JOINT FAO/IAEA DIVISION
OF NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE

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*REPORT*

# FAO/IAEA CONSULTANTS MEETING ON MICROBIOLOGICAL CONTAMINATION OF FOOD

**IAEA Headquarters, Vienna, Austria**
**18 to 22 August 1997**

# REPORT OF THE FAO/IAEA CONSULTANTS MEETING ON MICROBIOLOGICAL CONTAMINATION OF FOOD

## VIENNA, AUSTRIA 18-22 AUGUST 1997

## 1. Introduction

The Meeting was one in a series of meetings being convened by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture for the recently established Training and Reference Centre for Food and Pesticide Control under its mandate "to assist Member States and their institutions to fulfill requirements to support the implementation of international standards/agreements relevant to food safety and control, the safe use of pesticides and sanitary and phytosanitary measures **by providing training, quality assurance services and technology transfer.**" The Meeting was held at IAEA from 18-22 August 1997.

Dr. J.D. Dargie, Director, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture welcomed the participants and explained the evolution of the new Food and Environmental Protection Section, headed by Mr. Paisan Loaharanu. He stressed the need for strengthening the analytical capabilities of laboratories in developing countries to meet the quality and safety requirements of food in trade, based on the Agreement on Application of Sanitary and Phytosanitary Measures (SPS) being implemented by the World Trade Organization.

The Meeting was invited to consider the need for analytical microbiological methods for ensuring food safety and facilitating international trade, and other opportunities for the Centre in training, services and technology transfer.

Dr. Frank Busta (USA) and Dr. Terry Roberts (UK) were invited to serve as Chairman and Rapporteur of the Meeting, respectively. The Meeting agenda is attached as Annex 1. The list of participants is attached as Annex 2.

## 2. Objectives and Scope

2.1 To evaluate the importance of microbiological contamination of foods in relation to international trade, especially those originating from developing countries, and to identify major foodborne microbiological contaminants of relevance to international food trade.

2.2 To examine the impact of national, regional and international agreements, standards, guidelines/legislation and requirements concerning microbiological contaminants on food trade.

2.3 To advise on areas in food safety microbiology which the FAO/IAEA Training and Reference Centre for Food and Pesticide Control should cover, and on their priority, to maximize the impact of the Centre's activities in facilitating food trade.

2.4 To prepare a Plan of Activities for the Centre in food safety microbiology for the short and medium terms.

**Scope of the Meeting:** The Meeting was requested to consider, discuss and report on the following aspects:

2.5 Major microbiological contaminants in food implicated in rejection of food shipments in international trade, and their economic impact.

2.6 Present availability of analytical methods in food microbiology (conventional and specially rapid methods), certified by national or international bodies; status and possibilities for harmonization (acceptance and use) of such methods. These aspects should take into account the capabilities of developing countries in terms of personnel and equipment, cost and robustness of analytical kits.

2.7 Existing needs in analytical methods, in certification of laboratories, and in training of personnel as a means of strengthening analytical food control capabilities in

exporting countries.

2.8 Areas in food safety microbiology that the Centre should cover (in order of priority) and specific activities it should undertake (e.g., training, collaborative studies, standardization of analytical method, etc.) to answer the needs identified in (2.7); infrastructure and manpower requirements of the Centre under various scenarios (short, medium and long term), and timetable for implementation.

2.9 Areas where specific proposals could be prepared for funding by donor countries.

## 3. Background

### 3.1 Foodborne Illness

Foodborne illness occurs in every country. Many outbreaks are the consequence of a failed process, or inappropriate storage conditions (usually temperature abuse) during distribution, food service or by the consumer. There are also examples of sporadic outbreaks of illness attributed to raw products eaten unprocessed (e.g. lettuce, melons, raw fish). Foodborne illness has long been linked primarily to foods of animal origin, but in recent years many outbreaks of foodborne illness have been associated with fruit and vegetables (Beuchat, 1996).

There are also examples of imported foods causing human illness (Annex 3), exported from both developed and developing countries. Consequently there is widespread concern that food in international trade carries pathogenic microorganisms that could result in outbreaks of illness. Importing countries have sometimes responded to this concern with measures which are neither scientifically based nor statistically sound, and may be an impediment to fair trade.

### 3.2 Trade Barriers

International trade in agricultural products and commodities expanded greatly in the 1990's with a value estimated (in 1993) at US$381 billion. A substantial proportion of this international trade originates in developing countries. The possibility of introducing new foodborne pathogens into countries (e.g. new *Salmonella* strains ) or spreading pathogens across boundaries from endemic areas to low-endemic areas (e.g. *Vibrio cholerae*), with the associated risk of foodborne illness, has contributed to the diversity of national standards for food production and inspection, and a wide range of, sometimes conflicting, regulatory procedures.

A proportion of food exports are rejected by importing countries on the grounds of unacceptable contamination (e.g. with filth or the presence of bacterial pathogens or their toxins, marine toxins). Countries can also impose food safety-based technical barriers to trade that have more far reaching impact. These barriers to trade include restrictions due to scientifically insupportable low tolerance levels for *Salmonella, Listeria,* or other pathogens in foods. Such barriers can effectively limit, or even block, international trade of food and can result in substantial economic losses to the exporting country. The worldwide economic consequence from such food rejections are unquantified but substantial (Buzby and Roberts, 1997).

### 3.3 Inspection and Control

Agricultural products and animals have a wide range of microbes on, or in, them at harvest/slaughter. The numbers and types of microbes that comprise this primary contamination vary from one commodity to another, with geographic region, and with production and slaughtering or harvesting methods. Some can grow on the food during storage, causing spoilage; other constitute a hazard to man through illness caused either by infection, or by intoxication after they have multiplied in the food and produced a toxin. Levels of contamination can be influenced by changing technologies e.g. rapid shipment by air-freight, further processing in the country of origin to add value.

From the earliest religious edicts concerning food, ordinances, Codes of Practice and laws concerning the processing, handling and sale of foods have been promulgated by local, national and international bodies with the intention of protecting the public from adulteration, fraud and illness. Food laws can be traced to early history and include the prohibition of meat from animals that have died, other than from slaughter. Ancient food regulations are referred to in FAO/WHO (1976) which traces the development of food control through early history, the Middle Ages, and the Industrial Revolution to the 19th and 20th centuries. It also traces developments of food control in developing nations and reviews international implications. Adherence to such regulations has been based mainly upon inspection procedures although it is recognized that inspection as a means of attaining food safety has serious shortcomings. (ICMSF, 1988).

Food processors have generally attempted to comply with applicable laws through activities of in-house Quality Control departments, by observing operations and performing physical, chemical and microbiological tests. A major portion of those activities have been directed towards observations and measurements bearing little or no relationship to microbiological hazards.

### 3.4 End-Product Testing

Microbiological testing, as a means of assessing whether a product is microbiologically hazardous, is of recent origin in terms of man's association with food spoilage and foodborne disease. Microbiological controls have been successfully applied to drinking water, milk, milk products, and egg products to protect public health. Nevertheless, the use of testing to control microbiological hazards in foods has serious limitations (FNB/NRC, 1985). These include:

(i) the problem of sampling and examining a sufficient number of sample units to obtain meaningful information on the microbiological status of a batch of food (Kilsby & Pugh, 1981);
(ii) the difficulty in defining a batch (a lot);
(iii) constraints of time and cost to obtain results (ICMSF, 1986); and

(iv) reliable and comparable laboratory methods.

It is impractical to hold perishable products pending the results of microbiological analyses, and with shelf-stable products costly warehousing is necessary. Moreover, microbiological testing of products only detects that a failure has occurred and can only contribute indirectly to identification and control of causes of problems.

It is most important to appreciate that the microbiological safety of food can never be achieved by end-product testing. No sampling plan can ensure the absence of a pathogen(s) in a food, and testing products at point-of-production, port-of-entry, or in the retail distribution chain cannot guarantee food safety (ICMSF, 1986). All too frequently, industry has become aware of microbiological problems in its products as the result of spoilage in the market place or from reports of illness. Control measures are then applied as a response to an existing problem. Furthermore, the isolation of a bacterial pathogen from a food does not mean that the food necessarily is dangerous e.g. the food may be cooked before consumption. Nevertheless, microbiological testing, used appropriately, is one of the measures that can be used to achieve microbiological safety.

Although diseases seem to be the major microbiological problem related to food, post-harvest losses due to microbial spoilage are a major concern, and significant quantities of food are lost due to microbial spoilage (FNB/NRC, 1985). This is exemplified by food at import often being rejected due to decomposition.

Microbial spoilage, just as foodborne illness, cannot be controlled by end-product microbiological testing, and preventive approaches are required, often as simple as control of storage time and temperature.

Many years of experience have shown that control of microorganisms in foods cannot be achieved by imposition of analytical methods. Control of the various stages of the whole food chain is required.

In 1970, Sir Graham Wilson, the former Director of the Public Health Laboratory

Service in the UK, wrote: "Bacteriologists are better employed in devising means to prevent or overcome contamination than in examining more and more samples..... Control of processing is of greater importance than examination of the finished article..... Processing concerns the whole volume of the food, sampling only a minute fraction of it..... Finally, I put in a plea that all standards should be of an advisory, not of a statutory, nature" (Wilson, 1970). Despite such sound advice, many countries have introduced, and are continuing to introduce, microbiological standards for various foods at port-of-entry.

### 3.5 National and International Considerations

The approach to food hygiene issues has evolved, with national regulations and international recommendations moving steadily from end-product testing and detailed regulations, to a risk-based approach and the application of preventive measures along the food chain e.g EEC 91/493 for fishery products; US FDA Seafood HACCP regulation, Federal Register, December 18th, 1995; USDA/FSIS Pathogen Reduction: Hazard Analysis Critical Control Point Systems 9CFR Parts, 304, 308, 310, 320, 327, 381, 416, 417, Federal Register, July 25th, 1996.

At the international level, the Codex Alimentarius Commission through its Committee on Food Hygiene has recently revised the Recommended International Code of Practice - General Principles of Food Hygiene (CCFH, 1995), which includes an Annex on the HACCP Principles and Guidelines for their Application (Appendix II of CCFH, 1996). Commodity-specific Codes of Practice will need to be revised in order to integrate the General Principles and the HACCP approach and this revision has been initiated for fish and fishery products.

As regards microbiological criteria, the Codex Committee on Food Hygiene recently revised the Principles for the Establishment and Application of Microbiological Criteria to Foods (Appendix III of CCFH, 1996), whereby it is recognized that the safety of foods is principally assured by control at the source, the application of Good Hygienic Practices along the process in conjunction with the application of the HACCP system and that "This preventive approach offers more control than microbiological testing because the effectiveness of microbiological examination to assess the safety of foods is limited". The Committee is

also considering Principles and Guidelines for the Conduct of Microbiological Risk Assessment (Appendix IV of CCFH, 1996).

### 3.6 International Trade Agreements

International trade in food and agricultural commodities is governed by Agreements of the World Trade Organization (WTO). With respect to food safety matters, relevant provisions of the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) apply. The overall objective of the SPS Agreement is to permit countries to take legitimate measures to protect the life and health of their consumers (in relation to food safety matters), while prohibiting them from using those measures in a way that unjustifiably restricts trade. The Agreement calls on Members to harmonize sanitary and phytosanitary measures on as wide a basis as possible and on the basis of international standards, guidelines and recommendations where they exist. With regard to human health and food safety, sanitary measures which conform to standards, guidelines and recommendations of the Codex Alimentarius Commission are presumed to be consistent with the provision of the SPS Agreement. Members may apply measures which resulted in a higher level of protection if there is a scientific justification.

The SPS Agreement also recognizes the right of members of WTO to protect their consumers at a level they consider necessary, based on scientific principles and proper risk assessment, subject to certain discipline such as consistency and transparency. The agreement also recognizes the principle of equivalence of different measures. It should not be applied in a manner which constitutes a disguised restriction to trade. Governments that are Members of the WTO could be required to furnish justification for food import restrictions based on national regulations that are stricter than standards, guidelines and recommendations of competent international organizations.

### 3.7 Risk Analysis

The SPS Agreement requires Members to "ensure that their SPS measures are based on an assessment, as appropriate to the circumstances, of the risks to human, animal or plant

life, taking into account risk assessment techniques developed by the relevant international organizations". Risk analysis is widely recognized as the fundamental methodology underlying the development of food safety standards and risk analysis issues are given high priority in the activities of FAO and WHO, whether at the level of expert consultations or through the Codex Programme.

The Joint FAO/WHO Expert Consultation on the Application of Risk Analysis to Food Standard Issues (FAO/WHO, 1995) agreed on a number of definitions of risk analysis terms related to food safety, which were considered in the framework of Codex and adopted in 1997, among which risk analysis and its three components: risk assessment, risk management and risk communication.

The Consultation agreed that scientific risk assessment should be the basis for Codex risk management decisions and made a number of recommendations on the harmonization of approaches for chemical hazards. With respect to biological hazards, it agreed that Codex should encourage the development of risk assessment, while recognizing the specific problems associated with quantitative risk assessment in this area. On the basis of the Consultation's recommendations, general statements of principles on food safety risk assessment were adopted by Codex in order to provide a general orientation to Codex work on food safety.

The specific conclusions of the Risk Analysis Consultation concerning biological hazards were confirmed by the FAO/WHO Joint Expert Consultation on Risk Management and Food Safety (FAO, 1997), which noted "the need to reduce the risk to the minimum which is technically feasible and practical" and recognized that "risk assessment techniques must be applied to determine the significance of hazards and be used as a tool to evaluate risk management strategies such as HACCP". In particular, the Consultation recommended that:

- in Codex Standards and Codes, the intended outcome of processes and procedures in terms of food safety should be clearly stated;

- specific research directed towards identifying and characterizing biological hazards of concern should be encouraged by Codex to enable more quantitative

risk assessment.

The recommendations of both Consultations are providing guidance for the work of Codex as related to food safety, including food hygiene, and the integration of risk assessment principles in the decision process in currently underway in relevant Codex committees. This is of essential importance to ensure the scientific basis of international recommendations in view of the requirements of the SPS Agreement.

The Meeting recognized that the lack of harmonized and/or scientifically based regulations on food imports is a major barrier to trade.

The Meeting emphasized that all criteria / specifications must take into account what is achievable with Good Manufacturing Practice.

**4. Action Plan**

Based on the above discussions, the Meeting recommends that the following actions be part of an FAO/IAEA training centre:

**a) Training of regulators and processors in HACCP-based food production**

This activity, which should be a major element of the Centre, should be carried out in close collaboration with other ongoing FAO programmes and should, where needed, expand from those programmes. The training should emphasise the preventive approach to food control, rather than relying on end-product testing.

Whether done in developing or developed countries, and whether for export or import, the basic HACCP analyses and implementation are the same. However, the HACCP training should be adapted to the specific situation, i.e. training must be sector, process, site and product specific. An example is the fish quality assurance courses carried out by the FAO/DANIDA programme. The training programmes should include basic HACCP principles

and may in some areas focus just as much on Good Manufacturing Practices (GMP), good hygienic practices etc.

The Meeting recognized that there may be advantages in training regulators together with producers, distributors and processors, because collaboration between these groups in implementing HACCP is essential.

As many organizations and private companies are already offering HACCP training, it is important that courses at the Centre are specifically targeted at countries/commodities / processes where a need has been identified through regional programmes. The need for specific training of plant operators and other personnel in HACCP is anticipated. Therefore the Centre could also assist in development of materials for training of operating personnel in local processing plants.

Despite ongoing activities, the Meeting concluded that there is currently a significant need for this training which is not being met, and that this need will not diminish in the future. In addition, there is, and will be, a need for follow-up activities. It was the impression of the Meeting that the current demand in developing countries far exceeds the available programmes, and that not all of those programmes are tailored to the local conditions.

To establish the profile of the Centre in this area, it is recommended that regional workshops identifying specific problem areas and possible national coordinators are conducted. These should be followed up by national workshops.

The output of books and training manuals on HACCP and quality management from a variety of sources is enormous. It will therefore be an important role of the Centre to identify training manuals that complement the philosophy and practices embodied in the FAO HACCP Training Manual currently being finalized by FAO. An example of a training manual that is directed to a particular industry is "Assurance of Seafood Quality" (Huss, 1994) from the FAO/DANIDA programme for the fishery sector.

**b) Enhancement of laboratory activities for specific purposes**

This activity should assist developing countries in establishing and upgrading laboratory facilities and skills, where necessary, enabling them to carry out targeted microbiological studies as suggested in the Co-ordinated Research Programmes below.

The Centre should provide training in appropriate microbiological methodologies and on the interpretation of the results as related to the raw material, the local circumstances and processes.

The Meeting concluded that it is not essential that laboratories follow the route to accreditation (e.g. by the ISO), but rather that performance is evaluated, for example in an established proficiency testing scheme. The Centre should provide training on Good Laboratory Practice, laboratory management and quality control issues, and information on proficiency testing schemes. The training should emphasize that microbiological testing and evaluation of methodology is not the key element of HACCP but is one of the many tools in ensuring food safety.

**c) Compilation of microbiological methods**

The Centre should develop a database of bacteriological methods for the pathogenic bacteria found most commonly in foods and which are the subject of testing in foods in international trade. The compilation should, at least initially, be limited to methods accepted by importing countries.

In time the compilation may be extended to methods for bacterial toxins, foodborne and waterborne viruses, parasites, yeasts and moulds.

Consideration should also be given, at a later stage, to including methods for marine (seafood) toxins and biogenic amines.

There may also be an opportunity to list alternative ("rapid") methods for bacterial

pathogens and their toxins. The listing should identify those alternative methods that come into use in the food industry or are accepted as alternatives to the conventional test methods..

Compile results of methods comparisons (AOAC, "Micro Val", AFNOR) to inform developing countries.

Compile available training materials on HACCP (documentation, video, CD ROM) to identify those that can be used to complement the FAO Manual.

**d) Research elements**

**Co-ordinated Research Programme 1**

**Title:** Identification and characterization of factors affecting the microbiological safety of traditionally processed foods which may enter international trade.

The overall objective is to assist national food control authorities / institutions to improve food safety and stimulate international trade through the scientific determination of risks associated with consumption of traditionally processed foods.

Many food products in developing countries are processed by traditional methods with little scientific knowledge applied during their production and little understanding of the reasons for their microbiological safety. Examples of foods in local trade, but with the potential for export, will be identified.

For each food the preservative factors will be identified e.g. pH, water activity (aw), NaCl content (e.g. as % brine), fat content, other possible preservatives (e.g. garlic and other spices), "normal" numbers of key microorganisms e.g. lactic acid bacteria, yeasts, moulds. The microbiology of the raw materials will be documented, with respect to suspected pathogenic microorganisms. The process applied will be documented, e.g. pH and temperature profiles with time. A risk assessment will be performed, identifying the hazards and their potential for multiplication during the process, distribution and storage. This will lead to a clearer

understanding of the risks associated with the consumption of traditionally processed foods, and their potential for international trade.

**Co-ordinated Research Programme 2**

**Title:** Determination of profiles of human bacterial pathogens in foods for export by introduction of quality assured microbiological assays

The overall objective is to assist national food control authorities / institutions to improve food safety and to stimulate international trade by determining the profiles of (selected) human bacterial pathogens on (selected) raw materials and / or products.

Foodborne illness occurs in every country, often the consequence of a failed process or inappropriate storage conditions, usually temperature abuse, during distribution, food service or by the consumer. In recent years there have been several reports of human illness resulting from foods imported from both developed and developing countries. The consequence is widespread concern that foods in international trade often carry unacceptable numbers of pathogenic microorganisms and that their import constitutes a risk of introducing foodborne illness. The result is often the imposition of measures that are neither scientifically based nor statistically sound, and may be a barrier to trade.

In reality there is a poor understanding of the mode and level of potentially pathogenic bacteria on most foods from developing countries as well as the environments where the foods are produced. Laboratories in developing countries should participate in a quality assurance (proficiency testing) scheme to confirm that they have acquired the laboratory skills necessary to demonstrate the presence or absence of selected pathogenic bacteria in the commodities they export, or are seeking to export. Over several months they would determine the "profile" of contamination by the selected pathogens, and whether that profile is affected by season or climatic changes e.g. in the contamination of aquacultured fish and seafoods by salmonellae in run-off of rain after a prolonged dry spell, or by the particular stages of production. The aim is to establish whether contamination by pathogens is very rare, sporadic or common. If common, it might be necessary to determine the levels and their fluctuation with time.

The benefits would include:

- results from the laboratories would be accepted by importers because proficiency had been proven;
- microbiologically safe foods;
- foods that have no history of contamination with pathogens are identified;
- foods contaminated by pathogens are identified;
- the opportunity to suggest hygiene measures to reduce contamination of the raw food, and processing measures to ensure that it is not present on the product.

## 5. Conclusions

- that end-product testing be used only when there is no assurance that Good Manufacturing Practice and HACCP principles have been properly applied;

- that when end-product testing is used to assure microbiological safety of foods which carry the pathogen(s) of concern only occasionally (e.g. in less than 1-5% of units), the low probability of detection of the pathogen(s) and the associated poor assurance of safety be recognized;

- that food safety is controlled by applying a structured scientific risk analysis, following the Principles recommended by the Codex Alimentarius Commission;

- that, if a microbiological criterion is considered necessary, it only be established by following the Principles recommended by the Codex Alimentarius Commission;

- that before a criterion is set, account is taken of the cost / benefit relationship;
- that the mere presence of a pathogen in a raw food is not necessarily reason for its rejection;

- that the real barrier to a better understanding of what is achievable in microbiological

safety of foods is not the occasional presence of pathogenic microorganisms, but the perception, sometimes by regulators, that, contrary to common belief:

a) the mere presence of a pathogen may not be dangerous to human health;
b) with current technologies it is impossible to produce raw agricultural products that are free from pathogenic microorganisms;
c) that microbiological testing of relatively small quantities in a batch (lot) of food in trade and failing to find the pathogen of concern will not assure that it is not present in that batch (lot);

## 6. Recommendations

### 6.1 Training:

- that the Centre establishes and develops a role in training, compatible with ongoing FAO programmes, emphasizing the preventive (HACCP) approach to food control rather than by relying solely on end-product testing; that the HACCP training should be developed and adapted to specific situations (country, commodity, process, site, product) identified in Regional Workshops; that those Regional Workshops should be used to identify HACCP training that is suitable for producers, distributors, processors and regulators, and then encourage these groups to participate at the same time;

- that the Centre should identify appropriate training materials (e.g. manuals, videos, CD ROM) on HACCP and Quality Management to complement the FAO Manual;

- that the Centre should provide training and information on Good Laboratory Practice, laboratory management and advise on available proficiency testing schemes;

### 6.2 Microbiology Methods:

- that the Centre should advise on appropriate microbiological methodologies and the

interpretation of the results as related to raw materials, the local circumstances and the process;

- that the performance of laboratories should be evaluated in an established proficiency testing scheme, but that it is not essential for laboratories that receive assistance and participate in the Centre's programmes to follow the route to full accreditation (e.g. by the ISO);

**6.3 Microbiology Database:**

- that the Centre should develop a database of bacteriological methods for pathogenic bacteria found most commonly in foods and which are the subject of testing foods in international trade, limited initially to methods accepted by importing countries;

- that the Centre extend that database of methods to alternative "rapid" methods for bacterial pathogens and their toxins, especially those that come into use in the food industry or are accepted as alternatives to the established test methods;

- that, if the methods are used in attaining food safety, the compilation be extended to methods for bacterial toxins, foodborne and waterborne viruses, parasites, yeasts and moulds as the need arises;

- that, if the methods are used in attaining food safety, at a later stage the compilation be further extended to include methods for marine (seafood) toxins and biogenic amines;

- that the Centre compiles the results of methods comparisons by e.g. AOAC, AFNOR, Micro-Val, to inform developing countries;

- that the Centre monitors developments of alternative technologies in microbiology including physico-chemical and nuclear techniques for detection of potentially harmful microbes;

**6.4 Research:**

- that the Centre plays a directing and co-ordinating role in the Co-ordinated Research Programme on the identification and characterization of factors affecting the microbiological safety of traditionally processed foods with the potential for international trade;

- that the Centre plays a key role in the Co-ordinated Research Programme on determination of profiles of human bacterial pathogens in foods for export by introduction of quality-assured assays, and that additional data on the prevalence of foodborne pathogens on foods in international trade, especially produce (fruits and vegetables) should be a priority;

**6.5 Other:**

- the Meeting agreed that, in view of the SPS Agreement, governments be encouraged to review their current import regulations to confirm that they are based on scientific principles and make any necessary amendments to be consistent with the provisions of the SPS Agreement;

**7. References**

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remarks. Chemistry and Industry, 8: 273-274.

## ANNEX 1
## FAO/IAEA Consultants Meeting on Microbiological Contamination of Food

Vienna, Austria
18-22 August, 1997
**Agenda**

**Monday, 18 August**

09:00-12:00 Opening Announcements

FAO/IAEA Training and Reference Centre for Food and Pesticide Control
(J Dargie, FAO/IAEA Division, Vienna)

Overview of the microbiological contamination problem in food, particularly in international trade with special reference to EU regulations.
(R J Gilbert, UK)

FDA and USDA rules and regulations on microbiological safety of imported foods
(F F Busta, USA)

Experiences in microbiological analysis of imported foods in Australia
(K Newton, Australia)

12:30-13:30 Lunch

13:30-17:00

Microbiological contamination of food imported into or exported from Singapore with special reference to problems encountered in food exports
(S T Chew, Singapore)

Current microbiological problems in fishery products in international trade
(L Gram, Denmark)

ICMSF recommendations on microbiological specifications for foods in trade
(T A Roberts, UK)

**Tuesday, 19 August**

09:00-12:00 Discussion on Programme of Work related to microbiological contaminants to be carried out by the FAO/IAEA Training and Reference Centre for Food and Pesticide Control

12:00-13:30 Lunch

16:00 Visit to the microbiology laboratories of the Institute for Meat Hygiene, Veterinary University, Vienna.

## Agenda (continued)

**Wednesday, 20 August - Friday, 22 August**

Discussion and Preparation of Report and Action Plan on "Role of the FAO/IAEA Training and Reference Centre for Food and Pesticide Control on Microbiological Contaminants in Food".

## ANNEX 2
## FAO/IAEA Consultants Meeting on Microbiological Contamination of Food

Vienna, Austria
18-22 August, 1997

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## ANNEX 3

## EXAMPLES OF OUTBREAKS OF FOODBORNE DISEASE ASSOCIATED WITH FOOD IN INTERNATIONAL TRADE

(All occurred in 1990's - country of origin of food omitted deliberately)

| Food | Agent | Country where illness occurred |
|---|---|---|
| Alfalfa | *Salmonella spp.* | Finland, Sweden, U.S.A. |
| Iceberg lettuce | *Shigella sonnei* | U.K., Norway, Sweden |
| Melon | *Salmonella* spp. | USA, Canada |
| Strawberries | Hepatitis | USA |
| Raspberries | *Cyclospora* spp. | USA |
| Flavoured savoury snack | *Salmonella* spp. | UK, USA |
| Infant dried milk | *Salmonella* spp. | UK, Ireland |
| Fish (many examples) | Scombroid (histamine) | UK, France, Spain, Canada, Denmark |
| Oysters | Small Round Structured Viruses | UK, Denmark |
| Spices, paprika-flavoured snacks | *Salmonella* spp. | Germany |
| Clams | *Vibrio cholerae* | Japan |
| Fish | Ciguatera | Canada, USA. |
| Crabs | *Vibrio cholerae* | USA |
| Coconut milk | *Vibrio cholerae* | USA |
| Cockles | Hepatitis | Singapore |
| Coconut, de-shelled | *S. paratyphi* | Singapore |

## ANNEX 4

## TARGET HUMAN BACTERIAL PATHOGENS JUDGED BY KNOWN REJECTIONS OF FOOD AT IMPORT

| Frequency | Target pathogen | Commodity |
|---|---|---|
| Most common | *Salmonella* spp. | e.g. fresh and frozen seafood, cocoa, coconut, spices |
| | *Vibrio* spp. | seafood |
| | *Shigella* spp. | seafood, vegetables |
| Less common | *Listeria monocytogenes* | cheese, meat products, seafoods |
| | *Staphylococcus aureus* | cheese |