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Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf

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To the Reader

The Food and Environmental Protection Subprogramme continues to strengthen its joint efforts with the FAO and IAEA to protect human health and improve food safety by providing research, technical support and training, including technical support leading to the development and application of international standards that facilitate agricultural trade. These activities are primarily related to the implementation of traceability systems and analytical techniques to control food contaminants, the application of ionizing radiation to control food bacteria and harmful insect pests, and the preparedness and management of nuclear and radiological emergencies affecting food and agriculture.

It is very rewarding to be able to report that the Subprogramme is planning to hold an International Symposium on 'Food Safety and Quality: Applications of Nuclear and Related Techniques' in Vienna, Austria from 10–14 November 2014. The Forthcoming Events section provides more information on our plans for the Symposium, which will encompass food irradiation techniques to treat food directly as well as nuclear and related technologies for tracing food products in order to verify their provenance, or to detect and control contaminants and provide information for the continuous improvement of production systems.

In food traceability and authenticity work, the Food and Environmental Protection Laboratory is using its expertise in measuring trace quantities of chemicals in foods to develop a 'metabolomics' approach for assessing authenticity. Chromatographic techniques are being used in conjunction with mass spectroscopy as a means of

IAEA International Atomic Energy Agency

detecting and identifying characteristic markers for pure orange juice as part of laboratory research activities under an international project to implement nuclear techniques to improve food traceability. Research is focusing on orange juice diluted with other, less expensive, fruit juices.

The Food and Environmental Protection Laboratory is also applying stable isotope techniques as an advanced tool to probe and verify the origin and authenticity of foodstuffs. Analytical protocols for stable isotope techniques are being developed and refined with particular emphasis on practical issues, such as the adulteration of honey. Important technical work in support of these stable isotope approaches also includes ensuring that appropriate standard reference materials are available for analytical laboratories worldwide. The laboratory is working with other IAEA laboratories and collaborating institutes to develop certified reference materials for future use in food traceability and authenticity. Research has identified several candidate materials and work is continuing to verify that they meet the necessary stringent criteria.

In the area of food contamination, our extra-budgetary funding, obtained under the US Peaceful Uses Initiative (PUI), is helping to facilitate our train-the-trainer activities related to the establishment of food control systems that lead to enhanced food safety and quality. An example is the workshop hosted at the Food and Environmental Protection Laboratory in Seibersdorf, Austria, from 25 February–8 March, which involved analysts from 15 different member states. A comprehensive set of lectures and practical laboratory sessions were used to present and discuss a range of nuclear related technologies for the integrated control of contaminants in food, with special emphasis on pesticides. A full report on this can be found in the Food and Environmental Protection Laboratory section of this newsletter. The Past Events section of the Newsletter also provides further reports on workshops and training initiatives related to capacity building projects. These are funded through the IAEA Technical Cooperation programme and are enabling the Food and Environmental Protection Subprogramme to address requests for support from many different Member States. An example of activities in this area includes a recent workshop in Faisalabad, Pakistan, that focused on chemical residue monitoring as part of a national project on strengthening capabilities to monitor and control veterinary drug residues in food.

As indicated in the Past Events section, a Regional Asian Technical Cooperation Project Workshop on Best Practice for Food Safety and Quality and Sanitary Applications of Food Irradiation was convened in Shanghai, China from 6–10 May 2013. The initial part of the meeting was held jointly with a national meeting on food irradiation at the Shanghai Academy of Agricultural Sciences and was attended by more than eighty participants from 19 different countries. Among other outputs, the workshop reviewed and finalized a 'Best Practice Manual' of food irradiation for the purposes of ensuring food quality and destroying organisms that could cause food illness. Examples of educational and training materials were provided by participants and a scope and description of a training module was developed in preparation for the next phase of Project RAS5057.

In relation to work concerning the nuclear emergency in Japan and in follow-up to discussions at the Seventh Session of the Codex Committee on Contaminants in Foods (April 2013); the IAEA, and particularly the Joint FAO/IAEA Division, has remained fully involved in the review and potential revision of the Joint FAO/WHO Codex Alimentarius Guideline Levels for Radionuclides in Foods. Recent activities include participation at the 36th Session of the Joint FAO/WHO Codex Alimentarius Commission (July 2013), and at meetings of the Inter-Agency Committee on Radiation Safety and at the IAEA Radiation Safety Standards Committee. These activities have been part of the Joint FAO/IAEA Division's key role in preparing for and responding to nuclear and radiological emergencies affecting food and agriculture and in support of FAO, as a full member and co-sponsor of the Joint Radiation Emergency Management Plan of the International Organizations (EPR JPLAN 2010).

Subprogramme activities have included working in cooperation with other IAEA departments, World Health Organization (WHO) and other international organizations in the dissemination and interpretation of international standards, the collation and analysis of monitoring data (so that they may be included as necessary to up-date the FAO/IAEA database[1]), participation in the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Assessment of Exposure and Dose Assessment for the Public and Environment, and the implementation of activities related to the IAEA Action Plan on Nuclear Safety.

As of 30 May 2013, more than 460,000 samples have been reported by the authorities in Japan for over 500 types of foodstuffs. Results indicate that less than 1% of samples reported per month in 2013 are exceeding the Japanese standard limits for radioactive caesium in foods.

In closing, we all extend our warmest welcome to our new staff members, Ms Barbara Anna Massinger and Ms Kyoko Viitaniemi. Ms Massinger recently joined the Food and Environmental Protection Laboratory in Seibersdorf and Ms Viitaniemi has joined the Section as a Team Assistant at IAEA Headquarters.

Best wishes to you and your families for a safe, healthy and happy holiday this summer season.

Carl M. Blackburn
Acting Section Head

1 Approximately 126,000 records of radionuclide concentrations in over 500 types of foodstuffs, collected from 1076 locations in all 47 prefectures of Japan, have been compiled into this database. It has been used by UNSCEAR Expert Groups in their assessment of levels and effects of radiation exposure due to the nuclear accident after the 2011 great east Japan earthquake and tsunami. (http://www.unscear.org/unscear/en/fukushima.html)

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Feature Article

IAEA Collaborating Centre for Radiation Processing for Environmental Remediation, Advanced Materials and Food Irradiation, Korea Atomic Energy Research Institute (KAERI), Advanced Radiation Technology Institute (ARTI)

Technical Officer: Carl Blackburn

The Advanced Radiation Technology Institute (ARTI) is part of the Korea Atomic Energy Research Institute (KAERI), and is located in Jeongeup, in the Republic of Korea. Readers will recall that the ARTI was designated as an IAEA Collaborating Centre just over one year ago on 15 May 2012. D. Mohamad, IAEA Deputy Director General of the Department of Nuclear Sciences and Applications, attended the inauguration ceremony and unveiled an official IAEA plaque at ARTI to mark the occasion.

The mission of the ARTI is to develop state of the art nuclear technologies and to extend innovative and creative technologies for peaceful use. Facilities include a research farm unit; gamma irradiation facilities for research and commercial purposes; electron beam linear accelerators; an ion beam facility; and cyclotron; and laboratory animal unit; and an international collaborating research and conference centre. Areas of research and training include industrial applications of radiation technology; treatment of environmental pollutants; application of radiation to food science, biotechnology and agriculture; and radioisotope development.

The KAERI and ARTI have been collaborating with the IAEA in various capacities for many years in projects dealing with the application of nuclear science and technology to the fields of energy, environment, health, food and agriculture. Their work and research not only contribute to the capacity of their country but are also important on an international level and contribute to activities in many different Member States in the area of radiation technology, including food irradiation. In view of this, its expertise and, excellent facilities, the ARTI was designated as a Collaborating Centre in three areas of radiation processing: environmental, advanced material development and food irradiation. It is one of three IAEA Collaborating Centres in the Republic of Korea, the other two being the Medical College of Seoul National University (Collaborating Centre in nuclear medicine and molecular imaging), and the Korea Institute of Nuclear Safety (Collaborating Centre in radioactivity analysis).

IAEA Collaborating Centres

With interest in nuclear related technologies increasing worldwide, the IAEA works to develop networks and partnerships with world renowned nuclear research and education institutions to assist the IAEA in implementing a variety of activities, including regional and international training activities and fellowships. Working in partnership with Collaborating Centres has increased the Agency's capacity to host regional programmes, as well as to promote cooperation among Member States. An institution may be invited to participate in the Collaborating Centre scheme having proven the quality of its programme through formal cooperation with the IAEA in technical projects. The title of Collaborating Centre is awarded for four years and is a partnership that entails a combined work plan on human resource development for nuclear technologies and their applications. The Collaborating Centre status may be renewed pending a performance review, and the agreement holds no financial commitment for either party.

IAEA Collaborating Centre for Radiation Processing, including Food Irradiation

The ARTI is a premier research and development institute that was established in 2006 as an affiliate of the KAERI. It is under the Ministry of Education, Science and Technology (MEST), and is implementing a national plan to support research and development and expand capacity in the field of radiation processing and associated applications in the Republic of Korea. The institute is engaged in science and innovation in the areas of radiation processing technology, including material science development, environmental remediation, food irradiation, agriculture applications and related topics. Within a relatively short span of time, the ARTI has emerged as a premier research centre with world class specialists and research laboratories, and a focused research and development programme specializing in radiation processing technology and applications.

The institute has used high-dose irradiation technology to develop eight Korean 'space-foods' for astronauts (kimchi: fermented vegetable; ramen: ready-to-cook noodles; saengshik bar: raw grain bar; sujeonggwa: cinnamon beverage; bibimbap: cooked rice mixed with red pepper paste; bulgogi: grilled beef marinated with soy sauce; seaweed soup; mulberry beverage). These irradiated products are certificated by the Russian Institute of Biomedical Issues. There has been a lot of media interest in these "space foods" and they are often quoted as positive examples of the technology when discussing the safety and quality of irradiated food with the public. Research experience gained in the development of space foods has been used to develop foods for hospital patients under the IAEA Coordinated Research Project on Irradiated Foods for Immuno-Compromised Patients and other Potential Target Groups. These types of foods need to meet stringent microbiological safety criteria with minimal changes to nutrients and without significantly altering sensory attributes. Irradiation is capable of meeting this challenge and has been recommended as a method for preparing foods for hospital patients requiring sterile diets, espe-

cially for patients who have intensive therapy or disease that has suppressed their immune system. The ARTI has employed irradiation to produce a sterile porridge for hospital patients. This food is high in calories and easy to digest due to decreased viscosity after irradiation. Moreover, a survey on this type of irradiated food has been undertaken targeting patients, nutritionists and medical doctors in the Republic of Korea. The survey results were favourable towards the use of irradiation technology and the benefits it offers to patients. As a Collaborating Centre and research participant, the ARTI is making great efforts to establish international collaborations to develop special-purposed foods and to commercialize them with others in different Member States. Furthermore, the institute is also researching the use of irradiation technology to develop emergency ration packs, which require long-term storage at ambient temperature with ensured microbial safety.

As an IAEA Collaborating Centre, the ARTI is functioning as a hub for technological development and expansion, and its activities include hosting international meetings, training experts in developing countries and participating in the IAEA's collaborative research activities for developing irradiation technology and applications. The institute is playing an active role in both technical innovation and in transferring radiation technology from the laboratory to commercial applications.

In 2012, the institute hosted IAEA sponsored fellowships and international meetings. An example of training IAEA sponsored experts is when the institute hosted a food technology specialist from the National Institute of Agricultural Research of Morocco. The participant worked at the Collaborating Centre in order gain hands-on experience relating to food irradiation and specifically microbiological techniques that are used to identify and quantify organisms on food products post and pre-irradiation. The training was related to the IAEA's Technical Cooperation project in Morocco entitled: Using Nuclear Techniques to Support the National Programme for the Genetic Improvement of Annual and Perennial Plants and to Develop Agricultural Production. The institute has also hosted several international meetings and, workshops, including the Regional Asian Technical Cooperation Project Workshop on Best Practices for Phytosanitary Applications of Food Irradiation that was held in October 2012. As reported in the previous Newsletter, participants at the workshop reviewed and developed a 'best practice manual' and summarized trade in irradiated food, the status of food irradiation in each country, current legislation as well as bilateral or multilateral agreements related to phytosanitary (quarantine) irradiation treatments.

Joint activities will continue to capitalize on the institute developed capabilities in radiation processing, nuclear techniques and radiation generating technology to undertake technological development and innovation for the healthcare, agriculture, industrial and environmental business sectors, including commercial applications for food. In particular, they will focus on utilizing radiation technology for developing advanced products, such as foods, new materials, and medicinal goods, as well as researching and establishing radiation processing applications to benefit society, industry and health.

Forthcoming Events

17th International Meeting on Radiation Processing (IMRP 2013), Shanghai, China, 4–6 November 2013

Technical Officer: Carl Blackburn

The International Meeting on Radiation Processing (IMRP) is the premier international event for the global irradiation industry and is held every two years. This 17th meeting is being organised by the International Irradiation Association (IIA), and the event will provide participants with the opportunity to learn about the latest scientific and commercial developments and to network with other irradiation professionals from around the world. The last IMRP was held in Montreal, Canada, during June 2011, and attracted over 500 delegates from 39 different countries, with a broad range of people with an interest in irradiation technology, including business leaders, scientists and regulators.

IMRP Shanghai 2013.

The theme for IMRP 2013 is 'Irradiation for life: Safe, Green and Growing', and reflects the importance of irradiation technology globally and in the lives of a growing world population. Food irradiation will be addressed at the pre-conference day and during three sessions of the conference[2]:

Session I: Irradiated Food is Safe: Why is it so Hard to Believe?

No food process has been as thoroughly studied as food irradiation. The safety of irradiated food is well estab-

2 http://www.iiaglobal.com/IMRP2013/index.php?page=programme#irradiation

lished in the scientific community and by international organizations. However, in many countries this does not seem to be enough to persuade more distributors to offer irradiated products on shop shelves. Do consumers really fear irradiated food when there are none to buy or available? Half a century of research on the safety of irradiated foods will be summarized and recent concerns addressed. Research and experiences relating to consumers' attitudes in different countries will also be discussed.

Session II: Green Applications of Food Irradiation

Irradiation is a 'green' phytosanitary treatment. Its use has opened markets to which some countries did not have access; for example, Vietnam can now export dragon fruit to the USA. Irradiation is also an alternative to agrochemicals that have been phased out, or could soon be suspended. In the case of sanitary applications, irradiation can also be an alternative to some chemical preservatives.

Session III: Is Food Irradiation Growing?

The application of food irradiation is probably more growing in China than anywhere else. Across the world, the use of irradiation as a phytosanitary treatment has grown at a faster rate than any other application in the history of food irradiation. While less significant in terms of volumes of product treated, the use of irradiation is also spreading as a means of offering immune-suppressed patients a more diverse and pleasant diet. There are also new perspectives where the potential that food irradiation can offer is being explored, for example fresh fruit in vending machines, a novel concept in which irradiation is necessary for commercialization.

More details about IMRP 2013 can be found on the IIA website at http://www.iiaglobal.com/IMRP2013/.

International Symposium on Food Safety and Quality—Applications of Nuclear and Related Techniques, Vienna, Austria, 10–14 November 2014

Technical Officer: Andrew Cannavan

The Food and Environmental Protection Subprogramme plans to hold an international symposium in Vienna from 10–14 November 2014. The rationale and outline of the symposium are given below. An official notification with further information and a call for abstracts for oral and poster presentations will be distributed in the coming months.

Protection of the integrity of the food supply is of utmost importance in terms of food security, food safety and quality, consumer protection and international trade. Food safety may be threatened by microbiological or chemical contamination which can potentially occur at any point in the food chain, including the production phase and during post-harvest processing, packaging and distribution. Therefore, techniques to maintain and assure the quality and safety of food are necessary throughout the food production and supply chain.

The need for methods to monitor and verify food safety and quality is evidenced by the ever growing list of food product recalls due to contamination with, for example, Salmonella, *Escherichia coli* and Listeria, and scandals such as melamine, antibiotic and dioxin contamination. Emerging issues such as the adulteration of beef products with horse meat and the use of new technologies with as yet unknown food safety implications, such as nanoparticles in foods, have highlighted the need for continued refinement, development and innovation to improve measures to ensure food safety and quality. As well as having direct consequences for consumer health, being able to demonstrate food safety and quality is also related to trade issues. For example, the possibility of insect pests associated with food consignments may impede international trade and the distribution of food due to the risks posed to the environment and food production through the introduction of alien species.

To address these issues, effective methods to treat food and minimize the risk of its safety and quality being degraded are in use. These include food irradiation to treat food directly as well as nuclear and related technologies for tracing food products in order to verify their provenance, or to detect and control contaminants and provide information for continuous improvement of production systems.

Continued innovation and research to improve techniques facilitate the on-going improvement of control strategies and the implementation of effective and efficient farm-to-fork food safety and quality assurance systems. Integrated risk assessment tools and analytical monitoring using robust nuclear, physico-chemical and bio-assay methods are used to improve agricultural production practices whilst protecting the environment. Novel methodologies and applications, employing conventional techniques and radio- and stable isotopes, are being introduced into this area and are useful tools for detecting and measuring chemicals in food and also ensuring authenticity. Radiotracer studies are powerful tools for investigation into contamination routes in the environment and food. In addition, food irradiation is developing in response to food quality and security needs. For instance, machine generated food irradiation technologies (electron beam, Xray) are being developed alongside radionuclide technologies (gamma irradiation) as an effective means of minimizing food losses and waste as well as meeting quality, sanitary and phytosanitary needs.

The symposium will focus on food safety and quality and will include the optimization and protection of the integrity of the food supply chain as a holistic process, involving multiple stakeholders and requiring the application and integration of different analytical methods and processing technologies. It will bring together experts in these fields to present contemporary applications and discuss future perspectives and opportunities, and to provide

a forum for interdisciplinary networking between those from national institutes, public and private bodies. It will facilitate a broad understanding of the topics involved and promote the peaceful use of nuclear technologies.

It is envisioned that positive and significant inputs and strategies will be identified that have the potential to impact on food safety, quality and overall security, especially in developing countries. These strategies will further the benefits for consumers and industry and help secure access to lucrative export markets, thereby aiding economic development.

The general scope of the symposium will include:

- Analytical technologies for food authentication, traceability and contaminant control:
    - Isotopic and elemental 'fingerprinting' for food traceability and authenticity.
    - Analytical methods to detect adulterants and contaminants in food.
    - Tests to detect and authenticate irradiated food.
- Climate change and environmental factors that impact food safety and quality, including:
    - Integrated analytical techniques for food safety and environmental sustainability.
    - The potential for food irradiation and analytical techniques to moderate potential damages or to benefit from opportunities associated with climate change.
    - The use of radio tracers and stable isotopes for transfer studies/contaminant traceability.
- Chemometrics, statistical treatments and predictive models in food analysis.
- Emerging opportunities and threats to the integrity of the food supply and potential control techniques.
- Food irradiation and new technological approaches applicable to issues of international importance (e.g. reducing food waste and food losses and improving food security and safety).
- New approaches for the application of food irradiation technologies in order to support shelf-life extension, microbial decontamination and insect disinfestation (quarantine treatment) of various commodities to ensure wholesome, safe and high quality food.
- International guidelines/regulations for consumer protection and international trade.

It is expected that the proceedings of the symposium will constitute a review of state of the art applications of nuclear and related techniques for food safety and consumer protection which can be used by Member States to identify and apply these techniques to their advantage. Future directions and opportunities will be identified, and collaborations instigated, with national institutes and public and private agencies, including in the context of the medium term strategies and future strategic planning of the IAEA and FAO.

International Experts Meeting on Radiological Protection after the Fukushima Daiichi Nuclear Power Plant Accident, Vienna, Austria, 17–21 February 2014

Technical Officer: Carl Blackburn

The IAEA is planning an International Experts Meeting on Radiological Protection after the Fukushima Daiichi Nuclear Power Plant Accident, with the theme of 'Promoting confidence and understanding'. The meeting is scheduled for 17–21 February 2014 at the IAEA in Vienna, Austria. The deadline for submission of abstracts is 15 October 2013, and more details and updates will be announced through the IAEA web site[3].

Against the backdrop of the accident at the Fukushima Daiichi nuclear power plant, an IAEA Action Plan on Nuclear Safety was approved in 2011. The Action Plan sets out a comprehensive programme of work to strengthen nuclear safety worldwide. The Action Plan includes issues such as the protection of people and the environment from ionizing radiation following a nuclear emergency. Another key area is communication and information dissemination. This meeting is being organized in support of these areas, with an emphasis on preparing for and managing the long term consequences of a nuclear or radiological accident.

This International Experts Meeting will focus on:

- Identifying the key radiation protection issues to be addressed by the international community;
- Enhancing long term strategies in response to nuclear or radiological accidents;
- Assisting Member States in reviewing and updating their radiation protection programmes, as appropriate; and
- Supporting the IAEA's work in the area of radiation protection.

The March 2011 accident at the Fukushima Daiichi nuclear power plant led to a reconsideration and examination of global contingencies, preparedness and resilience for major events involving the dispersion of radionuclides into the environment. This international meeting will be an opportunity to examine and discuss issues, including those relating to food and agricultural production long after the emergency phase of an accident.

The Food and Environmental Protection Subprogramme is important in this area as the FAO works in partnership with the IAEA and other UN agencies through the Joint FAO/IAEA Division for matters relating to food and ra-

3 http://www-pub.iaea.org/iaeameetings/

dioactivity. After the events in Japan, considerable attention was focused on food and radioactive contamination, related standards and operational intervention levels. As indicated in previous newsletters, the Joint FAO/IAEA Division, through the IAEA Radiation Safety Standards Committee, has been intimately involved in discussions on reference levels for foodstuffs contaminated as a result of a nuclear or radiological emergency, with particular reference to the situation in Japan.

The Technical Officer participated as a member of the Organizing Committee for this meeting. The Organizing Committee met at the IAEA, Vienna, Austria, from 23–26 April 2013. It is envisaged that the International Experts Meeting will include a detailed update on the situation in Japan, followed by several technical sessions on different aspects of radiological protection issues and experiences.

The technical topics will focus mainly on radiological protection and controlling exposures long after a large release of radioactivity into the environment. In this regard, at least one session will include radioactivity in goods and trade, including food and commodities. In addition to technical sessions, there will be presentations from international organizations and other non-technical sessions which will include: risk communication; engaging the public using traditional media and social media. There will also be an open forum discussion.

The scope of the meeting was developed by the organizing committee, and a draft meeting programme was produced. It is hoped that several sessions will be available by live video feed over the internet and that other sessions will be recorded and posted on the web. The organizing committee was keen to include young professionals, and one of the themes of the meeting will be to encourage their participation and to promote the specialism of radiological protection.

The IAEA Division of Radiation, Transport and Waste Safety are tasked with making the arrangements for the expert meeting and they hosted a very enjoyable and productive meeting of the Organizing Committee, who were all fully supportive of their preparations for the event.

Past Events

45th Session of the Codex Committee on Pesticide Residues and a Seminar Presentation on a Database of Analytical Methods for Pesticide Residues, Beijing, China, 6–11 May 2013

Technical Officer: James Sasanya

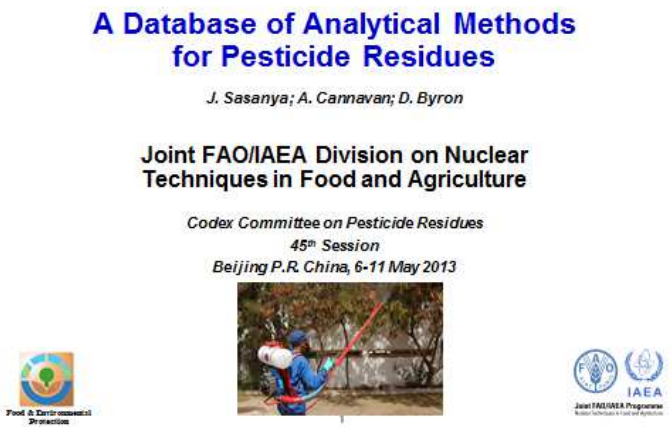
The 45th session of the Codex Committee on Pesticide Residues (CCPR) was recently held in Beijing, including the inaugural pre-CCPR workshop on Safety Assessment of Pesticide Residues.

Opening of the 45th Session of the Codex Committee on Pesticide Residues at the Beijing Friendship Hotel, Beijing, China.

The Food and Environmental Protection Subprogramme of the Joint FAO/IAEA Division reported on various activities including the following:

- International collaboration to improve food safety, protect consumer health and facilitate international agricultural trade for Member States by providing assistance Coordinated Research Projects (CRPs) and Technical Cooperation Projects (TCPs).
- Targeted scientific and technical support for food safety laboratories involved in the control of agrochemicals and food contaminants such as pesticides and veterinary drugs, as well as improving Good Agricultural Practices around the world.
- National, regional and interregional projects that develop/enhance food safety laboratory capacity (including laboratory networks) as well as project extrabudgetary support such as through the Peaceful Uses Initiative and training/stakeholder workshops for Member States. In this regard, delegates were also informed of the opportunity for their laboratories/institutions to host IAEA fellowships/scientific visits and participate in expert missions.
- Support for Member State laboratories through the publishing of analytical methods for chemical contaminants in the Food Contaminant Residue Information System (FRCIS) database (http://nucleus.iaea.org/fcris/). A seminar to create awareness among Member States, users and contributors alike was held.
- International collaboration to improve food safety, protect consumer health and facilitate international agricultural trade for Member States by providing as-

sistance Coordinated Research Projects (CRPs) and Technical Cooperation Projects (TCPs).



Introduction to a seminar on Food Contaminant Residue Information System (FRCIS) database at the 45th Codex Committee on Pesticide Residues Session, Beijing, China, 6–11 May 2013.

The presentation highlighted the Joint FAO/IAEA Division's support for efforts by Codex Alimentarius to develop guidelines for methods of analysis needed by many Member States.

Technical Cooperation Projects

Country/Region	Project Number	Title	Technical Officer
Afghanistan	**AFG5005**	**Study 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.**
Belize	**BZE5005**	**Providing Technical Assistance and Training for Upgrading National Laboratory Capacity**	**Maestroni, B.M. Jandrić, Z.**
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.**
Bolivia	**BOL1009**	**Introducing Radiation Processing Technology**	**Sabharwal, S. (NAPC) Blackburn, C.M.**

Country/Region	Project Number	Title	Technical Officer
Botswana	BOT5006	Establishing a Laboratory for Monitoring Residues of Veterinary Drugs in Food of Animal Origin to Protect Public Health and Enhance International Trade Through Utilization of Nuclear and Related Analytical Techniques	Cannavan, A. Jandrić, Z. Sasanya, J.J.
Chile	CHI1019	Establishing the Origin of Heavy Metal Contamination in Water and Soil	Fajgelj, A. (NAEL) Padilla A.R. (NAPC) Cannavan, A.
Chile	CHI5049	Determining Veterinary Residues and Contaminants in Agricultural and Animal Products for Human Consumption	Cannavan, A. Jandrić, Z. Sasanya, J.J.
China	CPR5018	Building Technological Capacity for Food Traceability and Testing of Pesticide Residues in Food	Cannavan, A. Frew, R.
China	CPR5021	Facilitating the Application of Electron Beam for Food Irradiation	Blackburn, C.M. Byron, D.H.
Costa Rica	COS1007	Establishing Gamma Irradiation Capabilities at the Costa Rican Insitute of Technology (ITCR) for the Use of Radiation Processing Technology	Blackburn, C.M. Byron, D.H.
Costa Rica	COS5029	Strengthening of Good Agicultural Practices (GAP) for Food Safety and Security and Environmental Protection	Maestroni, B.M. Nguyen, M.L. Dercon, G.
Ecuador	ECU5027	Improving Food Security and Environmental Sustainability by Monitoring Wetlands as Indicators of Good Agricultural Practice in Palm Oil Production	Maestroni, B.M.

Country/Region	Project Number	Title	Technical Officer
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. Byron, D.H.
Malaysia	MAL5029	Applying Mutation Breeding and Optimized Soil, Nutrient and Water Management for Enhanced and Sustainable Rice Production	Lagoda, P. 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	Nguyen, M.L. Blackburn, C.M. Sarsu, F.
Nicaragua	NIC5008	Improving Technical Capabilities for the Detection of Diseases and Residues in Agriculture	Viljoen, G.J. Sasanya, J.J.
Nigeria	NIR5037	Applying Nuclear and Related Techniques to Characterise 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.

Country/Region	Project Number	Title	Technical Officer
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. Cannavan, A.
Peru	PER5031	Improving and Strengthening Industrial Irradiation Techniques with an Emphasis on Agro-industrial Applications	Blackburn, C.M. Sabharwal, S. (NAPC)
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	RAS5061	Supporting Food Irradiation Technology to Ensure the Safety and Quality of Meals for Immuno-compromised Patients and Other Target Groups	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.
Europe	RER5019	Establishing a Sustainable Network on Irradiated Food	Blackburn, C.M. Byron, D.H.

Country/Region	Project Number	Title	Technical Officer
Latin America	RLA5053	Implementing a Diagnosis System to Assess the Impact of Pesticide Contamination in Food and Environmental Compartments at a Catchment Scale in the Latin American and Caribbean (LAC) Region (ARCAL CII)	Maestroni, B.M. Dercon, G.
Latin America	RLA5059	Harmonizing Official Control Laboratories to Analyse Chemical Contaminants in Food and Feedstuffs (ARCALCXXII)	Sasanya, J.J. Cannavan, A.
Latin America	RLA5060	Harmonizing and Validating Analytical Methods to Monitor the Risk of Chemical Residues and Contaminants in Foods to Human Health (ARCALCXXVIII)	Sasanya, J.J. Maestroni, B.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	RLA9072	Supporting a Database of Values of Radioactivity in Typical Latin American Food (ARCALCXXIX)	Blackburn, C.M. Byron, D.H.
Sri Lanka	SRL5043	Supporting the Operation of a Gamma Irradiation Facility for Preservation of Food, Sterilization of Medical Products and Quarantine of Fruits	Blackburn, C.M. Sabharwal, S. (NAPC)

Country/Region	Project Number	Title	Technical Officer
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.**
Uruguay	**URU5025**	**Determining Pesticide and Antibiotic Residues in Food for Local and Export Consumption**	**Maestroni, B.M.**

Workshop on Implementation of a Chemical Residue Monitoring Plan—Laboratory's Role from Training to Sustainability, Faisalabad, Pakistan, 24 May 2013

Technical Officer: James Sasanya

A food safety workshop entitled 'Implementation of a Chemical Residue Monitoring Plan—Laboratory's Role from Training to Sustainability' was recently held in Pakistan as part of Technical Cooperation Project (TCP) PAK5048 on "Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs". The TCP is hosted by the Animal Science Division, National Institute of Animal Science and Biology (NIAB), in collaboration with the National Institute of Biotechnology and Genetic Engineering (NIBGE), both of the Pakistan Atomic Energy Commission (PAEC). The event was attended by at least 70 NIAB and NIBGE staff and discussions centred on increasing awareness of the use of techniques such as radio immuno assays, radio receptor assays and stable isotopes to enhance analytical method performance in a residue monitoring program. This workshop was timely in view of NIAB/NIBGE's increasing role in agricultural research and researcher–end user interface and in view of its contribution to the prospective food safety authority, possibly under the Ministry of Food Security and Research.

A seminar presentation on food safety conducted by technical officer James Sasanya on May 24th 2013 at the National Institute for Animal Science and Biology, Pakistan Atomic Energy Commission, Faisalabad.

A seminar presentation on food safety conducted by technical officer James Sasanya on May 24th 2013 at the National Institute for Animal Science and Biology, Pakistan Atomic Energy Commission, Faisalabad.

The laboratory's role of informing multiple stakeholders (e.g. producers/farmers and veterinarians) about good practices that minimize risk of exposure to chemical con-

taminants in foods along the food chain were further demonstrated at a model buffalo dairy farm in Faisalabad. Discussions at the farm provided an insight into strategies to minimize use of agrochemicals such as veterinary drugs. Ways to create/promote sustainable rapport between producers/veterinarians and the laboratory were evaluated, including easy access to samples for laboratory analysis and the need for laboratories to provide feedback to producers on test results.

A model dairy buffalo farm visited by the participants.

The workshop also discussed a laboratory's role in the rapidly growing aquaculture industry in Pakistan, where efforts to transform saline waste land into productive agricultural land intensify.

Chronology of reclamation of saline waste land through R&D efforts by the National Institute for Animal Science and Biology, Pakistan Atomic Energy Commission (PAEC).

An aquaculture pond that NIAB uses as a model to demonstrate prudent/commercial fish production in a reclaimed saline waste land, including control of potential chemical food contaminants to ensure consumer safety/protection in Pakistan.

Identifying Regional Priorities for Nuclear Technology Technical Cooperation in Latin America and the Caribbean, Vienna, Austria, 13–17 May 2013

Technical Officers: Carl Blackburn, Britt Maestroni and James Sasanya

Experts from the Food and Environment Protection Section and Laboratory were involved in identifying regional priorities for Latin American and Caribbean countries. This took place as part of a meeting to discuss and redefine areas of importance for future projects under the Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL).

The meeting was held at the IAEA Headquarters in Vienna, Austria from 13–17 May, with the aim of updating the Regional Strategic Profile and identifying needs and priorities in a range of thematic areas. Technical Officers were invited to assist and participate in discussions with ARCAL signature countries on their regional needs and priorities. More than 60 people attended, including experts from the region, ARCAL Coordinators and IAEA staff.

The current Regional Strategic Profile was adopted in 2007, and this document has guided the implementation of projects in the regional IAEA Technical Cooperation Programme for this region. It is now time to revise and renew this document as necessary to ensure that it remains strategic in outlook for future Technical Cooperation activities. This meeting is part of the on-going process to develop a revised strategic profile for the region. It followed on from an earlier meeting, in December 2012, where participants assessed the content of the current Regional Strategic Profile, and reviewed the achievements and progress made in addressing the original priorities through IAEA Technical Cooperation Pro-

jects. Work to develop and refine the Regional Strategic Profile document will continue until the beginning of 2014. The next steps include finalizing the draft by thematic areas, consolidating the document and defining a strategy and agreeing on programmatic priorities.

The participants at the May 2013 meeting were organized into six groups, with each focused on one of the following thematic areas: food safety, human health, environment, energy, industrial irradiation, and radiation safety. In total, 42 needs and priorities were identified and will be taken forward and considered in the preparation of the new Regional Strategic Profile for the 2016–2021.

One of the areas of importance considered by the food safety group included ensuring food meets quality and safety standards. This has direct relevance to the work of this section and laboratory where we can assist with regard to food quality and safety, especially in relation to analytical methods (e.g. for chemical residues) and the certification of analytical processes and laboratories. Other areas identified as important included reducing food losses and waste or damage caused by pests. Here, an objective might be to implement techniques and strategies that can control and/or eradicate pests using alternative technologies to chemical treatments. This could be an interesting area for the Food and Environmental Protection Section's food irradiation activities. Food irradiation technology might also be able to assist the development of future initiatives that aim to develop the commercial potential of foods currently only available within the region (e.g. fruits and vegetables not normally found outside this part of the world).

When finalized, the Regional Strategic Profile will be a results-oriented document that both identifies regional priorities and provides indicators that can be used to monitor the overall progress of the technical programme in future. An additional benefit of the Profile is that it increases the visibility of the programme and projects in the region, and so helps to raise awareness of the potential of nuclear technology in addressing important development challenges, for example in food and agriculture. The Regional Strategic Profile should also help foster strategic partnerships with other organizations and regional bodies working to address common objectives.

IAEA/RCA Workshop on Best Practice for Food Safety and Quality (Sanitary) Applications of Food Irradiation, Shanghai, China, 6–10 May 2013

Technical Officer: Carl Blackburn

This meeting was scheduled under Project RAS5057, to develop a Best Practice Manual for both the sanitary and phytosanitary applications of food irradiation. In addition, the workshop was an opportunity to initiate the planning of a Training Module intended to assist advanced training in food irradiation. The workshop was held in Shanghai from 6–10 May 2013. The objectives were to review, finalize and endorse the draft Best Practice Manual on the application of food irradiation for the purposes of ensuring food quality and destroying organisms that could cause food borne illness, and to review existing information and educational material in preparation of a Training Module related to food irradiation in readiness for training workshops and executive management meetings.

Panellists of the IAEA/RCA Workshop in Shanghai.

The Asia-Pacific is a region in which the commercial application of food irradiation is increasing. All the major applications of food irradiation are applied within the region (sanitary, phytosanitary, food quality and extension of shelf life). However, there are several Member States in which food irradiation is either not yet carried out or is conducted at a research level and only to a limited extent commercially. Sustainable use and further applications of commercial food irradiation are dependent upon irradiation being conducted under a regime of Good Irradiation Practice (GIP). Within GIP, a system of Best Practices including the proper accreditation and audit of facilities is essential to ensuring effective outcomes and consumer trust in the process.

Meeting Participants during the IAEA/RCA Workshop.

Earlier activities under Technical Cooperation Projects RAS5050 and RAS5057 have produced Guidelines for the Audit and Accreditation of Irradiation Facilities used for Sanitary and Phytosanitary Treatment of Food and Agricultural Products and a Best Practice Manual for Phytosanitary Applications of Food Irradiation. The present workshop is intended to further elaborate the Best

Practice Manual to include sanitary applications, to ensure the quality of the commodities treated and to provide a complete document regarding GIP for food irradiation. A consultant, Y. Henon, prepared a pre-meeting draft manual that was circulated to all participants prior to the workshop.

Panellists and Meeting Participants of the IAEA/RCA Workshop in Shanghai.

The workshop was hosted by the government of China and sponsored by the China Atomic Energy Authority. Local hosting and arrangements were provided by the Shanghai Academy of Agricultural Sciences (SAAS), the Chinese Society of Nuclear Agricultural Sciences and with support from the Science and Technology Commission of the Shanghai Municipality, the Shanghai Science and Technology Development Foundation and the Shanghai ShuNeng Technology Co. Ltd. The proceedings were opened by the General Manager of Shanghai ShuNeng Irradiation Technology Co. W. Qi. He wished everyone present a warm welcome and thanked the IAEA for the opportunity to hold the meeting in Shanghai. Participants were welcomed by the President of SAAS, Aizhong Wu. Prof. Wu added his welcome to that of Mr Qi. He briefly noted the role and past successes of SAAS and wished the meeting every success.

Participants of the IAEA/RCA Workshop in Shanghai.

Yuejin Hua, representing the Chinese Society for Nuclear Agricultural Sciences and other related associations emphasized the many years of collaboration and technology transfer in the area of nuclear agriculture. He noted that China has a greater number of radiation facilities than any other country in the world, including for food irradiation.

This project is under the Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific, more popularly known by the acronym RCA. Representatives of all 17 current RCA countries were present at the meeting, including Nepal for its first RCA activity in this area. There were 36 participants from RCA member states, the FAO/IAEA Technical Officer and a consultant, Y. Henon. In addition, there were 48 observers from China who also participated in parallel sessions in a national meeting concerning food irradiation in China.

Five participating countries have yet to initiate commercial food irradiation although one, New Zealand, imports irradiated foods. The remaining 12 countries conduct commercial irradiation of food for a wide variety of purposes. However, there is a wide range in the volumes treated, from approximately 200 to 200,000 tonnes per year, while eight countries export irradiated products.

Country	**Commercial Use**	
	Sanitary = S Phytosanitary = PS Extend shelf life = E None = N	Domestic = D Export = E None = N
Australia	PS	D, E
Bangladesh	S, E	D, E
China	S, E	D, E
India	S, PS	D, E
Indonesia	S, E	D, E
Japan	E	D
Korea, Rep.	S	D
Malaysia	S	D
Mongolia	N	N
Myanmar	N	N
Nepal	N	N
New Zealand	N (but imports PS)	N
Pakistan	S, PS, E	D, E
Philippines	S	D
Sri Lanka	N	N
Thailand	S, PS	D, E
Vietnam	S, PS	D, E

Summary of the Commercial Use of Food Irradiation, Informational Materials and Training Courses relating to Food Irradiation within the RCA Member States.

At the close of the meeting, participants considered the objectives and outputs set for the workshop and the conclusions, recommendations and Draft Best Practice Manual. It was agreed that the meeting objectives and outputs were achieved. The rapporteurs presented a draft report that was discussed, revised and approved subject to general editing by Agency staff.

On behalf of the host institute, Prof. Qi thanked the Agency for the opportunity to host the meeting. He was pleased to have met the participants and hoped that the exchange of information would continue. He hoped that the participants had had an opportunity to visit the city of Shanghai and that they would return again. In response,

the Technical Officer thanked the local organizers and hosts for a well-run, enjoyable workshop. On behalf of all the meeting participants, Ms Koenari, of Indonesia, expressed the sincere gratitude of all participants to SAAS, the organizers of the meeting and to Prof. Qi. She thanked the Lead Country Coordinator and chair Ms Gao, the rapporteurs Mr Roberts and Ms Walker, and the IAEA expert consultant Mr Henon for their efforts, and the Agency for its support. Ms Gao thanked everyone for their participation and said that the workshop had been successful. She wished everyone a safe journey home and closed the workshop.

AFRA Training Course on ISO/IEC 17025:2005 for Enhanced Quality Management Systems in Food Safety/Control Laboratories, Lagos Nigeria, 8–12 April 2013

Technical Officer: James Sasanya

Food safety laboratories in Africa strive to meet quality demands by demonstrating fitness for purpose according to international standards such as ISO/IEC 17025:2005. A course was thus organized to enhance quality standards and was attended by nineteen participants from Algeria, Botswana, Cameroon, Egypt, Ethiopia, Namibia, Nigeria, Tunisia, Uganda, United Republic of Tanzania, Zimbabwe and. The participants consisted of managers, section heads and technicians from twelve organizations.

Participants from Algeria, Botswana, Cameroon, Egypt, Ethiopia, Namibia, Nigeria, Tunisia, Uganda, United Republic of Tanzania and Zimbabwe at the AFRA training course.

Training/meeting objectives were namely to: strengthen laboratory quality management systems in participating RAF5067 Member States; enhance laboratory accreditation of participating RAF5067 Member States and/or strengthen participation in proficiency, inter-laboratory test schemes or exercises; sharing relevant experiences and harmonizing national/individual quality management systems; and strengthen AFRA laboratory networking for food safety and consumer protection.

While objectives were met, the event also revealed that although a number of testing laboratories in agro-food production and processing sectors in ten African countries have been trained through RAF5067, many related laboratories in the region are not aware of the need and importance of accreditation. Thus, more courses are needed on the subject to address the demand for further technical assistance.

Sub-regional AFRA Training on Application of Nuclear and Complimentary Analytical Techniques under the Regional Project RAF5067 on Establishing a Food Safety Network through the Application of Nuclear and Related Technologies, Sidi Thabet, Tunisia, 28 January–01 February 2013

Technical Officer: James Sasanya

Scientists and laboratory technicians from north, west and central African official national food safety laboratories controlling chemical contaminants recently trained in the application of nuclear and complimentary techniques. Strategies to collaborate were also discussed.

Training goals included: strengthening capacity for use of radio–radio Receptor Assay Techniques (such as the CHARM II), Radio Immuno Assays and complimentary techniques (such as ELISA, HPLC, GC, etc.) to monitor chemical food contaminants in the sub-region; and optimizing analytical methods for non-chemical food contaminants such as selected mycotoxins, among others. The training also provided an opportunity to initiate/enhance laboratory networks in the sub-region as a way to strengthen a broader regional network of laboratories and identify solutions to common challenges in residue monitoring programs.

Participants of the Sub-regional Training Workshop in Sidi Thabet, Tunisia.

The participants in the training workshop acquired/enhanced hands-on skills in radio receptor assay techniques and also gained knowledge for optimal use of

complimentary techniques such as liquid/gas chromatography, including sample preparation.

AFRA RAF5067 trainees gaining hands-on experience in the application of radio receptor assay techniques to analyse chemical/natural food contaminants in various foods, such as eggs, in Tunisia.

Egg samples and basic sample preparation tools used in a radio receptor assay technique to analyse chemical/natural food contaminants in Sidi Thabet, Tunisia.

AFRA RAF5067 trainees participating in sample preparation and gaining/enhancing knowledge in use of chromatographic-spectrometric techniques to control chemical/natural food contaminants, as well as basic instrument maintenance and troubleshooting.

Demonstration of basic instrument maintenance and troubleshooting to some participants at the AFRA RAF5067 sub-regional training workshop.

Food and Environmental Protection Laboratory, Seibersdorf

Sustainability of Capacity Building Activities to Improve Food Safety and Quality through Nuclear Technology and Networking: An Interregional Train-the-Trainers Workshop on Integrated Analytical Techniques to Control Contaminants in Food, Seibersdorf, Austria, 25 February–8 March 2013

Technical officer: Britt Maestroni

In 2012, the Food and Environmental Protection Laboratory was successful in a bid for funding from the USA under the Peaceful Uses Initiative, the objective of which is to support the IAEA in facilitating greater access for Member States to the peaceful uses of nuclear technology.

One of the activities planned for 2013 under this project was an interregional train-the-trainers workshop on "Integrated Analytical Techniques to Control Contaminants in Food", which was held from 25 February–8 March 2013 at the Food and Environmental Protection Laboratory at Seibersdorf. Twenty-one developing country scientists from 15 different countries were trained in various aspects of food safety control. Countries represented were Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Lebanon, Nicaragua, Panama, Paraguay, Peru, Uruguay. Twelve external lecturers also contributed to the workshop, from various institutes in Europe and Latin America, the European Commission, analytical instrument manufacturers and the FAO.

A practical session on the use of radiotracer techniques for establishing method performance characteristics.

The objective of this workshop was to present a range of nuclear and related technologies for the control of contaminants in food in an integrated way, with a special focus on pesticides. The workshop covered various aspects related to farm-to-fork food safety systems, with lectures on food contaminant control, traceability and authenticity techniques, good agricultural practices (GAP), advanced analytical methodologies for residue analysis, quality systems and food control quality infrastructure, and nuclear technologies to support food control. Practical demonstrations focused on advanced analytical instrumentation such as high resolution/accurate-mass spectrometry, laser based spectroscopy, gas and liquid chromatography coupled to mass spectrometry, and isotope ratio mass spectrometry. Practical sessions were also held on method validation using the QuEChERS (Quick, Easy, Cheap, Effective, Rugged, Safe) multiresidue procedure as an example, on bioassays and biomonitoring, and on radiotracer techniques.

Workshop participants with Mr D.Mohamad (left), Deputy Director General of the Department of Nuclear Sciences and Applications.

Feedback from the participants indicated that the capacity building event was well received. It was agreed that a team building activity carried out on the first day of the workshop helped not only to establish a good working environment for the training, but also created links between participants for the future. The information on traceability and authenticity techniques to enhance food quality and safety was found to be extremely interesting and raised awareness about how much can be done in each country, especially with regard to certification of origin of fresh fruit and vegetables.

The participants appreciated the chance to be updated on topics such as the auditors' requirements for EU (FVO) audits, the EU food monitoring program and the rapid alert system, SANCO document 12495/2011 on method validation and quality control procedures, and quality systems and infrastructure. The example of monitoring of food safety in Brazil and the experience of Lanagro laboratories were considered very good examples of how to establish and build analytical capacity within a national

network, and reach harmonization on principles and methodologies. Participants commented that it would be useful to apply a similar model in Central America, and in some other countries in South America.

Group picture with the training workshop participants.

Comments were received on the radiotracers techniques indicating that it was very useful to gain knowledge on the many applications of radiolabeled compounds—the examples provided gave the participants an idea of the multiple uses and the information that can be obtained with this technology. The presentations on GAP were extremely important in defining the role of the analytical laboratory in the implementation of GAP; the experience of Costa Rica in this respect not only highlighted the implementation challenges but also the social aspects of GAP and the feeding back of results (laboratory and research) to farmers. It was considered that the information obtained on bioassays and bioindicator methodologies would open new possibilities for institutions to get complementary information to accompany the chemical results.

With regard to practical laboratory sessions, it was reported that all exercises were very useful, though participants would have liked to have had more time to learn more about different analytical methodologies, while discussing the analytical results obtained by the different groups.

Finally the participants enthusiastically discussed the activities of the laboratory network instigated in 2012 with FEPL assistance, the Red Analitica de Latino America y El Caribe (RALACA).

Assessment of orange juice authenticity using LC-MS/MS

Technical officers: Zora Jandrić and Marivil Islam

Fruit juice drinks, fruit juices, and fruit nectars are consumed worldwide and have become very popular in recent years due to their perceived health benefits. Fruit juices (orange and apple juice) were among the top 7 foods reported from 1980 to 2010 as the most common targets for adulteration. The most common fruit juice adulteration practices are dilution with water and addition of sugars, pulp wash, or other fruit juices. Analytical methods are needed to detect such adulteration in order to combat economic fraud and the possible food safety risks associated with the addition of undeclared substances to a food commodity.

As reported in a previous newsletter, an untargeted metabolomics approach using ultra performance liquid chromatography-quadrupole-time of flight mass spectrometry (UPLC-QTof MS) was applied in the Food and Environmental Protection Laboratory, enabling the detection and identification of characteristic markers (hesperidin (HES), narirutin (NAR), naringin (NGN), and limonin-17-β-D-glucopyranoside (LIM)) that can be used to detect adulteration of orange juice by grapefruit or mandarin juices. As a further development of this methodology, a robust and simple targeted liquid chromatography–tandem mass spectrometry (LC–MS/MS) method was optimised for the analysis of these characteristic markers. Fruit juice samples were prepared in the laboratory by pressing fresh fruits and adding 2, 5, and 10% of grapefruit or mandarin to orange juice. Aliquots of fruit juice were centrifuged, diluted with methanol, and filtered through a PTFE membrane filter before injection.

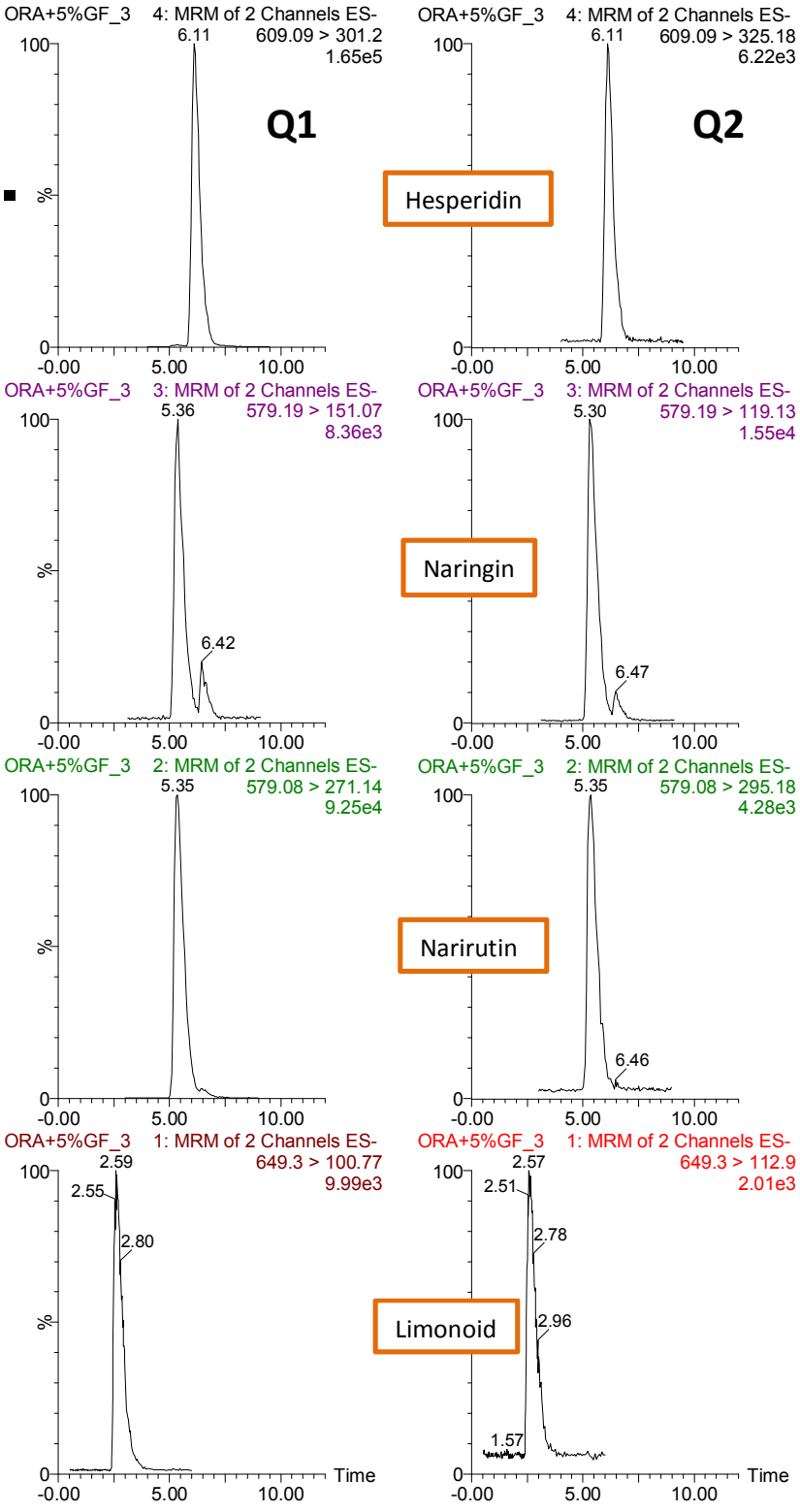
Ratios of limonoid to hesperidin and narirutin, narirutin to hesperidin, and naringin to limonoid have the potential to be used to detect the addition of grapefruit to orange juice down to 5%, and the addition of mandarin to orange juice down to 2%.

The upstream research and development in FEPL using UPLC-QTof MS enabled the development of this simpler, targeted methodology using a more generally available analytical platform (LC-MS/MS) that can be applied in developing or developed countries to detect/monitor specific adulteration practices used for citrus juices. The methodology is currently being further validated to evaluate its applicability to a wider range of fruit varieties.

This research is linked to the current international research project coordinated from FEPL, ‘Implementation of Nuclear Techniques to Improve Food Traceability’.

	NGN/LIM	*LIM/NAR*	*LIM/HES*	*NAR/HES*
100% orange juice		0.132	0.073	0.558
5% grapefruit in orange juice	0.087	0.099	0.063	0.635
10% grapefruit in orange juice	0.095	0.116	0.074	0.639
2% mandarin in orange juice		0.111	0.064	0.583
5% mandarin in orange juice		0.087	0.052	0.593
10% mandarin in orange juice		0.085	0.051	0.599

Average peak area ratios for characteristic markers evaluated in orange juice adulterated with grapefruit and mandarin juice at 2, 5 and 10.



Multiple reaction monitoring chromatograms of hesperidin, naringin, narirutin and limonoid in orange juice adulterated with 5% grapefruit juice.

FEPL Stable Isotope Activities

Technical Officer: Russell Frew

Current work in the Food and Environmental Protection Laboratory includes applying stable isotope techniques to the verification of the origin and authenticity of foodstuffs. In particular, we are working on honey as an example food for the development of the analytical protocols. One aspect is to try and counter the practice of adulteration of honey with rice syrup. Rice syrup cannot be detected using the conventional carbon isotope test (AOAC) so we are attempting to develop an internal standard test using hydrogen isotopes. The techniques applied to date include:

a) Purification and analysis of δ^2H on honey protein.
b) Determination of non-exchangeable δ^2H on sugars (H-exchange, nitration).
c) C, H and N on honey from international samples.

The analytical methodology is now in place and we are acquiring samples from around the world for analysis.

Reference Materials

A significant issue in applying stable isotope techniques to foodstuffs as a traceability tool is the need for large databases of analyses from authentic-origin samples. To ensure the quality of the data in the database it is essential that appropriate reference materials are used, i.e. those that have a food matrix. At present, there are very few food matrix reference materials available that are certified for their stable isotope ratios. A joint FEPL project with the FAO/IAEA Soil and Water Management and Crop Nutrition Laboratory, the IAEA Terrestrial Environment Laboratory, and the University of Otago has surveyed the composition of presently available IAEA trace element and radionuclide reference materials and has revealed many that are suitable for development as reference materials for stable isotope analyses. The survey results are shown in the following table. There is a very useful range of isotope ratio and elemental composition among these materials, meaning they may be suitable for a great many applications. These data were presented at the 2013 European Geophysical Union conference in April.

Work is now underway to verify the homogeneity and stability of the selected materials. Once that is completed those that are deemed suitable will be sent to participant laboratories for intensive analysis to verify the isotopic composition and subsequent certification.

Material	$\delta^{15}N_{AIR}$ ‰	N, % by mass	$\delta^{13}C_{PDB}$ ‰	C, % by mass	$\delta^{2}H_{VSMOW}$ ‰
IAEA 152: AMP (Dairy)	5.83 ± 0.19	5.57 ± 0.05	-25.03 ± 0.05	41.31 ± 0.25	-55.9 ± 3.3
IAEA 156: Clover	1.03 ± 0.24	2.41 ± 0.10	-27.11 ± 0.23	38.83 ± 0.41	-120.7 ± 2.3
IAEA 330: Spinach	4.76 ± 0.17	5.15 ± 0.05	-28.10 ± 0.11	42.14 ± 0.34	-144.6 ± 2.5
IAEA 336: Lichen	-13.46 ± 0.46	0.59 ± 0.02	-22.65 ± 0.09	42.23 ± 0.47	-92.8 ± 1.0
IAEA 359: Cabbage	18.64 ± 0.21	4.22 ± 0.02	-25.74 ± 0.08	39.26 ± 0.17	-80.3 ± 2.3
IAEA 372: Grass	2.26 ± 0.20	4.69 ± 0.11	-27.53 ± 0.11	44.37 ± 0.23	-135.3 ± 0.9
IAEA 373: Grass	0.82 ± 0.34	1.74 ± 0.11	-27.18 ± 0.14	45.32 ± 0.58	-130.2 ± 2.4
IAEA 413: Algae	2.42 ± 0.10	9.73 ± 0.08	-39.80 ± 0.26	46.77 ± 0.43	-113.8 ± 2.0
IAEA 447: Moss Soil	-2.48 ± 0.21	1.03 ± 0.02	-20.56 ± 0.24	15.39 ± 0.49	-101.7 ± 8.0
IAEA MA-A-1: Copepod	8.10 ± 0.18	7.92 ± 0.16	-22.83 ± 0.21	44.30 ± 0.61	-147.5 ± 2.0
IAEA V-8: Rye Flour	4.25 ± 0.42.	0.59 ± 0.01	-23.18 ± 0.11	39.81 ± 0.21	-75.3 ± 2.1
IAEA V-9: Cotton	-	<0.01	-24.47 ± 0.09	41.75 ± 0.20	-61.9 ± 2.6

Results from the survey of the stable isotope composition of selected IAEA reference materials.

Training: The major event in the TC project on Food Traceability (RAS5062) was the training course held in Universiti Sains, Penang, Malaysia. The course was held this year from 28 January–8 February. A total of 38 participants attended from Bangladesh, Cambodia, China, Indonesia, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam. The overall objectives of the training course were to gain theoretical knowledge and practical skills in

sample collection, sample processing, and analysis of stable isotopes and trace elements in food and beverages for the purpose of determining the point of origin of the food. As well as lectures and tutorials in the host institute, we conducted a field trip to the Mudi Agricultural Devlopment Authority (MADA) in Kedah Darul Aman. MADA has helped develop nearly 100,000 hectares of rice paddy field and has made major improvements in the quantity and quality of the rice grown in Malaysia. Participants were given insight into the production of rice including the factors that may affect the stable isotopes and trace element composition of the rice. These include the addition of fertilisers, how the fields are worked and the source and frequency of the irrigation. Participants were instructed on how to sample plant material as well as soil and water for elemental and stable isotope analysis. We would like to thank the Universiti Sains for providing the facilities for the training course, and especially Dr Syahidah Muhammed for hosting so expertly.

Training on sample collection for food traceability, Malaysia.

European Geophysical Union Conference: The EGU General Assembly was once again held in Vienna. This year's conference was a little smaller than last, but there were still in excess of 11,000 delegates from 95 countries in attendance. Staff from FEPL presented two papers. One was a poster on the reference material work, "Developing Potential New Reference Materials for Light Isotopes in Foodstuffs". The other was an invited talk on the food traceability programme of the FEPL "A Coordinated Research Project on the Implementation of Nuclear Techniques to Improve Food Traceability". Considerable interest in the work of FEPL was generated and has led to further connections being made with international researchers since the conference.

Training on stable isiotope analysis for food traceability, Malaysia.

Training for the Quality Control of Trypanocidal Drugs, Seibersdorf, Austria, 14–18 January 2013

Technical Officers: Andrew Cannavan and James Sasanya

Tsetse-transmitted African animal trypanosomosis is arguably the most important animal disease impairing livestock agricultural development in sub-Saharan Africa. Besides vector control, the use of trypanocidal drugs is the main method to control the impact of the disease on animal health and production in most sub-Saharan African countries. At present, only three compounds belonging to two chemical classes are widely available to treat trypanosomosis: diminazene aceturate (belonging to the class of aromatic diamidines); and isometamidium chloride hydrochloride and homidium (chloride and bromide salts), which belong to the phenanthridinium class of trypanocidal agents.

LACOMEV and TFDA staff being trained in FEPL on analytical techniques for the quality control of trypanocidal drugs.

Studies and market surveys on the quality of the various trypanocidal pharmaceutical formulations sold in different markets in sub-Saharan Africa have shown that a substantial proportion of the products were of sub-standard quality or even fake, containing no active trypanocidal substance. The use of poor quality and fake trypanocides has severe implications for animal health, public health and the local economy. Inappropriate treatment results in animal morbidity or mortality and increases the risk of the emergence of drug resistance in trypanosome populations; there are currently 17 African countries in which animal trypanocidal drug resistance has been reported. Moreover, food safety is compromised by allowing unspecified and potentially harmful chemicals to enter the food chain.

Dr Sutcliffe providing guidance on the analysis of trypanocidal drug formulations.

No internationally agreed standards are available for the quality control of these compounds, as either pharmacopoeia-type monographs or as documented product specifications. This means it is impossible to establish independent quality control and quality assurance standards for these agents.

An international alliance was set up to help address this problem. The alliance includes FAO, IFAH, GALVmed, IAEA and Manchester Metropolitan University (MMU). Analytical methods were developed and validated by MMU and FEPL, and pharmacopoeia-type monographs for isometamidium chloride hydrochloride, diminazene aceturate, homidium chloride and homidium bromide have been developed and submitted for publication through OIE as a first step towards their acceptance as international standards.

The knowledge and analytical procedures developed for the quality control and quality assurance of trypanocidal drugs are being transferred to two laboratories in sub-Saharan Africa, the Laboratoire de Contrôle des Médicaments Vétérinaires (LACOMEV), Dakar, Senegal, and the Tanzania Food and Drugs Authority (TFDA) laboratory, Dar Es Salaam. These laboratories will form the basis of a system to enable reliable quality control, for use by drug registration authorities.

In January 2013, S.A. Assey and G.S. Kulwa from TFDA and G. Akoda, A. Teko-Agbo and E. Niang from LACOMEV were trained in FEPL on the chromatographic methods for the quality control of the trypanocidal formulations. The training was funded by GALVmed and implemented by O. Sutcliffe (MMU) and FEPL staff. The initial implementation of the methods is now under way in the TFDA and LACOMEV.

The monographs developed through this alliance and the supporting analytical methodology will ultimately allow laboratories in Africa, Asia and South America, as well as those of veterinary pharmaceutical companies, to carry out the quality control of the described trypanocidal drugs on a common platform.

Closing of the training course on QC of trypanocidal drug formulations.

Fellowship Training

T.C. Mhande, B. Saidi, P. Jambra, and J. Burumu, from the Central Veterinary Laboratory in Zimbabwe, commenced two weeks' group fellowship training in FEPL on 4 February 2013. The fellows were trained in the field of contaminants and residues in animal products for human consumption, focusing on the quantitative determination of pesticide residues by gas chromatography–mass spectrometry (one week) and veterinary drug residues by liquid chromatography–tandem mass spectrometry (one week). The training also covered topics such as the principles of analytical method development, laboratory quality assurance and quality control, and method validation according to internationally accepted guidelines, focusing on SANCO/12495/2011 and European Commission Decision 2002/657 EC.

Fellows from Zimbabwe training in FEPL.

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