# FOOD AND ENVIRONMENTAL PROTECTION NEWSLETTER

Joint FAO/IAEA Division
of Nuclear Techniques
in Food and Agriculture
and FAO/IAEA Agriculture and
Biotechnology Laboratory, Seibersdorf
International Atomic Energy Agency
Vienna

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# TO THE READER

**Dear Colleague,**

The 49th Extraordinary Session of the Codex Alimentarius Commission, held in Geneva, 26-27 Switzerland, in September 2001, agreed to advance the draft Proposed Revised Codex General Standard for Irradiated Foods to Step 6 of the Codex procedure. The same Session also decided to accept the Proposed Codex Code of Practice for Radiation Processing of Food as new work for the Codex. Both the revised Codex Standard and Code of Practice, included in this issue, will be considered at the forthcoming Session of the Codex Committee on Food Additives and Contaminants, Rotterdam, the Netherlands, 11-15 March 2002.

The 18th Annual Meeting of the International Consultative Group on Food Irradiation (ICGFI), Rome, Italy, 23-25 October 2001, decided to phase out its activities with a final two year extension of its mandate from May 2002 to May 2004. This decision came following the successful achievements under the ICGFI mandate and the need to move on to a new type of organization with more emphasis on implementing the technology to meet the needs of member countries through enhancing food safety, security and trade and with active participation of the private sector. The highlights of the 18th ICGFI Meeting as well as its decisions are included in this issue.

Irradiated food is gaining acceptance in many countries especially in the USA where over 2000 supermarkets are putting it on sale on a routine basis, apparently with no opposition from consumers. Sale of irradiated food went well beyond expectations.

The tragic events of September 11 in New York and Washington, D.C. changed the world significantly. With the threat of anthrax spores in the mail, the reader may be interested to know that irradiation provides a ready solution to this problem as the US Postmaster General decided to purchase eight electron beam irradiators to treat mail to inactivate anthrax spores. While these machines are being built/installed, some one million pieces of mail have already been irradiated and distributed, using other commercially available machines.

Two new Co-ordinated Research Projects (CRPs) were implemented by the Section during the past year: (i) Use of Irradiation to Ensure Hygienic Quality of Fresh, Pre-Cut Fruits and Vegetables and other Minimally Processed Food of Plant Origin; and (ii) Irradiation to Ensure the Safety and Quality of Prepared Meals. Another CRP is in the pipeline and will be implemented in early 2002, i.e. Testing the Efficacy and Uncertainty of Sample Processing for Analysis of Food Contaminants. The details of these CRPs are described in this issue.

We bid farewell to Traude Strnadl, one of the secretaries of the Section, who decided to take early retirement because of health reasons after more than two decades of service including with the former Agrochemical and Residue Section. We thank her for her excellent service and dedication to the work and wish her well in her retirement. We also welcome Ms. Barbara Miller who is providing part time service to the Section until further notice.

The staff members of Food and Environmental Protection Section wish all our readers a happy and successful 2002.

**P. Loaharanu**
**Head**
**Food and Environmental Protection Section**

# A. STAFF

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# B. FORTHCOMING EVENTS

**FAO/IAEA Workshop on "Use of Irradiation to Ensure Microbiological Safety of Food", Mumbai, India, 4-8 February 2002**

This regional Workshop for Asia and Pacific will be convened under the scope of a regional Technical Cooperation project on "The Application of Irradiation to Improve Food Safety, Security and Trade" (RAS/5/042). The objective of this Workshop is to provide relevant information on recent developments related to acceptance and application of irradiation as a sanitary treatment for food, especially as a method to ensure its microbiological safety, as well as modern microbiological methods for determining contamination of food by pathogenic micro organisms. The programme will comprise of lectures, demonstrations, discussions, case studies, with emphasis on irradiation as a sanitary treatment for food and methodologies for determining pathogenic micro organisms in food and agricultural commodities. Fourteen participants from the region have been selected to attend.

**FAO/IAEA (RCA) Workshop on "Irradiation to Ensure Quarantine Security in Trade in Food and Agricultural Commodities", Canberra, Australia, 18-22 March 2002**

This Workshop will be held at Australian Quarantine Inspection Service (AQIS), Canberra with the objective of providing scientists/plant quarantine officials who are conducting research on quarantine treatment including by irradiation, with relevant information on recent developments related to the use of an internationally accepted research protocol leading to recognition of national regulatory authorities on irradiation as a phytosanitary treatment for fresh horticultural commodities in trade.

**Participants' Qualifications**: Participants must be scientists/officials from governments which are members of the RCA Agreement of the IAEA and who are responsible for research on various phytosanitary treatments including irradiation to ensure quarantine security in trade in fresh horticultural commodities.

**Background of The Workshop**: Irradiation is beginning to play a role as a sanitary and phytosanitary treatment for food and agricultural commodities based on the provisions of the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (SPS). Its use as a sanitary and phytosanitary treatment is being accepted in several advanced and developing countries and its application for these purposes is increasing. Commercial application of irradiation as a phytosanitary treatment already started in the USA since last year. The USDA/APHIS is finalizing its Proposed Rule on Irradiation: Phytosanitary Treatment for Imported Fruits and Vegetables, published in May 2000. Currently, the Australian New Zealand Food Authority is considering approval of irradiation for a number of tropical fruits to meet quarantine requirements in trade. A number of positive developments on this subject have occurred in Asia and the Pacific in recent years including acceptance of a protocol on irradiation as a quarantine treatment of fresh fruits and vegetables by ASEAN countries and the development of a guideline on irradiation as a phytosanitary treatment for Asia and the Pacific. The International Plant Protection Convention (IPPC) is also developing an international standard on irradiation as a phytosanitary treatment. Thus, the stage is set for the introduction of irradiation as a phytosanitary treatment in international trade. However, national authorities in major importing countries still require that proper irradiation is done based on the research protocol acceptable to them. It is therefore essential that scientists/officials who are conducting research on this discipline are brought up-to-date with the "internationally accepted" research protocol and regulatory requirements in trade in fresh horticultural commodities.

**Nature of Workshop**: The Workshop will consist of lectures, demonstrations, discussions, case studies, with emphasis on irradiation as a phytosanitary treatment for fresh horticultural commodities especially on research protocol acceptable to regulatory authorities.

**Final RCM on "Alternative Methods for Pesticide Residues in Grains", Beijing, 22-27 April 2002**

The Coordinated Research Project aims to elaborate and validate alternative methods to complement GC and HPLC analysis of pesticide residues. The eight participants will evaluate the results and prepare them for publication in the J. Environ. Sci and Health Part B. The meeting will be followed by a workshop demonstrating the techniques and methods developed within the project.

**FAO/IAEA Thematic Planning Meeting on "Irradiation as a Sanitary and Phytosanitary Treatment for the New Millennium", Vienna, 6-10 May 2002**

Background: Trade in food and agricultural commodities has to conform with the Agreement on the Application of Sanitary and Phytosanitary Measures of the World Trade Organization (WTO), which requires that strict measures be introduced to ensure the safety and quality of food in trade. Based on the increasing incidence of foodborne diseases, often well publicized by the media, there is an increasing awareness of the public in many countries of issues related to food safety and quality. Major importing countries are demanding the safety and quality of food from "Farm to Fork" to protect the health of their citizens as well as to prevent exotic pests damaging their local agriculture. Legislation in some major food importing countries requires zero tolerance levels of specific pathogenic microorganisms or pests. In addition, consumers in many countries prefer food products which are either fresh or fresh-like or minimally processed to maintain freshness. Such legislation and public demand have put additional constraints on many developing countries, most of which depend on export of their surplus in food and agriculture products for their economic development, to improve food production and processing methods to ensure the safety and quality of their food in trade. In addition, there is an urgent need to find a suitable alternative to methyl bromide fumigation of fresh and dried food products for insect control due to the global phasing out of this chemical because of its potent ozone depletion potential.

Irradiation has emerged as a viable sanitary and phytosanitary treatment for many types of food products to meet international standards and agreements related to safety and quality of food. There is a worldwide Codex General Standard for Irradiated Foods available since 1984 to ensure the safety and effectiveness of irradiation. An international standard on irradiation as a phytosanitary treatment for food is under development by the International Plant Protection Convention.

Currently, some 50 countries have approved the use of this technology for treating one or more food products or classes of food and over 30 of these countries are actually applying it for commercial purposes. In the USA, irradiation is widely used for sanitary treatment to ensure the microbiological safety of food such as ground meat, poultry meat, spices and dried vegetable seasonings, as well as a phytosanitary treatment for fruits from Hawaii for marketing in the US mainland. Many countries in Asia and the Pacific, Africa, Latin America, the Middle East have introduced legislation on food irradiation and several are actually applying this technology for different types of food products, especially spices and dried vegetable seasonings to ensure their microbiological safety. The European Union introduced a Directive approving the use of irradiation for spices and dried vegetable seasonings in 2000, and is considering the expansion of the list of food products to be treated by irradiation. The number of irradiation facilities available for food processing has increased significantly in the past five years. Many more countries are considering their approval of food irradiation and building irradiation facilities for this purpose. The volume of irradiated food produced globally has continued to increase in recent years to over 300,000 tonnes in 2000. With proper information dissemination, irradiated foods have sold well in all countries which have marketed them at retail.

Constraints and Opportunities: There is still a misperception by policy makers in some advanced and developing countries as to the safety, benefits and needs of food irradiation, resulting in slow acceptance of the process by regulators and limited application. The technology is also perceived to be expensive especially for limited volumes or types of food products initially planned to be treated.

Consumers in most countries are not fully aware of the microbiological risks of food available in the market and are not aware of the benefit which irradiation can bring. With regard to phytosanitary treatment, there are many species of insects of quarantine importance for which there are no data on the effectiveness of irradiation to ensure quarantine security. Infrastructure in several developing countries may not be appropriate to introduce food irradiation.

With regulatory requirements in major importing countries emphasizing the safety and quality of food from "Farm to Fork", opportunities exist to consider irradiation as a sanitary or phytosanitary treatment as part of the certification system to ensure the safety and quality of food. A recent attempt has been made to this effect through assistance of FAO and IAEA and the International Consultative Group on Food Irradiation (ICGFI), established under the aegis of FAO, IAEA and WHO in 1984, for countries in Asia and the Pacific and Latin America. FAO and IAEA could be a further catalyst in ensuring the acceptance of irradiation as a sanitary and phytosanitary treatment, thereby meeting international standards and agreements relevant to food trade.

Convergence: Trade in food and agricultural commodities from developing countries has to meet the increasingly strict sanitary and phytosanitary requirements introduced by major importing countries based on the provisions of the Agreement on the Application of Sanitary and Phytosanitary Measures of the WTO. Irradiation has a unique feature in satisfying both sanitary and phytosanitary requirements in food trade. It could provide a viable treatment for many types of food products from developing countries to meet regulatory requirements in importing countries. However, FAO and IAEA have limited human and financial resources to assist Member States to introduce this technology in many developing countries.

To provide necessary guidance, realistic criteria and logical framework to FAO and IAEA in introducing food irradiation as a viable sanitary and phytosanitary treatment in Member States, a thematic planning meeting is planned to provide the following answers:

- Criteria for successful introduction of irradiation as a sanitary and phytosanitary treatment
- Comparative advantages of irradiation
- Which Member States are prepared to introduce the application of this technology, for which food products?
- Where are the markets for irradiated food?
- How to implement a campaign leading to wide acceptance and application of food irradiation?
- What is the role and contribution of the private sector?
- Who in the international community should take the leadership in this field?

Such answers could lead to a better programme development and management strategies of Member States to implement the use of irradiation as a sanitary and phytosanitary treatment to facilitate trade in their food commodities. They would provide guidance to FAO and IAEA to meet their obligations in this subject.

**First RCM on "Irradiation to Ensure the Safety and Quality of Prepared Meals", Vienna, 3-7 June 2002**

The first RCM of this new CRP is tentatively planned for Vienna, 3-7 June 2002, to coordinate research activities planned to be carried out by research agreement/contract holders during the tenure of this CRP. It is expected to be attended by 10 research contract holders and 4 agreement holders.

**Final RCM on "Determination of Profiles of Human Bacterial Pathogens in Food for Export by Introduction of Quality Assured Microbiological Assays", Mexico D.F., Mexico. Tentatively planned for August 2002**

The overall objective of this CRP is to assist national food control authorities and institutions in improving food safety and stimulate international trade in food by determining profiles of (selected) human bacterial pathogens of concern to importers on (selected) raw materials and/or products, thereby increasing assurance in their food control measures.

The final meeting on this subject is tentatively planned for Mexico D. F., Mexico in August 2002. It is expected to be hosted by the Universidad Nacional Autonoma de Mexico. Twelve Research Contract/Agreement Holders under this Research Contract will be invited from Australia, Austria, Brazil, Chile, Indonesia, Mexico, Nigeria, Paraguay, Philippines, Republic of Korea, Thailand and United Kingdom.

**Final RCM on "Evaluation of Methods of Analysis for Determining Mycotoxin Contamination of Food and Feed", Cape Town, South Africa, 16-20 September 2002**

The final Research Coordinated Meeting (RCM) of the Coordinated Research Programme (CRP) on Evaluation of Methods of Analysis for Determining Mycotoxin Contamination of Food and Feed will be held at Medical Research Council (MRC), Programme on Mycotoxins and Experimental Carcinogenesis (PROMEC), Tygerberg 7505, Cape Town, Republic of South Africa. Participants including contract and agreement holders and observers (at present 15 contracts and 4 agreements) from Argentina, Australia, Brazil, Canada, China, Cuba, Egypt, Ghana, India, Indonesia, Italy, Malaysia, Philippines, South Africa, United Kingdom, United States, and Uruguay will be invited to participate in this RCM. The objective of this final RCM is to collect all results, conclusions, and recommendations from the CRP participants as well as other information needed to conduct an evaluation.

# C. PAST EVENTS

**ICGFI Workshop for Latin America on "Certification of Irradiation as a Sanitary and Phytosanitary Treatment for Food and Agricultural Commodities", Rio de Janeiro, Brazil, 9-13 July 2001**

The regional Workshop on "Certification of Irradiation as a Sanitary and Phytosanitary Treatment for Food and Agricultural Commodities", was held in co-operation of the Brazilian Government.

The Workshop was convened and organized under the International Consultative Group on Food Irradiation (ICGFI) framework. The objective of this Workshop was to inform food control officials and senior plant quarantine officials of government of a systematic approach in certifying irradiation as a sanitary and phytosanitary treatment to facilitate trade in food and agricultural commodities. A similar Workshop was held for the Asia and Pacific region, December 2000, Sydney, Australia. It was attended by 27 senior food control and plant quarantine officials from Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Honduras, Nicaragua, Panama, Peru and several observers from Brazil and USA, as well as representatives from IAEA and the Pan- American Health Organization (PAHO).

The participants endorsed "Guidelines on Certification of Foods Irradiated other than for Phytosanitary Purposes" adopted by senior officials from Asia and the Pacific at Workshop held in Sydney, December 2000, with minor amendments. They requested that such an amended Guideline should be sent to all ICGFI member governments for comments with a view to finalize it at the 18$^{th}$ ICGFI meeting, Rome, October 2001. Once endorsed by ICGFI, the Guideline should be brought to

the attention of the Codex Alimentarius Commission through its Codex Committee for Food Import-Export Inspection and Certification Systems (CCFICs) for further consideration. It was agreed that the IPPC Phytosanitary Certificate currently in use already has provisions to accommodate the use of irradiation as a phytosanitary certification. The participants also endorsed this IPPC Certificate as well as the irradiation certificate for phytosanitary purpose developed by the Latin American Workshop held in Mexico DF, December 2000.

**FAO/IAEA (RCA) Workshop on "Process Control of Irradiation as a Sanitary and Phytosanitary Treatment for Food", Beijing, People's Republic of China, 6-10 August 2001**

The Workshop was hosted by Institute for the Application of Atomic Energy, Chinese Academy of Agricultural Sciences, Beijing. It was attended by 20 food control and plant quarantine officials who are responsible either for control of food processes including irradiation or certifying treatments for quarantine purpose, from 12 RCA member countries. A series of lectures, demonstrations and an on-site visit to Beijing Agricultural Irradiation Centre were included as part of the programme. Based on the information provided at the workshop, the participants who did not yet have the experience in controlling the irradiation process were asked to prepare a flow chart on controlling irradiation either as a sanitary or phytosanitary treatment. The charts prepared by the participants clearly demonstrated that they had grasped the concept of process control of irradiation which should be useful for their future work for controlling this process in their countries.

**First RCM on "Use of Irradiation To Ensure Hygienic Quality of Fresh, Pre-cut Fruits and Vegetables and Other Minimally Processed Food of Plant Origin", Rio de Janeiro, Brazil, 5-9 November 2001**

This RCM was hosted by the government of Brazil (Ministry of Agriculture) and held in Rio de Janeiro. The meeting was co-sponsored by Pan-American Health Organization (PAHO). It was attended by Research Contract/Agreement Holders from Argentina, Brazil, Chile, Egypt, Hungary, India, Malaysia, Pakistan, Portugal, Turkey, United Kingdom and United States. Research Contracts/Agreement Holders from Canada, China and Republic of Korea did not attend the meeting. Some observers also attended the meeting.

The overall objective of the meeting was to evaluate the effectiveness of irradiation as a method to a) ensure the microbiological safety of pre-cut produce and other minimally processed food of plant origin, and b) appraise the quality of such products subject to radiation doses sufficient to control infectivity of these pathogens. The specific objective of this CRP is to use validated methods for microbiological determination of food and validated procedures for irradiation of food including proper dosimetry control in order to control various food borne pathogens in fresh, pre-cut produce and other minimally processed food of plant origin.

RCM participants deliberated on the approaches to be used throughout the CRP. This included a discussion on what constituted a minimally processed product and the use of standard methods. The last subject included standard methods for preparing inocula, the method of inoculation, irradiation conditions, use of internationally recognised microbiological methods and the need to use good experimental design.

It was agreed that a total of 12 pathogenic bacteria will be studied in/or more than 20 different products. All participants elaborated a detailed work program for the first year, including the milestones and dates to finish them.

The participants also visited an irradiation facility under construction (10 Mev accelerator of 15 KW) that would be in operation in 2002. Its capacity would be 120,000 tonnes/year. This is the first irradiation facility in a very large complex of commercial scale irradiators in Rio de Janeiro. This complex will be a Centre of Excellence in the field of food irradiation for training and commercial scale service to the local industry.

**IPPC Workshop on "Development of an International Standard for Phytosanitary Measures (ISPM) on the Use of Irradiation as a Phytosanitary Treatment", Mexico.D.F, Mexico, 14-17 November 2001**

The Workshop was held at the Headquarter of the Secretary of Agricultural, Cattle, Food, Fishery and Rural Development, Ministry of Agriculture. The Workshop was attended by experts from Australia, Brazil, Japan, Jordan, Mexico, Singapore, United States and United Kingdom. Mr. Robert Griffin and Dr. Tatiana Rubio, represented FAO and IAEA, respectively.

The topic was proposed by the International Plant Protection Convention (IPPC) Secretariat at the Third Session of the Interim Commission on Phytosanitary Measures (ICPM) in April 2001 based on awareness of several regional and national initiatives to elaborate regulations and standards for the use of irradiation as a phytosanitary treatment. The Third Session of the ICPM agreed to place this initiative within the current work programme with the stipulation that its implementation was dependent upon extra-budgetary resources. The IPPC Secretariat drafted specifications for a standard immediately following the decision by the ICPM. The specification was reviewed, modified, and agreed by the Interim Standards Committee in May 2001.

The experts reviewed existing standards and draft standards as well as other technical information available on the application of irradiation as a phytosanitary treatment and prepared a suitable draft which included aspects like: authority, objective, treatment, dosimetry, facilities, system integrity, documentation and monitoring, administration, research and commodity tolerance. The draft also includes some appendices (research protocol, checklist for facility approval, estimated doses for certain pest groups).

The draft standard will be reviewed by the ICPM Standards Committee and the document will be distributed to governments for consultation in May 2002. This would make it possible for comments from governments and international organizations during the period June-September 2002. The comments will be collected and the document will be reconsidered by the Standards Committee later in the year. Depending on the extent and nature of the comments, the Standards Committee may be able to approve the draft to be submitted to the ICPM for consideration and possible adoption during its Fifth Session in 2003. This is the earliest the standard could be adopted following the current standard-setting procedures of the IPPC. This would be the first standard for a specific treatment under the ICPM framework.

**Training Workshop on "Development of Quality Assurance for Mycotoxin Analysis of Food and Feed for Near East and African Countries", Cairo, Egypt, 1-6 December 2001**

The Workshop organized by Food and Agriculture Organization (FAO) of the United Nations and International Atomic Energy Agency (IAEA) through their Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, and World Health Organization (WHO), in cooperation with Agriculture Research Centre (ARC), Ministry of Agriculture, Egypt, was held at Central Laboratory for the Analysis of Pesticide Residues and Heavy Metals in Foods, Agriculture Research Centre, Cairo, Egypt. The workshop was attended by twenty-three participants from 16 countries (i.e., Bahrain, Egypt, Ethiopia, Ghana, Iran, Jordan, Kenya, Lebanon, Morocco, Niger, Nigeria, Saudi Arabia, Senegal, Sudan, Syria, and Turkey) and four observers from Egypt. The participants were scientists with ample experience in mycotoxin analyses, head analysts and/or quality assurance officers working in official laboratories/institutions responsible for control of import and export food and for food safety. The Training Workshop was designed to: (1) provide participants with general quality assurance principles and give theoretical and practical training in the implementation of Guide ISO 17025 and GLP, and (2) to assist mycotoxin control laboratories in complying with the requirements for international trade by establishing a quality system and obtain reliable analytical results necessary for accreditation. The training workshop provided the participants with criteria and tools for fulfilling ISO 17025 requirements necessary for seeking accreditation in mycotoxin analysis.

# D. STATUS OF EXISTING COORDINATED RESEARCH PROJECTS (CRPs)

**Use of Irradiation To Ensure Hygienic Quality of Fresh, Pre-cut Fruits and Vegetables and Other Minimally Processed Food of Plant Origin**

This CRP was initiated this year. It has 12 research contracts and 3 research agreements. The first meeting was held in Rio de Janeiro (5-9 November 2001), Brazil, where the participants who attended the meeting presented their progress reports. (See Past Events of this issue).

**Determination of Profiles of Human Bacterial Pathogens in Food for Export by Introduction of Quality Assured Microbiological Assays**

This CRP is in the fourth year of operation. Progress has been made in determining the profile of some pathogens bacteria, especially in seafoods and meats. The final meeting is tentatively planned for Mexico City, July 2002 (See Forthcoming Events).

**Evaluation of Methods of Analysis for Determining Mycotoxin Contamination of Food and Feed**

The Coordinated Research Programme (CRP) on Evaluation of Methods of Analysis for Determining Mycotoxin Contamination of Food and Feed is in the fourth year of operation with 14 research contracts and 6 research agreements from 17 countries. The evaluation of the CRP progress reports revealed significant achievements within various workgroups activities, and the collaborative studies on TLC methods for Fumonisin B1, Aflatoxins B1, 132, G1 G2 (in Maize and Peanut products), and Aflatoxin Ml (in Milk). The participation in proficiency tests coordinated by FAPAS, MAFF, UK on behalf of the FAO/IAEA Training and Reference Centre for Food and Pesticide Control (TRC) has positively effected CRP participants' expertise, showing the absolute importance of calling for the participation of all participants in the FAPAS proficiency tests.

**Use of Irradiation as a Phytosanitary Treatment for Food and Agricultural Commodities**

A number of important data have been generated by several participants to demonstrate the efficacy of irradiation as a method to ensure quarantine security against several species of insects and mites including codling moth, orange fruit borer, khapra beetle, sweet potato weevil, mango seed weevil, citrus rust mite, the larger grain borer, the lesser grain borer, etc. Data generated so far appear to support a generic dose of 300 Gy minimum for these insect species. The tolerance of different host commodities to radiation doses 2-3 times greater than that required to ensure quarantine security was established. The CRP is making good progress according to schedule.
The Final RCM is tentatively planned for Guangzhou, People's Republic of China, September 2002.

**Quality Control of Pesticide Products**

The specific objectives of this CRP are to:

- Elaborate GC and HPLC separation and detection conditions suitable for the analysis of a number of pesticides singly or in combination.
- Test the applicability of uniform instrumental analytical conditions for selected pesticides which are used in the country of the participating laboratories.
- Introduce appropriate internal quality control measures for assuring reliable results.
- Compare the results obtained with multi pesticide method with the results obtained with the CIPAC procedures.
- Validate the new procedures according the criteria of AOAC Peer Verified Method Programme.

The first Research Coordination Meeting was held in Velence, Hungary during 7 - 11 May 2001 with the participation of 16 analysts.

The Agilent, Merck and Varian Companies provided the chromatographic columns and some accessories to ensure the comparability of results and facilitate their standaridisation. The participants started the implementation of the work programme (http://www iaea org/programmes/nafa/d5/crp/workprogramme-qc.pdf) and submitted their progress reports. Based on the progress made, all research contracts have been renewed.

# E. NEW CO-ORDINATED RESEARCH PROJECTS

**Use of Irradiation to Improve the Safety and Quality of Prepared Meals**

Introduction: There is a dynamic growth of market for prepared meals to meet the busy life style of populations in many countries. Such meals which offer convenient and less time for preparation are marketed in advanced countries either under chilled with limited shelf-life or frozen for long term sale in supermarkets. In developing countries, many types of ethnic dishes are often freshly prepared and marketed at ambient conditions essentially on a day to day basis. There are growing trends to market frozen prepared meals intended for microwaving prior to consumption in many countries.

Irradiation offers a potential to improve the microbiological safety and shelf-life of a number of chilled, prepared meals. A number of prepared meals currently marketed under frozen condition could possibly be replaced through irradiation and chilled storage to ensure not only microbiologicasl safety but sufficient shelf-life to meet market requirements, resulting in saving in energy and cost. As for ethnic dishes in developing countries, irradiation either alone or together with chilling could improve not only microbiological quality but could extend shelf-life of the products. However, little data are available to demonstrate the effectiveness of irradiation to improve the microbiological safety and quality of many types of prepared meals currently being marketed either under ambient, chilled or frozen conditions.

Objective: The overall objective of this CRP is to evaluate the effectiveness of irradiation as a method to ensure microbiological safety and extend shelf-life of prepared meals, stored either under ambient, chilled or frozen and to evaluate the sensory quality of the treated products.

The specific objective of this CRP is to use validated methods for microbiological determination of food and validated procedures for irradiation, process control, sensory evaluation to determine microbiological safety and quality of irradiated prepared meals or ethnic dishes.

Expected Outputs: Methods for determination of bacterial pathogens and sensory evaluation of irradiated prepared meals will be validated and adopted by the participating laboratories. Progress of research work will be evaluated at specific intervals through co-ordination meetings. The proceedings of the final meeting to be organized under this CRP will be published and to provide specific recommendations to FAO and IAEA to pass to their Member States for adoption and implementation.

Activities: The CRP will involve up to 10 institutes/laboratories from developing and up to 5 institutes/laboratories from advanced countries. Selection will be made on the qualifications of counterparts with regard to microbiological methods and evaluation of quality attributes of prepared meals, availability of irradiation facilities and expertise on irradiation of food. Three research co-ordination meetings will be held to develop research protocols, review progress, evaluate results and outcomes and make recommendations. A TECDOC on the results of this CRP will be prepared for publication.

Duration: 5 years

Research contract/agreement proposals (http://www.iaea.oriz/programmes/ri/uc.htmi) related to the scope of this CRP may be submitted to IAEA Research Contract Administration, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

Further information about this CRP may be obtained from:

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**Testing the efficiency and uncertainty of sample processing for analysis of food contaminants**

This CRP, starting in 2002, aims to test:

- the efficiency (uncertainty) of sample processing (variability of residues in replicate analytical portions withdrawn from the homogenized laboratory sample), and
- the stability of residues during sample processing.

Both aspects have been overlooked in the past, but information on them is essential for assuring the validity of results, and satisfying the requirement of ISO 17025.

Further details can be found in the outline of the project (http://www.iaea.org/programmes/nafa/d5/) and the original paper describing the principle without the application of labelled compounds (Ambrus A, Solymosne M.E., and Korsos I., Estimation of Uncertainty of Sample Preparation for the Analysis of Pesticide Residues, J. Environ. Sci. Health. B31. No. 3 1996.) are attached for your information. The application of labelled compound and the preliminary results are further described in the papers presented by Maestroni et al, and for testing the stability of residues by El-Bidaoui et al., and Alan Hill at the International Workshop on Method Validation in Budapest in 1999 (Fajgelj A., Ambrus A., eds. Principles of Method Validation, Royal Society of Chemistry Cambridge UK 2000).

Application of labelled compounds has definite advantages, but both tests can be carried out applying ordinary analytical standards as it should be done in laboratories analysing pesticide residues. The compounds to be included in the pesticide mixture for testing the stability of residues and the matrices to be tested will be selected from those what the participants consider important for their own work and for which information on stability during sample processing is not available.

Research proposal (hltp://www.iaea.org/programmes/ri/uc.htm]) or research agreement
Proposal (http://www.iaea.org/programmes/ri/uc.html) as appropriate
(http://www.iaea.orgiprogrammes/ri/uc.htmi) to IAEA Research Contract Administartion (IAEA A-1400 P.O.Box 100 Vienna, Austria)

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# F. INTERNATIONAL CONSULTATIVE GROUP ON FOOD IRRADIATION (ICGFI)

**Excerpts from the 18th Annual Meeting**

The 18th ICGFI Meeting was held at FAO Headquarters, Rome, 23 -25 October 2001. It was attended by 30 designated experts from 22 member governments, 6 representatives of 4 intergovernmental organizations and 3 representatives of 3 non-governmental organizations. At the Opening, Dr. Louise Fresco, FAO ADG-AG, made a welcome statement on behalf of Directors General of FAO, IAEA and WHO. The following are the major decisions and follow-up actions arising from the 18th ICGFI Meeting:

**a. Decisions**

1. Extension of ICGFI Mandate: A unanimous decision was made to extend the ICGFI mandate for two FINAL years from the expiration date of its current mandate on 10 May 2002, based on the terms and conditions of the existing Declaration establishing ICGFI. The two-year Final extension of the mandate would allow reasonable time for ICGFI to:

   - Complete on-going activities
   - Prepare for the new organization to succeed ICGFI
   - Provide for a smooth transition to a new body.

   There was a consensus at the Meeting that the new organization to succeed ICGFI should continue to be an inter-government organization which is actively participated in and contributed by the private sector especially the food industry. FAO, IAEA and WHO will be invited to participate in the work of the new organization in an advisory capacity.

   The Meeting appointed a **Transition Committee** to develop the structure of the new organization, its mandate, membership and contributions, and activities, under the Chairmanship of Dr. Raja Abdul Aziz Raja Adnan, the designated expert from Malaysia. The following designated experts were appointed as members: Mr. G. Luckman (Australia), Prof Azhar Djaloeis (Indonesia), Dr. Y. Haruvy (Israel), Dr. Aly Rady (Egypt), Mr. Odilson L. Ribeiro a Silva (Brazil), and an expert from the USA (to be identified), representing governments; Mr. J. Medeiros (Brazil), Mr. J. Leemhorst or Mr. P. Dardenne (AIII), Mr. J. Kotler (Canada), representing the radiation processing industry; a member of the food industry (to be identified); Mr. S. Schaller (IIR), Dr. R. Ross (USA) and Dr. P. Roberts (NZ) as consultants; and Dr. G. Moy (WHO) and Mr. P. Loaharanu (FAO/IAEA) representing the ICGFI Secretariat. In consultation with Dr. Raja Adrian, the date of the Transition Committee Meeting, Vienna, was set at 15-17 January 2002.

2. First World Congress on Food Irradiation, 2003: Following the proposal made by Chairperson in her Action Plan 2002-04 which was circulated to all national contact points prior to the Meeting, the US Grocery Manufacturer Association (GMA) informed the Secretariat of its agreement to co-sponsor this Congress. An approach was also made to the US Food Marketing Institute (FMI) to co-sponsor the Congress and to host it during the FMI Show (normally attended by some 30,000 participants) in 2003. (FMI agreed soon after the 18th ICGFI Meeting to co-sponsor and host the Congress.)

   The 18th Meeting decided to convene the World Congress in 2003 as it would directly involve the food industry and could broaden the scope of interest of this sector. It would also provide a good opportunity to attract new members to the new organization to succeed ICGFI in May 2004.

3 R.E. Engel Award 2001: Based on the voting of ICGFI designated experts, the Meeting decided to confer the Award to Dr. **Christine M. Bruhn,** Director, Center for Consumer Sciences, University of California, Davis, California, for her outstanding contribution in the area of consumer acceptance of irradiated food which has resulted in a wide acceptance of irradiated food in many countries especially the USA; and Dr. **Irwin A. Taub,** Senior Research Scientist, US Army Natick Soldier Center, Natick, Massachusetts, for his outstanding contribution to the development on high-dose irradiation of food, especially his efforts in preparing the report of the Joint FAO/IAEA/WHO Study Group on High-Dose Irradiation of Food, for publication by WHO in 1999.

   Two silver plaques are being prepared by ICGFI for sending to the two recipients of this Award before the end of this year. (AIII contributed financially to the cost of these plaques).

**b. Follow-up Actions**

The following actions are required to be undertaken by national contact points urgently according to the respective deadlines:

1. Draft Brochure: Food Irradiation - A Global Food Safely Tool
   In co-operation with the International Food Information Council (IFIC), Washington, D.C., this colourful brochure was prepared for the benefit of policy makers in government, the food industry and consumer organizations. It was distributed at the 18th ICGFI Meeting. (Deadline for comments: 30 November 2001)

2. Draft Report: "Global Market Study to Determine the Potential for Increased Trade in Irradiated Fresh Horticultural Products"
   On behalf of ICGFI, FAO commissioned this study through a private consultant who provided a voluminous report with analysis on the potential impact on trade in irradiated fresh horticultural products in four major markets (USA, EU, Australia/NZ and Japan), assuming that there would be no regulatory barriers. A copy of the extended summary of this report was distributed at the 18th ICGFI Meeting. A full report is available upon request from the ICGFI Secretariat. (Deadline for comments: 20 December 2001)

3. EU "Communication from the Commission on Foods and Food Ingredients Authorized for Treatment with Ionizing Radiation in the Community"
   In response to the invitation from the European Commission (EC), the ICGFI will send its comments to the EC. ICGFI national contact points were requested to make a follow up comment to the EC along the line of comments of the ICGFI. (Deadline for comments to the EC: 30 December 2001)

4. Proposed Draft Revised Codex General Standard for Irradiated Foods

The 49th Extraordinary Session of the Codex Executive Committee, Geneva, Switzerland, 26-27 September 2001, decided to adopt the proposed draft revised Codex Standard at Step 5 and to circulate it as Step 6 to governments for comments. **(Annex 1)** As requested by the 33rd Session of the Codex Committee on Food Additives and Contaminants (CCFAC) which was designated by the CAC to consider matters related to Codex General Standard for Irradiated Foods, the 18th ICGFI Meeting decided to make comments on the proposed draft Codex Standard, to be submitted on behalf of ICGFI by the IAEA (this has been done). As the CAC procedures give more weight to comments made by member governments, **ICGFI national contact points** were strongly requested to brief their respective national Codex contact points and to make sure that they voice their support to further the proposed draft Codex General Standard for Irradiated Foods along the line of comments made by ICGFI, at the forthcoming 34th Session of CCFAC, Rotterdam, the Netherlands, 11-15 March 2002.

5. Proposed Draft Codex Recommended International Code of Practice for Radiation Processing of Food.

Further revisions were made following comments made at the 33rd Session of the CCFAC. The 49th Extraordinary Session of the Codex Executive Committee decided to approve it as a new work of the CAC. With additional inputs from designated experts from Germany, Malaysia, New Zealand and USA and the ICGFI Secretariat, the proposed draft Codex Recommended International Code of Practice for Radiation Processing of Food has been submitted to the Codex Secretariat for circulation and consideration at the 34th Session of CCFAC, Rotterdam, the Netherlands, 11-15 March 2002. **(Annex 2**) **ICGFI national contact points** were requested to inform their respective national Codex contact points accordingly.

*1.* 6. Certification System in Trade in Irradiated Foods**.**

A Guideline for Certification of Food Irradiated other than for Phytosanitary Purposes was originally developed by senior food control officials, at a regional workshop for Asia and the Pacific held in Sydney, Australia, 18-22 December 2000. This Guideline was slightly modified to fit the format of Codex by a similar group of food control officials in Latin America through a regional workshop sponsored by ICGFI, Rio, Brazil, 9-13 July 2001. It was circulated to all ICGFI national contact points for comments in September 2001**.** The 18th ICGFI Meeting endorsed the submission of this Guideline to the next Session of the Codex Committee on Food Import-Export Inspection and Certification System (CCFICs), Brisbane, Australia, 25 February – 1 March 2002. Mr. G. Luckman (Australia) was commissioned to edit the Guideline to follow the principle of the Guideline for Generic Official Certificate Formats and the Production and Issuance of Certificates, adopted by the CAC, prior to submitting it to the Codex Secretariat, and to represent ICGFI at the CCFICs Session in Brisbane. The representative of the Codex Secretariat agreed to bring the ICGFI Guideline to the attention of the next Session of the CCFICs in Brisbane. **ICGFI national contact points** were requested to bring this matter to the attention of their national Codex Contact points with a view to support this Guideline at the next Session of the CCFICs.

**c. General Matters**

The 18th ICGFI Meeting was informed that Messrs. Paisan Loaharanu (IAEA) and Morton Satin (FAO) would soon be leaving their organizations. Mr. Loaharanu will retire from the IAEA after more than 27 years of service including more than 17 years as Head Secretariat of ICGFI. Mr. Satin will leave FAO at the end of this year and will assume a role of Executive Director of International Agri-Business Management Association (IAMA), to be based in Washington, D.C., starting from January 2002. Words of appreciation for their valuable services were expressed by Dr. Louise Fresco on behalf of FAO, IAEA and WHO, and Dr. P. Roberts (NZ) on behalf of member governments of ICGFI.

The 19th Annual Meeting of ICGFI was agreed to be held in Vienna at a suitable date in October/November 2002.

## ANNEX 1

### PROPOSED DRAFT REVISED CODEX GENERAL STANDARD FOR IRRADIATED FOODS (At Step 5 of the Procedure)

### 1. SCOPE

This standard applies to foods processed by irradiation. It does not apply to foods exposed to doses imparted by measuring instruments used for inspection purposes.

### 2. GENERAL REQUIREMENTS FOR THE PROCESS

#### 2.1 Radiation Sources

The following types of ionizing radiation may be used:

(a) Gamma rays from the radionuclide 60 Co.
(b) X-rays generated from machine sources operated at or below an energy level of 5 MeV.
(c) Electrons generated from machine sources operated at or below an energy level of 10 MeV.

#### 2.2 Absorbed Dose

[The overall average dose absorbed by a food subjected to radiation processing should not exceed10 kGy. 1,2 ]

For the irradiation of any food, the minimum absorbed dose should be sufficient to achieve the technological purpose and the maximum absorbed dose should be less than that which would compromise wholesomeness or would adversely affect structural integrity, functional properties, or sensory attributes. [1]

#### 2.3 Facilities and Control of the Process

**2.3.1** Radiation treatment of foods should be carried out in facilities licensed and registered for this purpose by the competent authority.

**2.3.2** The facilities should be designed to meet the requirements of safety, efficacy and good hygienic practices of food processing.

**2.3.3** The facilities should be staffed by adequate, trained and competent personnel.

**2.3.4** Control of the process within the facility should include the keeping of adequate records including quantitative dosimetry.

[1] High Dose Irradiation: Wholesomeness of Food Irradiated with Doses above 10 kGy, Report of a Joint FAO/IAEA/WHO Study Group, Technical Report Series 890 WHO, Geneva, 1999; Safety and NutritionalAdequacy of Irradiated Foods, WHO, Geneva, 1994; and Wholesomeness of Irradiated Food, Report of Joint FAO/IAEA/WHO Expert Committee, Technical Report Series 659, WHO, Geneva, 1981.

**2.3.5** Premises and records should be open to inspection by appropriate authorities.

**2.3.6** Control should be carried out in accordance with the Recommended International Code of Practice for Radiation Processing of Food (CAC/RCP 19-1979, **under revisio**n).

## 3. HYGIENE OF IRRADIATED FOODS

**3.1** The irradiated food should be prepared, processed, and transported hygienically in accordance with the provisions of the Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1-1969, Rev. 3-1997), including the application of the seven principles of Hazard Analysis and Critical Control Point (HACCP) system where applicable for food safety purposes. Where appropriate, the technical requirements for the raw materials and end product should comply with applicable hygienic codes, food standards, and transportation codes.

**3.2** Any relevant national public health requirement affecting safety and nutritional adequacy applicable in the country in which the food is sold should be observed.

## 4. TECHNOLOGICAL REQUIREMENTS

### 4.1 General Requirement

The irradiation of food is justified only when it fulfils a technological need and is a benefit to consumers or where it serves a food hygiene purpose and should not be used as a substitute for good manufacturing practices.

### 4.2 Food Quality and Packaging Requirements

The doses applied should be commensurate with the technological and public health purposes to be achieved and should be in accordance with good radiation processing practice. Foods to be irradiated and their packaging materials should be of suitable quality, acceptable hygienic condition and appropriate for this purpose and should be handled, before and after irradiation, according to good manufacturing practices taking into account the particular requirements of the technology of the process.

## 5. RE-IRRADIATION

**5.1** Except for foods with low moisture content (cereals, pulses, dehydrated foods and other such commodities) irradiated for the purpose of controlling insect reinfestation, foods irradiated in accordance with Section 2 and 4 of this standard should not be re-irradiated.

**5.2** For the purpose of this standard, food is not considered as having been re-irradiated when: (a) the irradiated food is prepared from materials which have been irradiated at low dose levels for purposes other than food safety, e.g., quarantine control, prevention of sprouting of roots and tubers; (b) the food, containing less than 5% of irradiated ingredient, is irradiated, or when (c) the full dose of ionizing radiation required to achieve the desired effect is applied to the food in more than one increment as part of processing for a specific technological purpose.

**5.3** [The cumulative overall average dose absorbed should not exceed 10 kGy as a result of re-irradiation.]

## 6. LABELLING

### 6.1 Inventory Control

For irradiated foods, whether prepackaged or not, the relevant shipping documents should give appropriate information to identify the registered facility which has irradiated the food, the date(s) of treatment, the dose received, and lot identification.

### 6.2 Prepackaged Foods Intended for Direct Consumption

The labelling of prepackaged irradiated foods should indicate the treatment and in all aspects should be in accordance with the relevant provisions of the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985, Rev. 2-1999).

### 6.3 Foods in Bulk Containers

The declaration of the fact of irradiation should be made clear on the relevant shipping documents.

## 7. METHODS OF ANALYSIS AND SAMPLING

To be developed.

## ANNEX 2

## PROPOSED DRAFT RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR RADIATION PROCESSING OF FOOD

### INTRODUCTION

Food irradiation is the processing of food products by ionizing radiation in order to, among other things, control foodbome pathogens, reduce microbial load and insect infestation, inhibit the germination of root crops, and extend the durable life of perishable produce. Many countries are using industrial irradiators for processing of food products for commercial purposes.

The regulatory control of food irradiation should take into consideration the Codex General Standard for Irradiated Foods (CX-STAN 106-1983, under revision) and this Code.

The purpose of regulatory control of irradiated food products should be:

a) to ensure that radiation processing of food products is implemented safely and correctly, in accordance with all relevant Codex standards and codes of hygienic practice;

b) to establish a system of documentation to accompany irradiated food products, so that the fact of irradiation can be taken into account during subsequent handling, storage and marketing; and

c) to ensure that irradiated food products that enter into international trade conform to acceptable standards of radiation processing and are correctly labelled.

The purpose of this Code is to provide principles for the processing of food products with ionizing radiation that are consistent with relevant Codex Standards and codes of hygienic practice. Food irradiation may be incorporated as part of a HACCP-plan where applicable; but a HACCP-plan is not required for the use of radiation processing of food processed for purposes other than for food safety.

The provisions of this Code will provide guidance to the radiation processor to apply the Hazard Analysis and Critical Control Point (HACCP) system, as recommended in the International Code of Practice General Principles of Food Hygiene (RCP 01-1969, Rev 3-1997, Amd 1-1999), where applicable for food safety purposes, to foods processed by ionizing radiation.

## 1. OBJECTIVES

This Codex Code of Practice for Radiation Processing of Food identifies the essential practices to be implemented to achieve effective radiation processing of food products in amanner that maintains quality and yields food products that are safe and suitable for consumption.

## 2. SCOPE, USE and DEFINITIONS

### 2.1 Scope

This Code is concerned with food products processed by gamma rays, X-rays or accelerated electrons for the purpose of, among other things, control of foodborne pathogens, reduction of microbial load and insect infestation, inhibition of the germination of root crops, and extension of durable life for perishable foods.

This Code covers the requirements of the irradiation process in a facility; it also considers other aspects of the process as primary production and harvesting, post-harvest treatment, storage and shipment, packaging, irradiation, labelling, post-irradiation storage and handling, and training[2].

### 2.2 Use

The International Code of Practice - General Principles of Food Hygiene (RCP O 1-1969, Rev 3-1997, Amd 1-1999) and its annex on application of the HACCP system, as well as other relevant Codex Standards and codes of hygienic practice should be used with this document. Of particular relevance are the Codex General Standard for Irradiated Foods (CX-STAN 106-1983 -under revision) and the General Standard for the Labelling of Pre-Packaged Foods (CX-STAN002, Rev 2, 1999).

### 2.3 Definitions

For purposes of this Code, the terms and expressions below are defined as follows:

**Food Irradiation:** Processing of food products by ionizing radiation, specifically gamma rays, X-rays or electron beams as specified in the Codex General Standard for Irradiated Foods.

**Irradiated Food:** Food products processed by ionizing radiation in accordance with the Codex General Standard for Irradiated Foods. Such food is subject to all relevant standards, codes and regulations applicable to the non-irradiated counterpart.

**Dosimetry**: The measurement of the absorbed dose of radiation at a particular point in a given absorbing medium.

[2] Codes of good irradiation practice, compilations of technical data for the authorization and control of the irradiation of several food classes and also training manuals for facility operators and control officials have been produced by the International Consultative Group on Food Irradiation (ICGFI), available through the International Atomic Energy Agency, PO Box 100, A-1400 Vienna, Austria.

**Dose (absorbed):** The absorbed dose, sometimes referred to simply as 'dose', is the amount of energy absorbed per unit mass of irradiated food product.

**Dose Uniformity Ratio**: The ratio of maximum to minimum absorbed dose in the production lot.

**Dose Distribution:** The spatial variation in absorbed dose throughout the production lot with extreme values being the maximum absorbed dose and the minimum absorbed dose.

**Dose Limit:** The minimum or maximum radiation dose absorbed by a food product prescribed in regulations as required for technological reasons. Such dose limits are expressed as ranges or as single lower or upper values (i.e., no part of the food product shall absorb less than or more than a specified amount).

**Authorization** of Facility **to Irradiate Food:** Granting approval to a facility licensed for radiation processing in general to irradiate food products. Authorization may be general in nature or issued for specific classes or groups of food products.

## 3. PRE-IRRADIATION TREATMENT

### 3.1 Primary production and harvesting

Primary food products intended for radiation processing should comply with the Codex General Principles of Food Hygiene with reference to the hygienic requirements as well as other relevant Codex standards and codes of practice for primary production and harvesting, which ensure that food is safe and suitable for human consumption.

### 3.2 Handling, storage and transport

The intent to process food products by irradiation poses no unique requirements regarding handling, storage and transport of the food products prior to and subsequent to irradiation. All stages of the processing, i.e., pre-irradiation, irradiation and post-irradiation, should be in accordance with good manufacturing practices to maximize quality, to minimize contamination, and, if packaged, to maintain package integrity.

Radiation is applied to food products in forms in which they are normally prepared for processing, commercially traded or otherwise used. Food intended for radiation processing should conform to handling, storage and transport requirements of the Codex General Principles of Food Hygiene as well as relevant Codex standards and codes of practice for specific food products.

## 4. PACKAGING

In general, in order to avoid contamination or infestation after irradiation, food products should be packaged in materials that provide an effective barrier to re-contamination and reinfestation. Packaging must also meet the requirements of the importing country.

The size and shape of containers that may be used for irradiation are determined, in part, by the operating characteristics of the irradiation facility. These characteristics include the product transport systems and the irradiation source, as they affect the dose distribution within the container.

## 5. ESTABLISHMENT: DESIGN, FACILITIES and CONTROL

Facilities which carry out irradiation of food products should meet appropriate standards of occupational safety and good hygiene conditions, including:

- Regulations regarding design, construction and operation of radiation facilities
- General Principles of Food Hygiene
- General Standard for Irradiated Foods and this Code.

## 5.1 Design and layout

This section is concerned with the areas in which food products are stored and irradiated. Prevention of contamination requires that all measures be taken to avoid direct or indirect contact of the food product with sources of potential contamination and to minimize growth of microorganisms.

Irradiation establishments are laid out to provide storage for irradiated and non-irradiated food products (under ambient, refrigerated and/or freezing temperature conditions), an irradiator, and the normal accommodation and infrastructure for staff and plant services including record maintenance. In order to achieve inventory control there should be provision in both the design and operation of the establishment to keep irradiated and non-irradiated food products separate. This separation can be accomplished by controlled single-direction movement of the food products through the plant and by separated storage areas for irradiated and non-irradiated food products.

Radiation facilities must be designed to provide an absorbed dose in the food product within minimum and maximum limits in accordance with process specifications and government regulatory requirements. For economic and technical reasons (e.g. maintaining product quality), various techniques are used to minimize the ratio, which is termed the uniformity ratio.

The following factors largely govern the selection of irradiator design:

a) Means of transporting food products: The mechanical design of the irradiation and transport systems, including the source-to-product geometry in a given process, as required by the form of the product, e.g. bulk or packaged, and its properties.
b) Range of doses: The range of doses needed to process a wide variety of products for various applications.
c) Throughput: The amount of product to be processed within a defined period of time.
d) Reliability: The property of providing correct performance as needed.
e) Safety-systems: The systems intended to protect operating personnel from hazards posed by radiation.
f) Compliance: The adherence to good manufacturing practices and relevant govern ment regulations.
g) Capital and operational costs: The basic economic considerations necessary for sustainable operation.

## 5.2 Radiation sources

As described in the Codex General Standard for Irradiated Foods, the following sources of ionizing radiation may be used in food irradiation:

a) Gamma rays from radionuclides 6°Co or "'Cs
b) X-rays generated from machine sources operated at or below an energy level of 5 MeV
c) Electrons generated from machine sources operated at or below an energy level of 10 MeV

## 5.3 Control of operation

### 5.3.1 Legislation

Food processing establishments are constructed and operated in accordance with regulatory requirements in order to ensure safety of the processed foods for consumption and occupational safety of the plant personnel and the environment. A food irradiation facility is also subject to such regulation and should be designed, constructed and operated in compliance with relevant regulations

### 5.3.2 Requirements for staff

The staff at an irradiation facility is subject to relevant sections of the General Principles of Food Hygiene (RCP 01-169, Rev 3-1997, Amd 1-1999) for personal hygiene recommendations and to the General Standard for Irradiated Foods for recommendations regarding the need for an adequate, trained and competent personnel.

### 5.3.3 Requirements for process control

Requirements for process control are included in the General Standard for Irradiated Foods. Measuring the dose and monitoring of the physical parameters of the process are essential for process control. The need for adequate record keeping, including records of quantitative dosimetry, is emphasized in the General Standard. As for other physical methods of food processing, records are essential means for the regulatory control of processing by ionizing radiation. Evidence for correct processing, including adherence to any legal or technological dose limits, depends on the maintenance of full and accurate records by the irradiation facility. The facility's records link all the information from several sources to the irradiated food products. Such records enable verification of the irradiation process and should be kept.

### 5.3.4 Control of applied dose

The effectiveness of the irradiation process depends on proper application of the dose and its measurement. Dose distribution measurements should be carried out to characterize the process for each food product; and thereafter dosimeters should be used routinely to monitor correct execution of the process in accordance with internationally accepted procedures. [3]

For certain public health or quarantine applications, there may be specific requirements to regulate the minimum absorbed dose in order to ensure that the desired technological effect is achieved.

### 5.3.5 Product and inventory control

Plant design and administrative procedures should ensure that it is impossible to mix irradiated and non-irradiated food products. Incoming products should be logged and given a code number to identify the packages at each step in its path through the irradiation plant. All relevant parameters such as date, time, source strength, minimum and maximum dose, temperature, etc. should be logged against the code number of the product.

It is not possible to distinguish irradiated from non-irradiated product by visual inspection. Therefore, it is essential that appropriate means, such as physical barriers, be employed for keeping the irradiated and non-irradiated product separate. Affixing colour change indicator label on each package, where applicable, provides another means of distinguishing irradiated and non-irradiated product.

[3] Such procedures are specified, for example, by the American Society for Testing and Materials (ASTM) in their annual handbooks.

## 6. IRRADIATION

### 6.1 General

Refer to the Codex General Standard for Irradiated Foods (CX-STAN 106-1983, under revision).

6.2 Process determination

It is important that all steps in the determination of process procedures are documented to:

a) ensure that the application of the process complies with relevant regulatory requirements
b) establish a clear statement for the technological objectives of the process
c) estimate the dose range to be applied to achieve the technological objective based on appropriate knowledge of the food product
d) demonstrate that irradiation of test samples has been carried out to confirm the estimated dose range under practical production conditions
e) ensure that it is possible to meet the technological requirements, e.g. dose range and effectiveness of treatment, under practical production conditions
f) establish the process parameters under practical production conditions.

### 6.3 Dosimetry

Successful radiation processing practice depends on the ability of the processor to measure the absorbed dose delivered to each point in the food product and in the production lot.

Various techniques for dosimetry pertinent to radionuclide and machine sources are available for measuring absorbed dose in a quantitative manner.[4] For dosimetry procedures, consult relevant Standards and Codes of Practice, e.g. ASTM and ISO .[5]

In order to implement these irradiation practices, facilities should be adequately staffed by competent personnel trained in dosimetry and its application in radiation processing.

The calibration of the dosimetry system used in radiation processing should be traceable (i.e., calibrated) to national and international standards.

### 6.4 Dosimetry systems

Dosimeters are devices that are capable of providing a quantitative and reproducible measurement of dose through a change in one or more of the physical properties of the dosimeters in response to the exposure to ionizing radiation energy. A dosimetry system consists of dosimeters, measurement instruments and their associated reference standards, and procedures for the system's use. Selection of appropriate dosimetry system for radiation processing of food will depend on a variety of factors, including the dose range needed to achieve a particular technological objective, cost, availability, and ease of use. A variety of dosimetry systems are available.[6]

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[4] Manual of Food Irradiation Dosimetry, International Atomic Energy Agency, Vienna, 1977, under revision.

[5] Such procedures are specified, for example, by the American Society for Testing and Materials (ASTM) in their annual handbooks. Several such procedures have also been officially adopted by ISO.

[6] Manual of Food Irradiation Dosimetry, International Atomic Energy Agency, Vienna, 1977, under revision; and for example "Standard Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing" ISO 15556 (1998)/ASTM E 1261-00.

### 6.5 Dosimetry and process control

In food irradiation, the key quantity that governs the process is the absorbed dose. It is influenced by various parameters, such as: radiation source type, strength and geometry; conveyor speed or dwell time; food product density and loading configuration; and carrier size and shape.[7] Their overall influence on dose distribution must be taken into account to ensure that the intended technological objective is achieved throughout the production lot.

The application of radiation processing is mainly governed by the minimum absorbed dose achieved in the dose distribution within a given product. If the required minimum is not applied, the intended technical effect may not be achieved (e.g. sprout inhibition, pathogen reduction). There are also situations where the application of too high a dose would impair the quality of the treated food (e.g. off flavours or odours). The process may be described as being self-regulating in a technological or economic sense.[8]

### 6.6 Records of irradiation

Radiation processors should maintain adequate records showing the food processed, identifying marks if packaged or, if not, the shipping details, the bulk density of the food, the dosimetry results, including the type of dosimeters used and details of their calibration, the date of irradiation and the type of radiation source. All documentation should be available to authorized personnel and accessible for a period of time established by food control authorities.

### 6.7 Control of hazards

Controls of microbiological hazards are described in the International Code of Practice -General Principles of Food Hygiene (RCP 01-1969, Rev 3-1997, Amd 1-1999).

The radiation processor should apply HACCP principles, as described in the Codex Hazard Analysis Critical Control Point System and Guidelines for Its Application (1999), as appropriate. In the overall HACCP context, irradiation is a means of reducing hazards associated with infectious parasites and microbial contamination of foods and may be used as a method of control.

## 7. POST-IRRADIATION STORAGE AND HANDLING

Refer to the International Code of Practice - General Principles of Food Hygiene (RCP 01-1969, Rev 3-1997, Amd 1-1999) for general storage and handling guidance.

## 8. LABELLING

The Codex General Standard for Irradiated Foods (CX-STAN 106-1983, under revision) and the Codex General Standard for the Labelling of Pre-Packaged Foods (CX-STAN-002, Rev 2, 1999) contain provisions for labelling of irradiated foods, including the internationally recognized symbol (logo) and the inclusion of information in shipping documents, and for the labelling of prepackaged

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[7] "Standard Practice for Dosimetry in Gamma Irradiation Facilities for Food Processing" ISO 15554 (1998)/ASTM E 1204-97.

"Standard Practice for Dosimetry in Electron and Bremsstmhlung Irradiation Facilities for Food Processing" ISO 15562 (1998)/ASTM E 1431-098

[8] Codes of good irradiation practice and compilations of technical data for the authorization and control of the in-adiation of several food classes have been produced by ICGFI, available through the International Atomic Energy Agency, PO Box 100, A-1400 Vienna, Austria.

irradiated foods, respectively. All food labelling must meet any additional requirements established by competent authorities.

### 9. COMPETENCY

Refer to the International Code of Practice - General Principles of Food Hygiene for objectives and requirements regarding awareness and responsibilities, training programmes, instruction and supervision, and refresher training. The Codex General Standard for Irradiated Foods requires that the facilities shall be staffed by adequate, trained and competent personnel. Such training should be appropriate and correspond to national or international standards.

## G. NEW APPROVALS OF IRRADIATED FOODS

**AUSTRALIA NEW ZEALAND FOOD STANDARDS COUNCIL (ANZFSC)**

**JOINT COMMUNIQUE**

Thursday, 13 September 2001

**Food Ministers agreed to phase out ethylene oxide (used to disinfect certain foods) and to permit the limited use of food irradiation as a safer alternative for herbs, spices, and herbal teas.**

The Australian New Zealand Food Standards Council (ANZFSC), meeting today by teleconference, decided that in the longer term interests of public health and safety, the chemical Ethylene Oxide, used to disinfect some foods, must be completely phased out from the food supply by 1 October 2003.

The council also approved the limited use of food irradiation of herbs, spices, and herbal infusions as a safe and effective replacement technology.

**Food Irradiation**

This is the first application to irradiate food since ANZFSC agreed to a food irradiation standard in 1999. The decision followed a stringent safety assessment by the Australian New Zealand Food Authority (ANZFA) over a ten-month period, which was subject to scientific peer review by local and international experts. The safety assessment concluded that the treatment of herbs, spices and herbal infusions, with the stated doses of irradiation was safe.

Ministers agreed not to approve irradiation of nuts. While it is considered a safe practice, they concluded on the scientific evidence available, that there was no technological need for the irradiation of nuts on quarantine grounds.

The Ministers considered that irradiation has considerable benefits for consumers and industry in preventing food poisoning and pest infestation and controlling weeds.

The safety assessent also took account of two studies by the World Health Organisation in 1994 and 1999, which confirm the safety of food irradiation.

Food irradiation has been used extensively overseas over the past two decades with no indication of safety problems and is currently permitted for use in food in over 40 countries worldwide. All irradiated foods will be required to be labelled so that consumers can make an informed choice.

**The phase out of the use of Ethylene Oxide**

Ethylene oxide is a processing aid which is used to disinfect herbs and spices. Its use is being phased out worldwide and is being replaced with alternatives such as food irradiation and steam treatment. In order to ensure that public health and safety is protected, Ministers agreed to maintain the current strict maximum level in herbs and spices for ethylene oxide of 20mg/kg. In addition, a withholding period of three weeks will be required in the future to allow a reduction of any residues after treatment. This will ensure that these foods continue to be disinfected while a smooth transition to other safer and more sustainable technologies can occur.

This is an Australian only standard as New Zealand regulates Ethylene Oxide under its own legislation.

Ministers have detemined that this chemical will be completely phased out over the next 2 years with no exemptions for stock-in-trade at the end of this period.

Ministers agreed to the need for a strong public information program about these issues to help consumers make informed choices.

# H. THE FAO/IAEA TRAINING AND REFERENCE CENTRE FOR THE CONTROL OF FOOD AND PESTICIDES (TRC)

**Summary of Activities of TRC**

The activities carried out within the TRC were reviewed and discussed at the Coordination Committee Meeting.

Activities started in 1977 before the official establishment of the TRC in 1998 and inauguration of the new Pesticide Residue Laboratory in Seibersdorf in 1999. They included the organization of training workshops, fellowship training and advisory actions. International or regional training workshops covered 5 major areas, and they were attended by participants from Africa, Asia, Central and Latin America, and Europe. The number of participants varied depending on the laboratory facilities and funding available.

**Training workshops**

Introduction of QA/QC principles in pesticide residue analysis,
- 1998 Miskolc, Hungary: 22 participants from 4 continents
- 1999 Seibersdorf/Vienna Austria: 26 participants from 4 continents
- 2000 Seibersdorf/Vienna Austria: 19 participants from 4 continents

Introduction of QA/QC principles in analysis of pesticide products,
- 1977 Suwon, Korea: 18 participants from South East Asia
- 2001 Velence, Hungary: 19 participants from 4 continents

Development of Quality Assurance for Mycotoxin Analysis of Food and Feed,
- 1999 Philippines: 15 participants from South-East Asia
- 2000 Vienna: 11 participants from Europe
- 2000 SaoPaolo, Brazil: 15 participants from Latin America
- 2001 Cairo, Egypt: 25 participants from Middle East and North Africa

In spite of the very intensive programme, the participants were generally very active during the workshops and rated them excellent or very good. According to the questionnaire completed after the courses 80-96 % of participants assessed the workshops in general as excellent or good and 93-100 %

indicated that participation made them more qualified professionally and that they could utilize the knowledge and information gained in their home country. They felt that the subjects of the lectures were most valuable and well balanced (90-93%), while the laboratory exercises were rated 85-96%, respectively. Some also gave written comments, such as: "Most subjects are relevant to my work"; "Some subjects are very useful but I've never done before, I'll apply knowledge from the workshop to improve my laboratory."; "A lot of things have been taught to me that will be of great importance to my area of specialization."; "I received a lot of information and techniques, especially SOPS".

A questionnaire was issued in June 2001 to ask about the utilization of the information obtained during the workshops. Twenty-six replies were received from the 67 participating laboratories. Replies are still arriving. It may be concluded that the workshops had significant positive impacts on the performance of the laboratories.

The most up-to-date CD containing the training and background materials will be sent to all laboratories replying to the questionnaire.

The training materials are highly valued. Universities from China, Columbia, Costa Rica, Guatemala and Malaysia requested the permission for using/translating our training materials in their regular training programmes.

The review of some of the training materials by internationally recognized experts and university professors is being processed.

**Fellowship and individual training (1999-2001)**

Mr. Yongyuth Phaikaew, Thailand (6 months); Mr. Andrew Ongera Mageto, Kenya (9 months); Ms. Roseline Okafor, Nigeria (6 months); Ms. Hanan Gainer Eldin, Sudan (6 weeks); Mr. Ghayath Swied, Syria (6 months), Mr. Mohamed LoayHabbab, Syria (4 months); Ms. Alexa Meyer, Austria, (1+ 2 months internship); Ms. Elisabeth Goutier, France (3 months internship); Hiba Najib, Iraq-Austria (2 months internship); Mr. Tamas Hatfaludi, Austria (6 months internship for MSc); Mr. Alessandro Zecchini, Italy (MSc student 9 months); Ms. Rametu Omamagbe Momodu, Nigeria (6 months).

**Forthcoming Training Workshop**

A training workshop for advanced analysts on "Introduction of QA/QC principles in pesticide residue analysis" is planned, subject of availability of funds, at Seibersdorf Laboratories during June-July 2002.

Details on the subjects and conditions for application can be found at the Home Page of the TRC (www.iaea.org/trc ) or obtained from:

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Advance nomination can already be submitted. Nominating institutions and analysts will be notified about the exact dates 3 months before the training workshop.

# I. PUBLICATIONS

El-Bidaoui, M., Jarju, O.P., Maestroni, M. Phakaeiw Y., and Ambrus A., Testing the effect of sample processing and storage on stability of residues, pp.75-88, in Fajgelj A., Ambrus A., eds. Principles of Method Validation pp. 49-58, Royal Society of Chemistry Cambridge UK 2000

# IN MEMORIUM

***Obituaries (by Dr. Ari Brynjolfsson)***

Dr. Edward S. Josephson, scientist and a leader in Food Irradiation.

Dr. Edward S. Josephson, formerly Deputy Director of U. S. Army Natick Laboratories, Natick, and a leading scientist and one of the pioneers in food irradiation, died 30 October 2001 in Rhode Island. He was 86.

Born in 1915 and raised in Boston, he graduated from Boston Latin School in 1932, Harvard College in 1936 with a major in mathematics, and Ph. D. from MIT in 1940 with a major in biochemistry and minor in organic chemistry. He worked during World War II and until 1951 at the National Institute of Health in Washington D.C. on improving the chemotherapy of malaria. In 1951 he joined the U. S. Army Laboratories and later helped with the transition of Quarter Master Food & Container Institute in Chicago to U. S. Army Natick Laboratories and headed the Food Irradiation Program from 1961 to the end of 1971, when he became Deputy Technical Director with responsibilities for the U. S. Army Research and Development of Food until 1975. He then became a senior lecturer in the Department of Applied Biological Sciences at MIT and later Adjunct Professor, Department of Food Science and Nutrition at the University of Rhode Island.

Dr. Josephson has been a staunch supporter of food irradiation process and frequently appeared before Committees of Congress in Washington D.C. and General Court of Massachusetts. He has authored more than 100 publications on chemotherapy of malaria and other tropical diseases, nutrition and world food problems and on preservation of food by ionizing radiations. As editor, he compiled a multi-volume textbook entitled “Preservation of Food by Ionizing Radiations” published by CRC Press in 1982-1983. Dr. Josephson has served as Science Advisor to the Council for Agricultural Science and Technology, Inter American Nuclear Energy Commission, the Speaker of the New Hampshire House of Representatives in Concord, United Nations’ International Atomic Energy Agency and Food and Agricultural Organization, and to several developing nations.

He leaves his wife, Blanche (Andelman) Josephson, daughters, Nancy Wall and Dr. Betty King and son, William, as well as his brothers, Dr. Elliot Josephson and the late Marcus Josephson. He also leaves four grandchildren, Eric Seth Wall, Geoffrey King, Matthew Josephson and Poalina Josephson.

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