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To Our Readers

I am pleased to announce that Josef Brodesser has been selected to fill our professional post for a Food Safety Specialist within the Food and Environmental Protection Section of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. Dr. Brodesser has a PhD in analytical and environmental chemistry, with a focus on pesticide analysis in water and environmental hygiene, from the University of Bonn in Germany. These and other staff changes, including the departure of Dr. Arpad Ambrus and Dr. Eugenia Soboleva from the FAO/IAEA Agriculture and Biotechnology Laboratory in Seibersdorf, are highlighted in the Staff Changes section of this newsletter.

This issue of our newsletter also includes a summary of the consideration of the revised Codex Guideline Levels for Radionuclides in Foods for Use in International Trade under our Feature Article. The Guideline Levels were considered by the 36th Session of the Codex Committee on Food Additives and Contaminants (CCFAC), which was held in Rotterdam, The Netherlands, from 22-26 March 2004. We are pleased to report that the full plenary session of the CCFAC agreed to forward the proposed draft Revised

Guideline Levels for Radionuclides in Foods for Use in International Trade to the forthcoming 27th Session (June 2004) of the Joint FAO/WHO Codex Alimentarius Commission for preliminary adoption. It is anticipated that the technical assistance provided by our colleagues in the Division of Radiation and Waste Safety will help to ensure the successful final adoption of the Guideline Levels by the 28th Session of the Codex Alimentarius Commission in 2005.

As you might also recall from the January 2004 issue of our Newsletter, the 20th Meeting (October 2003) of the Joint FAO/IAEA/WHO International Consultative Group on Food Irradiation (ICGFI) agreed that a new successor organization would not be created and that prior to the expiration of the ICGFI mandate on 8 May 2004, a working group consisting of government-designated experts would meet in Vienna in early 2004 to discuss and provide advice on future activities related to the application of irradiation for sanitary and phytosanitary purposes. The Report on The International Consultative Group on Food Irradiation (see page 13) provides a summary of the ICGFI Working Group deliberations, including its conclusions and recommendations to its sponsoring organizations and ICGFI member governments.

These working group recommendations led in part to the holding of a successful Consultants Meeting on the Use of Ionising Radiation as a Quarantine Treatment (see Past Events) which, among other responsibilities, proposed specific irradiation doses for commercial applications in order to further elaborate Annex 1 of the International Standard for Phytosanitary Measures (ISPM) No. 18, Guidelines for the Use of Irradiation as a Phytosanitary Measure. Other activities arising from the working group recommendations include the proposed convening of a Seminar on the Application of Irradiation for Sanitary and Phytosanitary Purposes in conjunction with the FAO/WHO Global Forum of Food Safety Regulators - Building Effective Food Safety Systems, which will be held in Bangkok, Thailand, from 12-14 October 2004. These are but a few examples of continuing activities within the Food and Environmental Protection Section focused on the application of irradiation for sanitary and phytosanitary purposes.

In closing, I wish to convey my best wishes to you and your families in our northern climes for a safe, happy and healthy holiday this summer season.

Sincerely,

David H. Byron

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Staff Changes

Food Safety Specialist

We are pleased to announce that Josef Brodesser has been selected to fill our professional post for a Food Safety Specialist within the Food and Environmental Protection Section of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. Dr. Brodesser has a PhD in analytical and environmental chemistry, with a focus on pesticide analysis in water and environmental hygiene, from the University of Bonn in Germany. Josef has worked in environmental analysis, including in the context of registration of agrochemicals and pharmaceuticals, and has experience in establishing analytical laboratories as well as method development and training. Dr. Brodesser also has wide experience in quality management (QM) and laboratory accreditation, and most recently undertook work related to technical cooperation projects for FAO, WHO, IAEA and the EU in various developing countries. It is envisioned that Josef will greatly assist the FEP in its activities related to food safety and food control, with an emphasis on helping laboratories and institutions to meet international standards for laboratory performance.

Agrochemicals Unit Head

As many of you are aware, Dr. Árpád Ambrus, who most recently served as Head of the Agrochemicals Unit at the FAO/IAEA Agriculture and Biotechnology Laboratory at Seibersdorf, retired from the Agency on 27 April 2004. Among other Agency initiatives, Dr. Ambrus took an active role in the establishment of the FAO/IAEA Training and Reference Centre for Food and Pesticide Control (TRC) since it was first envisioned in 1983 and, as Head of the Agrochemicals Unit from 1998-2004, he played a major role in the implementation of the pesticide related activities of the Centre.

Among other accomplishments, and with the active participation of invited experts and staff of the Agrochemicals Unit, Dr. Ambrus organized and conducted workshops on QA/QC in Pesticide Residue Analysis, Analysis of Pesticide Formulations, Advance Techniques in Pesticide Residue Analysis, and the Application of Good Agricultural Practices in Growing Fresh Fruits and Vegetables. These workshops resulted in the training of over 230 analysts and specialists in their respective fields.

Under his leadership, the Agrochemicals Unit developed and validated procedures to facilitate the time and cost effectiveness of internal quality controls related to pesticide residue analysis, which included testing the efficiency of sample processing, monitoring the performance of GC columns, quantifying the matrix effect in GC analysis and quantifying the random error of the individual steps of pesticide residue analysis. Several procedures for pesticide residue analysis and determination of mycotoxins were also adopted and validated for use in Agency training programmes. These elaborated methods and principles provided the basis for the elaboration of working documents on the estimation of uncertainty of measurements and confirmation of test results for further consideration by the Codex Committee on Pesticide Residues. Additional activities related to the work of the Joint FAO/WHO Codex Alimentarius Commission included the elaboration of Guidelines for Single-Laboratory Validation of Analytical Methods for Trace Level Concentrations of Organic Chemicals as well as the basic document that was incorporated into the Codex Guidelines for Good Laboratory Practice adopted by the Codex Commission in 2003.

Analytical Chemist

Dr. Eugenia Soboleva, who has served as an Analytical Chemist with the Agrochemicals Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory at Seibersdorf since March 1999, left the Agency on 30 June 2004. Eugenia was responsible for:

- Organizing and delivering training programs on quality assurance and quality control measures in analytical laboratories, new techniques for residue analysis of food products, quality control of pesticide products and good agricultural practice;
- Advising analytical laboratories on internal auditing and accreditation according to GLP and ISO 17025 standards;
- Coordinating and implementing the laboratory work and research projects on quality control of pesticide products, estimation of uncertainty of analytical results, sampling and validation and adaptation of analytical method for measuring pesticide residues in agricultural products;
- Consulting and advising analysts on the selection of the appropriate equipment, methods, techniques and regulations in residue analysis of pesticides and organic pollutants;
- Developing distance learning training packages.

The activities undertaken by Dr. Ambrus and Dr. Soboleva greatly enhanced the international recognition and acceptance of the work generated by the FAO/IAEA Agriculture and Biotechnology Laboratory. We wish both of them continued success, health and happiness in their future endeavours.

Feature Article

Consideration of the Proposed Draft Revised Guideline Levels for Radionuclides in Foods for Use in International Trade

Backround

The 35th Session (March 2003) of the Codex Committee on Food Additives and Contaminants (CCFAC) requested the International Atomic Energy Agency (IAEA), in collaboration with the Delegation of Finland, to prepare a revised version of the Codex Guideline Levels for Radionuclides in Foods Following Accidental Nuclear Contamination for Use in International Trade for circulation, comment and further consideration at its 36th Session. The 26th Session (July 2003) of the Codex Alimentarius Commission approved as new work the revision of the Codex Guideline Levels for Radionuclides in Foods Following Accidental Nuclear Contamination for Use in International Trade (CAC/GL 5-1989), including Guideline Levels for Long-Term Use.

In response to the request of the CCFAC, the IAEA convened a consultants meeting from 18-22 August 2003 to revise the Codex Guideline Levels for Radionuclides to other radionuclides and to consider the establishment of guideline levels for long-term use. The consultants meeting was attended by participants from Denmark and Finland as well as representatives of the WHO Department of Protection of the Human Environment, the IAEA Division of Radiation and Waste Safety and the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

Subsequently, the IAEA convened a consultants meeting of a high-level group of experts to advise the Agency on radiological criteria for radionuclides in food moving in international trade from 19-21 January 2004. The high-level group of experts was chaired by the Chairman of the International Commission on Radiological Protection (ICRP) and was attended by the Director of the State Research Centre of the Russian Federation Institute of Biophysics, the Chairman of the Radiation Effects Research Foundation, the Secretary of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and representatives of the European Commission, the IAEA Division of Radiation and Waste Safety and the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

On the basis of the above IAEA discussions, the resulting newly named Revised Guideline Levels for Radionuclides in Foods for Use in International Trade were transmitted to the Codex Secretariat in January 2004 for distribution and consideration by the 36th CCFAC (March 2004) under document CX/FAC 04/36/35.

Discussions at the 36th Session of the Codex Committee on Food Additives and Contaminants

Notwithstanding the fact that written comments were not formally requested on the Revised Guideline Levels for Radionuclides in Foods for Use in International Trade contained in document CX/FAC 04/36/35, a written submission was provided by the European Community (EC) for consideration by the 36th CCFAC.

The IAEA representatives attending the meeting discussed the written comments submitted by the EC prior to the consideration of the Guidelines in the full plenary session of the CCFAC. As a result of these discussions, and based on the written submission of the EC, the following revisions were made to the Guideline Levels for Radionuclides in Foods for Use in International Trade:

- The introduction of an additional safety factor for the actinide group (Pu and Am), while taking account of assessment uncertainty. This resulted in a lowering of the Guideline Level for the actinide group from 10 to 1 Bq/kg;
- An increase in the Guideline Level for ^{99}Tc from 1000 to 10000 Bq/kg based on the assessment for adults; and
- Subsequent minor revisions to the text.

As a result of these amendments, the full plenary session of the CCFAC agreed to forward the proposed draft Revised Guideline Levels for Radionuclides in Foods for Use in International Trade to the forthcoming 27th Session (June 2004) of the Joint FAO/WHO Codex Alimentarius Commission for preliminary adoption.

The resulting proposed draft Revised Guideline Levels for Radionuclides in Foods for Use in International Trade are contained in the Annex to this Newsletter.

Forthcoming Events

Seminar on the Application of Irradiation for Sanitary and Phytosanitary Purposes, Bangkok, Thailand, 12-14 October 2004

Technical Officer: David H. Byron

As a result of the Report and Recommendations of the Working Group Meeting on the International Consultative Group on Food Irradiation (ICGFI) (see Section G), the IAEA is proposing to hold a Seminar on the Application of Irradiation for Sanitary and Phytosanitary Purposes in conjunction with the FAO/WHO Global Forum of Food Safety Regulators– Building Effective Food Safety Systems, which will be held in Bangkok, Thailand, from the 12-14 October 2004.

The full day Seminar, which is scheduled to be held immediately prior to the Global Forum on 11 October 2004, will address several aspects related to the application of ionising radiation, including a background summary of past and future international activities in the field, the activities of the IAEA and other international organizations, and technical aspects related to the application of irradiation for both sanitary and phytosanitary purposes.

It is anticipated that Global Forum attendees will participate in the Seminar on their own accord. It is also envisioned that ICGFI Member governments nominating candidates with experience in irradiation treatments would be financially supported as a priority. We expect that approximately 50 participants will attend the Seminar.

FAO/IAEA (RCA) Workshop on Quality Assurance for Irradiation Facilities; Beijing, China, RAS/5/042, 23-27 August 2004

Technical Officer: Tatiana Rubio Cabello

Due to unforeseen circumstances, the Workshop on Quality Assurance for Irradiation Facilities (Beijing, China) has been postponed until 23-27 August 2004. The Workshop is open to one participant of each country of the RCA (Regional Cooperative Agreement for Asia and Pacific) project RAS/5/042 and observers of the hosting country. Nominations for participants have already been requested through official channels.

Past Events

Workshop on the Introduction And Implementation of Principles of Good Agricultural Practice in the Production of Fruits and Vegetables, Nairobi, Kenya, 17-19 February 2004

Technical Officer: Eugenia Soboleva

The second workshop on Good Agricultural Practices (GAP) was held in Nairobi, Kenya, from 17-19 February 2004 for senior government officials involved in the promotion, introduction and practical application of GAP principles in the production of fresh fruits and vegetables.

Fifteen participants attended from Algeria, Botswana, Egypt, Ethiopia, Gambia, Ghana, Kenya, Madagascar, Niger, Nigeria, Senegal, and Zambia.

Second Research Coordination Meeting on Irradiation to Ensure the Safety and Quality of Prepared Meals, Pretoria South Africa, D6.20.07, 26-30 April 2004

Technical Officer: Tatiana Rubio Cabello

The second Research Coordination Meeting of the Coordinated Research Project on Irradiation to Ensure the Safety and Quality of Prepared Meals was held in Pretoria, South Africa, from 26-30 April 2004.

The objective of the meeting was to evaluate the achievements of the project over the past 18 months. The meeting was held at the University of Pretoria, and was attended by Research Contract/Agreement holders from Argentina, China, Ghana, Greece, India, Indonesia, Israel, Korea, Syria, South Africa, Thailand, United Kingdom and the United States of America, as well as five observers from South Africa.

Based on research obtained to date, it was evident that ionising radiation had the potential to improve the safety and quality of prepared meals as well as extending their shelf life. The technology could potentially be advantageous to food manufacturers and consumers.

It was also envisaged by the participants that a wider variety of hand-made ethnic meals would soon be available due to the interest in increasing product shelf life and improving the safety and quality of these products.

In order to improve results in the application of irradiation technologies in prepared meals on a commercial scale, it was also recommended that intensified efforts should be made within the industry to address all legal aspects of their petitions and to encourage the enactment of legislation related to the use of the technology.

Consultants Meeting on Estimation of Uncertainty of Measurements and Confirmation of Results, IAEA Headquarters, 22-26 March 2004

Technical Officer: Arpad Ambrus

The Codex Committee on Pesticide Residues (CCPR) requested the FAO/IAEA Training and Reference Centre for Food and Pesticide Control to prepare 'Draft Guidelines on Estimation of Uncertainty of Results' and on the 'Use of Mass Spectrometry (MS) for Identification, Confirmation and Quantitative Determination of Residues' in cooperation with drafting partners from Australia, Denmark, The Netherlands, the UK and the USA.

The Agrochemicals Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory prepared the working documents and circulated them among analysts who expressed their interest in cooperating. Comments were received from Australia, Denmark, Germany, Hungary, The Netherlands, the UK and USA.

The Joint FAO/IAEA Division called an expert consultants meeting to:

- review the draft documents prepared by the Agrochemicals Unit and the comments received from the contributing analysts;
- discuss the pending issues and find solutions for contradicting opinions; and
- prepare the working document for CCPR with recommendations.

The Meeting was attended by five consultants as well as staff members of the Agrochemicals Unit.

The Meeting reviewed the draft documents prepared by the Agrochemicals Unit and agreed with the written comments received stating that the complex topics were covered in a scientifically sound, systematic and comprehensive way. It was further agreed that the documents would provide a good source of background information for analysts who would like to study specific aspects of the problems in detail.

Taking into consideration the objectives of the documents and the comments received from the analysts of Member States, the meeting prepared documentation for consideration by the 36th Session of the CCPR for eventual inclusion into the recently revised Codex Guidelines on Good Laboratory Practice in Residue Analysis.

The 36th Session of the CCPR (April 2004) decided to circulate the proposed draft amendments to the Codex Guidelines on Good Laboratory Practice for comments on revisions to the text based on the document provided by the consultants meeting on the use of mass spectrometry for identification, confirmation and qualitative determination of residues and on the estimation of uncertainty of results.

Consultants Meeting on Using Ionizing Irradiation as a Phytosanitary Treatment, IAEA Headquarters, 10-14 May 2004

Technical Officer: Tatiana Rubio Cabello

The Food and Environmental Protection Section (FEPS) of Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has a productive history of supporting investigation, education, and cooperation in the use of ionising irradiation as a postharvest quarantine treatment since activities in this area began in 1986. A number of technical meetings were sponsored to set parameters for research, effectiveness, and regulation. Three Coordinated Research Projects have resulted in specific phytosanitary disinfestation doses for a number of arthropod pests, especially tephritid fruit flies, and tolerance limits for commercially important commodities. Good research practices and operational guidelines that would optimise this method were formulated and disseminated. ICGFI complemented the activities of the FEPS by organizing workshops, training regulatory agencies, and analyzing research on this subject.

In 1991 generic (default) doses of 150 Gy for tephritids and 300 Gy for all arthropods were proposed by ICGFI. However, these doses were preliminary estimates as insufficient data were available to make definitive determinations at that time. Research largely funded and coordinated by the FEPS has supported the default dose of 150 Gy for tephritids, and the United States (US) Department of Agriculture, Animal and Plant Health Inspection Service is drafting a proposal that sets a default dose of 150 Gy for all tephritids, even those for which no data are available, on all hosts imported into the US. This significant step in the regulation of irradiation as a phytosanitary treatment was in large part due to the efforts and findings of the FEPS. When fully implemented, irradiation of fruits against fruit flies will result in better quality fruits for the consumer, as irradiation is the most widely tolerated treatment for fruit disinfestation.

Research funded and/or coordinated by the FEPS indicates that a default dose for all arthropods might be >300 Gy, but because of the very broad range and variations in response of different arthropods to radiation, further research is needed before a default dose can be recommended for the entire phylum.

Objectives

One of the two main purposes of the Consultants Meeting was to identify specific irradiation phytosanitary treatments that have been researched sufficiently for commercial application with a view towards the further elaboration of Annex I of the ICPM Guidelines for the

Use of Irradiation as a Phytosanitary Measure. Table 1 lists these recommendations.

Only species (or group in the case of Tephritidae) where large numbers of organisms have been treated under physical, biological, and statistical conditions that support high levels of control (at least 99.99%) are included. Doses for other organisms could be recommended if the overall pest risk was considered low, as in the case of mango seed weevil, but this was not concluded due to the variable levels of risk that could be envisioned for different country-commodity-pest combinations.

The other major objective of this Consultants Meeting was to analyse the need for future research to determine a single, default dose for irradiation of all arthropods and doses for significant subgroups of Arthropoda, the following recommendations were made:

Thrips

Thrips (Thysanoptera) are an important group of quarantine pests on cut flowers and foliage, many vegetables, and some fruits. Although primary quarantine pests, they are also sometimes found as secondary pests on commodities treated for other pests, such as fruit flies. With other treatments, such as fumigation, when thrips or other non-target arthropods are present, an indication of dead pests is often sufficient proof for regulatory purposes. However, as products treated by irradiation would most likely result in the rejection of produce due to the presence of live pests, doses necessary to sterilize thrips should be developed.

Mites

Mites from the phytophagus families Tetranychidae, Eriophyiidae, and Tenuipalpidae are quarantined pests on a wide variety of fresh commodities. Research has been conducted with several species, but large-scale testing to support a commercial treatment has only been done with one species. It would be advantageous to determine a default dose for all mites, because this group is probably among the most radiotolerant arthropods and knowledge of doses required for mites would aid the discovery of a default dose for all arthropods.

Mealy bugs

Mealybugs (Homoptera: Pseudococcidae) are a widespread group of quarantine pests. They are often found on fruits that must be treated for fruit flies, so doses that control them need to be known in order to avoid rejection of properly irradiated fruits for fruit fly quarantines. Scale insects (Homoptera: Diaspididae and Coccidae) are quarantined pests on many fruits. Work with this group is also recommended.

Lepidoptera

Lepidoptera may pupate in the commodity to be shipped. Pupae of Lepidoptera often require among the highest doses among the Arthropoda to prevent reproduction, so having doses to control Lepidoptera pupae would contribute to a generic, default dose for all Arthropoda.

Other insects that should be investigated in the future are aphids, leaf miners, white flies, khapra beetle, and weevils. It was recommend that research with these insects only be supported after studies with the other insects mentioned above are concluded.

Due to the fact that some commodities may not tolerate the level of treatments needed to achieve pest control efficacy (i.e, avocados may only tolerate a maximum of 100-150 Gy, which is insufficient when treatments against fruit flies are applied on a commercial level), the combination of two different treatments theoretically may allow for efficacious treatments. Synergistic control, or a combined effect that exceeds the sum of each effect, may be possible. Although some research has been done on combination treatments, only one is used commercially, low temperature combined with methyl bromide fumigation. Combination treatments utilizing irradiation should be also investigated.

The conclusions of the Consultants meeting can be summarized as follows:

1) To increase support to the Food and Environmental Protection Section (FEPS) to enable the revision and adoption of the ISPM Guidelines for the Use of Irradiation as a Phytosanitary Measure by the International Plant Protection Convention. Contracting parties and FAO Members may increase their demands for technical support in this regard.

2) Actions must be taken in support of the findings of the FAO/IAEA Thematic Plan for Irradiation as a Sanitary and Phytosanitary Treatment for Food in the New Millennium (6-10 May 2002), in that the first priority should be assistance to Member States to meet phytosanitary treatment requirements for trade through capacity building.

3) To carry out research towards determining a default dose for all mites and insects and default doses for specific sub-groups within the Arthropoda as well as doses to surmount specific phytosanitary trade barriers.

4) To increase collaboration between the IPPC Technical Panel on Phytosanitary Treatments and the FEPS to facilitate the application of irradiation as a phytosanitary treatment.

5) Training of regulatory officials should be a continuing effort to ensure that the expertise for implementing irradiation phytosanitary treatments is available according to need and the increased commercial use of the technology.

6) The International Database on Insect Disinfestation and Sterilization (IDIDAS) should be actively maintained and expanded to ensure up to date coverage of relevant technical developments.

Table 1.

Pest	Criterion for efficacy	Dose (Gy)
All fruit flies (Diptera: Tephritidae)	Prevent adult emergence	150
Anastrepha ludens (Mexican fruit fly)	Prevent adult emergence	70
A. obliqua (West Indian fruit fly)	Prevent adult emergence	100
A. serpentina (Serpentine fruit fly)	Prevent adult emergence	100
A. suspensa (Caribbean fruit fly)	Prevent adult emergence	70
Bactrocera jarvisi (Jarvis fruit fly)	Prevent adult emergence	100
B. tryoni (Queensland fruit fly)	Prevent adult emergence	100
Rhagoletis pomonella (apple maggot)	Prevent adult emergence	50
Brevipalpus chilensis (false red mite)	Prevent reproduction	300
Cydia pomonella (codling moth)	Prevent adult emergence	200
Grapholita molesta (oriental fruit moth)	Prevent adult emergence	200
Cryptophlebia illepida (koa seedworm)	Prevent adult emergence	250
C. ombrodelta (litchi fruit moth)	Prevent adult emergence	250
Conotrachelus nenuphar (plum curculio)	Prevent reproduction	92
Cylas formicarius (sweetpotato weevil)	Prevent reproduction	165

Technical Meeting for the Coordinated Research Project on "Classification of Soil Systems based on Transfer Factors of Radionuclides from Soil to Reference Plants", D5.50.01, IAEA Headquarters, 22 April 2004

Technical Officer: Ian G. Ferris

Mr. Ray Hance (NAFA consultant) and representatives from the Agency's Laboratories, Seibersdorf, NE and NS met on 22 April 2004 to review the draft TecDoc for the Coordinated Research Project (CRP) "Classification of Soil Systems based on Transfer Factors of Radionuclides from Soil to Reference Plants" and the draft summary of the first workshop on practical agricultural countermeasures held last year in Crete (see last issue of Newsletter).

A total of 14 papers were included for the proposed TecDoc including an invited paper on the results of the interlaboratory comparisons that is in preparation. These together with the TecDoc summary and appendices will ensure this publication becomes a valuable reference for sustainable remediation of radioactively contaminated environments. Mr. Hance was commended for his editing and the TecDoc summary. Special thanks were accorded to Mr. Martin Frissel for his contribution and in guiding the CRPs on radionuclide transfer factors for a decade. It is hoped that much of the IUR database on radionuclide transfer factors that was developed by Mr. Frissel will be incorporated into the proposed website on agricultural countermeasures (See news update below).

After discussing the workshop summary on practical agricultural countermeasures it was agreed that a CD-ROM would be preferable to an unpriced publication. This would allow incorporation of the STRATEGY (http://www.strategy-ec.org.uk/) templates and other important resource materials in a more coherent way. A draft was discussed and comments incorporated into a web version (http://www.iaea.org/programmes/nafa/dx/emergency/). The CD-ROM would have the same cover design as on Technical Report Series 363 "Guidelines for Agricultural Countermeasures Following an Accidental Release of Radionuclides". This would signify the origins and evolution of agricultural countermeasures. Further, the meeting suggested that both the FAO and IAEA DGs sign a joint communication to bring the CD-ROM to the attention of Member States.

International Forum on Food Irradiation in the Industry, Montevideo, Uruguay, 24 May 2004

Technical Officer: Tatiana Rubio Cabello

One hundred sixty-five professionals and technicians of the private and public sector in Uruguay from more than 20 institutions and enterprises attended the International Forum on Food Irradiation in the Industry. The Forum was held at the Headquarters of the Laboratorio

Tecnológico del Uruguay (LATU) which is a leader in transfer technology in Uruguay. The purpose of the Forum was to discuss the benefits of food irradiation for the internal and external market. The keynote address was given by Tatiana Rubio Cabello of the Food and Environmental Protection Section.

The Forum was jointly co-sponsored by the Ministry of Industry, Energy and Mining with Chamber of Industry, Chamber of Food Industry and other public institutions and private companies.

The Forum was organized under the project "Feasibility to install an irradiation facility in Uruguay", which is headed by LATU.

The Forum was followed by a round table, which confirmed the need of using irradiation technology to solve sanitary and phytosanitary problems in Uruguay.

International Forum on Food Irradiation, Montevideo, Uruguay

Report on Ongoing and Planned Coordinated Research Projects (CRPs) and Rearch Coordination Meetings (RCMs)

Testing the Efficiency and Uncertainty of Sample Processing for Analysis of Food Contaminants, D5.40.03

Technical Officer: Josef Brodesser

The second research coordination meeting planned for January 2004 in Costa Rica has been postponed to the the beginning of 2005.

Quality Control of Pesticide Products, D6.10.23

Technical Officer: Josef Brodesser

The progress reports of the fifteen research contracts and agreement holders are currently being evaluated.

Use of Irradiation to Ensure Hygienic Quality of Fresh, Pre-Cut Fruits and Vegetables and other Minimally Processed Food of Plant Origin, D6.10.22

Technical Officer: Tatiana Rubio Cabello

Considerable progress has continued in determining the feasibility of using irradiation in these products in order to improve their microbiological quality without affecting their sensorial and nutritional properties.

FAO/IAEA Agriculture and Biotechnology Laboratory

Fellowship Training

Two fellows from Burkina Faso (Mr. Sako and Mr. Sidibe) were trained on mycotoxin analysis by using Thin Layer and Liquid Chromatography. HPLC maintenance and evaluation of the results has been completed.

Internship and Scientific Visits

A scientific visitor from Senegal, Dr. Guiro, joined the Agrochemicals Unit for one week in relation to Technical Coorporation Project SEN5027.

One intern from Turkey, Ms. Yolci, completed her study on pesticide residue analysis in cabbage, cucumbers and star fruit, quantification of uncertainties in sample processing and analysis and internal QA/QC related to the analysis.

Internal Training Programme

In order to systematically introduce the underlying theory of procedures and actions related to the analysis of pesticide residues in food and environmental samples and mycotoxin residues in food, fellows studying at the Agrochemicals Unit attended internal seminars to discuss the evaluation of residue data for establishing MRLs and EUREPGAP general regulations and components of plant production affecting the quality and safety of products.

Adaptation and Validation of QuECheERS Method

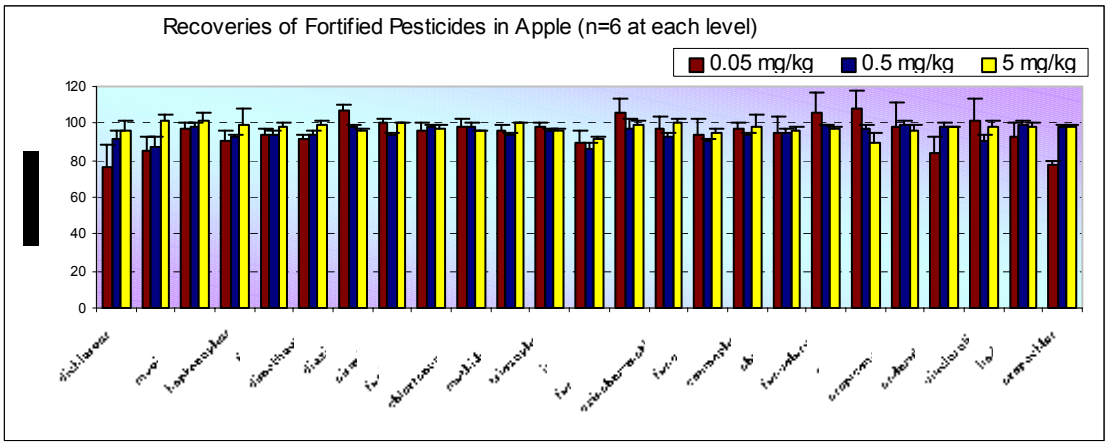
The QuEChERS method, which was introduced by M. Anastassiades et al. (2003), was modified to permit the use of GC with ECD/NPD by employing ethyl acetate for extraction. In validation experiments, tomato, apple and frozen green bean were each fortified with 25 selected pesticides in six replicates at each of three levels from 0.05-5 mg/kg.

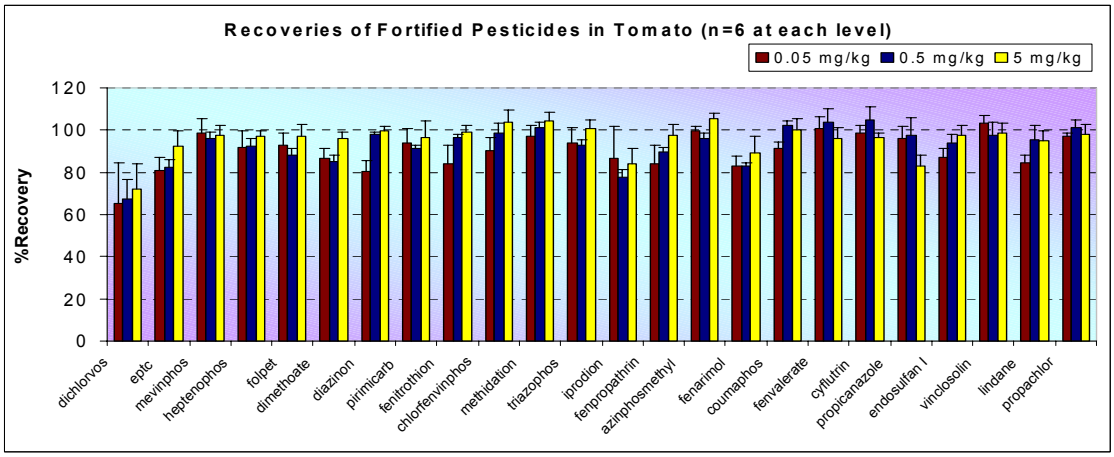
In the modified procedure, 30 g comminuted sample was extracted with 60 ml ethyl acetate using a probe blender, dried with 30 g anhydrous Na_2SO_4 and neutralised with 5 g $NaHCO_3$. After centrifugation, clean-up and removal of residual water were performed simultaneously by using rapid procedure called dispersive solid-phase extraction, in which 25 mg primary secondary amine (PSA) sorbent and 150 mg anhydrous Mg_2SO_4 per 1 ml aliquot (1 g sample equivalent) were mixed with the ethyl acetate extract. After clean-up, 1µl extract was injected GC-ECD/NPD. Only low spiked extracts were concentrated, but not the others. For the quantification, matrix-matched standards and weighted linear regression were used.

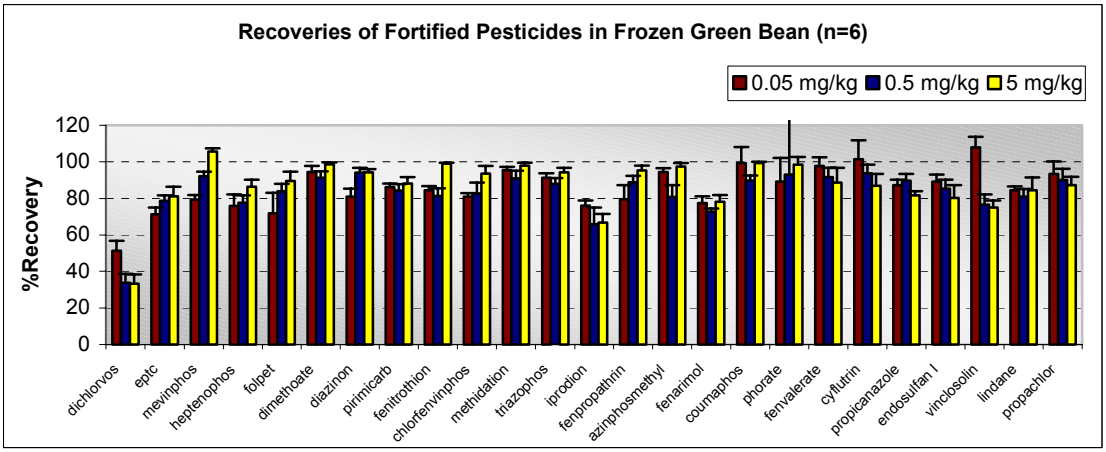
Dichlorvos could not be properly recovered by the method; iprodion determination in green bean was obstructed due to interference with matrix and phorate determination due to degradation.

Overall average recovery of the method was 93% with RSD = 10% (n=1182), for 22 analytes at all three fortification levels in all three commodities.

The EtAc-modified QuEChERS method was successfully validated by a single laboratory using GC/ECD+NPD for analysis. This method can be very useful for the analysis of pesticide residues in non fatty foods, especially in developing country laboratories which were not equipped with expensive MS instrumentation.







Nuclear Preparedness

Preparedness for and response to nuclear emergencies

A work plan to improve preparedness for and response to nuclear emergencies was adopted by a meeting of FAO's Emergency Coordination Group on 12 February 2004. Priority was given to making FAO's extensive research data available over the Internet. This would facilitate preliminary assessment of the scale and potential impact of nuclear emergencies affecting food and agriculture. In addition, it would allow more integrated and holistic approaches to the long-term sustainable remediation of radioactively contaminated environments. Open source project such as Jeeves (http://sourceforge.net/projects/jeeves/) and Deegree (http://deegree.sourceforge.net/) offer an efficient delivery mechanism that would minimize unnecessary duplication of effort, improve information coherence and system maintenance.

The Joint FAO/IAEA Division is collaborating with the Department of Nuclear Energy's Planning and Economics Study Section (PESS) to implement an information system for growing safe food products from contaminated land. The proposed radionuclide countermeasures information system, tentatively RCMIS, will provide easy access to the countermeasures and radionuclide transfer databases for researchers. For decision makers, information will be provided on agricultural countermeasures that can be implemented on contaminated soil as well as financial indicators of economical viability of such countermeasures in a local context. Consultants have implemented the basic pre-requisites, including interfaces to ensure interoperability with existing systems, several security issues raised by the Division of Information Technology and basic training for database custodians.

Core data will include radionuclide transfer factors and STRATEGY templates (http://www.strategy-ec.org.uk/). It is anticipated that content will also be provided by Agency's Seibersdorf Laboratory, Nuclear Safety and the FAO and IAEA's Departments of Technical Cooperation through national and regional projects. To ensure a broad co-sponsorship of the RCMIS, consultants have outlined a project document and are developing a functional specification for consideration by FAO, IAEA, IUR, WB and WHO. The documentation will include the delivery schedule for the prototype and final system.

The final implement is anticipated in the 2006/2007 programme of work and budget. In the meantime, essential information will be provided as static pages under the website of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (http://www.iaea.org/programmes/nafa/dx/).

International Consultative Group on Food Irradiation (ICGFI)

Report and Recommendations of the Working Group Meeting on the International Consultative Group on Food Irradiation (ICFI)

Background

The 20th Meeting (October 2003) of the Joint FAO/IAEA/WHO International Consultative Group on Food Irradiation (ICGFI) agreed that a new successor organization would not be created and that prior to the

expiration of the ICGFI mandate on 8 May 2004, a Working Group consisting of government-designated experts from Australia, Belgium, Egypt, New Zealand, Thailand and Turkey would meet in Vienna in early 2004 to discuss and provide advice on:

- The closure of any outstanding activities/obligations of ICGFI;
- Future follow-up activities related to the use of irradiation as a sanitary and phytosanitary treatment;
- Utilization of the remaining ICGFI budget;
- Options or mechanisms for future international cooperation in the field of food irradiation; and
- Any other related issues communicated in writing.

It was further agreed that a report of the Working Group would be disseminated to ICGFI member governments, government-designated experts and observer organizations.

The Working Group Meeting was attended by designated experts from Australia (G. Luckman), Belgium (P. Dardenne), Egypt (A.H. Rady), New Zealand (P. Roberts), Thailand (P. Loaharanu) and Turkey (N. Cetinkaya). Representatives of the WHO (G. Moy) and the IAEA (D. Byron, T. Rubio-Cabello, C. Thottakara) also attended the Meeting. Written communications provided by Carolin Vandenberg (Canada) and Dieter Ehlermann were also considered by the Meeting as well as a presentation on the proposed International Council on Food Irradiation by P. Loaharanu.

The Working Group was chaired by Peter Roberts (New Zealand); Gary Luckman (Australia) and David H. Byron (FAO/IAEA) served as rapporteurs to the Meeting.

Conclusions and Recommendations

The Working Group reached the following conclusions and made the following recommendations to the sponsoring organizations and ICGFI member governments:

General

1. Agreed that a written communication (letter, press release, website notice) and CD-ROM should be prepared by the Joint Secretariats around May 2004 containing information on the end of the ICGFI mandate and a summary of the achievements of the ICGFI to date. It was agreed that the letter would be circulated to ICGFI member governments, government-designated experts and observer organizations.

2. Encouraged the continuation of FAO, IAEA and WHO activities on the application of irradiation as a sanitary and phytosanitary treatment through the use of existing mechanisms, including technical cooperation projects (national and regional), coordinated research programs, workshops, seminars and training.

3. Recommended that future activities within the Food and Environmental Protection Section (FEP) of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (NAFA) consider:

a. The recommendations of the panel convened to consider Thematic Planning (May 2002) for food irradiation within the Agency for a) the development of market access for irradiated foods, and b) feasibility studies and business planning related to international trade in irradiated foods.

b. Studies on the socio-economic benefits, including a cost-benefit analysis, on the use of food irradiation.

c. Greater use of regional activities related to food irradiation.

4. Supported the convening of future regional and international fora for the dissemination and exchange of information on food irradiation with particular emphasis on the implementation of recent Codex and IPPC Standards related to the irradiation of foods.

Utilization of Remaining ICGFI Funds

The Working Group reviewed the ICGFI Programme of Work and Budget for 2004 (ICGFI/XX/WP-7), endorsed and retained several of the items proposed and made the following additional recommendations:

1) Agreed as a top priority to extend the services provided by one full time support staff member of the of the ICGFI Secretariat within the FEP/NAFA until 31 December 2004 through the utilization of remaining ICGFI funds.

It was further agreed that duties undertaken would include the updating of the ICGFI databases and website. These duties should then be transferred to, and funded by, the NAFA/FEP on an ongoing basis. This decision was taken with the understanding that the ICGFI web page and information contained therein would be integrated into the website of the NAFA/FEP.

2) Supported, in collaboration with the International Plant Protection Convention (IPPC) Secretariat, the further elaboration of Annex 1 of the Guidelines for the Use of Irradiation as a Phytosanitary Measure to facilitate its application on a practical basis, and especially to compile, evaluate and identify gaps in the data on the efficacy of irradiation as a phytosanitary treatment for specific pest/commodity combinations of significance in international trade.

3) Agreed to update and re-print the ICGFI information booklet on Facts about Food Irradiation.

4) Agreed to the preparation of a CD-ROM as an information source on food irradiation. The CD would include a brief history and summary of ICGFI achievements, copies of available publications of ICGFI and their sponsoring organization related to food irradiation as well as a reference list of IAEA publications on food irradiation.

5) Agreed that the IAEA Secretariat would request the Secretary of the Codex Alimentarius Commission to prepare and publish the two new Codex publications on food irradiation in dedicated booklet form.

Further Recommendations

The Working Group requested the Joint FAO/IAEA Division and WHO to consider the provision of funds to implement the following recommendations for which ICGFI funding had not been identified:

1. Supported the convening of a seminar, preferably in conjunction with the second Joint FAO/WHO Global Forum of Food Safety Regulators (Bangkok, late 2004), specifically to promote the use of irradiation as a phytosanitary and food safety tool for horticultural produce traded internationally. It was envisioned that ICGFI member governments nominating candidates with experience in phytosanitary treatments would be financially supported as a priority (see Forthcoming Events above).
2. Agreed to encourage the formulation of a distance-learning module on food irradiation within the context of the current NAFA/FEP initiative. In this regard, it was further agreed that the two existing ICGFI training manuals would be updated and made accessible on the web.
3. Agreed that initiatives on food irradiation within the EU should be supported when appropriate.
4. Supported the continued maintenance and updating of national databases located in Germany and the USA on food irradiation by their governments. The Joint Secretariats agreed to draft a letter seeking clarification as to the current status and future activities envisioned in the further updating of these valuable databases into digital form.

Websites

FAO/IAEA Training and Reference Centre for Food and Pesticide Control: Control: http://www.iaea.org/trc

International Database on Insect Disinfestation and Sterilization – IDIDAS: http://www-ididas.iaea.org/

International Food Contaminant and Residue Information System – INFOCRIS: http://www-infocris.iaea.org

Annex

Proposed Draft Revised Guideline Levels for Radionuclides in Foods for Use in International Trade (At Step 5 of the Procedure)

TABLE 1: GUIDELINE LEVELS (IN BQ/KG) FOR RADIONUCLIDES IN FOODS

Radionuclides in foods	Guideline Level (Bq/kg)
^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Am	1
^{90}Sr, ^{106}Ru, ^{129}I, ^{131}I, ^{235}U	100
^{35}S, ^{60}Co, ^{89}Sr, ^{103}Ru, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{192}Ir	1000
^{3}H*, ^{14}C, ^{99}Tc	10000

*This represents the most conservative value for tritium (organically bound).

Scope: The Guideline Levels apply to radionuclides contained in foods destined for human consumption and traded internationally, which are inherently contained in the food or have been incorporated into the food from any source. These guideline levels apply to food after reconstitution or as prepared for consumption, i.e. not to dried or concentrated foods, and are based on an intervention exemption level of around 1 mSv in a year.

Application: As far as generic radiological protection of food consumers is concerned, when radionuclide levels in food do not exceed the corresponding Guideline Levels, the food should be considered as safe for human consumption. When the Guideline Levels are exceeded, national governments shall decide whether and under what circumstances the food should be distributed within their territory or jurisdiction. National governments may wish to adopt different values for internal use within their own territories where the assumptions concerning food distribution that have been made to derive the Guideline Levels may not apply, e.g. in the case of wide-spread radioactive contamination.

Radionuclides: The Guideline Levels do not include all radionuclides. Radionuclides included are those important for uptake into the food chain; are usually contained in nuclear installations or used as a radiation source in large enough quantities to be significant potential contributors to levels in foods; are routinely discharged or could be accidentally released into the environment from typical installations or used in applications or might conceptually be employed in malevolent actions. Radionuclides of natural origin are generally excluded from consideration in this document.

In Table 1, the radionuclides are grouped according to the guideline levels rounded logarithmically by orders of magnitude. The guideline levels have been checked against age-dependent ingestion dose coefficients defined as committed effective doses per unit intake for each radionuclide, which are taken from the "International Basic Safety Standards" (IAEA, 1996).[1]

Multiple radionuclides in foods: The guideline levels have extensive conservative assumptions built-in and therefore there is no need to add contributions from radionuclides in different groups. Each group should be treated independently. However, the activity concentrations of each radionuclide within the same group should be added together.[2]

Small quantity or concentrated foods: Special considerations apply to certain classes of food which are consumed in small quantities (at most a few percent of total diet), such as spices. If such foods represent a small percentage of total diet and hence a small addition to the total dose, the Guideline Levels for these foods may be increased by a factor of 10, in accordance with the internationally agreed basic safety standards (IAEA, 1996).

[1] Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Labour Office, OECD Nuclear Energy Agency, Pan American Health Organization, World Health Organization (1996) International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, IAEA, Vienna.

[2] For example, if ^{134}Cs and ^{137}Cs are contaminants in food, the guideline level of 1000 Bq/kg refers to the summed activity of both these radionuclides.

Scientific justification for Proposed Draft Guideline Levels for Radionuclides in Foods[3]

The proposed draft Guideline Levels for Radionuclides in Foods and specifically the values presented in Table 1 above are based on the following general radiological considerations and experience of application of the existing international and national standards for control of radionuclides in food.

Infants and adults: As presented in the attached appendices, significant improvements in the assessment of radiation doses resulting from the human intake of radioactive substances have become available since the Guideline Levels were issued by the Codex Alimentarius Commission in 1989 (CAC/GL 5-1989). The levels of human exposure resulting from consumption of foods containing radionuclides listed in Table 1 at the suggested guideline levels have been assessed both for adults and infants and checked for compliance with the appropriate dose criterion. As a result, the present Guideline Levels in Table 1 are relevant to all kinds of foods destined for human consumption and traded internationally, including infant foods.

In order to assess public exposure and the associated health risks from intake of radionuclides in food, estimates of food consumption rates and ingestion dose coefficients are needed. According to Ref. (WHO, 1988) it is assumed that 550 kg of food is consumed by an adult in a year. The value of infant food and milk consumption during the first year of life used for infant dose calculation equal to 200 kg is based on contemporary human habit assessments (F. Luykx, IAEA-SM-306/120, 1990; US DoH, 1998; NRPB-W41, 2003). The most conservative values of the radionuclide-specific and age-specific ingestion dose coefficients, i.e. relevant to the most absorbed from the gastro-intestinal tract chemical forms of radionuclides, are taken from the (IAEA, 1996).

Radiological criterion: The appropriate radiological criterion, which has been used for comparison with the dose assessment data below, is a generic intervention exemption level of around 1 mSv for individual annual dose from radionuclides in major commodities, e.g. food, recommended by the International Commission on Radiological Protection as safe for members of the public (ICRP, 1999).[4]

Naturally occurring radionuclides: Radionuclides of natural origin are ubiquitous and as a consequence are present in all foodstuffs to varying degrees. Radiation doses from the consumption of foodstuffs range from a few tens to a few hundreds of microsieverts in a year. In essence, the doses from these radionuclides when naturally present in the diet are unamenable to control; the resources that would be required to affect exposures would be out of proportion to the benefits achieved for health. Therefore, these radionuclides are excluded from consideration in this document.

One-year exposure assessment: It is conservatively assumed that during the first year after a major environmental radioactive contamination caused by a nuclear or radiological event[5] it might be difficult to replace readily foods imported from contaminated regions with the ones imported from unaffected areas. According to FAO statistical data (see Appendix 1) the mean fraction of major foodstuff quantities imported by all the countries worldwide is 0.1. The values in Table 1 have been derived to ensure that if a country continues to import all the major foods from areas contaminated with radionuclides, the mean annual internal dose of its inhabitants will not exceed around 1 mSv (see Appendix 2). As the assessment has extensive conservative assumptions built-in, the result should be considered as the upper level of the possible dose range.

Long-term exposure assessment: Beyond one year after a major environmental contamination with radionuclides, most of the foods imported from areas with radioactive residues will be replaced with the ones imported from unaffected areas. However, foods contaminated with radionuclides may be still imported occasionally.

The estimated level of public exposure can be assessed taking account of import/production statistics. Based on FAO statistical data, the worldwide mean value of the import/production factor can be set at 0.0001-0.001 (see Appendix 1). Thus, for a country occasionally importing foods from areas with radioactive residues, the mean annual effective internal dose to its inhabitants is estimated to be no more than around 10 μSv (see Appendix 2), which is considered to give trivial health risk to the individual (ICRP, 1991; IAEA, 1988, 1996). As the assessment has extensive conservative assumptions built-in, the result should be considered as the upper level of the possible dose range.

Health risk estimation: Owing to the extremely conservative assumptions adopted, it is most unlikely that the application of the Guideline Levels would result in a committed effective dose from consumption of foods

[3] The Codex Alimentarius Commission at its 18th Session (Geneva 1989) adopted Guideline Levels for Radionuclides in Foods Following Accidental Nuclear Contamination for Use in International Trade (CAC/GL 5-1989) applicable for six radionuclides (^{90}Sr, ^{131}I, ^{137}Cs, ^{134}Cs, ^{239}Pu and ^{241}Am) during one year after the nuclear accident.

[4] International Commission on Radiological Protection (1999). Principles for the Protection of the Public in Situations of Prolonged Exposure. ICRP Publication 82, Annals of the ICRP.

[5] In this document, nuclear or radiological event means nuclear or radiological emergency or terrorist situation involving nuclear facility or major radiation source.

during first year after a major nuclear or radiological event to any individual exceeding a small fraction of one mSv. This would add a lifetime risk of death from a radiation-induced cancer of no more than about 10^{-5}.

The added lifetime risk of death from a radiation induced cancer to individuals consuming foodstuffs imported from areas with radioactive residues that comply with the Guideline Levels in Table 1 will be no more than 10^{-6} from one year of long-term consumption. The corresponding lifetime risks from the consumption of such foodstuffs year by year over a lifetime would be substantially less than 10^{-4}.

Estimation of the import/production factor values based on FAO food statistics

The import/production factor (IPF_{CA}) is defined as the ratio of the amount of foodstuffs imported per year from areas contaminated with radionuclides (I_{CA}), to the total amount produced and imported ($P+I$) annually in the region or country under consideration.

$$IPF_{CA} = I_{CA} / (P+I)$$

Individuals may be considered to consume this proportion of contaminated imported food relative to the total amount of food consumed.

The region-specific or country-specific values of the IPF_{CA} can be determined based on local import and production statistics. In order to numerically estimate the worldwide mean contribution of imported food from areas contaminated with radionuclides, to total food production values needed for the present document, the statistical data on production, import and consumption of major foodstuffs worldwide from the FAOSTAT Food Balance Sheets[6] have been used.

Based on the FAOSTAT data for the recent five-year period (1997-2001), the mean fraction of major foodstuff quantities (i.e., cereals, starchy roots, vegetables, fruit, meat, milk and fish and seafood) imported by all the countries worldwide (IPF_W), weighted by major foodstuffs consumption, is 0.11 which can be rounded to 0.1. The mean fractions for particular major foodstuffs range between 0.05 for vegetables and up to 0.27 for fish and seafood.

The contribution of food produced in areas affected by a major nuclear accident to the worldwide food import $(I_{CA}/I)_W$ can be assessed based on the experience of the Chernobyl accident that resulted in the radioactive contamination of large agricultural areas. In the three countries mostly affected by the Chernobyl accident (Belarus, Russia and Ukraine), 0.4% to 23% of their territories were significantly contaminated with radionuclides, i.e., above 37 kBq/sq.m (1 Ci/sq.km) of ^{137}Cs. These three countries yield in total about 5%, and their contaminated areas produce less than 0.2%, of major foodstuffs world produce. Taking into account the contribution of other European countries with the Chernobyl contaminated spots, this fraction can be estimated as being 0.3% and accounting for uncertainties ranged between 0.1% and 1% (10^{-3} to $10^{2)}$.

As the worldwide mean fraction of imported food comprises about 0.1 of the produced and imported food, the mean fraction of food imported from areas contaminated with radionuclides due to major nuclear or radiological event $IPF_{CA,W}$ can be estimated as 10^{-4} to 10^{-3}.

Assessment of human internal exposure when the guideline levels are applied

For the purpose of assessment of the mean public exposure level in a country caused by the import of food products from foreign areas with residual radioactivity, in implementing the present guideline levels the following data should be used: annual food consumption rates for adults and infants, radionuclide- and age-dependent ingestion dose coefficients and the import/production factors as defined in Appendix 1. When assessing the mean internal dose in infants and general public it is suggested that due to monitoring and inspection the radionuclide concentration in imported foods does not exceed the present guideline levels. Using cautious assessment approach, it is considered that all the foodstuffs imported from foreign areas with residual radioactivity are contaminated with radionuclides at the present guideline levels.Then, the mean internal dose of the public, E (mSv), due to annual consumption of imported foods containing radionuclides can be estimated using the following following formula.

$$E = GL(A) \cdot M(A) \cdot e_{ing}(A) \cdot IPF$$

where:

- $GL(A)$ is the Guideline Level (Bq/kg);
- $M(A)$ is the age-dependent mass of food consumed per year (kg);
- $e_{ing}(A)$ is the age-dependent ingestion dose coefficient (mSv/Bq);
- IPF is the import/production factor as defined in Appendix 1 (dimensionless)

Assessment results presented in Table 2 both for infants and adults demonstrate that for most of twenty radionuclides under consideration, except of ^{14}C, ^{129}I, ^{134}Cs and ^{137}Cs, higher doses might be received by infants than for adults. However, for all the twenty radionuclides doses from consumption of imported foods during first year after major radioactive contamination do not exceed

[6] http://apps.fao.org/lim500/wrap.pl?FoodBalanceSheet&Domain=FoodBalanceSheet&Language=english

around 1 mSv and from annual consumption in the long term (beyond one year) do not exceed around 10 μSv.

For ^{239}Pu as well as for a number of other radionuclides (except of ^{3}H, ^{14}C, ^{35}S, iodine and caesium isotopes) the dose estimate is especially conservative because elevated gastro-intestinal tract absorption factors and associated ingestion dose coefficients are applied for the whole first year of life whereas this is valid mainly during suckling period recently estimated by ICRP to be as average first six months of life (ICRP Committee 2, to be published in 2004). For the subsequent six months of the first year of life the gut absorption factors are much lower.

As an example, dose assessment for the most topical case of ^{137}Cs in foods is presented below separately for the first year after the area contamination with this nuclide and for long-term exposure.

One-year exposure assessment:

For the first year after a major environmental radioactive contamination it is conservatively assumed that it might be difficult to replace readily foods imported from contaminated regions with the ones imported from unaffected areas. Therefore, the mean worldwide value of the import/production factor equal to 0.1 (see Appendix 1) is used for the mean dose estimation.

Cs-137:

For adults: $\boldsymbol{E}$ = 1000 Bq/kg ·550 kg ·$1.3\cdot10^{-5}$ mSv/Bq ·0.1 = 0.7 mSv;

For infants: $\boldsymbol{E}$ = 1000 Bq/kg ·200 kg ·$2.1\cdot10^{-5}$ mSv/Bq ·0.1 = 0.4 m.

Assessment of a dose for infants and adults from ingestion of imported foods in a year

Radionuclide	Guideline Level (Bq/kg)	Annual dose, mSv		
		First year after major contamination		Long term Exposure Ranges
		Infants	Adults	
^{238}Pu*	1	0.08	0.01	0.00001-0.0008
^{239}Pu*		0.08	0.01	0.00001-0.0008
^{240}Pu*		0.08	0.01	0.00001-0.0008
^{241}Am*		0.07	0.01	0.00001-0.0007
^{90}Sr	100	0.5	0.2	0.0002-0.005
^{106}Ru		0.2	0.04	0.00004-0.002
^{129}I		0.4	0.6	0.0004-0.006
^{131}I		0.4	0.1	0.0001-0.004
^{235}U		0.7	0.3	0.0003-0.007
^{35}S	1000	0.2	0.04	0.00004-0.002
^{60}Co		1	0.2	0.0002-0.01
^{89}Sr		0.7	0.1	0.0001-0.007
^{103}Ru		0.1	0.04	0.00004-0.001
^{134}Cs		0.5	1	0.0005-0.01
^{137}Cs		0.4	0.7	0.0004-0.007
^{144}Ce		1	0.3	0.0003-0.01
^{192}Ir		0.3	0.08	0.00008-0.003
^{3}H**	10 000	0.02	0.02	0.00002-0.0002
^{14}C		0.3	0.3	0.0003-0.003
^{99}Tc		***	0.4	0.0004-0.004

*For actinides, the additional safety margin of an order of magnitude has been introduced taking into account the assessment uncertainty.

**This represents the most conservative value for tritium (organically bound).

***Whereas ^{99}Tc is basically found in the marine environment and contained in seafood, its contribution to ingestion by infants is not considered.

Long-term exposure assessment:

Beyond one year after a major environmental contamination with radionuclides, most of foods imported from areas with radioactive residues will be replaced with the ones imported from unaffected areas. In these conditions, foods contaminated with radionuclides may be still imported occasionally. Therefore, the mean worldwide value of the import/production factor ranging from 0.0001 to 0.001 (see Appendix 1) is used for the mean dose estimation:

Cs-137:

For adults: $\boldsymbol{E}$ = 1000 Bq/kg ·550 kg ·$1.3\cdot10^{-5}$ mSv/Bq ·(0.0001-0.001) = 0.0007 - 0.007 mSv;

For infants: $\boldsymbol{E}$ = 1000 Bq/kg ·200 kg ·$2.1\cdot10^{-5}$ mSv/Bq ·(0.0001-0.001) = 0.0004 - 0.004 mSv.

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