Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Food & Environmental Protection Newsletter

http://www-naweb.iaea.org/nafa/index.html
http://www.fao.org/ag/portal/index_en.html

ISSN 1020-6671

Vol. 17, No. 2, July 2014

Contents

To Our Readers	1
Our 50th Anniversary	3
Staff	4
Feature Articles	5
Forthcoming Event	9
Past Events	9
Coordinated Research Projects	14
Technical Cooperation Projects	18
Food and Environmental Protection Laboratory	29
Announcement	34
Publications in 2014	35

To Our Readers

©FAO/Olivier Thuillier

The Food and Environmental Protection Subprogramme is part of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (the Joint Division) which this year celebrates its half century of exemplary collaboration within the United Nations system. During this time the Joint Division has promoted the mandates of both the International Atomic Energy Agency (IAEA) through peaceful uses of nuclear-related technology to promote global health and prosperity and of the Food and Agriculture Organization of the United Nations (FAO) in its efforts to eliminate world hunger and reduce poverty through sustainable agricultural and rural development, improved nutrition and food security.

Our previous newsletter of January 2014 mentioned exciting developments related to the new capital investment project to support the renovation and modernization of laboratories including the Food and Environmental Protection Laboratory (FEPL). As you will recall, the Member States of the IAEA have called for an initiative to renovate and modernize the Nuclear Sciences and Applications Laboratories in Seibersdorf, which is called the ReNuAL project. In the 52 years since the IAEA's Nuclear Applications laboratories were established, there has not been a comprehensive renovation nor a significant upgrade of equipment across the whole complex. The ReNuAL project is therefore necessary to

ensure the continuing ability of the laboratories to respond to Member States' growing and evolving needs. This is particularly important for the Joint FAO / IAEA Division with its five laboratories that work in the agricultural area at the Seibersdorf complex, including our FEPL. The ReNuAL project has a €31 million target budget established by the IAEA Director General. The Ground-breaking ceremony is planned for 29 September 2014, with completion of the project by December 2017 and we look forward to keeping you informed of progress.

By reading this newsletter I hope you will appreciate how the Food and Environmental Protection Subprogramme helps build and strengthen the capabilities of member countries in their use of nuclear-related techniques. For example, by developing techniques to support sustainable food security and disseminating such techniques through international activities in research, training and outreach in FAO and IAEA Member Countries. The subprogramme responds to the needs of Member Countries by coordinating and supporting research; providing technical and advisory services; providing laboratory support and training; and by the collation, analysis and dissemination of information. Our activities are implemented through technical cooperation and coordinated research projects in the main work areas of food authenticity and traceability; the analysis and control of chemical contaminants; food irradiation; and nuclear and radiological emergency preparedness, response and management relating to food and agricultural production.

There are two feature articles in this newsletter, the first gives an overview of the subprogramme achievements in the area of food contaminants. It uses examples from our work with countries in the Latin America and the Caribbean region, the services provided through national and regional technical cooperation projects, the outputs that have also been delivered through coordinated research projects and how these two mechanisms can work in tandem to provide support for participating countries. The second article is an up-date on food irradiation and provides information on irradiation treatments developed as a plant health measure against invasive insects, an important area of our work that is growing rapidly and aims to support trade in fresh produce.

One of our major events this coming year is the International Symposium; "Food Safety and Quality: Applications of Nuclear and Related Techniques", arrangements are being finalized and thank you to all those who have registered to participate. The symposium will take place at the IAEA Headquarters in Vienna, Austria from 10 to 14 November 2014 and we are looking forward to welcoming scientists, laboratory analysts, policymakers, regulators, food producers and others concerned with food safety and quality as well as with the integrity of the food supply chain.

On a more personal note regarding staffing, we extend a warm welcome to three new members of staff; Mr Yves Hénon, who joins us as a food irradiation specialist with many years of experience in radiation processing; Ms Ana Maria Ojeda Vinueza who is working as a Team Assistant based in Headquarters and helping to support the work of the subprogramme as a whole, and finally but by no means least we are very happy to welcome Ms Victoria Ochoa who is assisting at the laboratories as an Intern. Ms Laura Natalia Fernandez Cedi has completed her internship at the FEPL and we wish Laura every success for the future.

In closing, best wishes to you our readers and to your families for a safe, healthy and happy holiday this summer season.

Sincerely,

Carl M. Blackburn
Acting Section Head

Joint FAO/IAEA Division
of Nuclear Techniques in Food and Agriculture
50 years, 1964–2014

50TH ANNIVERSARY: 1964-2014 & Beyond

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture

Established on 1 October 1964, the FAO and IAEA created the Joint FAO/IAEA Division as a strategic partnership in order to mobilize the talents and resources of both organizations and hence to broaden cooperation between their Member States in the peaceful application of nuclear science and technology in a safe and effective manner to provide their communities with more, better and safer food and agricultural produce while sustaining natural resources.

Fifty years later, this FAO/IAEA partnership still remains unique, with its key strengths based on interagency cooperation within the United Nations family. It is a tangible joint organizational entity with a fusion of complementary mandates, common targets, a joint programme, co-funding and coordinated management. It entails close cooperation, greater efficiency and shared approaches, and geared to demand-driven and results-based services to its Members and to the international community at large.

Nuclear applications provide added value to conventional approaches in addressing a range of agricultural problems and issues, including food safety, animal production and health, crop improvement, insect pest control and sustainable use of finite natural resources. Over the past 50 years, this partnership has brought countless successes with distinct socio-economic impact at country, regional and global levels in Member States.

During the past 50 years the mission of the Joint Division has proactively evolved to embrace the adaptation to and mitigation of climate change and the adverse effects of globalisation, to increase biodiversity and to further contribute to agricultural development and global food security. Today, both FAO and IAEA strive to mobilize commitment and concerted action towards meeting the Millennium Development Goals and the Sustainable Development Goals through appropriate use of nuclear and related technologies for sustainable agriculture and food security.

Ren Wang
Assistant Director-General
FAO

Daud Mohamad
Deputy Director General
IAEA

50th Anniversary of the Joint FAO/IAEA Division: 1964-2014 & beyond

Staff

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture
Vienna International Centre
Wagramer Strasse 5, P.O. Box 100
A-1400 Vienna, Austria
Telephone: +43 1 2600 + extension; Fax: +43 1 2600 26007
Email: Official.Mail@iaea.org

Name	Title	Email	Extension
Liang Qu	Director	Q.Liang@iaea.org	21610

Food and Environmental Protection (FEP) Section

Name	Title	Email	Extension
David H. Byron	Section Head	D.H.Byron@iaea.org	21638
Carl M. Blackburn	Acting Section Head	C.Blackburn@iaea.org	21639
James J. Sasanya	Food Safety Specialist (Veterinary Drug Residues)	J.Sasanya@iaea.org	26058
Johannes Corley	Food Safety Specialist	J.S.Corley@iaea.org	21695
Yves Hénon	Food Irradiation Specialist	Y.Henon@iaea.org	21616
Lan Chen	Consultant	Lan.Chen@iaea.org	21672
Kyoko Viitaniemi	Team Assistant	K.Viitaniemi@iaea.org	26061
Ana Maria Ojeda Vinueza	Team Assistant	A.M.Ojeda-Vinueza@iaea.org	21641

Food and Environmental Protection Laboratory (FEPL)
A-2444 Seibersdorf, Austria

Name	Title	Email	Extension
Andrew Cannavan	Laboratory Head	A.Cannavan@iaea.org	28395
Russell Frew	Food Safety Specialist (Traceability)	R.Frew@iaea.org	28326
Britt M. Maestroni	Food Scientist	B.M.Maestroni@iaea.org	28398
Zora Jandrić	Analytical Chemist	Z.Jandric@iaea.org	28373
Aiman Abrahim	Laboratory Technician	A.Abrahim@iaea.org	28327
Marivil Islam	Laboratory Technician	M.Islam@iaea.org	28394
Tamara Wimberger	Team Assistant	T.Wimberger@iaea.org	28267
Barbara A. Massinger	Team Assistant	B.Massinger@iaea.org	28259
Victoria Ochoa	Intern	V.Ochoa@iaea.org	28357

Feature Articles

The Control of Food Contaminants - Improving Food Safety, Protecting Consumers and Facilitating Trade

Technical Officer: James Sasanya

People need safe and wholesome food and the joint FAO/IAEA Division recognizes this basic requirement in its work with Member Countries. This feature article discusses this issue in terms of the Food and Environmental Protection (FEP) section and laboratory in the area of food contaminants, using examples from our work with countries in the Latin America and the Caribbean region.

The FEP section and laboratory facilitates capacity building and coordinates research to solve practical issues in many countries. The results are well illustrated by our work with countries in the Latin America and the Caribbean region over the past two years. The FEP section and laboratory staff have worked with colleagues in Latin America and the Caribbean to improve food safety, protect consumers and facilitate trade by coordinating and supporting research initiatives and through direct support using national and regional technical cooperation projects.

Staff of Servicion Nacional de Sanidad Agraria, Peru conducting routine analysis of chemical contaminants in foods. The laboratory has benefited from an IAEA Coordinated Research Project (CRP) and Technical Cooperation Projects (TCP), and is one of the avenues for promoting laboratory networking and transfer of technology from CRPs to TCPs.

In the Latin America and the Caribbean region, laboratory quality management systems have been strengthened and over the last couple of years our tangible outputs include helping 19 laboratories in the region obtain accreditation for their analysis of foods and environmental materials in terms of veterinary drug, pesticide, heavy metal and mycotoxin residues and contaminants. In addition to assisting laboratories to achieve accreditation we have also helped in the development of food monitoring initiatives. As a result of our activities there are 12 national monitoring programs for chemical residues in foods that are functioning to both ensure food safety and boost exports using sampling and analytical methods that meet international standards for these contaminants.

The FEP subprogramme has also ensured that methods for detecting contaminants in food were developed and made available for others to use. Over the past two years, this resulted in more than 125 analytical methods either being validated or re-validated for measuring contaminants in food and environmental samples and 17 other methods having been developed by adapting established methods so that they can also be used to monitor various different contaminants. The experience of our staff has also been used to produce numerous standard operating procedures (SOPs) for routine use in control laboratories. In addition, FEP activities over the past two years have also resulted in more than 206 laboratory personnel receiving training on analytical procedures and the use of specific methods of analysis.

One of the most rewarding aspects of the FEP section and laboratory activities involves the initiation of projects to encourage laboratories to network with counterpart laboratories in other countries. Such laboratory networking relies on working in cooperation with people who are involved with our international activities and events. For example through the regional technical cooperation project RLA/5/059, a laboratory network on veterinary drugs residues and related contaminants has been established. Links have been forged between 15 laboratories that apply nuclear/isotopic analytical techniques for the detection of these residues in Argentina, Bolivia, Brazil, Costa Rica, Chile, Cuba, Dominican Republic, Ecuador, Honduras, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. This network has provided a platform for the laboratories to share experiences and resources on a sustainable basis.

The FEP subprogramme also cherishes its role in addressing the needs of Member States through research, by coordinating international research initiatives at laboratories and institutions in both developing and developed countries. Not only are these research activities helping to develop improved techniques and detection methods for contaminants in food, but the research findings are also transferred to laboratories and institutes where they are used and applied. In this way research projects are used to develop new methods and technical cooperation is used to transfer and consolidate the improvements. Two coordinated research projects involving the monitoring and detection of pesticides (D52035) and veterinary drug

residues (D52036) involve over 20 institutions at different locations around the world, including Brazil, Peru and Costa Rica. Research findings generated through these projects have been transferred to food safety laboratories in the Latin America and the Caribbean region through the production of laboratory protocols and SOPs to support national residue monitoring programmes. Mechanisms for transferring experience and know-how also involve training laboratory staff. For example, regional group training at the Servicion Nacional de Sanidad Agraria (SENASA) in Peru (an institution that is also a research contract holder under D52036) trained laboratory staff from six countries (Argentina, Chile, Uruguay, Ecuador, Panama and Costa Rica) as part of technical cooperation project RLA/5/059. This illustrates how participation in both technical cooperation work and research activities can benefit Member Country laboratories, with SENSA not only hosting training but also enhancing its laboratory capability, with technical assistance from the FEP subprogramme helping the laboratory gain accreditation by ANSI-ASQ National Accreditation Board–ACLASS.

National residue monitoring in Latin America, as in other regions, is guided by Codex Alimentarius, the 'international food code'. The FEP subprogramme is intimately involved with the practical application of many of these standards and guidelines and is therefore also able to feedback and provide expert support to the Codex Alimentarius Commission and its expert committees, including regional coordinating committees such as the FAO/WHO Codex Coordinating Committee for Latin America and the Caribbean. The experience gained by FEP subprogramme staff and the outputs produced through their work are promulgated and made available to other laboratories worldwide, for example by using the internet as a platform to share laboratory analytical methods and protocols through the Joint FAO/IAEA database Food Contaminant Residue Information System (httphttp://nucleus.iaea.org/fcris/Default.aspx/) and through both research and technical cooperation projects.

The FEP subprogramme not only works hard to build regional laboratory networks, but it also encourages participants to forge links with their counterparts across the globe. A good example of promoting further international collaboration through "South–South" cooperation is a recent initiative arranged with Chile and Angola. The Servicio Agrícola y Ganadero (SAG) of Chile is utilizing capacity enhanced with IAEA support to help residue monitoring activities in Angola by the Instituto de Investigacao Veterinaria in Wako Kungu. A memorandum of understanding has been signed between these institutions and thus far SAG has trained three food safety laboratory personnel from Instituto de Investigacao Veterinaria.

Under the FEP subprogramme we help improve food safety, with the aim of protecting consumers and facilitating trade. We do this by helping build and strengthen capacities for the uses of nuclear related techniques and to disseminate the use of such techniques through international activities in research, training and outreach in FAO and IAEA Member Countries. We respond to the needs of Member Countries by coordinating and supporting research; providing technical and advisory services; providing laboratory support and training; and the collation, analysis and dissemination of information. Our activities are implemented through technical cooperation and coordinated research projects. Although this article has focused on the control of food contaminants and used examples from the Latin America and the Caribbean region, I hope it has illustrated how our work in relation to food control laboratories is helping to ensure that the need for safe and wholesome food can be satisfied.

Irradiation of fruit and vegetables for phytosanitary purpose: an overview

Technical Officer: Yves Hénon

For several years now, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has been actively supporting the development of irradiation as a phytosanitary measure for fresh fruit and vegetables. Besides being environmentally beneficial by replacing some harmful chemical fumigants, it also has the potential to facilitate international trade.

The Joint FAO/IAEA Division has participated in the development of six adopted International Standard Phytosanitary Measures (ISPMs) and provided technical expertise to the International Plant Protection Commission (IPPC) Technical Panel on Phytosanitary Treatments (TPPT) to facilitate the successful adoption of 14 irradiation phytosanitary treatments for pests of quarantine importance as part of ISPM 28 (2007), *Phytosanitary Treatments for Regulated Pests.*

The Coordinated Research Project on the Development of Generic Irradiation Doses for Quarantine Treatments created a research network to determine generic and specific treatment doses for 29 insect species from 13 arthropod families of quarantine importance. The results will help reduce technical barriers and facilitate international trade in agricultural produce.

Guidelines produced in the course of an Asia and Pacific Regional Technical Cooperation Project were the basis of a Regional Standard on Phytosanitary Measure (RSPM) on Approval of Irradiation Facilities that was approved in 2013 by the Asia and Pacific Plant Protection Commission (APPPC). By working closely with 17 countries in the region, a *Good Irradiation Practice Manual* was written to support the application of the guidelines. The Manual should be published as an IAEA document in 2014.

The efforts that have been made are coming to fruition. Irradiation has allowed growers and traders from various

countries to access markets from which they were barred. The delicious Vietnamese dragon fruit can now be sold in the USA. The significant growth in volumes being treated proves that irradiation is a viable alternative to harmful chemical treatments as a post-harvest pest control method. It also demonstrates that consumers do buy irradiated products when they are available on the shelves of their stores.

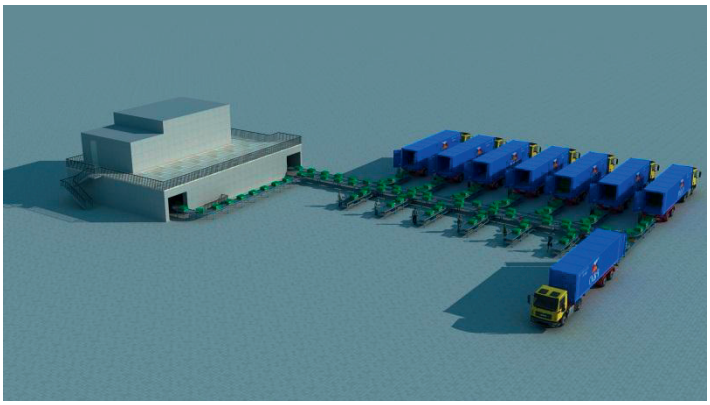
Mexico, South-East Asia countries and Australia are presently the main exporters of irradiated fruit while the USA (see table 1) and New Zealand are the main importers. There is also domestic trade within Australia and between Hawaii and continental USA.

Year	Mexico	Vietnam	Thailand	India	South Africa	Total / *metric tons*
2007	-	-	195	-	-	195
2008	262	121	2 440	276	-	3 099
2009	3 559	117	2 247	132	-	6 055
2010	5 672	754	1 540	94	-	8 060
2011	5 539	1 445	743	80	-	7 807
2012	8 349	1 765	937	217	16	11 284
2013	9 526	1 967	1 060	283	16	12 852

Table 1: Quantities of irradiated fruit (in metric tons) imported into the USA from 2007 to 2013. Source: USDA-APHIS database.

Fruit and vegetables irradiated by X ray in Hawaii are also marketed in continental USA. In 2012, the quantity was approximately 4,300 tons, with sweet potatoes making up the bulk of this trade.

New Zealand is importing approximately 1,000 tons of irradiated Australian mangoes each year and 2013 saw the first imports of irradiated Australian tomatoes and capsicum (bell peppers). Malaysia is also a new market and received nearly 300 tons of irradiated mangoes from Australia in 2013.



Chinese project of facility to irradiate fruit imported from Vietnam
Photo courtesy of Nuctech.

The countries which are already taking action to also export irradiated fruit and vegetables in the near future include Malaysia, Philippines and Peru. In the southern Chinese province of Guangxi, an electron beam facility with a capacity of 100,000 tons per year is being built by Nuctech (picture) to irradiate fruits imported from Vietnam at the point of entry in Pingxiang.

While most of the products are irradiated in the country of origin, USDA-APHIS has taken measures to facilitate irradiation upon arrival in the USA, which should decrease the overall cost by removing the necessity to have an inspector in attendance when irradiation is performed abroad. This initiative will also enable countries without domestic irradiation facilities to take advantage of "irradiation-on-arrival" as a means to meet the USA phytosanitary requirements.

The facilities where irradiation is, or may be, used for phytosanitary purpose are listed in Table 2. Except for the Steritech facility in Queensland that treats products for the domestic market, New Zealand and Malaysia, all other facilities treat products for the USA market and have been approved by USDA-APHIS.

The growing pressure to restrict and reduce the use of various chemicals leaving potentially harmful residues as well as the negative effects on sensory qualities of cold treatments and vapour heat treatments should result in the further growth of alternatives such as irradiation as a phytosanitary treatment.

	Gamma	EB	X Ray
Australia	Steritech (Queensland)	-	-
India	Krushak	-	-
Mexico	Sterigenics Benebion	-	-
South Africa	Hepro	-	-
Thailand	TINT-Thai Irradiation Centre Synergy Health	-	-
USA	Gateway (MI) Pa'ina (HI) Sterigenics (FL)	Sadex, (Iowa) National Research Centre for Electron Beam (Texas)	Hawaii Pride (HI)
Vietnam	Anphu	SonSon	-

Table 2: Irradiation facilities for phytosanitary treatments.

Forthcoming Event

Announcement of the 2nd year Master's Programme "MAN-IMAL - Man-Animal-Food Health: Transdisciplinary Management of Global Health and Nutritional Safety", Nantes, France, November 2014–September 2015

Technical Officer: Andrew Cannavan

Our colleagues at the National College of Veterinary Medicine, Food Science and Engineering (ONIRIS) in Nantes, France are pleased to announce that, following the successful launch of their "One Health" Master's Programme in November 2013, **applications for the 2nd year Master's Degree are now open for the academic year 2014–2015.** More information is available on the website: **http://www.man-imal.fr/en/**

The 2nd year Master's Programme is entitled "MAN-IMAL Man-Animal Food Health: Transdisciplinary Management of Global Health and Nutritional Safety" and is taught entirely in English.

It includes a Biological & Chemical Risks module covering subjects such as: indicators for chemical hazard analysis, methods and tools for hazard analysis, toxicology principles, statistical aspects, metrology, etc.

Classes take place in Nantes (France) from November 2014 to September 2015 and **the programme is open to international students in the following fields: medicine, pharmacy, veterinary, agricultural or food-processing engineering.**

The application form must be completed online via the MAN-IMAL website: http://www.man-imal.fr/en/ (see ''Apply now'').

Past Events

The 46th Session of Codex Committee on Pesticide Residues (CCPR), Nanjing China, 5–10 May 2014

Technical Officer: Johannes Corley

The Technical Officer (TO) represented the Joint FAO/IAEA Division at the 46th Session of the Codex Committee on Pesticide Residue and reported on its activities during the past year. These included assisting member nations in building capacity to ensure the safety of their agricultural produce and the free to use internet resource; Food Contaminant and Residue Information System (FCRIS) database hosted by the IAEA.

The FCRIS database contains several detailed analytical methods for the analysis and quantification of pesticide, veterinary drug and other chemical contaminant residues. These methods of analysis are greatly needed by residue monitoring laboratories worldwide. Also available from the database is information related to the physical, chemical and toxicological properties of pesticides and veterinary drugs and links to other internet resources also providing valuable information to scientists and laboratories involved in food safety and national regulatory and scientific advisory bodies.

During the session, representatives from Nigeria along with several other countries expressed their appreciation to the Joint Division for projects which have helped their countries in developing food safety standards. They also expressed a strong desire for these and other similar projects to be continued. Several countries also expressed their desire for easy access to residue analytical methods in food analysis as available from the FCRIS database and requested that more methods be made available on the database.

Mr Johannes Corley
46th Session of Codex Committee on Pesticide Residues (CCPR)
Nanjing China, 5–10 May 2014.

The representative of the Joint Division assisted the working group on "Acceptable Standards for Residue Analytical Methods" in developing globally acceptable performance criteria for methods of analysis. The draft document is currently undergoing final review through an electronic working group of which the Joint Division remains an active participant. The document is expected to be presented to the 47th session of the CCPR for final approval in 2015.

The representative from the Joint Division is also assisting in editing the revision document of the Risk Analysis Principles applied by the CCPR which will be presented for acceptance to the 47th CCPR in 2015.

During the meetings and breakout sessions, the Joint Division representative held discussions with several representatives from African (Kenya, Tanzania, Uganda, Nigeria, Cameroon, Ghana, Sudan), Latin American (Costa Rica, Ecuador, Paraguay) and Asian (Korea, Singapore, Thailand) nations on issues of importance to these countries related to food safety. The Representative of the Joint Division was invited to attend regional break-out sessions where rrepresentatives from several of these countries expressed interest in cooperative projects with the Joint Division and TC projects involving the nuclear applications in food and agriculture.

Several member nations strongly encouraged the continuation of the capacity building activities and the FCRIS database hosted by the Joint Division. The expertise provided by the Joint Division in the development of guidance documents and standards set by Codex was greatly appreciated and the need for such expertise is expected to increase in future years in the area of nuclear applications in food and agriculture.

Second Food Integrity & Traceability Conference, Belfast, UK, 8–10 April 2014

Technical Officer: Andrew Cannavan

The second International Food Integrity and Traceability Conference was held at Queen's University Belfast, UK, from 8 to 10 April 2014. The conference focused on mechanisms and systems to protect the integrity of the food supply chain. This included the control of threats posed by microbiological and chemical contamination of food, traceability along the food supply chain to facilitate targeted and efficient recall of contaminated products and allow trace-back to contamination sources for mitigation and ongoing improvement of farm-to-fork food safety systems, and guaranteeing the authenticity of food products to combat fraudulent practices and control adulteration for economic, food safety and cultural reasons. The conference had more than 350 participants from more than 30 countries worldwide.

Mr Cannavan presented a poster entitled "Discrimination of honey of different floral origins by a combination of various chemical parameters", which was the result of collaborative research between FEPL, Queen's University Belfast, UK, and Otago University, New Zealand. This work represents potential methodology for combating fraud and helping to ensure food safety in Member States in the future. As a member of the Scientific Committee of the conference, Mr Cannavan also chaired a plenary session dedicated to early stage researchers.

The conference also provided an opportunity to advertise the FAO/IAEA International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, to be held in Vienna, 10–13 November 2014. Two invited speakers were confirmed through direct discussion.

The ReNuAL project was also discussed with several instrument manufacturer representatives to investigate the possibilities for cost-effective instrument acquisition or even donation of instruments through governmental channels. This is open for further discussion.

Participation in the Food Integrity and Traceability Conference provided the opportunity to present some of the research performed at Seibersdorf and to interact with a large number of scientists working in this field. Such interaction is necessary in order to foster collaboration and leverage the power of larger research and development groups for the benefit of our Member States. The conference also provided a forum for outreach with respect to both the ReNuAL project and the up-coming FAO/IAEA International Symposium on Food Safety and Quality.

The Eight Session of the Codex Committee of Contaminants in Foods, The Hague, Netherlands, 31 March–4 April 2014

Technical Officer: James Sasanya

The technical officer participated in the meeting and also provided an up-date report on activities of the Joint FAO/IAEA on contaminants relevant to Codex. The up-date included recent activities on radionuclides in food and water, work on mycotoxins and heavy metal contaminants including capacity building. Based on the report, the session resolved to re-establish an electronic working group to evaluate the application of Codex guidelines for radionuclides in foods and water, co-chaired by The Netherlands and Japan with the Joint Division's support.

The Eighth Session of the Codex Committee on Contaminants in Foods held in The Hague, Netherlands and attended by several delegates from many IAEA Member Countries and observers.
Photo courtesy of J.J. Sasanya.

The electronic working group is following up on the conclusions and recommendations of an Inter-Agency Working Group instigated by the IAEA in 2013 to discuss international standards and the conditions under which they are intended to be used, including the guideline levels for radionuclides in the General Standard for Contaminants and Toxins in Food and Feed (CODEX STAN 193-1995). The issues raised in this regard include i) the stage of food production to which the Codex guidelines on radionuclides apply; ii) the period of time these guidelines should apply in food trade following a nuclear and radiological emergency; iii) the identification of internationally validated methods of analysis of radionuclides in food; and iv) the development of sampling plans to enhance the implementation of the Codex guidelines.

Nuclear & Radiological Emergency Preparedness and Response; Criteria and Standards Related to Radionuclides in Food

Technical Officer: Carl Blackburn

An International Experts Meeting "Radiation Protection after the Fukushima Daiichi Accident: Promoting Confidence and Understanding" was held at the IAEA Headquarters, Vienna, Austria, from 17 to 21 February 2014. This was the sixth International Experts Meeting organized under the IAEA Action Plan on Nuclear Safety. The purpose of the meeting was to provide an opportunity for experts to discuss the various radiation protection issues, that have been highlighted by the Fukushima accident and to consider how these should be addressed at both the national and international levels.

The meeting was attended by more than 200 participants from 69 Member Countries and involved ten International Organizations, including the technical officer who participated as the Food and Agriculture Organization of the United Nations.

In terms of nuclear accidents and radionuclides in foodstuffs, several important issues were raised at this meeting in respect of the control of foodstuffs and drinking water contaminated as a result of a radiological or nuclear accident. In his report of the meeting the chairperson, Sigurður Magnússon, recorded that currently many national and international standards exist in terms of activity concentration in foodstuffs, but these are not always consistent in terms of the permitted maximum concentrations, the terminology used and the circumstances to which the standards apply. This was regarded as a cause for confusion for both national authorities and the public. This is a particular issue for developing countries who may not have the necessary infrastructure to both establish, and monitor compliance with, national standards for radioactivity in foodstuffs.

The chairperson further reported that the existence of different national standards has a direct impact on trade in that it may be difficult for States to export foodstuffs that exceed the values they apply nationally. If importing countries reduce activity concentrations in existing national standards to comply with those levels established by the exporting country, the public may feel that in the past they were not adequately protected. In areas which are seriously affected by radioactive contamination, the optimized strategy is normally to apply countermeasures. Continuing to grow food which cannot be sold generates large amounts of waste that needs to be managed, while discontinuing farming has a negative impact on the ecosystem. Both these latter options also have significant economic and societal costs and so it is preferable to maintain the lifestyle of farmers, fishermen and hunters. The production of alternative non-food crops is an option provided that there is a market for such products, and they are acceptable to the public.

The chairperson concluded that the relevant international organizations need to prioritize work to develop a harmonized approach to the control of foodstuffs and drinking water contaminated as a result of a nuclear or radiological accident. This needs to be simple to implement and take fully into account the issues that apply in the Accident State, other affected States and non-affected States. Similarly, guidance needs to be developed on the

international trade in and the control of contaminated non-food commodities.

As has been reported previously in this newsletter, considerable attention is focused on radionuclide contamination of food and related standards and applicable criteria. The Food and Environmental Protection subprogramme, through the Joint FAO and WHO Codex Alimentarius Commission and its Codex Committee on Contaminants in Foods (CCCF) as well as the IAEA Radiation Safety Standards Committee (RASSC) and also the Inter-Agency Committee on Radiation Safety has been and remains directly involved with discussions and work on reference levels for foodstuffs contaminated as a result of a nuclear or radiological emergency, with particular reference to lessons learned from the situation in Japan and the guideline levels for radionuclides in the General Standard for Contaminants and Toxins in Food and Feed (CODEX STAN 193-1995). One of the key outputs in this regard will be a Technical Document (TECDOC) on the control of foodstuffs and drinking water contaminated as a result of a nuclear or radiological emergency.

The TECDOC will detail the various national and international standards related to radionuclide contamination of food and drinking water, the basis on which they have been derived and the circumstances in which they are intended to be used. It will include a framework to help countries develop activity concentration levels for use at national level in an existing (post-accident) exposure situation. A Technical Meeting with the purpose of providing guidance and input on the development of the TECDOC will be held at the IAEA Headquarters, Vienna, Austria from 8 to 12 September 2014. The meeting will focus on radiological criteria including radionuclide activity concentrations used as the basis for the control of foodstuffs and drinking water in the recovery phase following a nuclear or radiological emergency (i.e. this is termed an "existing exposure situation" because it is after the radiological emergency phase). The numerical values of radionuclide concentrations used for the control of foodstuffs in international trade will also be covered by this meeting. The meeting and the TECDOC publication will be important for food authorities and the CCCF in their consideration of the guideline radionuclide levels in CODEX STAN 193-1995.

The Food and Environmental Protection Subprogramme looks forward to its continued collaboration with the CCCF and RASSC in the on-going revision of international standards and in assisting governments to effectively respond to nuclear and radiological emergencies through the provision of support and the development, coordination and implementation of standards, management procedures and emergency preparedness and response mechanisms related to food and agriculture.

Second International Food Safety Conference (IFSAC2013), Kuala Lumpur, Malaysia, 2–3 December 2013

Technical Officer: Zora Jandrić

The Second International Food Safety Conference (IFSAC2013), which had the theme "Food Safety; critical Dimension of Food Security in Emerging Economies", was held in Kuala Lumpur, Malaysia. The conference was focused on food safety as an integral component of food security, which exists when populations have access to sufficient and nutritious food.

The conference considered current issues and future challenges in food safety and was attended by more than 200 participants from more than 15 countries. The topics covered included critical food safety issues, regional food safety concerns, the impact of climate change on food safety, chemical and microbiological risks, analytical challenges, and safety evaluation of functional ingredients. The scientific program addressed areas such as the safety of animal products, pesticides, permitted food additives, biogenic amines, heavy metals, mycotoxins, and veterinary drugs.

Ms Jandrić presented a poster on applied research done in the Food and Environmental Protection Laboratory (FEPL) at Seibersdorf on the classification of honey of various floral and geographical origins using ultra-performance liquid chromatography coupled to quadrupole time-of-flight mass spectrometry with multivariate data analysis. The objective of the research was to investigate possible analytical methodology for food safety and traceability, to support IAEA Member States in ensuring sustainable food systems.

The presentation was followed by extended discussion with several symposium participants, both in the poster sessions and afterwards in the break sessions. Some issues relevant to the complexity and challenges in ensuring food safety in developing countries were discussed with conference participants. Food safety is a precondition for the welfare of the society as a whole. According to the latest statistics released in 2013, around 842 million people are undernourished and 63% of these live in Asia.

Participation in the conference offered an excellent way to network and share ideas with scientists, researchers and also government and industry personnel from many countries. Food safety is a key issue, not only for public health, but also in business and trade because improvements in food safety will certainly impact positively on productivity, economic activity and national food trade at the regional and global levels. In this

challenging time, governments and stakeholders need to discuss and find new and innovative ways to create a favourable environment that can bring into the market adequate, affordable, safe and healthy food.

The conference helped to identify critical aspects of food safety systems in developing countries and pinpoint appropriate research areas for future IAEA projects.

Coordinated Research Projects (CRPs) and Research Coordination Meetings (RCMs)

CRP Reference Number	Ongoing CRPs	Scientific Secretary
D5.20.36	Development of Radiometric and Allied Analytical Methods to Strengthen National Residue Control Programmes for Antibiotic and Anthelmintic Veterinary Drug Residues	Sasanya, J.J. Cannavan, A.
D5.20.37	Implementation of Nuclear Techniques to Improve Food Traceability	Frew, R. Cannavan, A.
D5.20.38	Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety	Frew, R. Cannavan, A.
D6.20.08	Development of Generic Irradiation Doses for Quarantine Treatments	Blackburn, C.M. Hénon, Y.
D6.20.09	Development of Irradiated Foods for Immuno-compromised Patients and Other Potential Target Groups	Byron, D.H. Blackburn, C.M.

CRPs at the Planning Stage	Working Titles	Scientific Secretary
2082	Development of New Applications of Machine Generated Food Irradiation Technologies	Hénon, Y.
2084	Development and Strengthening of Radio-Analytical and Complimentary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products	Sasanya, J.J.

Second Research Coordination Meeting of the Coordinated Research Project on the Implementation of Nuclear Techniques to Improve Food Traceability, Lisbon, Portugal, 26–30 May 2014

Technical Officer: Russell Frew

The second Research Coordination Meeting (RCM) of the Coordinated Research Project (CRP) on Implementation of Nuclear Techniques to improve Food Traceability was held at the Faculdade de Ciências da Universidade de Lisboa, Portugal 26–30 May 2014.

This CRP concerns food traceability and safety, in particular the development of technologies for the verification of the authenticity of food. Globalisation and the increasing complexity of trade in food provide opportunities and risks to Member States. There are increasing opportunities for those states that produce high-quality, safe food to obtain a premium price for it. The risks are associated with inadvertent or fraudulent mislabelling of products causing damage to the brand. This is of particular importance when food safety is compromised. When food safety is compromised it is imperative that the traceability system can rapidly and robustly identify the origin of the risk enabling it to be removed from the supply chain. To that end a group of 11 projects have been operating under this CRP to develop and apply nuclear techniques for the verification of the authenticity of many different foodstuffs. This was the second Research Coordination Meeting of the project and provided an opportunity to review progress and prepare the future work plans.

Participants of the second RCM at the Faculty of Sciences of Lisbon University, Lisbon, Portugal.

The main aims of this second RCM were to:

a) evaluate and discuss the progress made by each contract holder in relation to the work plans agreed at the 1st RCM (16−20 May 2011, Vienna);

b) prepare work plans for the next phase of the project;

c) facilitate a broader understanding of the relationship each participant has to the overall objectives of the CRP and to promote interaction between the participants;

d) prepare recommendations and guidelines to facilitate project tasks and for the participants to agree a common approach and way forward.

The main objective of the CRP is to address challenges faced by developing countries in implementing effective food traceability systems. In particular, activities under this project will help laboratories in Member States to establish robust analytical techniques for determining the provenance of food through the assessment of the isotopic and elemental composition of foodstuffs. The immediate benefit to laboratories will be the application of state-of-the-art nuclear measurement and complementary techniques to determine the provenance of foodstuffs. This strengthened capacity in food traceability will contribute to the effective implementation of holistic systems for food safety and control.

The specific objective of the CRP is to establish robust analytical techniques, validated to international standards, and databases. These techniques and databases will be applied to analytically verify food traceability systems and claims related to food origin, production and authenticity. To that end the importance of Standard Operating Procedures with appropriate validation data was stressed.

The Contract Holders presented their current work on using nuclear and related techniques in studies of food traceability and authentication. A common theme was that the contracts had produced good datasets but there was a need for assistance and guidance in the interpretation. Mr Anders Nordgaard, Swedish National Laboratory of Forensic Sciences (SKL), Sweden, presented an extended tutorial on statistical techniques that can be applied to the interpretation of the data being generated by the research activities of this project. Mr Nordgaard began by guiding participants on the philosophy behind the use of statistics. He then explained the principles of and correct application of many of the statistical tools available. These included the multi-variate methods such as Principal Components Analysis, Linear Discriminant Analysis and Cluster Analysis. This tutorial enhanced the understanding of statistics and was greatly appreciated by the participants. The Meeting identified the need for more resources in statistics and training in their use.

The Agreement Holders also provided short presentations on a range of topics of relevance to the projects. These presentations reinforced understanding of the principles of food traceability using nuclear and complementary techniques as well as providing case studies of how the data generated can be applied in actual traceability situations. The insights provided by the Agreement Holders helped the Contract Holders formulate the next steps in their own projects.

The Research Contract Holders' presentations highlighted the constraints and the problems encountered in their research. A significant amount of the Meeting was spent on refining the individual projects to ensure satisfactory outcomes. This was done using the "World Café" style group interaction led by Mr Thomas Prohaska. Contract Holders were first asked to prepare and present a very short (3 minute) presentation that focused on the purpose of their research, what analytical tools they were using, what has been achieved and what problems have been encountered. Participants were then split into three groups, each to consider a particular project in terms of it challenges, obstacles and concerns, reasons for the concerns and what actions to be taken. The results of this exercise were used to prepare a further short presentation that provided the focus for further feedback. The large amount of feedback and comment obtained enabled Contract Holders to prepare detailed revisions to their research plans.

Each Research Contract Holder's work was reviewed to ensure that high scientific standards and the objectives of the CRP were met and their work plans, activities and deliverables for the next phase of the project were finalized. The general conclusions of the Meeting are:

- To ensure that the primary objective of the CRP is met it was agreed that all methods developed and used by the contract holders will be presented as Standard Operating Procedures with appropriate validation data, using either Codex or EU guidelines. Agreement Holders will provide assistance where needed.
- The first phase of the project focused on the sampling and analysis of a range of foods. These preliminary studies have shown that C and N isotopes alone are generally not applicable to reliably determine the provenance of food. The addition of at least one of $\delta^{18}O$, $^{87}Sr/^{86}Sr$ or trace element concentration is recommended for all food origin studies.
- Hydrogen isotope measurements do provide good geographical discrimination but there are still too many analytical issues related to sample preparation and validated reference materials for these methods to be recommended to the participants.

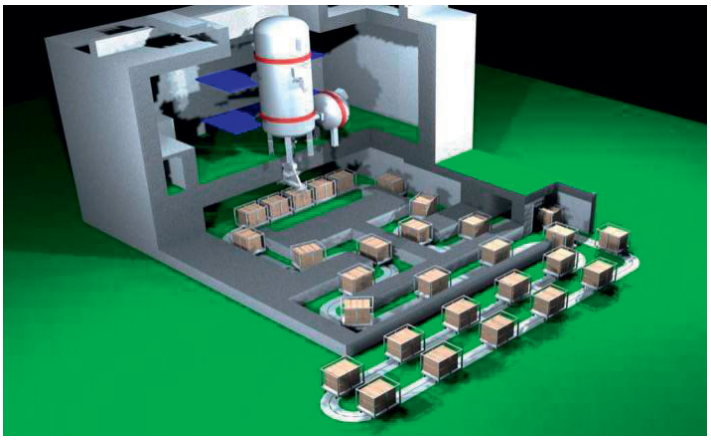
Several recommendations arose from the meeting conclusions:

- Quality control was raised as one of the major issues in this CRP. It was identified that it is of crucial importance to establish validated methods and to provide evidence of the precision and accuracy of measurements and the data produced (including total combined uncertainties) before inclusion in a database. This is a prerequisite for comprehensive measurements of samples and for providing reliable data. Several Contract Holders have to sub-contract their analytical services to other laboratories and in these circumstances the SOPs have increased significance to ensure that the accepted methodology is followed.
- Methods used and developed by the participants should be validated according to one specific fit-for-purpose validation procedure. Validation protocols are readily available: (e.g. Method validation – Pure Appl. Chem., 2002, 74, 5, 835–855; Referencing strategies and techniques in stable isotope research, R. Werner and W.A. Brand, Rapid Commun. Mass Spectrom., 2001, 15, 501–519) and should be described in a standard operating procedure and distributed between all CRP contract and agreement holders. In addition, Contract Holders were advised to use the Forensic Isotope Ratio Mass Spectrometry Guide to Good Laboratory Practice (available from http://www.forensic-isotopes.org/gpg.html).
- Collaborative studies, i.e. unofficial proficiency tests, for methods and standards developed in the CRP should be organized by relevant members. The priority analytes are: Rice, Oil, Protein.
- Proficiency tests are one of the most important tools in order to prove 'fitness for purpose' of the applied method (mainly focusing on sample preparation and analysis and not on homogeneity or sampling strategies). Each laboratory is requested to either participate in existing PT schemes, distribute in-house reference materials to establish between laboratory comparability of results, or participate in a PT scheme which is organized for the specific needs of a group of contract holders. Whereas the first two can be accomplished with reasonable financial means it is evident that the organization of PT schemes is beyond the scope of this project and can only be justified if a significant number of laboratories request the same material and measurand.
- A recommendation be made to the IAEA Reference Materials group that a new CRM for food be developed. The priorities are rice/ oil/ meat/ beet sugar. There is a particular lack of materials for $\delta^{2}H$ and $\delta^{18}O$ measurements.
- The Meeting recommended that additional IAEA support should be sought to develop and maintain a database of stable isotope and trace element data. This would be a repository of the data collected in this CRP and could then subsequently be used for other CRPs or technical contracts if there was a long term commitment from the IAEA/FAO to store SI data from food analysis.

Consultants' Meeting for the Development of New Applications of Machine Generated Food Irradiation Technologies, Vienna, Austria, 26–30 May 2014

Technical Officer: Yves Hénon

The Joint FAO/IAEA Division is developing a proposal for an international coordinated research project to facilitate the use of electron beam and X ray sources for food irradiation. From 26 to 30 May 2014, five consultants were invited to attend at the IAEA Headquarters to formulate this project which, if approved, would start in 2016.



X ray facility for food irradiation.

Getting the input from industry, including industrial electron beam and X ray machine manufacturers was deemed essential for the relevance and success of this initiative and the envisaged actions that will be undertaken under the project. On 27 and 28 May 2014, 24 representatives from 18 commercial companies in 12 countries came to Vienna to provide input and to debate three main topics: the desirable evolution of electron beam and X rays machines in the years to come, the issues that need to be addressed by research to use these machines to irradiate food and the opportunities for cooperation between the research and industry communities.

Several presentations provided an update on the current status of food irradiation in various regions. The vast majority of food is presently irradiated by gamma radiation but some new developments show that this could change in the not-too-distant future. For example, in China an electron beam facility is being installed at the main point of entry of fruits from Vietnam in order to ensure they are free of quarantine pests. While most manufacturers are working to refine and improve the performance and reliability of existing models, some of them are developing low energy machines (300 keV beam energy or below) that could be used to irradiate food products on conveyor systems, as an integral part of food processing at a factory or warehouse. These new technologies have already been adopted on a large scale by the packaging industry where electron beam irradiation replaces hydrogen peroxide to sanitize the package before it is aseptically filled.

Final Research Coordination Meeting of the Coordinated Research Project on the Development of Radiometric and Allied Analytical Methods to Strengthen National Residue Control Programs for Antibiotic and Anthelmintic Veterinary Drug Residues, Natal, Brazil, 14−18, April 2014

Technical Officer: James Sasanya

The meeting concluded a five-year project that involved food safety research institutions and laboratories from Austria, Belgium, Brazil, China Peoples' Republic, Germany, Kenya, Mongolia, Peru, Tunisia and Republic of Korea. Others were Sri Lanka, Thailand, The Netherlands, United Kingdom and United States of America.

Participants at the final technical meeting of the IAEA Coordinated Research Project "Development of Radiometric and Allied Analytical Methods to Strengthen National Residue Control Programs for Antibiotic and Anthelmintic Veterinary Drug Residues" in Natal, Brazil 14−18 April 2014. Photo courtesy of J.J. Sasanya.

The CRP has successfully initiated and enhanced communication and collaboration between the laboratories of different Member States, resulting in exchange of knowledge and analytical methods. The project has also provided an opportunity for participants to conduct joint experiments involving processing samples in teams and comparing the results. Analytical capabilities to develop and validate methods for monitoring contaminants have been strengthened. Some of the CRP findings have now been transferred to other laboratories through the IAEA's technical cooperation program. A manual composed of standard operating procedures developed during the CRP is being prepared and will be made available to other Member State laboratories to support their residue monitoring programs.

Consultants' Group Meeting on New Methods for the Detection and Quantification of Irradiation in Intercepted Insects, 10−14 March 2014, Vienna, Austria

Technical Officers: Carl M. Blackburn, Andrew G. Parker and Yves Hénon

A Consultants' Group Meeting was held in Vienna from 10 to 14 March 2014 to advise the IAEA on the current status of research and technology for the detection of irradiated insects, in view of the objections sometimes raised by countries to the possibility of live, mobile insects being present in agricultural commodities that have undergone phytosanitary irradiation. There is also the possibility of using such techniques to confirm the irradiation status of an unmarked insect caught in a monitoring trap in a pest free area in conjunction with an SIT programme.

Current techniques used in the detection of irradiated food were discussed and their applicability to confirming the irradiation status of insects. The techniques can be divided into three groups: biochemical/ microbiological techniques; chemical detection of radiolytic products; and free-radical detection.

Current technology lacks the necessary sensitivity to be used on individual insects but can be used to confirm irradiation of the commodity when the insect is still associated with the commodity. Recent advances in analytical and biochemical techniques could provide substantial gains in sensitivity, potentially getting to the levels needed to analyse individual insects, but research is needed to validate these new techniques and to develop practical tests that can be used in the field. Issues of specificity also need to be addressed, if a systems approach is not ultimately acceptable.

Technical Cooperation Projects

Country/Region	Project No.	Title	Technical Officer
Afghanistan	AFG5005	Studying Food Irradiation as a Solution to Food Security Issues	Blackburn, C.M. Byron, D.H.
Angola	ANG5009	Enhancing Veterinary Drug Laboratories for the Quality Control of Local Milk Production to Improve Public Health Checks	Sasanya, J.J. Cannavan, A.
Azerbaijan	AZB5001	Establishing a Spectrometry Laboratory at the State Metrology Service under the State Committee for Standardization, Metrology and Patents	Kis-Benedek, G. (NAEL) Blackburn, C.M.
Benin	BEN5008	Establishing Enhanced Analytical Capability to Comply with International Standards for the Evaluation and Control of Veterinary Drug Residues in Food of Animal Origin	Sasanya, J.J.
Benin	BEN5009	Monitoring Safe Food Supply through Total Diet Studies and the Application of Nuclear and Complementary Analytical Techniques	Hénon, Y. Blackburn, C.M. Sasanya, J.J. Pitois, A.R.R. (NAEL)
Bolivia	BOL1009	Introducing Radiation Processing Technology	Blackburn, C.M. Hénon, Y. Sabharwal, S. (NAPC)
Botswana	BOT5010	Enhancing Veterinary Drug Residue Monitoring Capabilities	Cannavan, A. Sasanya, J.J.
Belize	BZE5007	Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority	Corley, J. S. Viljoen, G. J. Maestroni, B.M.
Central African Republic	CAF5007	Enhancing Laboratory Capacity to Control Chemical and Bacteriological Hazards in Foodstuffs of Animal Origin	Sasanya, J.J.
Costa Rica	COS1007	Establishing Gamma Irradiation Capabilities at the Costa Rican Institute of Technology (ITCR) for the Use of Radiation Processing Technology	Hénon, Y. Blackburn, C.M.

Costa Rica	COS5029	Strengthening of Good Agricultural Practices (GAP) for Food Safety and Security and Environmental Protection	Maestroni, B.M. Nguyen, M.L. Dercon, G. Corley, J. S.
Costa Rica	COS5032	Enhancing the Capacity to Control Contaminants and Residues of Veterinary Medicines and Pesticides in Foodstuffs of Animal Origin Using Nuclear and Conventional Analytical Techniques	Sasanya, J.J.
China	CPR5021	Facilitating the Application of Electron Beam for Food Irradiation	Hénon, Y. Byron, D.H. Blackburn, C.M.
Ecuador	ECU5027	Improving Food Security and Environmental Sustainability by Monitoring Wetlands as Indicators of Good Agricultural Practice in Palm Oil Production	Maestroni, B.M. Corley, J. S.
Ecuador	ECU5028	Consolidating Food Security and Environmental Sustainability in Palm Oil Production Using Nuclear Applications	Cannavan, A. Maestroni, B.M. Nguyen, M.L. Heng, L.K.
Guatemala	GUA7004	Developing Capabilities to Evaluate the Transfer and Fate of Water Pollutants to Improve the Management of Major Basins and the Safety of Agricultural Products	Maestroni, B.M. Nguyen, M.L.
Indonesia	INS5040	Supporting the National Mycotoxins Reduction Programme and Enhancing the National Reference Laboratory of the Indonesian Research Centre for Veterinary Science (BBALITVET)	Sasanya, J.J. Cannavan, A.
The Former Yugoslav Republic of Macedonia	MAK5007	Assessing and Enabling the Implementation of Food Irradiation Technologies	Blackburn, C.M. Hénon, Y.
Malaysia	MAL5029	Applying Mutation Breeding and Optimized Soil, Nutrient and Water Management for Enhanced and Sustainable Rice Production	Nguyen, M.L. Nielen, S. Blackburn, C.M.
Mongolia	MON5019	Enhancing Analytical Equipment for Animal Disease Prevention, Diagnosis and Surveillance	Sasanya, J.J. Cannavan, A.
Morocco	MOR5033	Using Nuclear Techniques to Support the National Programme for the Generic Improvement of Annual and Perennial Plants and to Develop Agricultural Production	Hénon, Y. Sabharwal, S. (NAPC) Nguyen, M.L. Blackburn, C.M. Sarsu, F.

Morocco	MOR1008	Developing Application and Implementation of Quality Management Protocols for Multipurpose Gamma Irradiation Facility	Hénon, Y. Sabharwal, S. (NAPC) Blackburn, C.M.
Morocco	MOR5034	Improving Veterinary Drug Residue Detection and Animal Disease Diagnosis with Nuclear and Molecular Techniques	Naletoski, I. Sasanya, J.J.
Namibia	NAM5013	Assessing the Spatial Distribution of Lead, Cadmium and Selected Pesticide Residues in Livestock Farming	Corley, J.S. Cannavan, A. Sasanya, J.J.
Niger	NER5017	Improving Onion Quality and Storage Life by means of Gamma Irradiation	Hénon, Y. Blackburn, C.M.
Nigeria	NIR5037	Applying Nuclear and Related Techniques to Characterize Chemical Contaminants in Food for Risk Assessment and Management of Toxic Pollutants and Residues in Food, Feedstock and Water Resources through Training of Analytical Scientists	Sasanya, J.J. Maestroni, B.M.
Oman	OMA5003	Strengthening National Capabilities in Food Safety and Food Traceability	Corley, J.S. Maestroni, B.M.
Pakistan	PAK5048	Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs	Sasanya, J.J.
Panama	PAN5021	Enhancing Analytical Capability to Evaluate and Control Use of Veterinary Drugs through Residue Monitoring and Diagnostic Toxicology	Sasanya, J.J.
Panama	PAN5022	Determining Pesticides and Inorganic Pollutants in Vegetables and Studying the Adsorption and Migration Through Nuclear Technologies in Zones of High Pollution Incidents to Guarantee Safe Food for Consumers	Maestroni, B.M.
Paraguay	PAR5010	Strengthening the National Network of Laboratories Involved in Chemical Risk Analysis to Ensure Food Safety Through the Use of Nuclear and Complementary Non-Nuclear Techniques	Corley, J.S. Maestroni, B.M. Sasanya, J.J.
Qatar	QAT5004	Upgrading the Central Food Laboratory	Blackburn, C.M. Ceccatelli, A. (NAEL)
Africa	RAF5067	Establishing a Food Safety Network through the Application of Nuclear and Related Technologies	Sasanya, J.J. Cannavan, A.

Asia	RAS5057	Implementing Best Practices of Food Irradiation for Sanitary and Phytosanitary Purposes	Blackburn, C.M. Byron, D.H.
Asia	RAS5062	Building Technological Capacity for Food Traceability and Food Safety Control Systems through the Use of Nuclear Analytical Techniques	Frew, R. Cannavan, A. Maestroni, B.M. Jandrić, Z.
Asia	RAS5071	Strengthening Adaptive Climate Change Strategies for Food Security through the Use of Food Irradiation (RCA)	Hénon, Y. Blackburn, C.M.
Latin America	RLA 5061	Supporting Quality Management for the Assessment and Mitigation of Impacts of Contaminants on Agricultural Products and in the Environment (ARCALCXXIV)	Maestroni, B.M.
Latin America	RLA5065	Improving Agricultural Production Systems Through Resource Use Efficiency (ARCAL CXXXVI)	Maestroni, B.M. Nguyen, M.L. Sakadevan, K.
Latin America	RLA5066	Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food	Hénon, Y. Blackburn, C.M.
Latin America	RLA7019	Developing Indicators to Determine the Effect of Pesticides, Heavy Metals and Emerging Contaminants on Continental Aquatic Ecosystems Important to Agriculture and Agroindustry (ARCAL CXXXIX)	Maestroni, B.M. Vasileva-Veleva, E.T. (NAEL)
Latin America	RLA9072	Supporting a Database of Values of Radioactivity in Typical Latin American Food (ARCALCXXIX)	Blackburn, C.M.
Sri Lanka	SRL1008	Providing Technical Support for Smooth, Safe and Sustained Operation of the Multipurpose Gamma Irradiation Facility	Hénon, Y. Sabharwal, S. (NAPC) Blackburn, C.M.
Sri Lanka	SRL5043	Supporting the Operation of a Gamma Irradiation Facility for Preservation of Food, Sterilization of Medical Products and Quarantine of Fruits	Hénon, Y. Blackburn, C.M. Sabharwal, S. (NAPC)
Sudan	SUD5035	Establishing a Laboratory for Monitoring Veterinary Drug Residues and Prohibited Substances in Livestock and Livestock Products through Application of Nuclear and Related Techniques to Protect Public Health	Sasanya, J.J. Cannavan, A.
Uganda	UGA5034	Strengthening National Capacity for Testing and Monitoring of Drug Residues in Animal Feeds and Animal Products	Sasanya, J.J.

RAF5067 Coordination Meeting and Training on Enhancing the Use of Radio Receptor Assays and Related Techniques in Food Safety, Algiers, Algeria, 1−5 June 2014

Technical Officer: James Sasanya

The event was hosted by the Institut National de Recherche Agronomique en Algerie (INRAA) to discuss the work done in the past year and plan for upcoming activities. Training on and analysis of chemical and microbial hazards in locally consumed samples as well as cereals from the visiting countries were undertaken. Analyses were performed using a radio receptor assay and related chromatographic/spectrometric techniques. Local and non-local participants benefited from the event and discussed ways to strengthen the network of food safety labs including initiation of an African Food Safety Network (AFSan) to be hosted by INRAA for now.

Participants at the opening of the RAF5067 Coordination Meeting and food safety training held in Algiers, Algeria, 1−5 June 2014. The Director General Institut National de Recherche Agronomique en Algerie (INRAA), the NLO/AFRA Coordinator Algeria and a representative of the Minister of Agriculture, Algeria were present. Photo courtesy of J.J. Sasanya.

Contributing to the Food Safety in Uganda under the IAEA Technical Cooperation Project: UGA5034 "Strengthening National Capacity for Testing and Monitoring of Drug Residues in Animal Feeds and Animal Products"

Technical Officer: James Sasanya

The Technical Officer (TO) undertook a project inception mission under the TCP UGA5034 that is aiming at strengthening the capability of the nation's bureau of standards and her collaborators, to monitor chemical food contaminants such as veterinary drug residues and related hazards in foods. The TO presented talks and lectures on IAEA's activities and Member State support, monitoring chemical residues as well as analytical method development and validation. Meetings were also held with stakeholders from key institutions that could collaborate with the UNBS to establish a national residue monitoring program.

Staff of the Chemistry Laboratory at the UNBS following a meeting with the technical officer to discuss monitoring of chemical food contaminants in Uganda with IAEA's support. Photo courtesy of J.J. Sasanya.

Encouraging Stakeholder Partnerships to establish a National Chemical Residue Monitoring Program in Uganda

Technical Officer: James Sasanya

A stakeholders' meeting was also held during the Technical Officer (TO) mission under the TCP UGA5034 to explore mechanisms for sister institutions to develop a national residue monitoring program. These include the Uganda National Bureau of Standards (UNBS), Ministry of Trade, Industry and Cooperatives; The Ministry of Agriculture Animal Industry and Fisheries; National Drug Authority, Ministry of Health; The Dairy Development Authority all supported by the National Codex Committee.

Participants at a stakeholder meeting aimed at exploring mechanisms to establish a national chemical residue monitoring program supported by a centre of excellence in residue monitoring. Representatives from UNBS, NDA, DDA, MAAIF and Uganda's National Codex Committee, as well as the IAEA attended; 22 May 2014, Uganda National Bureau of Standards, Kampala. Photo courtesy of J.J. Sasanya.

The FAO country representative in Uganda – during a courtesy call by the TO – appreciated this collaborative spirit that he pledged to support in liaison with the Joint FAO/IAEA Division, for the good of food safety initiatives in Uganda.

Supporting the Establishment of a Food Safety Laboratory Network in Africa through Group Training of Analysts, Onderstepoort Veterinary Institute (OVI), Pretoria, South Africa, 7 April–2 May 2014

Technical Officer: James Sasanya

Training was recently provided for 10 food safety laboratory personnel from Egypt, Uganda, Tanzania, South Africa and Zimbabwe under the AFRA regional food safety project RAF5067. The training featured various chromatographic and spectrometric techniques including the application of stable isotopes and was tailored to the needs and backgrounds of the participants. Strategies and fundamentals of preparing for laboratory accreditation as well as effective participation in proficiency testing schemes were also addressed. The training has enhanced partnerships among the RAF5067 counterparts with leading institutions such as OVI of the Agricultural Research Council, South Africa.

RAF5067 participants at the Onderstepoort Veterinary Institute, Agricultural Research Council in South Africa, training on the routine operation of an HPLC tool for analysis of veterinary drug residues and related contaminants in foods; Training was held from 7 April–2 May 2014. Photo courtesy of L. Sibanda.

RLA5066: Increasing the Commercial Application of Food Irradiation, Texas A&M University, College Station, USA, 30 March–4 April 2014

Technical Officer: Carl Blackburn

One of the purposes of this meeting was to discuss partnership opportunities with Texas A&M University and in particular the USA National Centre for Electron Beam Research (NCEBR). Technical cooperation project RLA5066 aims to increase the commercial application of machine source food irradiation technology (electron beam and X ray irradiation) in addition to gamma irradiation in the Latin America and Caribbean region. Project participants also met and took part in a workshop to learn more about electron beam and X ray irradiation to bring this work to the attention of others and to improve the framework and work plan of the project.

At the food development laboratory; finding out more about the use of

electron beams to irradiated food, including food for astronaut menus.

Meetings with Suresh Pillai, the Director of the NCEBR, his colleagues and other personnel from Texas A&M University enabled a more detailed understanding of the capabilities and cooperation opportunities with the University. Furthermore, meetings were also held with electron beam and X ray irradiation technology providers, entrepreneurs from the region, food companies and regulators with interests in the trade of irradiated food. The university facilitated these meetings and a NCEBR workshop was also held and included participants from project RLA5066. All those that we met were encouraged to become involved and assist in this technical cooperation project.

Project RLA5066 aims to harmonize national approaches and strategies related to the commercialization of food irradiation and to be successful it needs to include representatives from industry including those who produce equipment used to generate electron beams and X rays. There remain many reasons for increasing the amounts of food irradiated and these including minimizing food losses and waste, ensuring food quality and safety and combating insect pests that are a hazard to plant health. The latter use of irradiation is rapidly increasing with more exporters using irradiation as a phytosanitary (quarantine) treatment to enable the trade of fresh produce with minimal risk that this trade will introduce invasive insect species to food production areas.

The project will also address the establishment of an agreed regional program to enhance the utilization of irradiation processing, share and build on the experiences gained in countries that have already embraced food irradiation and agree on regional guidelines for trade in irradiated foods. A key element of the project is for participating regional Member Countries to develop additional know-how in terms of electron beam and X ray irradiation technologies and one of the measures of a successful outcome will be their countries' future investment in irradiation facilities that use machine sources to generate ionizing radiation.

An exercise to dose map fresh fruits to ensure that electron beam treatments are of the correct intensity.

At present food irradiation relies mainly on radionuclide sources (cobalt-60) which are becoming increasingly difficult to transport and supply. Recently a producer of cobalt-60 ceased to trade and although there are other commercial producers, there remains a finite capacity to supply this radionuclide. The long-term strategy of the project is therefore to facilitate and enable the up-take of additional (electrically generated electron beam and X ray) approaches that can also be used to irradiate food in the region.

Viewing the irradiation chamber as part of a tour of the electron beam facility.

The project scope, logical framework and work plans at a regional and national level were revised and improved and the baseline from which to assess project progress during implementation and completion was discussed. Many meetings and presentations provided a better understanding of the electron beam and X ray irradiation technologies currently available and enabled the roles and responsibilities that each partner would play in the implementation of the project to be clarified.

Food irradiation, Skopje, the Former Yugoslav Republic of Macedonia, 24–26 March 2014

Technical Officer: Yves Hénon

Food irradiation is a new topic in the Former Yugoslav Republic of Macedonia (FYR Macedonia), a country that is preparing itself to be part of the European Union in the not-too-distant future. In 2013, the IAEA supported scientific visits by Macedonians to European laboratories specialized in the detection of irradiated food.

The Faculty of Electrical Engineering and Information Technologies of the Ss. Cyril and Methodus University in Skopje, Former Yugoslav Republic of Macedonia, organized a National Workshop on Food Irradiation on 25 March 2014. A third of the attendants came from the food industry.

The National Workshop on Food Irradiation attracted media attention.

The Dean of the Faculty, Prof. Mile Stankovski introduced the Workshop and Prof. H. Spasovska presented the IAEA project. Mr Yves Hénon, the IAEA expert, provided and presented information about different irradiation technologies and their many applications, with an emphasis on food. A representative of the Food and Veterinary Agency presented information on the Food Irradiation Regulations in Macedonia. The national regulation adopted in 2007 and following the European Union Directives had to be amended to take into account recent modifications of the national Food Law.

Prof. M. Girovsla gave a presentation on methods used to detect irradiated food. With the assistance of the Joint FAO/IAEA Division and the IAEA Department of Technical Cooperation, the Faculty will soon be equipped with both a Photo Stimulated Luminescence reader and a Thermo Luminescence reader. Accreditation to ISO 17025 will be sought.

First Coordination Meeting of TC Project RLA7019, San José, Costa Rica, 24–28 February 2014

Technical Officer: Britt Maestroni

The first Coordination Meeting of the ARCAL project RLA/7/019, "Developing Indicators to Determine the Effect of Pesticides, Heavy Metals and Emerging Contaminants on Continental Aquatic Ecosystems Important to Agriculture and Agroindustry" was held in San José, Costa Rica, 24–28 February 2014. Ms Britt Maestroni participated in the meeting as the Project Technical Officer, and was accompanied by the IAEA Programme Management Officer.

Under the ARCAL project RLA/5/061, "Supporting Quality Management for the Assessment and Mitigation of Impacts of Contaminants on Agricultural Products and in the Environment", a regional network of laboratories was established to monitor residues of pesticides in water, soil and air. The concentrations of pesticide residues found can indicate whether the agriculture practices being applied are compliant with Good Agricultural Practice (GAP) and the feedback can help in the implementation of measures to prevent contamination at source. The new project, RLA/7/019, is building on the previous project and includes the participation of 11 laboratories from Latin American countries.

The first Coordination Meeting brought together laboratory representatives from Argentina, Brazil, Chile, Costa Rica, Cuba, Ecuador, Guatemala, Mexico, Nicaragua, Panama and Uruguay. The project coordinators gave short presentations highlighting their existing laboratory infrastructure (both human and technical) and the proposed national project work plan. The participants worked in plenary and in small groups on different aspects of the project, verifying the existing capacity within each institution and identifying all the project activities which need to be put into place in order to achieve the project objectives. The original project work plan was analysed in detail and all necessary project activities and inputs were identified. The IAEA officers gave presentations covering the criteria for participation in project activities, the role of the RALACA network, and gave support for the preparation of the overall project work plan.

Participants in the RLA/7/019 Coordination Meeting.

The meeting participants participated in the preparation of a regional work plan and contributed to the project in the areas where they are able to have the greatest impact, thus focusing resources to maximize project results. The importance of outreach as an additional activity for the analytical laboratory was also discussed and a specific group of communicators was identified to help produce the expected outputs in this area. For example, feedback to stakeholders on estimates of environmental risk due to pesticide use should result in changes of management practices and therefore add value to the food production chain for several participating countries.

Training Course on the Analysis of Stable Isotope and Trace Element Composition of Food Materials, Philippines, 3–14 February 2014

Technical Officer: Russell Frew

The capability to certify food origin or authenticity is of significant economic importance to many stakeholders in developing countries. For example, some food products can be marketed using labels (e.g. GI, Geographic Indication) that are based on standards of identity or composition related to a very specific production area. This adds value to such products in terms of marketability and increased export value. Basmati rice from India and Pakistan, for example, is defined by its cultivar and also by its area of production. Genomic techniques can easily confirm the cultivar of Basmati rice, while isotopic and elemental fingerprinting is essential to determine the geographical origin. Isotopic parameters have recently been added to the PDO (Protected Denomination of Origin) technical specification of certain kinds of cheese and other food commodities are undergoing similar characterization.

The IAEA project (RAS/5/062) on "Building Technological Capability for Food Traceability and Food Safety Control Systems Through the Use of Nuclear Analytical Techniques" further strengthens the National Project Teams of each participating Member State to respond to the needs of the industries in the region to enhance food safety through improved traceability systems. Activities and work plans are designed to advance the capability of the region in utilizing nuclear techniques in systems for verifying the origin of food products.

A core component to the project is training in the analysis of the stable isotope and trace element composition of food materials. A training course was held from 3 to 14 February 2014 in cooperation with the Government of the Philippines through the Philippine Nuclear Research Institute (PNRI). The meeting was attended by 26 participants from Member States as well as several participants from the host country. Participating countries were Bangladesh, Cambodia, China, Indonesia, Iraq, Kuwait, Jordan, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Syrian Arab Republic, T.T.U.T.J of T. Palestinian A, Thailand, Vietnam and Yemen.

Dr Alumanda dela Rosa, Director of PNRI delivered the inaugural speech and emphasized the importance of regional cooperation under the RCA in enhancing capacities of the member states for the effective application of food safety and traceability.

The objectives for the training were to:

- Promote the use of nuclear and complimentary techniques for food authentication through education and the provision of education resources.
- Provide training in analytical techniques (stable isotopes and trace elements) as applied to food analysis.
- Provide training in data handling and interpretation.
- Increase confidence in maintaining and troubleshooting instruments.
- Review, develop and refine individual work plans.
- Promote networking.

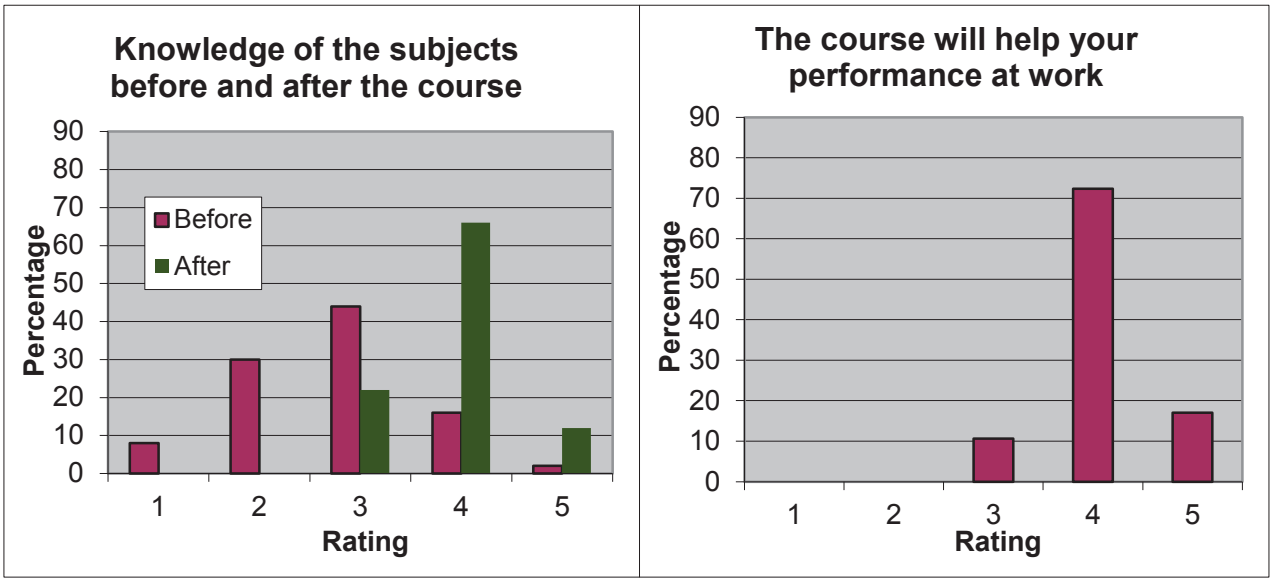
The trainees were from a variety of backgrounds. Only eight were stable isotope analysts and the remainder worked mainly with trace metal analyses. The course was organized to concentrate on the stable isotope techniques in the first week under the tutelage of Dr Simon Kelly (University of East Anglia, UK).

The course in the second week covered trace metal analyses and inductively coupled plasma mass spectrometry. The trace metal components were taught be Prof. Stewart Walker (Flinders, Australia) and Dr Carlos David (University of Philippines).

Trainees were asked to assess the course. The important results of the assessment are:

1) Trainees considered that their knowledge of the subject covered in the course had improved significantly by the end of the course.

2) The trainees expected the training would have a significant and immediate impact on their performance in the workplace.



Final Coordination Meeting of TCP RLA/5/060, Pachuca, Mexico, 7–10 December 2013

Technical Officer: Britt Maestroni

Regional project coordinators from 11 countries in Latin America and the Caribbean convened to discuss the results of TCP RLA/5/060 in Pachuca, Mexico, from 7 to 10 December 2013. The overall objectives of the project were to help ensure food safety, to promote good agricultural and production practices and to enhance food exports through the establishment and harmonization of analytical systems for food monitoring in participating countries. This, and related projects in the area, have produced a large number of significant outputs, as summarized below.

In the course of the one and a half year implementation time, four laboratories involved in the project have established accredited methods for pesticide residues in food/environmental samples, five laboratories have accredited methods for heavy metals in food/environmental samples, one laboratory has accredited methods for mycotoxins in food, nine laboratories are currently working towards accreditation and four laboratories have just launched quality systems under ISO17025. Seventeen analytical methods, including methods for pesticides, heavy metals and mycotoxins were adapted, 24 methods were validated, and 37 analytical methods were revalidated in the laboratories. One hundred and fifteen staff were trained in different aspects of quality systems, quality assurance/quality control measures, and ISO17025 requirements.

Several “centres of excellence for food control” have been created in the region thanks to this and related ARCAL projects: six for pesticide residue analysis, six for heavy metals control, one for veterinary drug residue control and one for mycotoxins control. Nineteen proficiency testing rounds were successfully implemented. More than 1000 new standard operating procedures were written in the laboratories, and more than 20 quality audits were performed in the network of laboratories.

The project resulted in the strengthening of the laboratory network, with the participation of all laboratories in the Red Analitica de Latino America y el Caribe (RALACA) network (http://red-ralaca.net), which was established with assistance from the FAO/IAEA Food and Environmental Protection Laboratory. The sustainability of the project is ensured by the RALACA working committees that are currently developing work plans for the next biennium.

Participants in the RLA/5/060 Coordination Meeting.

Food and Environmental Protection Laboratory, Seibersdorf

Discrimination of honey of different floral origins by a combination of various chemical parameters

Technical Officer: Zora Jandrić

In the previous newsletter, we reported on research into methodology for the classification of honey of various floral and geographical origins using UPLC-QToF MS and MVA.

The research on honey authenticity was expanded using multivariate data analysis of data generated by a number of different analytical techniques to discriminate honeys of different floral origins.

The feasibility of a multivariate approach, including various chemical parameters and multivariate data analysis, for the discrimination of various honeys originating from one region, was explored.

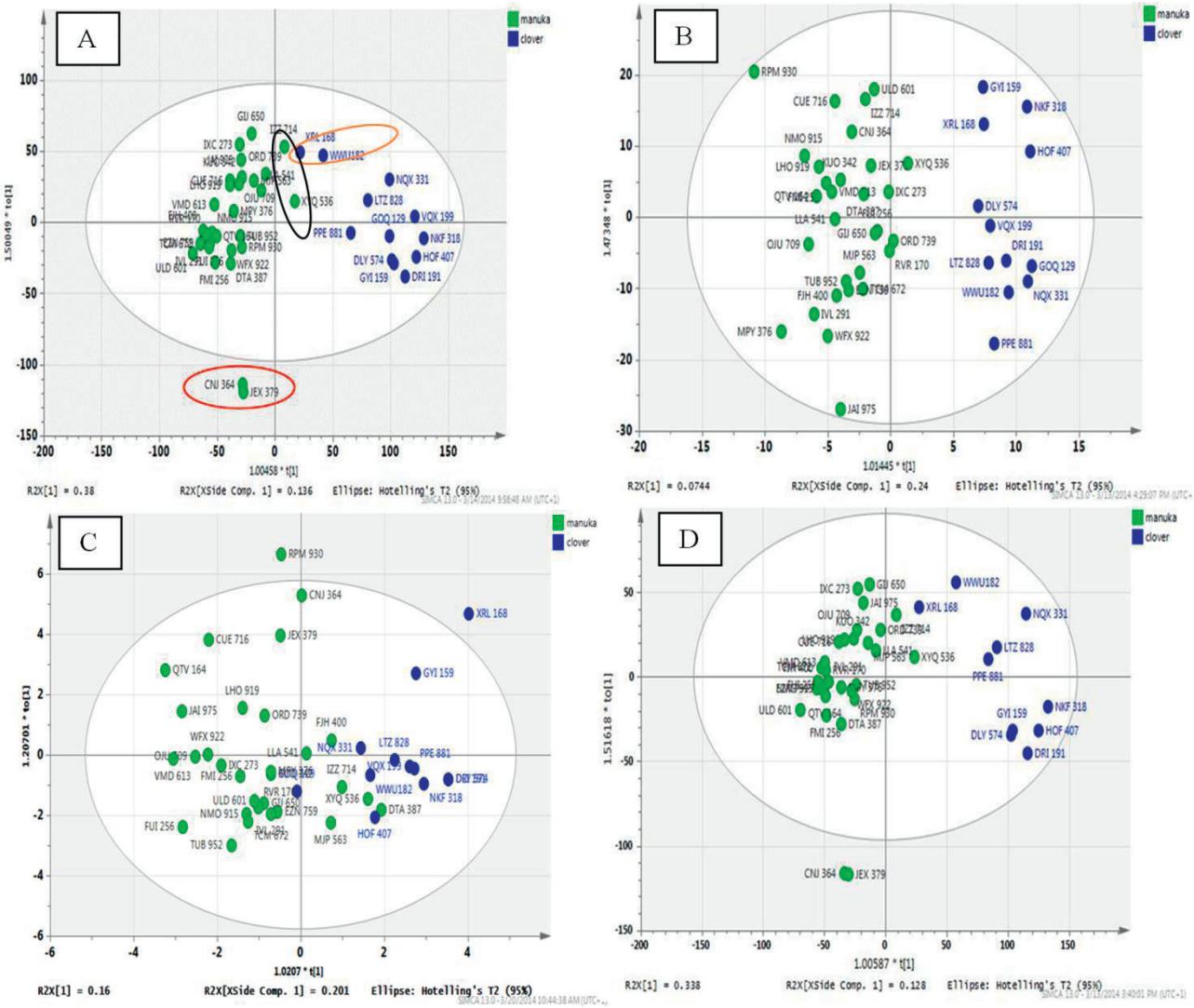


Figure 1. Discrimination of honeys of different floral origins (see text for explanation).

The chemical analyses used were elemental profiling, stable isotope analysis, metabolomics (UPLC-QToF MS), NIR, FT-IR, and Raman spectroscopy fingerprinting. Partial least squares discriminant analysis (PLS-DA) was used to determine which technique or combination of techniques provides the best classification and prediction ability.

Authentic honey samples with different floral origins (clover vs. manuka, >50%) were used to test this approach. Various chemical parameters (metabolites, stable isotope ratios of carbon ($\delta^{13}C$) and hydrogen ($\delta^{2}H$), concentrations of major, minor and trace elements, and spectroscopic data) were used to investigate possible clustering between honeys.

Variability in the metabolite fingerprint was the single best discriminator (classification success rate 77%) (*Fig. 1A*). Higher contents of secondary pollen had an effect on sample clustering (red circles, ~26% rewarewa; orange circles, ~30 % manuka; and black circles, ~30% clover). Segregation between the two sample groups was also obtained using the combined spectroscopic data (*Fig. 1B)* and combined trace elements/isotope ratio data (*Fig. 1C)* but with lower classification success of 44% and 36%, respectively.

The combination of all chemical parameters analysed did not significantly improve classification success (78%) (*Fig. 1D*).

The results demonstrate the potential of multivariate analysis for the differentiation and classification of honeys traded between countries. This approach could provide a potential tool to help Member States to protect their own authentic honey products and to detect adulterated or counterfeit/mislabelled honey products on the market.

The results of this research were presented as a poster at the second Food Integrity and Traceability Conference in Belfast, UK, 8−10 April 2014.

Stable Isotopes Applied to Authenticating Honey

Technical Officers: Russell Frew and Aiman Abrahim

One of the earliest applications of nuclear techniques for food authenticity was the use of carbon isotopes to detect the addition of cheap sugars in honey in the 1970s. The principle is that the cheap sugar (fructose) is derived from corn and has a higher $^{13}C/^{12}C$ that the fructose from honey. This difference is due to the different photosynthetic pathways; corn is a C4 plant and that mechanism does not discriminate against the ^{13}C as much as the C3 pathway used by most honey-producing plants. Consequently the two plant types have quite different carbon isotope ratios (see figure). Thus measurements of the carbon isotope ratios can distinguish between the two sources of fructose. However, within each plant population there is natural variability in isotope ratios. This makes detecting the addition of small amounts of corn syrup difficult. The test was further refined by its developers to use $^{13}C/^{12}C$ measurements on protein purified from the honey as an internal reference, based on the fact that if the sugar and protein are from the same plant then they should be closely related in isotopic ratio. This refined method was adopted by the Association of Analytical Chemists as an official method (AOAC 998.12) and is part of the Codex Alimentarius standard for testing authenticity of honey. This test is generally reliable. However, some honey, notably New Zealand manuka, has a frequent fail rate. Manuka is a premium honey valued for its non-peroxide antimicrobial activity (NPA).The NPA is thought to be due to high levels of methyl glyoxal (MGO) and it is the manuka honey with high levels of MGO that fail the C4 sugar adulteration test. Work by FEPL indicates that this is partly due to the beekeeping practice of feeding sugar to bees during the winter. However, that does not explain the late season failures, or that the extent of failure increases as manuka honey ages. The MGO levels in manuka increase with age and it has been shown that high MGO is correlated with high apparent C4 sugar content.

Current research in this field in FEPL is focused on modifying the AOAC method to overcome these false positives in the C4 sugar adulteration. A method has been developed for the removal of MGO prior to the purification of the protein that is measured as internal standard. It is hoped that the removal of the MGO will eliminate the interference in the isotope test. Tests are now underway to establish the optimum conditions for the removal of MGO and to show that the additional procedure does not affect the isotopic composition of the purified protein. Once those tasks are completed the work will move to the validation stage and involve other laboratories to test the procedure.

A consequence of MGO being responsible for the NPA that gives manuka honey its high value is that it provides motivation for unscrupulous operators to attempt to gain higher prices by doping honey with MGO. Work being conducted in parallel with the modification to the C4 sugar test aims to apply stable isotope measurements to see if different sources of MGO may be distinguished, hence providing a test for adulteration with MGO. So far, methods have been established for quantifying MGO in honey by GC and HPLC. We are awaiting the availability of GC-rIRMS facilities in FEPL to complete this work.

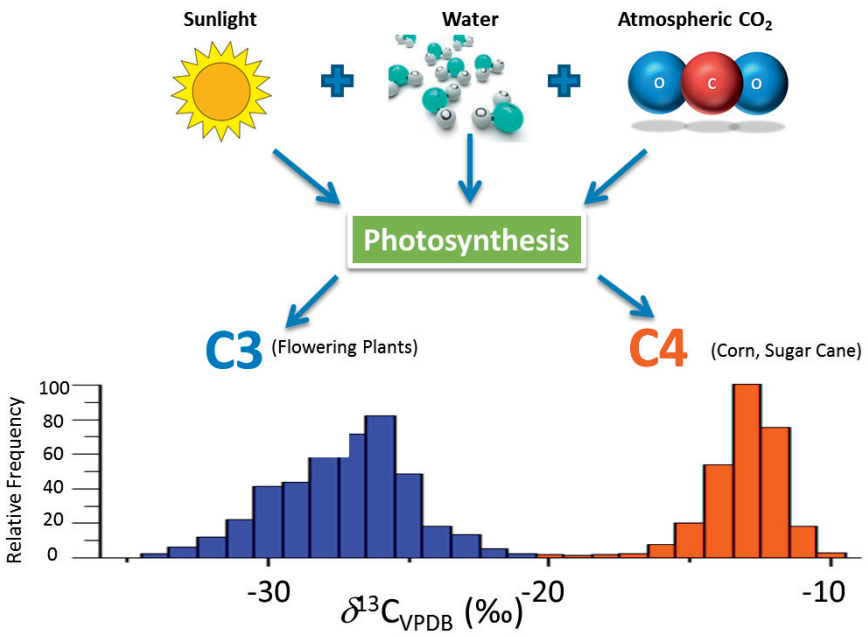


Figure showing the distribution of 13C/12C (expressed as δ13C values) for C3 and C4 plants. The more complex biochemical reactions involved in the C3 pathway results in greater discrimination against the 13C hence the more negative values for the 13C/12C when expressed as δ-values.

The use of analyte protectants in pesticide residue analytical work

Technical Officers: Britt Maestroni and Victoria Ochoa

A common challenge in gas chromatography (GC) is the quantification of certain important pesticides in cases where there are apparent analyte losses and/or peak tailing. For susceptible analytes, significant peak quality improvements can be obtained when matrix components are present because they fill active binding sites in the GC system, thus reducing analyte interactions with those binding sites. This phenomenon is called "matrix-induced chromatographic response enhancement' and has been a subject of many studies in the last decade.

The FEPL is currently carrying out a study on method validation for the detection of several pesticides in potato samples. The extraction and clean-up method used is known as the Quick, Easy, Cheap, Effective Rugged and Safe (QuEchERS) for pesticide residue determination, and uses a gas chromatograph coupled to a mass selective detector (GC-MSD) for analyte separation and detection. According to the SANCO document (SANCO/12571/2013), matrix effects should be assessed at the initial method validation stage. Therefore as part of the calibration strategies for our method both matrix-matched and solvent calibrators were prepared. It was noticed that in the case of potato samples matrix effects were present for several pesticides, as shown in Figure 1.

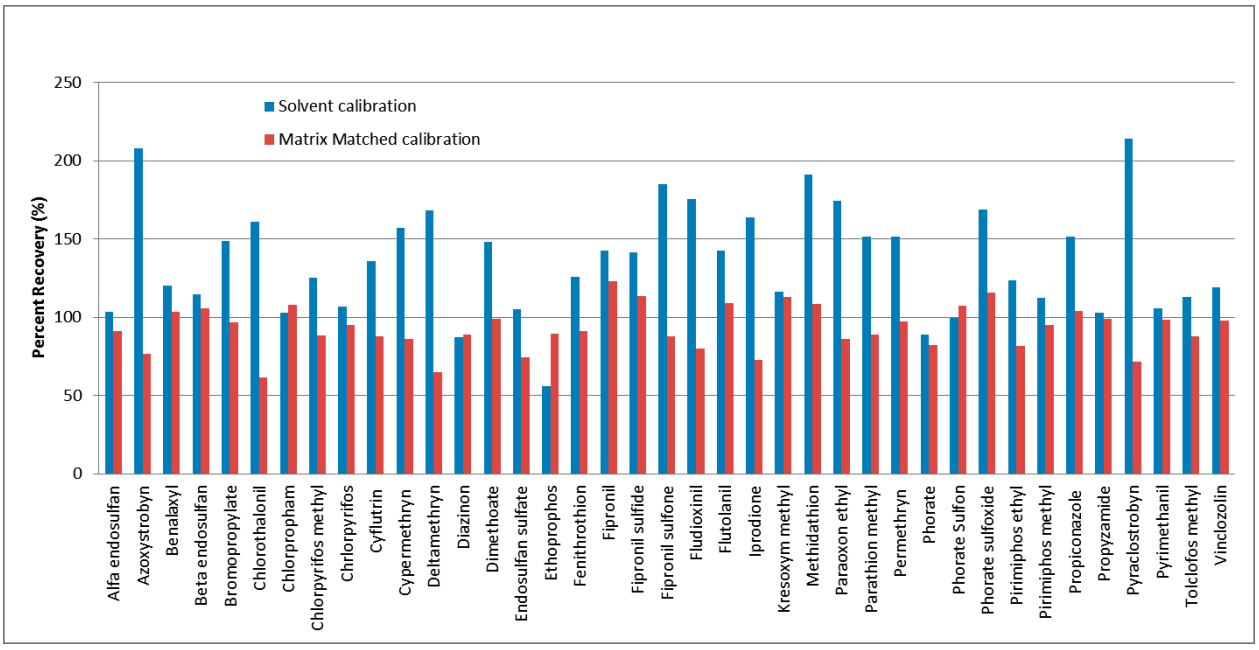


Figure 1: Matrix effects in potato samples.

Since the effective elimination of the sources of the matrix-induced response enhancement is usually not feasible in practice, some means of compensating for the effect is necessary. The current compensation approaches include the use of matrix-matched standards and standard addition methods. These techniques require extra labour and costs; moreover, they may still lead to quantitation inaccuracies because the extent of the effect depends on analyte concentration and matrix composition. Another way to compensate for the matrix effect problem is the use of analyte protectants (AP). Analyte protectants prevent/minimize pesticide interactions with the active sites in the GC system and protect pesticides from degradative interactions.

The matrix-matched calibration involved the preparation of calibration standards in blank extracts in an attempt to provide the same amount of matrix-induced enhancement as in the sample extracts. This procedure works reasonably well. However it does have some disadvantages: the availability of "blank" matrix in a reasonable amount, extra time, labour, and expense for preparing the blank extracts for calibration standards; a greater amount of matrix material injected onto the column which leads to greater GC maintenance; and greater potential for analyte degradation in the matrix solution. In addition, while matrix matched calibration is easy for validation studies, it is difficult to implement in routine testing since there may be differences in the matrix between individual samples, or various different matrices may be included in an analytical sequence.

According to the literature, the best AP coverage along the whole run time was given by a combination of ethylglycol, gulonlactone, and sorbitol. In our experiments we adopted the same composition, and to avoid the use of water, we prepared the AP mixture in ethylacetate: DMSO (80:20). One set of samples was spiked at 0.01 mg/kg and we assessed the validity of using APs at a concentration of 0.48 mg/mL (gulonlactone and sorbitol) and 4.8 mg/mL (ethylglycol). Different calibration strategies were employed: calibration in solvent, calibration in solvent with APs added, matrix matched calibration and matrix matched calibration with APs. All calibration curves had correlation coefficients higher than 0.999. The samples were also injected with and without analyte protectants. The results obtained for some of the pesticides can be found in Figures 2 and 3.

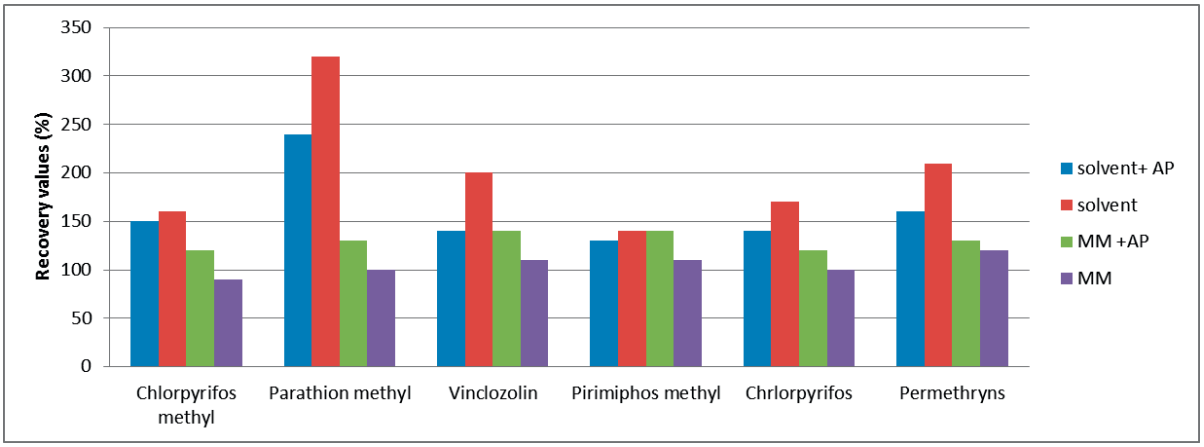


Figure 2: Recovery values of pesticides from potato samples spiked at 0.01 mg/kg and injected with Analyte Protectants (AP), calibrated using matrix matched (MM), matrix matched with AP, solvent, and solvent with AP.

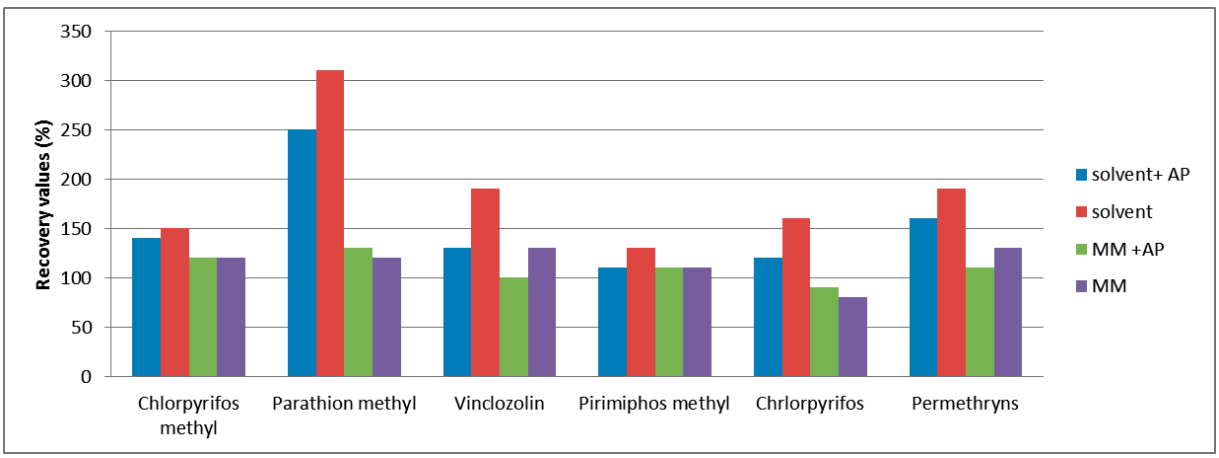


Figure 3: Recovery values of pesticides from potato samples spiked at 0.01 mg/kg and injected without AP, calibrated using matrix matched (MM), matrix matched with AP, solvent, and solvent with AP.

As can be seen from Figure 2, the quantification of residues using calibrators prepared in solvent is not recommended for chlorpyrifos methyl, parathion methyl, vinclozolin, pirimiphos methyl, chlorpyrifos and the permethryns. In our experiments, and for the selected compounds shown in the figures, the addition of analyte protectants to solvent calibrators did not improve the results; high recovery values were obtained. The best calibration was observed using matrix matched strategies either with or without APs. This is also the case for chlorpyrifos which, in previous experiments, did not show any matrix effects. When the samples were injected without the addition of AP acceptable recoveries for all of the compounds discussed above were obtained by matrix matched calibration.

Practical aspects of using analyte protectants should also be mentioned. In our experience the injector port and the source became "dirty" very quickly, after only 18−20 injections (see photo 1) in contrast to reports in the literature of at least 1000 injections without the need for ion source cleaning.

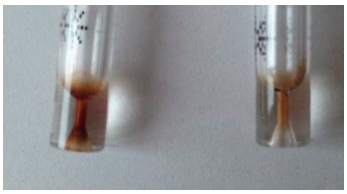


Photo 1: Liners became dirty very quickly in the injection port.

However, it is recognized that this is the first experience of the use of analyte protectants in FEPL and further studies are needed to provide better information on their usefulness and applicability. For example, the use of DMSO as dissolution agent for the APs needs to be thoroughly evaluated, as well as the effect of AP concentration on our chromatographic system. Further experiments are needed to better assess the applicability of analyte protectants in the routine analysis of fresh fruits and vegetables for pesticide residue analysis.

FEP Laboratory Staff

During the first half of 2014, FEPL said goodbye to one intern and hello to another.

In January, Ms Laura Natalia Fernandez Cedi completed a 4-month period as an intern in the laboratory, having accepted a position as a consultant in UNIDO. During her time in FEPL, Natalia worked with staff in a number of areas, principally on methodology for the authentication of foods using metabolomics. She also provided support in activities related to the RALACA laboratory network and the set-up of its web site. We wish Natalia all the best in her new position.

In April, we welcomed Ms Victoria Ochoa, who commenced an internship in the laboratory. Victoria is currently working with FEPL colleagues on the development and validation of a multi-residue method for pesticide residues in potato, and also using her native Spanish language skills in the translation and preparation of technical documents.

Announcement

International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, IAEA Headquarters, Vienna, Austria, 10–13 November 2014

Technical Officer: Andrew Cannavan

The International Symposium will take place at the IAEA Headquarters in Vienna, Austria from 10 to 13 November 2014. The formal announcement, call for papers, participation form, grant application form and more detailed information on the symposium are now available at the following dedicated web-link, which will be updated regularly:

http://www-pub.iaea.org/iaeameetings/46092/Food-Safety-and-Quality

The symposium will include a wide range of topics involving nuclear techniques in food and agriculture; not only food irradiation but also analytical technologies for food authentication, traceability and contaminant control. Related issues such as climate change, emerging opportunities and threats to the integrity of the food supply and potential control techniques will be covered, as will issues such as chemometrics and guidelines for consumer protection and international trade.

The symposium will:

- Bring together experts in the field to present contemporary and novel applications, identify gaps and discuss future perspectives and opportunities;
- Provide a forum for interdisciplinary networking between professionals from different backgrounds, including industry, national institutes, academia, and public and private bodies;
- Facilitate a broad understanding of the topics involved; and
- Promote peaceful applications of nuclear technologies.

The organizers send a warm invitation to scientists, laboratory analysts, policymakers, regulators, food producers and others concerned with food safety and quality as well as with the integrity of the food supply chain, who are all welcomed to participate in the symposium.

Facilities will be available for commercial vendors' displays/exhibits during the symposium and interested parties should register their interest by sending an email to the following:

- FEP-Symposium-2014.Contact-Point@iaea.org

Publications in 2014

S. Pillai, C. Bogran (Texas A&M University, USA) and C. Blackburn (IAEA, Austria), Ionizing irradiation for phytosanitary applications and fresh produce safety; Pages 221-232 in Global Safety of Fresh Produce. A Handbook of Best Practice, Innovative Commercial Solutions and Case Studies, Jeffrey Hoorfar (Ed) , ISBN: 978-1-78242-018-7, Woodhead Publishing 2014.

Jandrić, Z., Frew, R., McComb, K., Haughey, S, Elliott, C and Cannavan A. (2014). Discrimination of honey of different floral origins by a combination of various chemical parameters. Book of abstracts of the 2nd Food Integrity & Traceability Conference, Belfast, UK, 8−10 April 2014, 57.

J.J. Sasanya; A. Cannavan; C. M. Blackburn (2014). Activities of the Joint FAO/IAEA Division of Nuclear Techniques In Food And Agriculture (CX/CF 14/8/4). Eighth Session of the Codex Committee on Contaminants in Foods, The Hague, Netherlands, 31 March–4 April 2014.

J. Corley; J.J. Sasanya; A. Cannavan (2014). Activities of the Joint FAO/IAEA Division of Nuclear Techniques In Food And Agriculture (CX/PR 14/45/4). Forty Sixth Session of the Codex Committee on Pesticide Residues, Nanjing, China, 5−9 May 2014.

Impressum

Food and Environmental Protection Newsletter Vol. 17, No. 2, July 2014

The FEP Newsletter is prepared by the Food and Environmental Protection Section,
Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and
FAO/IAEA Agriculture & Biotechnology Laboratory, Seibersdorf.

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, July 2014

14-26131