects of their presence in foods with a view to collecting information on them in future years.

(e) Total diet studies. The Meeting expressed the view that consideration should be given in Stage II to the desirability and feasibility of conducting total diet studies for certain contaminants.

(f) Biological contaminants. It was agreed, as recommended in the Report of the Expert Consultation on the Joint FAO/WHO Food Contamination Monitoring Programme, Geneva, 17-21 March 1975 (WHO-FAD/FCM/75.1, FAO-ESN:MON 75.1), to:

(i) collect information on ongoing national monitoring programmes which could be used to assist other countries;

(ii) collect, review and disseminate information on biological contaminants obtained in national monitoring programmes and determine trends where possible;

(iii) select and recommend internationally acceptable and agreed upon methodologies for sampling and analysis of foods for biological contaminants.

4.3 Stage III - 1979

It is anticipated that by 1979, a number of institutions in developing countries will have been designated as Collaborating Centres and will be contributing data on food contaminants.

(a) Continue with the collection of data on the organochlorine pesticides and polychlorinated biphenyls in whole fluid milk, whole dried milk, butter, human milk and in edible fats and oils (for the previous one-year period), and in addition, provide data on these contaminants in fish (and possibly fish liver), specified cereals and possibly eggs and fruits and vegetables (for the previous five-year period).

(b) Cadmium and lead in total diets.

(c) Aflatoxins in peanuts, maize, milk, animal feeds and, if available, in total diets.

(d) Arsenic in total diet plus specified food commodities.

(e) Biological contaminants. Carry out a review of the monitoring for biological contaminants of major importance in foods.

(f) Polycyclic aromatic hydrocarbons. Carry out a review of these compounds as food contaminants and consider methodology.

5. SYSTEM OUTPUT AND INPUT REQUIREMENTS

The Meeting endorsed the proposals for output and input requirements for food contamination monitoring contained in the Report of the Expert Consultation on the Joint FAO/WHO Food Contamination Monitoring Programme, Geneva, 17-21 March 1975 (WHO-FAD/FCM/75.1, FAO-ESN:MON/75.1). For the details of these requirements see Appendix I.

6. TYPE OF DATA TO BE COLLECTED

The Meeting agreed that the data to be collected on contaminants in food should be representative of the commodity in the country as a whole or, in the case of large countries, of areas within the country. Data on foods examined because of suspicion of contamination should not be included. Wherever possible, the data provided should indicate whether the food was domestically produced or imported.

It was suggested that data which had been collected by a non-governmental organization within a country could also be utilized if the national Collaborating Centre was satisfied that the data were reliable and consistent with the requirements of the Programme.

The Meeting was appraised of the activities of the FAO Fisheries Data Centre and concluded that this Centre should be utilized as much as possible for information on contaminants to be found in fish. FAO and WHO should continue to explore the possibility of obtaining information from this Centre which would be suitable for the Food Contamination Monitoring Programme.

7. USE OF COMPUTERS

The Meeting suggested that, for the Pilot Study, the data submitted be processed manually in order to gain experience for the eventual computerization of the Programme. It is envisaged that in Stages II and III the data would be stored in a computer for subsequent retrieval.

8. GUIDELINES FOR ESTABLISHING OR STRENGTHENING NATIONAL FOOD CONTAMINATION MONITORING PROGRAMMES.

The Meeting had before it a first draft of a document prepared by Dr S.A. Slorach entitled "Guidelines for Establishing or Strengthening National Food Contamination Monitoring Programmes".

It was agreed that Dr Slorach would revise this document based upon the comments received, that the revised version would be sent to the representatives of the Collaborating Centres and other experts early in 1977, and that it would be finalized at the June 1977 meeting.

9. MATTERS TO BE DISCUSSED AT JUNE 1977 MEETING OF THE REPRESENTATIVES OF THE COLLABORATING CENTRES AND OTHER EXPERTS

While all aspects of Phase II of the Food Contamination Monitoring Programme would be discussed at the June 1977 meeting, it was suggested that the following matters be given special consideration - (i) the desirability and feasibility of conducting total diet studies, (ii) the question of the setting aside and preserving indefinitely samples of foods which could be analysed at a later date, sometimes referred to as "food banks", and (iii) the value of monitoring foods in those centres where air and water are to be monitored.

TABLE I SUMMARY OF PROPOSED DATA TO BE COLLECTED IN PHASE II OF THE JOINT FAO/WHO FOOD AND ANIMAL FEED CONTAMINATION MONITORING PROGRAMME

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Stage	Contaminant	Purpose of Collection (see following foot- note Nos)	Food or Diet	Time Frame
Stage I (Pilot Study) - 1977	(a) Organochlorine pesticides and polychlorinated biphenyls	(a) 1,3,4	(a) Whole fluid milk, whole dried milk, butter and human milk	(a) 5 years
	(b) Lead	(b) 1,2,5,7	(b) Potatoes, carrots, beet-roots, lettuce, cabbage, Brussels sprouts, peas, molluscs and crustaceans	(b) 5 years
Stage II - 1978	(a) Organochlorine pesticides and polychlorinated biphenyls	(a) 1,3,4	(a) (i) Whole fluid milk, whole dried milk, butter, human milk (ii) Edible fats and oils	(a)(i) previous 1 year (ii) 5 years
	(b) Cadmium	(b) 1,7	(b) Shellfish, cereals and cereal products and potatoes	(b) 5 years
	(c) Mercury	(c) 1,2,5,7	(c) Fish and canned fish	(c) 5 years
	(d) Organophosphorus pesticides	(d) 1,3,4	(d) Review	
	(e)	(e)	(e) Total diet studies - review	
	(f) Biological contaminants	(f) 6,7	(f) Collect information on national activities	
Stage III - 1979	(a) Organochlorine pesticides and polychlorinated biphenyls	(a) 1,3,4	(a)(i) Whole fluid milk, whole dried milk, butter, human milk and edible fats and oils (ii) Fish, cereals, eggs, fruits and vegetables	(a)(i) previous 1 year (ii) 5 years
	(b) Cadmium and lead	(b) 1,5,7	(b) Total diet	(b) 5 years
	(c) Aflatoxin	(c) 1,2	(c) Peanuts, maize, milk, animal feeds and total diets	(c) 5 years
	(d) Arsenic	(d) 1,7	(d) Specified food and total diets	(d) 5 years
	(e) Biological contaminants	(e) 6,7	(e) Review of biological contaminants	
	(f) Polycyclic aromatic hydrocarbons	(f) 1,2,3,4	(f) Review	

FOOTNOTES TO TABLE I

1. To determine global trends in food contamination
2. To identify groups within a population that may be at high risk
3. To determine the geographical spread of certain specific highly toxic substances
4. To determine the total intake via food of substances having the same toxic effect (target organs)
5. To determine the total exposure to a contaminant through air, water and food
6. To determine the extent and trends in the contamination of foods by biological agents
7. To provide information to those responsible for the development of international food standards containing a contaminant component

SYSTEM OUTPUT AND INPUT REQUIREMENTS
FOR FOOD CONTAMINATION MONITORING **

1. SYSTEM OUTPUT REQUIREMENTS

The meeting decided that the following are essential system requirements for the preparation of outputs to meet the needs of the users:

- (a) food
- (b) contaminant
- (c) origin or source of food
- (d) consumer population at risk
- (e) level of contaminant
- (f) methodology -
 - (i) sampling
 - (ii) analytical
- (g) time

Each of the above requirements may further define other sub-item needs.

1.1 Food

The meeting recommended, in view of the number of food classification systems, that a system for the classification of food products at a level of detail appropriate for the intended uses of the data is required. The meeting also stipulated additional sub-item requirements which are:

- (a) cooked or raw
- (b) processing and preservation techniques
- (c) physical form (part or portion)
- (d) container material (metal, plastic, paper, glass, etc.)

1.2 Contaminants

According to the recommendations made by the Rome Consultation, the following contaminants have been selected as suitable for inclusion in the system output (JFCMP) :

- (a) aflatoxins (total, B1, B2, G1, G2, M1, M2)
- (b) organochlorine compounds:
 - DDT
 - DDT + metabolites (specified if possible)
 - HCH (BHC)
 - HCH (BHC) isomers (total)
 - endrin
 - heptachlor and its epoxide
 - aldrin and dieldrin (expressed as dieldrin)
 - methoxychlor
 - HCB
 - PCBs*
- (c) heavy metals (cd, Pb, total Hg)

* Expressed by three eluants (6% ethyl ether or 20% methylene chloride in hexane) and separated from co-eluted organochlorine pesticides by chromatography on silicic gel, as discussed in working paper of Rome Meeting 7-11 October 1974, by Dr E. Somers (WHO-FAD/FCM/74.19; FAO-ESN:MON/74.19).

** Taken from the Report of the Expert Consultation on the Joint FAO/WHO Food Contamination Monitoring Programme, Geneva, 17-21 March 1975 (WHO-FAD/FCM/75.1, FAO-ESN:MON/75.1).

The system must be capable of indicating when the same group of samples has been analyzed for more than one contaminant.

1.3 Origin or source of food

The meeting felt it was necessary to distinguish between food of domestic and foreign origin. For staple food the country (or region) of harvesting was an output requirement. For processed food, information should be supplied, if possible and where available, on the country where the food was processed.

1.4 Consumer population at risk

Unless information is available about a particular group of the population towards which the product is directed for consumption, e.g. children or babies, the output from this section will refer to the total population of a specified country.

1.5 Levels of contaminants

Concentrations were to be expressed as microgram or milligram per kilogram ($\mu\text{g}/\text{kg}$ or mg/kg) of wet weight or dry weight of the food or as percentage of the fat content of the food in the case of pesticides which accumulate in fat.

Levels will usually be expressed as concentrations present in the food as consumed or as sampled. The re-calculation of results expressed in dry weight for application to the original food as eaten, should utilize the average moisture content value for that commodity.

In addition, statistical parameters will need to be applied which may vary somewhat according to the particular contaminant and food product. Which measure of dispersion is appropriate depends on the form of statistical distribution, i.e. (the standard deviation, variance and standard error of the mean become less appropriate as the distribution deviates from 'normal').

In general, the statistical parameters can be put into two classes: Class A are priority requirements for further evaluation of the data and Class B requirements are supplementary, but should be supplied if available.

Class A (Priority)

Class B (Supplementary)

- | | |
|---------------------------------------------------------------------------------|----------------------------------------------------------|
| (a) Number of samples | Standard deviation |
| (b) Arithmetic mean | Standard error of mean |
| (c) Number of samples in each of (up to) 10 defined ranges of contamination | Geometric mean
Measure of variation of geometric mean |
| (d) Percentage of samples in each of (up to) 10 defined ranges of contamination | Overall range |
| (e) Level of contamination below which 95% of samples fall | |

1.6 Methodology

1.6.1 Sampling

It will not be possible for the output to give details of how the food sample was taken other than to state at which point in the distribution chain the sample was taken, e.g. production, processing, storage, transport including port of entry, retail centre, etc.

It will be assumed that the sample is representative of the food at that part of the distribution chain. It would not be possible to give as an output on what basis this was assessed, since there are quite different approaches to the assessment of randomness. Where samples are non-random and unrepresentative this information will be clearly indicated.

1.6.2. Analytical

The analytical procedures should be harmonized with reference to the recommendations of the Rome Consultation (1974). For this purpose a detailed description of the methodology used is called for as well as the information on the contaminant detection level for the particular commodity.

The actual outputs will be given according to the sub-items below:

- (a) Standard name(s) for the method
- (b) Portion of food sample analyzed (standard name(s))
Examples: edible -vs- non-edible, drained, etc.
- (c) Sample preparation (washing, etc.)
- (d) Country in which analysis was performed

1.7 Time

In general, the output will be given annually and in the following form :

- (a) Date of harvest or slaughter [year, season (if available)]
- (b) Date of sampling
- (c) Year of analysis
- (d) Periodicity of summaries of continuing monitoring
- (e) Recover retrospective data since 1970, if possible

It was accepted that requirement (b) was not always going to be available but it was felt to be very relevant to the system output.

2. SYSTEM INPUT REQUIREMENTS

Since there will be two different levels at which the data handling and collection may occur, i.o.

- (a) the national level
- (b) the international level (FAO/WHO Central Unit) in collaboration with international collaborating centres

the input requirements will have to be specified in accordance with their respective functions. In practice the input item classes will be the same as the basic output item classes and very minor changes in the sub-item requirements, e.g. inputs will be 1.7(a), (b) and (c) but not sub-items (d) and (e). Another important input requirement is the need to check and evaluate reference standards data.

If the data at the national focal points are received in absolute values the transfer to the international level will have to involve processing into defined class ranges which will have to be separately specified for each commodity.