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. 20, No. 1, January 2017

Contents

To Our Readers

As we end the year 2016 and reflect on the impact and results we have achieved and look forward to our upcoming activities, we have successfully completed the planning for the IAEA programme and budget 2018-2019 on Improvement of Food Safety and Food Control Systems. We will continue to support on-going projects that include: (1) food irradiation applications using novel radiation technologies, (2) traceability for food safety and to enhance international trade and (3) preparation and response to nuclear and radiological emergencies in food and agriculture. New tasks and resources are assigned to these projects with clear indicators and detailed output expectations.

As announced in the last issue of our newsletter, a Technical Workshop on the Remediation of Radioactive Contamination in Agriculture was organized by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and the National Agriculture and Food Research Organization (NARO) of Japan and held on 17-18 October 2016 at IAEA Headquarters in Vienna, Austria. The meeting was planned in collaboration with NARO and the team in Vienna comprised technical officers from four different sections within the Joint Division, coordinated by the Food and Environmental Protection Section. Representatives of the three host organizations IAEA, FAO and NARO of Japan and over 100 experts from around the world participated in the event. This year marks the 5th and 30th anniversaries of the accidents at the Fukushima Daiichi and Chernobyl nuclear power plants, respectively. The plenary session provided overviews of key agricultural events and five technical sessions focused on remediation activities. All of the presentations and discussions focused on research results and practical experience from Japan and from countries affected by the Chernobyl NPP accident.

The workshop produced a set of conclusions, recommendations and observations for Member States and international organizations to enhance the preparedness and responses for nuclear emergencies and radioactive incidents affecting food and agriculture. One feature article in this issue is devoted to the workshop. In addition, an article also details the practical arrangement (PA) signed between the Joint Division and NARO to further strengthen future cooperation in the area of nuclear techniques for food and agriculture.

Photo courtesy of A. Cannavan

Achievements with real impact have been obtained from our coordinated research projects (CRPs). For example, CRP D52037 on *Implementation of Nuclear Techniques to Improve Food Traceability Systems* has generated a significant number of novel food authenticity and traceability datasets, developed new analytical methods, standard operating procedures (SOPs), facilitated many

scientific collaborations and promoted involvement in national and international food authenticity projects and networks. It successfully demonstrated the feasibility of using stable isotope analysis (SIA) to establish the geographical origins of several important food products produced in developing Member States. Significant progress can also be observed from CRP D52038 on *Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety* and D52039 on *Development and Strengthening of Radio-Analytical and Complimentary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products*. More details on both D52038 and D52039 can be found in reports inside this issue. A second feature article in this issue covers Nuclear and Related Techniques to Determine Food Authenticity. We have included this additional Feature Artilce to meet requests from our readers and feedback from our Member State counterparts who are particularly interested in food authentication.

Efforts to facilitate Member States in their implementation of international standards, guidelines and recommendations for the production of safe and quality-assured foods and for strengthening international trade are key elements of the subprogramme. We help to address these through participation in activities and meetings of the Codex Alimentarius Commission and relevant committees. Reports inside this issue provide information on our participation at the 23rd Session of the Codex Committee on Veterinary Drugs (CCRVDF), 17-21 October, 2016, Houston, USA, and the 20th Session of The Joint FAO/WHO Food Standards Programme, FAO/WHO Coordinating Committee for Asia (CCASIA), 24 September to 1 October 2016, New Delhi, India.

In response to requests from Member States and international organizations, we provide technical assistance and participate in various activities on behalf of the Joint Division. In this issue we report on: providing assistance on food safety and risk assessment to the Bulgarian Food Safety Agency in response to a request from the Bulgarian Nuclear Regulatory Agency; attendance at the 10th European Development Days (EDDs), Brussels, Belgium - a leading annual forum organized by the European Commission; participation at the International Symposium on Integrated Management of Agricultural Environment for Food Security, Busan, Republic of Korea, and a meeting on strengthening INFOSAN (International Food Safety Authority Network) and national food safety systems in Asia, convened by the WHO in collaboration with FAO, in Singapore. Other important events reported in this newsletter include several regional workshops and technical meetings.

As for technology transfer and capacity building, we continue to support many technical cooperation (TC) projects. The focus is on transferring new technologies, often developed by our subprogramme, to Member States. For example, a special "FAST-1" training course in Food Authenticity, Safety and Traceability was developed and held in Vienna, Austria, to raise awareness of issues and analytical methodologies to address current challenges. The course was well-received by participants and it was designed to assist those new to working with the subprogramme, so we were particularly pleased that it achieved an overall "excellent" rating. Currently, we provide technical support to 47 national and 11 regional TC projects – these are listed in this newsletter, which also includes articles specific to recent TC activities. To implement these, we work in close collaboration with counterparts in Member States and colleagues in the IAEA Department of Technical Cooperation. More recently, we have provided technical support in the design of 28 new TC projects for the 2018-2019 biennium.

As regards personnel news, I would like to say thank you and a fond farewell to Mr Johannes Solomon Corley who completed his work as a food safety specialist in December. We wish Johannes every success for the future and look forward to working with him as a collaborator in the coming years. One of our team assistants, Ms Anita Pavkovic successfully gained a position in our Director's office. Although this means she left FEPL, we send Anita our congratulations, and are happy that we still benefit from her excellent skills and the services she provides now to the whole division. We also welcome Ms Stephanie Beckham, who joined us as team assistant for both FEPL and the Insect Pest Control laboratory (IPCL). We also say thanks and goodbye to Ms Valeria Avossa who completed a one-year internship at FEPL in November and Mr Sharif Shawky who completed a two–month FEPL internship in August.

Finally, I would like to take this opportunity to thank all of our readers for your continued support and encouragement and to extend my best wishes to you and your families for a happy, healthy and prosperous 2017.

Sincerely,

Zhihua Ye
Head, Food and Environmental Protection Section

IAEA 60 Years
Atoms for Peace and Development

Set up in 1957 as the world's centre for cooperation in the nuclear field, the International Atomic Energy Agency (IAEA) works with its Member States and multiple partners worldwide, especially in the developing world, to promote the safe, secure and peaceful use of nuclear technologies. In September 2016, the IAEA held its sixtieth regular session of the General Conference, and in recognition thereof, the Secretariat will commemorate its sixtieth anniversary throughout the coming year.

Nuclear technologies continue to provide competitive and often unique solutions to help fight hunger and malnutrition, combat plant and animal diseases and pests, improve agricultural productivity and environmental sustainability and ensure that food is safe. Since 1964, the IAEA and the Food and Agriculture Organization of the United Nations (FAO) have worked in partnership through the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture to help Member States use these technologies safely and appropriately. Throughout this time the programme of the Joint FAO/IAEA Division, with its unique laboratories at Seibersdorf, has continuously evolved to meet the world's changing needs. In doing so, it has focused on expanding its ongoing contribution to agricultural development and global food security, and proactively embraced and added its expertise to efforts to adapt to and mitigate the effects of climate change, respond to globalization, conserve ecosystem services and broaden biodiversity. Today, it strives to mobilize commitment and concerted action towards meeting the Sustainable Development Goals of the United Nations through the appropriate integration of nuclear and related technologies for sustainable agriculture development and food security.

We take this opportunity to thank our numerous partners worldwide, whether institutions or individuals, for their dedication and continuous support to our mission since 1964.

Staff

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

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

Food and Environmental Protection Subprogramme

Name	Title	Email	Extension	Location
Zhihua Ye	Section Head	Z.Ye@iaea.org	21638	Vienna
Carl M. Blackburn	Food Irradiation Specialist	C.Blackburn@iaea.org	21639	Vienna
James J. Sasanya	Food Safety Specialist (Veterinary Drug Residues)	J.Sasanya@iaea.org	26058	Vienna
Kyoko Viitaniemi	Team Assistant	K.Viitaniemi@iaea.org	26061	Vienna
Malgorzata Rydeng	Team Assistant	M.Rydeng@iaea.org	21641	Vienna
Andrew Cannavan	Laboratory Head	A.Cannavan@iaea.org	28395	Seibersdorf
Simon Kelly	Food Safety Specialist (Traceability)	S.Kelly@iaea.org	28326	Seibersdorf
Britt M. Maestroni	Food Scientist	B.M.Maestroni@iaea.org	28398	Seibersdorf
Zora Jandrić	Analytical Chemist	Z.Jandric@iaea.org	28373	Seibersdorf
Aiman Abrahim	Laboratory Technician	A.Abrahim@iaea.org	28327	Seibersdorf
Marivil Islam	Laboratory Technician	M.Islam@iaea.org	28394	Seibersdorf
Stephanie Beckham	Team Assistant	S.Beckham@iaea.org	28259	Seibersdorf
Tamara Wimberger	Team Assistant	T.Wimberger@iaea.org	28267	Seibersdorf

Food and Environmental Protection Section
Vienna International Centre, Wagramer Strasse 5, PO Box 100, 1400 Vienna, Austria
Tel.: (+) 43 1 2600 + Extension; Fax: (+) 43 1 26007; Email: Official.Mail@iaea.org

Food and Environmental Protection Laboratory
FAO/IAEA Agriculture and Biotechnology Laboratories
2444 Seibersdorf, Austria
Tel.: (+) 43 1 2600 + Extension; Fax: (+) 43 1 26007; Email: Official.Mail@iaea.org

http://www-naweb.iaea.org/nafa/fep/index.html
http://www-naweb.iaea.org/nafa/fep/fep-laboratory.html
http://www.fao.org/ag/portal/age-index.html

Feature Articles

Technical Workshop on Remediation of Radioactive Contamination in Agriculture IAEA Headquarters, Vienna, Austria, 17-18 October 2016

Carl Blackburn, Gerd Dercon, Ivancho Naletoski, Stephan Nielen, Zhihua Ye

The year 2016 marks the fifth anniversary of the accident at the Fukushima Daiichi nuclear power plant (NPP) and the 30th anniversary of the accident at the Chernobyl NPP. A Technical Workshop on Remediation of Radioactive Contamination in Agriculture was organised by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and the National Agriculture and Food research Organization (NARO) of Japan and held at the IAEA headquarters, Vienna, Austria from 17 to 18 October 2016. Over 100 experts from around the world participated in the event and all of the presentations and discussions focused on research results and practical experience from Japan and from countries affected by the Chernobyl NPP accident. This was a great success in promoting and sharing knowledge and experience related to remediation of radioactive contamination in food and agriculture. Copies of the presentations are now available online at http://www-naweb.iaea.org/nafa/news/2016-FAO-IAEA-NARO.html.

From an agricultural perspective, the impacts of both these major accidents are related to caesium radionuclides, specifically caesium-137, which is a relatively long lived isotope with a half-life of some thirty years. Research and technical efforts to remediate and ameliorate the impact of this radioactivity on agricultural production aim to minimize and prevent the contamination of foods and other commodities, and further to assist the social and economic recovery of affected rural communities by enabling sustainable production. However, these efforts are not widely appreciated outside of the affected areas.

The two-day event commenced with opening statements from representatives of the three host organizations: Mr Aldo Malavasi, Deputy Director General of the IAEA; Mr Qu Liang, Director of the Joint FAO/IAEA Division in representation of FAO and Mr. Imbe Tokio, President of NARO.

The plenary session provided technical overviews of key agricultural events since the Fukushima Daiichi NPP accident in 2011 and the main activities in this area over the 30 years since the accident at the Chernobyl NPP. A very touching presentation was also made by a farmer from the Fukushima Prefecture in Japan and this highlighted the importance of remediation not only in terms of radiation safety but also to help alleviate the social and psychological impact on communities. The plenary closed with an overview of current joint FAO/IAEA activities related to the control of radionuclides in food and agriculture. The plenary set the scene for the five technical sessions that followed, where presentations and discussions were held under the headings of: (i) Agricultural Land and Water, (ii) Plants and Crop Products, (iii) Animals and Animal Feeds, (iv) Food and Commodities, (v) Socio-Economic Aspects. Presentations and discussions focused on research results and practical experience from Japan and from countries affected by the Chernobyl NPP accident.

Agricultural Land and Water

An overview was given about some of the new insights in the mechanisms of caesium dynamics in agro-environments. New insights about the caesium dynamics also showed the need for improvements in soil sorption and crop uptake modelling. Further, lessons learnt about the different remediation techniques were discussed, for areas affected by the Chernobyl as well Fukushima Daiichi NPP accidents. Advantages and limitations of such remediation tools were discussed openly.

Plants and Crop Products

Various phytomanagement approaches were presented as countermeasures to reduce the transfer of radionuclides in the food chain and to facilitate the return of affected soils to agricultural practices after a nuclear accident. The effectiveness and feasibility of the approaches considering radiological and technical criteria were discussed. Studies on soil-to-plant transfer of radiocaesium have shown that the transfer can be predicted with soil and plant properties. Alternative land uses are potential approaches to revitalise contaminated agricultural land and also non-soil (direct) based phytomanagement approaches (green houses, soil or aquaculture) are high-potential new venues for contaminated land recovery.

Animals and Animal Feeds

A comprehensive system for early detection of radioactive contamination that may affect animals and animal products was presented. The response to eventual contamination was linked to comprehensive contingency plans for remediation in animal production systems, aimed to prevent entry of the contaminated products into the food chain. The response measures based on the experiences from Chernobyl were presented as a comprehensive package of corrective monitoring of farm inputs (animal feeds and water supply), application of caesium binders to decrease transfer of caesium into the milk and meat, changing the type of production (shift from milk to meat production) and processing of animal products aimed to decrease the activity concentration in the animal products.

Food and Commodities

A detailed presentation provided an overview of food management following the Chernobyl accident and focused mainly on the affected areas that were former in the USSR but subsequently are parts of Belarus, Russian Federation and Ukraine. Countermeasures in agricultural areas after Chernobyl and the Fukushima accidents were then considered, the importance of monitoring and taking early actions to restrict food distribution and therefore protect consumers was highlighted, as were methods for further reducing radionuclide content in food. The influence of food processing and cooking on radiocaesium content was also discussed in the context of research in Japan that focused on grains and legumes (brown rice, wheat, buckwheat, soya bean) produced in contaminated areas.

Socio-Economic Aspects

A presentation by NARO gave details on the current situation in the affected area in Fukushima and also included key past events. The socioeconomic and environmental impacts and prospects was presented to up-date the meeting on international recovery and development projects related to Chernobyl affected countries of Belarus, Russian Federation and Ukraine. This stimulated a great deal of discussion and raised awareness of the actions of international organizations working together to provide assistance. The session closed with a thought provoking presentation on an economic project to investigate work structure of farming households in affected areas in Japan as a means of helping in the restoration of farming.

The workshop was successfully accomplished with a set of conclusions, recommendations and observations as well for international organizations and Member States to enhance the preparedness and responses for nuclear emergencies and radioactive incidents related to food and agriculture in the future.

The meeting was planned in collaboration with NARO and the team in Vienna comprised technical officers from four different sections within the Joint Division, coordinated by the Food and Environmental Protection Section. An appreciation of continuing developments and activities in this area will greatly improve emergency preparedness related to food and agricultural production in Member States. It will also support efforts to re-establish agricultural trade from areas currently affected by residual levels of radionuclides.

The organizers would like to thank all participants especially those who provided technical contributions. In recognition of the high level of interest in this technical area, the Joint FAO/IAEA Division and NARO have entered into a practical agreement for mutual collaboration, with a view to holding similar events in future.

Nuclear and Related Techniques to Determine Food Authenticity

Andrew Cannavan, Simon Kelly, Zora Jandrić

Food quality, including food safety, is a major concern facing both food industry and consumers. Recurrent food authenticity and safety crises endanger public health and provoke loss of public confidence in the integrity of the food supply. Current food labelling and traceability systems cannot always guarantee that the food we eat is authentic, of good quality and safe. Globalization in food trade has increased the need for effective food control systems to protect consumers from contaminated and fraudulently presented food. Food crime – intentional mislabelling or adulteration of food commodities on an organized and large scale for financial gain – has become a major criminal activity which can result in substantial economic losses to authentic product manufacturers and can discredit entire economic sectors, leading to barriers to international trade. Although the driver for food fraud is financial gain, there is frequently a food safety risk involved, since adulterant or counterfeit products will not have undergone the same controls as a genuine product and the constituents may be unknown. Examples include the addition of melamine to milk powder to increase apparent protein content, which caused many thousands of illnesses and several infant deaths due to the toxicity of melamine; the adulteration of high quality extra-virgin olive oil with other, cheaper, oils such as groundnut oil, which are undeclared on the label and may cause serious allergenic reactions; copper sulphate added to table olives to enhance look and feel of the products; and even counterfeit rice made from potato starch and industrial synthetic resin which can be deadly if eaten on a daily basis.

Analytical Techniques

The need for analytical methods to help combat food fraud has grown rapidly. These techniques enhance food safety by underpinning mechanisms for tracing the origin of food commodities, authenticating food products, detecting adulteration and verifying food traceability. Demand will most probably continue to increase in future as food supply chains become more complex and with advances in food technology. In recent years, considerable effort and funding have been invested in research to address these issues in many countries and regions.

Stable Isotope Measurements

Nuclear techniques provide key attributes required for food authenticity testing. For example the measurement by isotope ratio mass spectrometry (IRMS) of the ratios of naturally occurring stable isotopes of the bio-elements hydrogen, carbon, nitrogen, oxygen, sulphur in foods can often provide information on the geographical origin or the production technique of the food through linkages to the ratios of the isotopes in the environment or, for example,

the fodder or food used in the feeding regime of animals. Heavy element stable isotopes, or geo-isotopes, measured using thermal ionization mass spectrometry (TIMS) or multi-collector inductively coupled mass spectrometry (MC-ICPMS) can also provide information useful for food authentication. The most commonly used is the ratio of the radiogenic isotope strontium-87 (^{87}Sr) to the non-radiogenic ^{86}Sr. The variation in isotope abundances is due to spontaneous nuclear transmutation over geological time-periods, and the measurements can provide information related to the geology of the area of origin, which is transferred through bioavailability in soils to plants and animals. Stable isotopes are difficult to manipulate and defraud because they are intrinsic characteristics of atoms in the food.

Elemental Profiling

Elemental profiling of foods by inductively coupled plasma-mass spectrometry (ICP-MS) provides important information on its safety with regard to the concentration of potentially toxic elements such as arsenic, cadmium, lead and mercury. Furthermore, combining information on the concentration of macro, micro and trace elements can provide data that links food to its place of production. The multi-element composition of animal and plant tissues reflects, to some extent, that of the vegetation they eat. Likewise, the composition of vegetation mirrors the bio-available and mobilized nutrients present in the soils from which they were cultivated. For example, alkaline metals especially rubidium and caesium being easily mobilized in the soil and easily transported into plants, are good indicators of geographical identity. Trace element availability depends on several factors such as soil pH, humidity, porosity, clay and humic complex. Consequently, the range of soils present and bioavailability mean that elemental composition may provide unique markers in food that characterize geographical origin and traceability.

Fingerprinting

Metabolomic fingerprinting, the analysis of metabolites which are the result of cellular or molecular processes in an organism, is another important technique commonly used for authenticity testing. Nuclear magnetic resonance (NMR) and mass spectrometry (MS) are key methods used for metabolomics. Metabolomics can be either targeted, focusing on groups of related metabolites to provide direct functional information for metabolomics modelling, or untargeted, detecting patterns in the metabolome that can differentiate between sample sets and can be used to build models for classification of unknown samples based on the metabolic pattern or fingerprint. All such techniques rely heavily on advanced chemometrics to process and interpret the results. Nuclear magnetic resonance can be applied to studies of complex mixtures in a food commodity without prior separation of the components, and can provide information on, amongst other characteristics, the geographical origin, the presence of adulterants, the quality and the processing method of a food. An example of the application of this type of technique is spin-generated fingerprint profiling using proton-NMR spectroscopy to screen fruit juices and wines. The results of an unknown sample are matched with a dataset of authentic samples of known provenance, showing either agreement, if the sample is authentic, or deviation if it is not.

These techniques, in combination with others such as vibrational spectroscopy, trace element analysis, DNA analysis and microbial fingerprinting, and with chemometric statistical analysis and machine-learning, are proving invaluable for authenticating foodstuffs.

Accessible Authenticity Testing Techniques

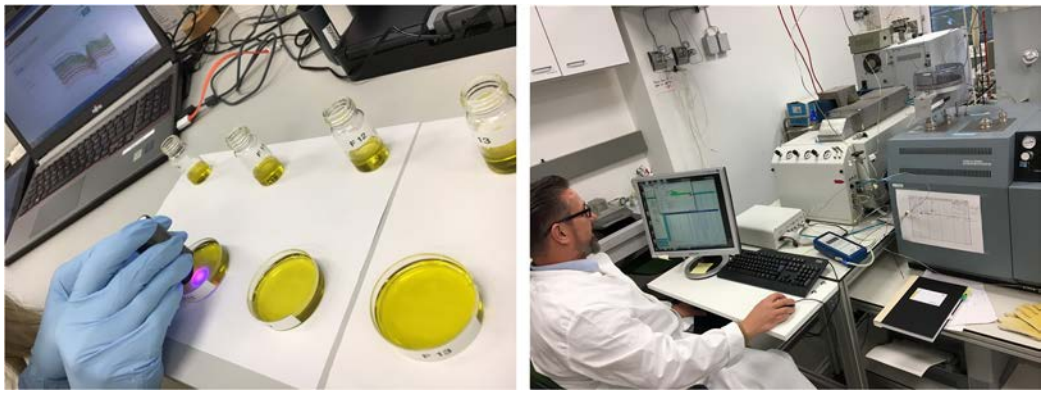
Although various promising food testing methods have been developed using a variety of analytical techniques, the implementation of effective controls has been hampered to date by factors such as the lack of harmonization of approaches, availability of accessible databases of authentic product characteristics and data, absence of suitable food-matrix reference materials, lack of awareness in industry and regulatory bodies of the possibilities for food testing, and the cost of putting the methods in place.

However, recent developments in analytical instrumentation are making the required analytical techniques more accessible. Various categories of instruments that were previously used only in the laboratory are becoming available in more affordable bench-top, portable or hand-held versions, which may be able to provide a screening capability. For example, bench-top NMR instruments costing tens of thousands of dollars have recently become available that can perform screening analyses previously run on high-field NMR instruments that cost several hundreds of thousands of dollars and require specialized infrastructure and dedicated personnel. Similarly, portable and hand-held X ray fluorescence (XRF) and near-infrared spectrometers are now commercially available and finding applications in food testing. Some infrared spectrometers are currently available as palm-held instruments costing only a few hundred dollars, connectable to spectral libraries via smart-phones or tablets, with the next generation of such instruments expected to be integrated into smart phones. Other bench-top or portable techniques that have potential applications for authenticity testing include ion-mobility spectrometry, which employs a Nickel-63 ionization source and has recently become widely used to screen for explosives and drugs, for example in airports, and isotope ratio measurement by laser ablation molecular isotope spectrometry (LAMIS).

The successful application of such techniques requires research on their application for different food commodities, the development and maintenance of extensive databases of measurement results from authentic foodstuffs, and robust statistical analysis and modelling.

Conclusions

A range of nuclear and related analytical techniques are available for food authenticity testing. The cost-effectiveness and accessibility of these modern techniques means that they could potentially be used to screen foods at multiple points along the food production/processing/distribution chain by stakeholders in the food industry, regulators and even consumers, which would significantly increase the effectiveness of control systems. If required, products that fail the screening test could be tested further using the more expensive, high-end confirmatory techniques at a central or reference laboratory to provide more detailed information on the product characteristics that indicated non-authenticity for follow-up investigations and possibly prosecution.



Screening of foods for authenticity using cheap, hand-held infra-red sensors (left) with further investigation of suspect samples by confirmatory nuclear techniques such as isotope ratio mass spectrometry (right) makes the technology accessible for a variety of user and Member States.

Forthcoming Events

Research Coordination Meetings (RCMs) of FAO/IAEA Coordinated Research Projects (CRPs)

Second RCM on the Development of Electron Beam and X ray Applications for Food Irradiation (D61024-CR-2), 27−31 March 2017, Strasbourg, France (TBC)

First RCM on Field-deployable Analytical Methods to Assess the Authenticity, Safety and Quality of Food (D52040-CR-1), 15−19 May 2017, Vienna, Austria.

First RCM on Integrated Radiometric and Complenetary Techniques for Mixed Contaminants and Residues in Food (D52041-CR-1), 19−23 June 2017, Vienna, Austria

Third RCM on the Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety. (D52038-CR-3), October 2017 (TBC), Vienna, Austria

Training Courses/Workshops

RALACA/PUI Meeting on data quality and management (D6-TR-56165),18-19 May 2017, San Jose, Costa Rica

International Meetings/Conferences

11th Session of the Codex Committee on Contaminants in Foods Food Metabolomics Conference, 3−7 April 2017, Rio de Janerio, Brazil

49th Session of the Codex Committee on Pesticide Residues, 24−29 April 2017, China.

6th Inter-Agency Committee on Radiation Safety (IACRS), 14−17 May 2017 San Jose, Costa Rica

19th Inter-Agency Committee on Radiation Safety (IACRS), September 2017, Washington, USA (TBC)

26th Regular Meeting of the Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE), 27−29 June 2017, Brussels, Belgium

40th Session of the Joint FAO/WHO Codex Alimentarius Commission, 3−7 July 2017, Geneva. Switzerland

2017 Annual Hands-on Workshop in eBeam Technologies, National Center for Electron Beam Research, Texas A&M University, USA, 19–24 March 2017

Carl Blackburn

The IAEA collaborating centre for Electron Beam Technology for Food, Health and Environmental Applications is to hold a practical workshop to address the needs of the food, phytosanitary, agribusiness, and pharmaceutical industries. This week-long hands-on workshop in eBeam technologies will be the eighth in an annual series, held by the National Center for Electron Beam Research (NCEBR) at Texas A&M University, College Station, Texas, USA. A modest registration fee will cover hotel accommodations, food, refreshments, all workshop materials and local transportation.

This event offers a unique opportunity to learn about electron beam technology at a commercial scale facility. Further information and contact details can be found on the NCEBR website; http://ebeam-tamu.org/

A mixture of theory & practical sessions at a previous eBeam Workshop.

Seventh Annual Phytosanitary Irradiation Forum, Chapman University, Orange, USA, 21–22 March 2017

Carl Blackburn

Organized by Chapman University in cooperation with the Joint programme of the FAO/IAEA and the US Department of Agriculture, the objective of the forum is to increase the understanding and use of irradiation as a post-harvest phytosanitary treatment to enable and enhance global trade by addressing the threat of invasive pests.

Presentation and discussion topics will focus on the technology, efficacy of treatments, acceptance, global use, logistical challenges in trade, regulatory perspectives, certification, market access and trade. Topics are illustrated with reference to success stories from around the world. The use of irradiation as a phytosanitary treatment is increasing and more facilities are applying the technique on a commercial basis. Further details and online registration can be found here:

http://www.chapman.edu/scst/conferences-and-events/phytosanitary-irradiation-workshop.aspx

Past Events

INFOSAN Meeting, 'New Science for Food Safety: Supporting Food Chain Transparency for Improved Health', Singapore, 7–10 November 2016

Andrew Cannavan

The International Food Safety Authority Network (INFOSAN), a WHO/FAO initiative, was set up in response to the increased likelihood of international incidents involving contaminated food as a consequence of the rapid globalization of food production and trade.

A recent meeting on strengthening INFOSAN and national food safety systems in Asia, convened by the WHO in collaboration with FAO, stated that more work is needed to consider the globalization and increased complexity of the food chain, and the potential application of new technologies. The meeting also called for strengthening INFOSAN and national food safety systems in Asia with emphasis on foodborne disease surveillance, laboratory capacity and multi-sectoral coordination.

The potential linkage between authorities related to food safety and food production regulatory action and science institutions in the region would enable a faster and more consistent introduction of new international science-based developments in this area. Likewise, the internationally adopted (WHO and FAO) food safety risk analysis principles suggests independent scientific advice as the basis for food safety risk management and food control. The rapid rise of food science and applied technologies in the Asia region opens new possibilities for regional collaboration in support of scientific and regulatory development. The recent creation of the ASEAN Risk Assessment Centre (ARAC) is one example of such developments.

In recent years, several new important scientific developments have emerged with significant future implications for food production and food safety – and with direct impact upon the future food chain transparency and food safety solutions. In this context, INFOSAN convened a meeting on regional perspectives on food science and developments in Asia. The meeting, 'New science for food safety: supporting food chain transparency for improved health', was co-organised by Nanyang Technological University Food Technology Centre (NAFTEC), FAO and WHO. The meeting had more than 160 participants from 30 countries.

The meeting focused on four inter-related major subjects where new scientific developments are already resulting in major changes to food science and food regulatory systems in Europe and the Americas: Foodborne Disease Burden - finally obtaining science-based estimates for policy prioritization; Risk Assessment and Sustainability; Next Generation (DNA) Sequencing – linking data for faster and better decisions, and; Novel Food Technology – hindering fraud and helping health. Mr. Cannavan was invited to give a presentation on 'International Efforts to Combat Food Fraud' in the last of these sessions. The presentation focused on the issues around food fraud and the FAO/IAEA coordinated research and capacity building projects in this field, as well as international EU projects in which FEPL is involved. The presentation prompted several questions and discussion from the floor. He also served as a member of the expert panel following the session to respond to further questions and foster discussion.

The officer also participated in break-out sessions on the potential for regional use of foodborne disease burden estimates in food science and regulation, and on the potential for regional collaboration on next generation DNA sequencing in food science and food regulation. The conclusions of the breakout groups were presented and discussed in the following plenary sessions.

The direct interaction between regulatory authorities and science/research agencies and institutions has developed rapidly in both the EU and the US systems. It was clear from the presentations and discussions at the INFOSAN meeting that this modality should also be encouraged and promoted in Asia, with support from the relevant international organizations in this area, including WHO and FAO.

Mr Andrew Cannavan taking questions at the INFOSAN meeting.

23rd Session of the Codex Committee on Veterinary Drugs (CCRVDF), Houston, Texas, USA, 17-21 October 2016

James Sasanya

The Technical Officer represented FEP at the 23rd CCRVDF and reported relevant activities. An estimated 230 participants from several Member States and observer organizations attended the meeting. A number of developing countries reported in session, support they have received from the Joint FAO/IAEA Division, and how this has made a significant difference in their countries' food control systems, public health and trade initiatives. They also reported to the committee how this support boosted their meaningful participation in Codex meetings and other activities. In this regard, two conference room documents (CRDs, 5 and 10) were prepared by some of the countries, to record their appreciation. The CRDs are linked to the final report the 23rd CCRVDF adopted. The participants requested for continued support from the IAEA/Joint Division to improve their food safety programs.

The officer also participated in plenary discussions on current pertinent food safety, public health and trade matters, including among others, unintended presence of veterinary drug residues in food commodities, resulting from the carry-over of drug residues into feed. The officer also attended a side event to discuss the 81st meeting report of the Joint FAO/WHO Expert Committee on Food Additives (JECFA) on residue evaluation of certain veterinary drugs.

Furthermore, the officer held meetings and discussions with individual/group delegates from the various CCRVDF Members States, to create and/or enhance awareness on the role of nuclear/isotopic and complementary techniques in national food and environmental safety programmes. In this regard, the officer also attended meetings organized by the Codex Committee for Latin America and the Caribbean *Counterparts of an interregional food safety project at the 23rd CCRVDF, Houston, Texas* (CCLAC) and the Codex Committee for Africa(CCAFRICA) on the sidelines of the main sessions.

New Practical Arrangements Between the Joint Division and the National Agriculture and Food Research Organization (NARO) of Japan, Vienna, Austria 14 October 2016

Carl Blackburn

The Joint Division signed an agreement of "Practical Arrangements" with the National Agriculture and Food Research Organization (NARO) of Japan. These practical arrangements formalized already successful cooperative working arrangement in the area of nuclear techniques for food and agriculture. For example, our feature article reports on the Technical Workshop of remediation of radioactivity in agriculture that was organized and hosted jointly with the NARO.

Signing Ceremony - photo courtesy of Mr R Cardenas-Soria.

This new agreement will help both organizations to further cooperate, sharing expertise in research and development as well as providing assistance for training and the exchange of staff. The agreement was signed on 14th October by Mr. Qu Liang, Director of the Joint FAO/IAEA Division and Mr. Imbe Tokio, President of NARO, at a meeting in Vienna attended by NARO and Joint Division Staff.

Working in collaboration with expert partners using Practical Arrangements like these help the Joint FAO / IAEA programme to address and service the requests for assistance from our Member States. This type of framework for cooperation proves to be mutually beneficial for our collaborative partners as well as for institutions world-wide in our member countries.

New IAEA Collaborating Centre for Electron Beam and X ray Technologies: Aérial Technology Resource Centre and Technical Institute for the Food Industry, Illkirch cedex France, 21 October 2016

Carl Blackburn

In October 2016 a new IAEA Collaborating Centre was inaugurated in France. The *IAEA Collaborating Centre for Multidisciplinary Applications of Electron Beam and X ray Technologies and Related Dosimetry, Especially for Food Irradiation* is at Aérial[1], an institute located in Illkirch Cedex, France. Aérial is a Technology Resource Centre and Technical Institute for the Food Industry and is no stranger to the Food and Environmental Protection

[1] Aérial-Parc d'Innovation- 250 Rue Laurent Fries, CS 40443-67412. Illkirch cedex, France http://www.aerial-crt.com/en.html

subprogramme. We have collaborated in previous IAEA research initiatives and Aérial has also helped with technology transfer for several developing countries as part of IAEA Technical Cooperation Projects. I would also like to congratulate our new collaborating centre on the good news that the centre will be hosting the International Meeting on Radiation Processing (IMRP) conference in 2019. IMRP is the major conference for radiation processing and is held every three years – this is already great news for a new partnership.

There are many synergies in the mandates of both organizations. Aérial is already helping to progress an IAEA international coordinated research project to develop electron beam and X ray applications for food irradiation. We already have an international meeting scheduled to take place at the institute in March 2017. The year 2016 marked the thirtieth anniversary of Aérial, it was also the IAEA's sixtieth anniversary. Thirty years ago, Aérial started with food irradiation and applied research on shelf-life enhancement, elimination of pathogens for food safety and work on developing detection tests for irradiated foods it has continued to develop and today maintains an impressive portfolio, with its services as a Technology Resource Centre and its food and bio-industry expertise. This centre has developed and grown to include different radiation processing application, not just food irradiation. Aérial now also extends its expertise in various different fields, not just food safety and quality.

Aérial is a reference laboratory for high level dosimetry, and in this respect it is currently undertaking a dose inter-comparison exercise involving radiation processing facilities in several IAEA member states. Aérial is als an official laboratory for the detection of irradiated food. In the past we have sponsored scientists for other member states to visit and learn these skills, and we have several more countries requesting assistance in this area and in the area of radiation processing.

Working with Aérial is going to be exciting – not only because of the resourceful Director Alain Strasser and his staff, but because of its experimental irradiation facility with an electron accelerator and five highly capable laboratories working in the areas of dosimetry, microbiology, physical-chemistry, sensory analysis and experimental freeze drying. The future is also bright; the FEERIX project means that in two years' time the collaborative centre will install a new Rhodotron electron accelerator with two beam-lines, one for electron beam irradiation and the other for X rays. The FEERIX project will ensure that Aérial's facilities remain as state of the art and we hope that our partnership will help maintain its position as a centre of excellence in food irradiation and radiation processing in general.

The IAEA Collaborating Centre scheme aims to promote the practical use of nuclear techniques worldwide and help to implement activities for the peaceful uses of nuclear sciences. Focusing on research, development and training, the FEP section welcomes Aérial as a new IAEA Collaborating Centre.

At the 21 October 2016 inauguration ceremony Nathalie Colinet (left), Head of the Nuclear Applications Contracts Administration Section of the IAEA, presents the collaborating centre plaque to Alain Strasser, Director of Aérial.

Second International Max Rubner Conference on Food Metabolomics, Karlsruhe, Germany, 10–12 October 2016

Zora Jandrić

The second international Max Rubner Conference on Food Metabolomics was held at Max Rubner-Institute, in Karlsruhe, Germany. The conference was focused on food quality, food safety and the effect of food and nutrition on human health, which are of great interest for consumers, policy-makers and the food industry.

The conference was organised to discuss the current status of metabolomics in food sciences and the, advantages and limitations of the current analytical methods used, describe the status quo of metabolomics databases, and present results of recent applications in food quality, food safety and nutrition, through presentations and plenary meetings. The following topics were covered: the use of food metabolomics in the characterisation of food, metabolomics databases, metabolite profiling: a tool to assess safety and quality of crops, metabolomics approaches to detect food spoilage, and metabolomics as a tool to asses food authenticity. The conference was attended by more than 200 participants from more than 15 countries.

Ms Jandrić presented current applied research done in the Food and Environmental Protection Laboratory (FEPL) at Seibersdorf on applying a non-targeted approach for discrimination of Sri Lankan teas using ultra-performance liquid chromatography coupled to quadrupole time-of-flight mass spectrometry and multivariate data analysis. The research was done to provide analytical methodology on food authenticity and safety, to support

IAEA&FAOMember States in ensuring sustainable food systems.

Participation in the conference offered an excellent way to network, discuss and share ideas with scientists and researchers from different countries interested in the rapidly developing field of metabolomics . Food safety and quality are issues of wide relevance to consumers and manufacturers. Recently food fraud has become a key food quality issue in IAEA&FAO Member States. Food fraud as such is not always a direct food safety issue, but once the legal line is crossed, undetected cases may develop into more serious problems. Moreover, food fraud can lead to significant economic losses, brand damage, and loss of consumer confidence in entire food sectors. Metabolic profiles of food are influenced by many factors, such as: variety, growth conditions, ripeness stage, processing conditions, etc. Therefore, metabolic profiles carry valuable information on the product's history, which could be used to verify the authenticity of a certain food product.

Authent-Net Workshop on Funding and Target Commodity Priorities for Food Traceability/Authenticity, Dublin, Ireland, 6–7 October 2016

Andrew Cannavan

Authent-Net is a two-year European Union Horizon 2020 research and innovation project in which the FAO/IAEA's Food and Environmental Protection Laboratory (FEPL) is a partner.

It is acknowledged that historically anti-food fraud capability within Europe has not been consolidated and lacks the coordination and support structures available to those working in food safety. There are various initiatives underway to redress this balance e.g. DG Santé's Food Fraud network, DG Research's FoodIntegrity project, as well as numerous national programmes and industry initiatives.

One pivotal area that still needs to be addressed is bringing together national research funding bodies to facilitate the development of transnational research programmes. Authent-Net will address this need by mobilising and coordinating relevant research budget holders in order to facilitate the eventual development of a transnational European funding vehicle that will allow Members States (MS) to jointly fund anti-fraud research. Authent-Net comprises a core group of 19 participants from 10 member states, 1 NGO and the US, who are either National research funding bodies; experts in food authenticity, and/or experts in transnational funding mechanisms. The FEPL, represented at the meeting by Mr Cannavan, provides expertise in food authenticity and a link to researchers and funding bodies both within and outside Europe.

The meeting encouraged and enabled discussion and agreement between various funding bodies and researchers in the field of food authenticity.

A road-map was developed for the project's duration and for future sustainability of the outcomes, based on a number of inputs and models, including the EU reference laboratory network structure and the networking activities of FEPL, within TC and CRP mechanisms as well networking activities such as the RALACA network set up using extra-budgetary funding (e.g. the Peaceful Uses Initiative).

Authent-Net will bring together relevant member states R&D budget holders to coordinate inter-disciplinary research effort and build a cohesive and sustainable network, and develop a high level research and innovation strategy for transnational research on food authenticity. A coherent research strategy will enable integration of IAEA research projects with European projects to provide synergism and leveraging of European research to the benefit of IAEA and FAO member countries world-wide.

The two year project will have the following expected impacts:

- Improved coordination and communication between relevant member states research budget holders
- Enhanced cognisance of existing national research
- A joint strategy for food fraud R&D
- Agreed priorities and capability to deliver transnational research on food fraud

20th Session of The Joint FAO/WHO Food Standards Programme, FAO/WHO Coordinating Committee for Asia (CCASIA), New Delhi, India, 24 September to 1 October 2016

James Sasanya

Mr Sasanya represented FEP at the 20th FAO/WHO CCASIA meeting focusing on food safety and quality, standards and guideline setting as well as trade. The officer contributed to deliberations on a theme entitled "Prioritization of the needs of the region and possible approaches to address them" and also gave an oral presentation in plenary to report activities of the Joint FAO/IAEA Division relevant to CCASIA.

The officer informed the delegates how the Joint FAO/IAEA Division supports the development and implementation of holistic food safety and control systems, through international coordinated research activities that also encourage networking among developing and developed countries. Some examples of relevant Coordinate Research Projects were reported, including a prospective one on mixed contaminants and residues in foods. A number of national, regional and interregional

yechnical cooperation projects (TCPs) in which CCASIA members are involved or could take advantage of, were also reported. The officer added that the regional and interregional TCPs besides focusing on capacity building, aim at building networks among food safety laboratories for information and knowledge sharing around the world.

The committee meeting underscored the need to strengthen food control systems in the region so as to better safeguard consumers and enhance public health and trade. The committee identified some lingering challenges such as disparities in levels of food control systems/capabilities that therefore calls for closer cooperation among MSs to facilitate sharing of experiences and know-how. The committee also felt that there is need for greater networking and exchange of Scientists as well as more emphasis on building capacity for risk assessment. These needs and wishes are in line with the networking initiatives and capacity building activities the FEP and Joint Division supports and promotes.

IAEA represented at the 20th CCASIA, Sept-Oct 2016

Food Irradiation and Strengthening Adaptive Climate Change Strategies for Food Security, Bangkok, Thailand, 22–26 August 2016

Carl Blackburn

Identifying innovative technologies and practices for coping with the adverse impacts of climate change is a priority. As regards food, nuclear science has the potential to address some of the food security challenges we face. For example, IAEA project RAS/5/071, involving the Joint FAO/IAEA Division and the IAEA Department of Technical Cooperation has brought together climate change specialists and food technologists from Member States in the Asia and Pacific Region. Funded through a Regional Cooperative Agreement, this project is reviewing the opportunities that more widespread use of food irradiation could offer in future.

Food Irradiation is where food is exposed to ionising radiation. Energy is transferred from X rays or accelerated electron beams, both generated by electricity, or by gamma rays emitted from cobalt-60. The process takes place in specially designed facilities - food does not come into direct contact with the energy source and its temperature or appearance is not affected and unlike chemical treatments there are no residues. The beams are penetrating and pre-packaged food remains protected from infestation or contamination after treatment. Today, various foods are treated by irradiation in nearly 80 countries but this represents a relatively small proportion of food traded annually. Using food irradiation more widely could help meet the following food security challenges in the future:

- **Food Irradiation to Combat Food Losses and Protecting Food Quality**

Levels of spoilage organisms are significantly reduced by irradiation. As a result, the microbiological quality of irradiated food is safeguarded. In combination with good packaging and storage this can reduce food losses and wastage, especially of fresh fruits, vegetables, meat and fish.

Irradiation can address insect infestation. Low intensity treatments stop insects from developing and reproducing in stored products. Dried fish, fruits, aromatic plants, spices and some legumes are good candidates for this but it could also be used to treat less expensive staples (cereals and grains) in future. For the moment, in spite of the residues that they leave, chemical fumigants remain a cheaper option than irradiation.

- **Food Irradiation to Reduce the Risk of Foodborne Illnesses**

The World Health Organization (WHO) calculates that almost 1 in 10 people fall ill every year from food poisoning and 420 000 die. Climate change and increasing average surface temperatures is predicted to make conditions more favourable for foodborne illnesses. Organisms like Salmonella, Shigella, Staphylococcus aureus and Vibrio cholera, all are sensitive to low or moderate doses of irradiation, making the technology a very effective tool to ensure microbiological safety. It is already being used in many countries to treat dried products such as herbs and spices. Some countries in Asia and Europe also irradiate shrimp and frog legs and, in the USA, beef patties are irradiated to ensure that they are free of food poisoning bacteria. So in future, more widespread use of food irradiation may help reduce the incidence of food poisoning. Irradiation will also inactivate molds before they can start producing mycotoxins in stored food products. It may therefore also be useful at maintaining the quality of strategic food reserves; e.g. cereal stockpiles that can be used to supplement diets when there are shortages.

- **Food Irradiation as a Phytosanitary Measure against Invasive Pests**

Climate change is already increasing the range and habitats available for invasive insects to establish and colonize; it is

influencing the spread of pests of quarantine importance. Chemical fumigation is a cheap countermeasure, but leaves residues or involves ozone depleting substances such as methyl bromide. Irradiation is a viable alternative phytosanitary treatment and is being used increasingly in the trade of fresh agricultural commodities such as fruits and vegetables.

- **Food Irradiation as a Tool to Prepare Emergency Rations**

Emergency rations are meals and high-calorie foods needed to feed or supplement diets in times of need. The difficult conditions that result from natural disasters call for foods that are not only safe to eat but which can be kept without cold storage for long periods. Irradiation can be used to prepare ready-to-eat food in ration packs that are stable for months at ambient temperatures.

THE Solution?

Food irradiation alone cannot address all of the food security issues that we will face in the future, but using it more widely could make a significant difference to food safety, food availability and ensuring continued international trade. An IAEA project involving climate change specialists and food technologists is making sure that policy makers in the Asia and Pacific region are aware of the technology, the current applications in the region and the future potential.

IAEA Regional Workshop to Review and Update National Action Plans to Control Public Exposures, Jakarta, Indonesia, 11–12 August 2016

Carl Blackburn

The TO represented the Joint FAO/IAEA Division and participated in this workshop in order to facilitate discussions on the prioritization and key issues for regulatory and health authorities for the control of radioactivity in food (in existing exposure situations) and to assist in discussions related to Codex Standards and IAEA safety standards, reference levels and guidance.

The meeting was attended by more than 30 participants from 17 countries (Bangladesh, Indonesia, Iran, Iraq, Jordan, Kuwait, Malaysia, Myanmar, Oman, Pakistan, Qatar, Sri Lanka, Syria, Thailand, United Arab Emirates, Viet Nam and Yemen) and three international organizations (FAO, IAEA and WHO). Discussions on radioactivity in food centred on TECDOC 1788 *Criteria for Radionuclide Activity Concentrations for Food and Drinking Water*. Readers will recall that this new publication was highlighted in the Announcement section of our previous Newsletter. The framework for calculating specific reference levels for radionuclides in food as set out in TECDOC 1788 was explained and discussed in detail, as where the assumptions that underpin such calculations. Guidance was also provided on how to calculate National Reference Levels for radioactivity in food.

Few countries appeared to have National Reference Levels for radionuclides in food that are in the form of activity concentrations. Participants were encouraged to consider adopting reference values equal in magnitude to those already in International Food Standards of the FAO/WHO Codex Alimentarius Commission for international trade. The meeting also discussed how the approach in TECDOC 1788 is consistent with Codex Guideline Levels.

European Food Integrity Project Workshop and Workpackage 1 Meeting, University of Lisbon, Portugal, 4–5 July 2016

Mr Simon Kelly

A selection of attendees at the Food Integrity workshop "Geographic origin and authenticity of food products:from tools to legislation" held at the University of Lisbon Portugal Portugal, on 4th July 2016.

The integrity of European foods is under constant threat from fraudulently labelled imitations that try to exploit their added value. The European Framework 7 Integrated Project "FoodIntegrity" started in 2014 and its goal is to provide assurance to consumers and other stakeholders about the safety, authenticity and quality of European food (its integrity), which is of prime importance in adding value to the European Agri-food economy. The Food and Environmental Protection Laboratory is an active participant in the FoodIntegrity project. In July 2016 the project organised a workshop entitled "Geographic origin and authenticity of food products: from tools to legislation" at the University of Lisbon in Portugal. The aim of this workshop was to present recent developments in analytical tools, as well as applications and quality control systems that can be applied to the authentication of a range of food products. Additionally, the workshop brought together not only researchers and academics, but also stakeholders, distributers, and producer associations. Accordingly to the framework goals of FoodIntegrity, the opportunity to have all the relevant actors together, including legislators, involved in food authenticity issues, was a mark of success. Mr Simon Kelly presented the opening lecture on "The application of nuclear techniques in food authentication and traceability" covering an overview of the work of

NAFA in promoting the use of nuclear and related techniques to detect food adulteration in developing countries and some relevant examples in the fight against food fraud and verifying labelling claims such as organic, Halal and country of origin.

The Food Integrity Workpackage 1 participants met to discuss progress and revise their workplans for the remainder of the project after the workshop. The workpackage participants are currently preparing a set of position papers for publication in refereed journalsOther activities include the formation of expert committees on the authentication of different food types and the preparation of E-learning materials and educational videos.

International Symposium and Annual Meeting, "Integrated Management of Agricultural Environment for Food Security", Busan, Republic of Korea, 4–9 July 2016

Andrew Cannavan

The Korean Society for Environmental Agriculture's International Symposium and Annual Meeting, 'Integrated Management of Agricultural Environment for Food Security' was held in Busan, Republic of Korea, 7- 9July 2016. The symposium had approximately 350 participants and comprised opening and plenary sessions, as well as parallel sessions and workshops. Mr Cannavan gave an invited oral presentation on 'Food Authenticity- Fighting Food Crime' in the plenary session of the symposium. The presentation was well received and prompted a number of questions from the audience and follow-up discussions outside the plenary.

Prior to the symposium Mr Cannavan also gave a lecture entitled 'The Joint FAO/IAEA Division – Food and Environmental Protection Activities' to students at Pukyong National University (PKNU) in the KOICA-PKNU International Graduate Program of Fisheries Science. The lecture was attended by approximately 30 overseas students, who were interested in both the science and the capacity building aspects of the Joint Division's work. The students included representatives from several countries with which IAEA is currently working through technical cooperation or coordinated research projects.

Following the PKNU lecture, the officer visited the laboratories of the university's fisheries program and discussed current activities of the Joint FAO/IAEA Division related to the control of chemical residues in aquaculture.

The symposium provided an opportunity to interact with other scientists working in food and environmental protection and in related fields, and to demonstrate the research and capacity building activities of the Joint FAO/IAEA Division to an international audience. Representatives of several institutes expressed an interest in future collaboration with IAEA and the Joint Division in the field of food traceability and authenticity.

The students in the KOICA-PKNU International Graduate Program were also very interested in both the technology and the capacity building of the IAEA and the Joint Division. Professor Kang, representing KOICA, agreed that further communication between the capacity development programs of KOICA and related IAEA TC projects would be of great benefit in optimising results in developing countries.

Mr Cannavan presenting "Food Authenticity – Fighting Food Crime" at the annual KSAE International Symposium.

Summer School, "Food Safety and Food Security in Europe: Feeding the City", Brescia, Italy, 4 July 2016

Britt Maestroni

The second annual summer school on "Food Safety and Food Security in Europe: Feeding the City" was organized under the patronage of the University of Brescia. It provided students with a multidisciplinary perspective on the societal and scientific challenges of food security and of food safety in an urban context. Ms Maestroni presented an introductory lecture on food safety.

Students at the Brescia summer school.

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. 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, quality and ensure food traceability is evidenced by the ever growing list of food product recalls due to contamination or food fraud. The introductory lecture highlighted the central role played by the analytical laboratory in providing end product testing and advice in the context of food control systems. A workshop was held in the afternoon to discuss various issues, including urban and peri-urban horticulture, street food, distribution and retailing, the role of local government, environmental issues. The lecture and the workshop were attended by 25 university students from Italy.

The lecture was well received and met the expectations of both students and organizers.

39th Session of the Joint FAO/WHO Codex Alimentarius Commission, Rome, Italy, 27 June to 1 July 2016

Zhihua Ye

The technical officer (TO) participated at the 39th session of the joint FAO/WHO Codex Alimentarius Commission, and provided a report on activities of the Joint FAO/IAEA Division relevant to Codex work, including collaboration with the Codex Secretariat and committees.

On representation of IAEA, an updated information paper on relevant activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture was provided to the Commission as a formal document with the code CAC/39/INF/7.

Based on the information paper, the TO also made a verbal statement at the Session of Relations between the Codex Alimentarius Commission and Other International Organizations, and provided highlights of recent activities of the Joint Division relevant to Codex including active participation in relevant activities and meetings of the Codex and, particularly, at the Codex Committee on Contaminants in Foods (CCCF), the Codex Committee on Pesticide Residues (CCPR) and the Codex Committee on Residues of Veterinary Drugs in Foods (CCRVDF).

He also briefed the Commission that the IAEA in collaboration with FAO and WHO finalized and published a Technical Document (TECDOC) entitled Criteria for Radionuclide Activity Concentrations for Food and Drinking Water. This TECDOC was disseminated to delegates at CCCF10 through the Codex Secretariat and will be very useful for Member Countries to develop national radionuclide reference levels for existing exposure situations.

He offered that the Joint Division and its laboratories at Seibersdorf will continue to support the activities of the Member Countries in their efforts to ensure food safety, quality and authenticity and, also continue to collaborate with the Codex and relevant committees in their efforts to address these issues.

The Commission expressed its appreciation to the Representative of the IAEA for the useful information provided on the fruitful activities and for the collaboration with Codex.

A video on Nuclear Techniques in Codex was displayed in cycles during the lunch time of the first day of the Commission and showed to all the delegates the work of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture on development of nuclear and related technologies, and the very central role that nuclear science has played in the development of international food standards.

Asian Development Bank Food Security Forum 2016: "Safe, Nutritious, and Affordable Food for All", Manila, Philippines, 21–24 June 2016

James Sasanya

The FEP/NA was represented at the forum organized by the Asian Development Bank (ADB) by the officer who participated in technical discussions on collaborative strategies for food security, safety and quality in Asia as well as a techno show for the IAEA to share past, current and future contributions to the region on the subject. The forum aimed at providing a platform to share knowledge, showcase innovations, and foster partnerships among relevant stakeholders.

The officer and the Director TCAP Ms Najat Mokhtar joined ~250 government and industry leaders, development partners, practitioners, academics, farmers and other experts at the forum. The two officers held discussions and attended various meetings aimed at fostering partnerships in food safety, quality and security.

Deliberations on potential FAO/IAEA role in ADB's planned support to Central Asia Regional Economic Cooperation Countries (CAREC). Talks centred on a background paper "For the Proposed Regional Capacity Development Technical Assistance for Strengthening the Sanitary and Phytosanitary Measures in Food Safety Standards in CAREC". These countries include Afghanistan, Azerbaijan, China, Kazakhstan, Kyrgyz Republic, Pakistan, Mongolia, Tajikistan, Turkmenistan and Uzbekistan. ADB-IAEA consultations are ongoing.

Meeting with ADB's Senior Director, Sector Advisory Service Division, Sustainable Development and Climate Change Department, Mr. Gil–Hong Kim, to discuss IAEA -ADB potential collaboration on food safety/quality and security. Mr. Kim expressed willingness to cooperate and possibly visit the Joint Division in future on the matter.

The officer and Director TCAP also participated in the Food Security Forum Techno Show that drew 19 local and international exhibitors. The IAEA booth that attracted several attendees (including no less than 70) exhibited materials including but not limited to various Joint Division and NA (as well as TC) booklets, brochures, hand-outs; posters and videos.

The technical officer also met and discussed opportunities for collaboration on food safety and quality with staff of the FAO Regional Office for Asia and Pacific. The officer visited the Philippines Nuclear Research Institute (PNRI) and interacted with staff at the irradiation facilities as well as the food traceability and entomology labs. Ongoing and future activities related to NAFA supported CRPs and TCPs (including work on contaminants under RAS/5/078) were discussed.

European Development Days, Brussels, Belgium, 15–16 June 2016

Aiman Abrahim

An IAEA delegation composed of representatives of the Director General's Office for Coordination, the Department of Nuclear Sciences and Applications (NA) and the Department of Technical Cooperation attended the tenth edition of the European Development Days (EDD) - Europe's leading forum on development and international cooperation. The EDDis organized yearly by the European Commission, brought together a global audience of development experts and practitioners, political leaders, civil society and the private sector as well as major multilateral and bilateral development agencies. Mr Abrahim, from the Joint FAO/IAEA Division's Food and Environmental Protection Laboratory, represented NA at the IAEA exhibition stand.

The IAEA held and webcast a 75 minute interactive debate under the umbrella of 'Planet', which looked at the EDD sub-themes of water, energy and food nexus, and climate change. The IAEA also participated in the EDD Global Village, showcasing three projects conducted through IAEA technical cooperation and the Joint FAO/IAEA Programme on Nuclear Techniques in Food and Agriculture. The projects were on tackling soil erosion in Viet Nam, supporting food safety controls in Chile, and using SIT to control mosquitos and fight the Zika outbreak in Latin America and Caribbean. At the stand, around 200 visitors were able to examine pupae, larvae and adults of various types of insect pests that can be suppressed using SIT, learnt about soil sampling and, by using a handheld molecular sensor demonstrated by Mr Abrahim, were shown how to analyse the protein and fat content of various products and learned about the potential applications of such technology to food authenticity testing.

The EDD were a high-profile opportunity to increase visibility, extend influence, and advocate for an enhanced role for nuclear science and technology in the development field. This event provided an opportunity to build awareness of the role of IAEA&FAO in nuclear sciences and applications in the fields of food and agriculture.

IAEA exhibition stand at the European Development Days meeting.

11th European Pesticide Residue Workshop, Limassol, Cyprus, 24-27 May 2016

Britt Maestroni

The European Pesticide Residue Workshop (EPRW) - hosted every second year by a different European member state – is the premier European meeting for the presentation and discussion of the latest concepts and developments in the field of pesticide residues in food and drink.

The objective of this well established and internationally recognised format is to provide a platform for the exchange of information and experience in the field and to bring together people from each of the relevant sectors.

The 11th European Pesticide Residue Workshop had more than 250 participants from the around the world. The topics covered included the development and application of pesticide residue analytical methods, toxicology and risk assessment, regulatory issues and monitoring, and a special themed day on sampling, sample preparation and sample processing.

Ms Maestroni gave an oral presentation on a study carried out in the Food and Environmental Protection Laboratory comparing two approaches for the robustness testing of an analytical method. Analytical laboratories need to demonstrate, through method validation, that a testing method is fit for the intended purpose

During the conference, the technical officer and RALACA representatives took the opportunity to meet and discuss several issues related to the use of GC-MS/MS instrumentation, such as the use of analyte protectants, calibration accuracy, ion ratios and sample preparation for conazole herbicides.

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

CRP Reference Number	Ongoing CRPs	Scientific Secretary
D52038	Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety	S. Kelly A. Cannavan
D52039	Development and Strengthening of Radio-Analytical and Complimentary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products)	J.J. Sasanya
D52040	Field-deployable Analytical Methods to Assess the Authenticity, Safety and Quality of Food	S. Kelly A. Cannavan
D52041	Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods	J.J. Sasanya Z. Ye
D61024	Development of Electron Beam and X ray Applications for Food Irradiation (DEXAFI)	C.M. Blackburn

Final RCM of CRP D52037 on the Implementation of Nuclear Techniques to Improve Food Traceability, Vienna, Austria, 7–11 November 2016

Scientific Secretary: Simon Kelly

The 4th and final RCM of the CRP on Implementation of Nuclear Techniques to Improve Food Traceability Systems was held at the Vienna International Centre, Austria from the 7th to the 11th November 2016. The RCM was formally opened by Mr Zhihua Ye, Head of the Food and Environmental Protection Section in the FAO/IAEA's Joint Division of Nuclear Techniques in Food and Agriculture. Mr Ye reflected on the many personnel changes during the lifetime of the 5-year project and concluded that despite many challenges the project had achieved significant outcomes. The meeting was chaired by Ms Cristina Maguas, University of Lisbon, with Mr Brett Tipple, University of Utah, as the rapporteur and Mr Simon Kelly (Food Safety Specialist, FEPL, IAEA) as scientific secretary.

The meeting included the final progress presentations from each of the contract holders with slides focusing on an impact assessment of the project for the contract holder and Member State. This included scientific publications, posters, oral communications, related studentships, developed methods and SOPs, databases, teaching materials, improved Member State capability, enhanced access to export markets, success stories, new collaborations (academic & food industry), network of expertise and any other examples of how the CRP had made an impact, e.g. laboratory staff trained and now taking on work that was previously out-sourced.

The meeting agreed that the work achieved by the contract holders since the last RCM had been outstanding. This clearly demonstrates the importance of the RCMs for the success of the projects. This CRP had been significantly hampered by the delay in holding the 2nd RCM but progress since the third RCM was such that much of that setback had been reversed. The agreement holders are to be congratulated on the quality advice and tangible support (e.g. sample analyses) they have provided but it is the hard work put in by the contract holders that has made this project (and the CRP) so successful.

Group sessions in the "world café" format were then held to assist each of the contract holders to outline their contributions to the technical document. Each research contract holder's work was reviewed by the entire consortium using the world café session to ensure that all of the relevant scientific information covering collection of authentic samples, through analysis to the appropriate use of chemometric statistics was fully covered. Finally an action table was prepared to ensure the remaining project time to the end of December 2016 was effectively used and deliverables achieved.

Participants of CRP D52037 at the final RCM, Vienna International Centre, Vienna, Austria.

To ensure that a primary objective of the CRP, to populate a database with high-quality data from authentic-origin, is

met a further world café session was held to brainstorm the format and gathering of data and sharing of relevant information. The consortium proposes to take the first steps in maintaining the database beyond the lifetime of the project with the assistance of the agreement holders. This will be achieved by initially sharing a common database format in Excel to gather relevant information before launching a platform through the University of Natural Resources and Life Sciences, Vienna (BOKU) for beta-testing.

The meeting concluded that the CRP had successfully demonstrated the feasibility of using stable isotope analysis (SIA) to establish the geographical origins of several important food products produced in developing Member States. At the same time the CRP had also been an important vehicle for raising awareness of stable isotope and related nuclear techniques such as neutron activation analysis for characterising the elemental profile of foods to determine their provenance and authenticity. In so doing the project has generated a significant number of food authenticity and traceability datasets for the first time.

The project has also been successful in enhancing the Member State capabilities in SIA and generating several new methods, SOPs, and training opportunities. Furthermore, the project has facilitated investment by several of the Member States in these capabilities, and helped secure new funding for projects and equipment, at the same time facilitating new scientific collaborations and involvement in national and international food authenticity projects and networks. All of these achievements have raised awareness and allowed consortium members to interact with food industry stakeholders and regulators within their respective Member States, helping to bring nuclear techniques into implementation and improving food traceability systems.

Consultants' Meeting on a Proposed CRP on Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods, Vienna, Austria, 7-11 November 2016

Scientific Secretary: James Sasanya

The purpose of the meeting was to discuss the feasibility and development of a proposed project planned to research new techniques for testing "cocktails" of contaminants/residues in foods and associated matrices. The CRP's would enhance Member States food and environmental safety control systems and risk assessment programmes through improvement of laboratory capabilities needed to gather reliable data on mixed contaminants/residues rather than individual categories. The research project would also contribute some answers to the knowledge gap on antimicrobial use, residues and possible association with the development of antimicrobial resistance.

In this regard, the meeting concluded among others that based on the proposal drafted by the technical officer, a new CRP on mixed contaminants/residues is worthwhile implementing. The meeting noted that risk management of contaminants and residues in food and associated matrices such as feed and water currently depends on health risk assessments based on data from studies on individual substances. However, consumer exposure to a variety/mixture of contaminants through food products is potentially very high, given the nature of agricultural production around the world.

Once approved, the CRP will be open to interested and competent research institutions and scientists from IAEA Member States, and should commence early-mid 2017.

Consultant meeting participants and organizers

Second RCM of CRP D52039 on Control of Veterinary Drug Residues and Related Chemicals in Aquaculture Products, Rancagua, Chile, 24–28 October 2016

Scientific Secretary: James Sasanya

The above RCM for CRP D52039 on the "*Development and Strengthening of Radio-Analytical and Complementary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products*, was implemented as planned at the LABSER-Merieux Nutriscience facility in Rancagua. Progress made by the different chief scientific investigators was reviewed and new programmes of work developed and fine-tuned. Significant progress has been made, a number of new methods developed and validated/initiated and draft standard operating procedures prepared.

Under a project *Development and Validation of a Radioimmunoassay (RIA) Kit for the Screening of Chloramphenicol in Fish and Shrimp Tissues and Related Feeds* Chloramphenicol (CAP) antibody production, including Bovine Albumin and now Keyhole Limpet Hemocyanin (KLH) has been done to support RIA work.

An LC-MS/MS confirmatory method has also been developed to establish equivalence with the RIA screening method. Method development and validation for analysis of CAP in shrimp muscle is also under way. These methods will support the analysis of CAP in tilapia and catfish in countries such as Brazil.

In another research study, preliminary development of an isotope based LC-MS/MS method has been done for analysis of 28 β-lactams, tetracyclines, anthelmintics, quinolones, synthetic hormones, β-agonists and sulfonamides in fish muscle. An additional LC-MS/MS method for detection of antibiotics and pesticides was improved by incorporating stable isotope-labelled internal standards.

Additionally, the distribution of labelled residues was monitored in aquaculture production units to establish contamination profiles and highlight critical matrices to be analysed. Some finfish samples analyzed showed presence of Caesium (Cs).

A stable isotope based LC-MS/MS method for dyes, tetracyclines, quinolones, macrolides and amphenicols, among others in fish (including salmon) and fish feed has been developed, and initial validation done.

Improving analytical methods for food hazards such as triphenylmethane dyes is necessary for testing laboratories and a combination of the analytes with other pharmacologically active substances in the same method (which is ongoing) will greatly enhance Chile's export of fish products such as salmon.

An on-line solid phase extraction LC-MS/MS method for the determination of 12 antimicrobials in sediment and surface water has been developed and validated.

The spatial distribution of antimicrobials showed that the main source of contamination were the fish farms. This study demonstrated that the proposed method is reliable for the monitoring of antimicrobials in water and sediments. Two papers under this project: (a) "Simultaneous determination of multi-class antibiotic residues in Nile Tilapia (Oreochromis niloticus) by LC-MS/MS"; (b) "Study of spatio-temporal distribution of antimicrobials in water and sediments from caged fish farms by on-line SPE LC-MS/MS" have been submitted for publication.

Elsewhere under the research on "Development of Methods Based on Isotopic Dilution in Connection with LC-MS to Evaluate the Presence of Veterinary Drugs and Related Chemicals in Aquaculture Fish", four extraction/clean-up procedures and analytical methods based on high resolution mass spectrometry (HRMS) and MS/MS have been developed to better understand matrix (water, whole fish and fish tissues) differences. Stable isotope-labelled standards have been used to improve the precision and ruggedness/robustness of the methods.

The methods developed in this study have been applied to evaluate levels of pharmaceuticals (including some veterinary drugs), in river water, wild fish and laboratory exposed fish. The HPLC-HRMS (QTOF) screening method showed good sensitivity enabling reliable analysis of the pharmaceuticals in water, but not in whole fish. This will be improved. Additionally, a quantitative method, based on isotope-labelled compounds, modernized extraction techniques including accelerated solvent extraction, and HPLC-MS/MS (triple quadrupole), was found to be suitable for testing 20 pharmaceuticals in fish. Further method validation for veterinary drug residues, mainly antibiotics (tetracyclines, flumequine and others), in aquaculture products and associated matrices is ongoing.

The analysis of ^{15}N in water, shrimp and fish from three lakes having different levels of eutrophication has also been done, demonstrating possible exposure to δ15N in aquaculture water, shrimp and fish, and suggesting risk associated with the presence of sewage/manure.

A multi-residue HPLC-HRMS screening method has been developed with suitable chromatographic conditions and mass parameters optimized, covering majority of the 60 target drugs belonging to: stilbenes, amphenicols, nitrofuran metabolites, nitroimidazoles, antimicrobials, beta lactams, tetracyclines, quinolones, fluoroquinolones, sulfonamides, diaminopyrimidines, aminoglycosides, macrolides, polypeptides, lincosamides, anthelmintics, triphenylmethane dyes and antiseptics. A preliminary exact mass database has been established with information on retention times, exact mass of precursor and major fragment ions of the target chemicals. A generic sample preparation method has also been set-up with reference materials and trial runs yielding preliminary satisfactory sensitivities for most of the target drugs. Improvement in sample preparation procedures and chromatographic conditions are still required for challenging analytes, such as aminoglycosides, stilbenes and nitrofuran metabolites.

Participants at the 2nd RCM of CRP D52039 at the meeting venue in Rancagua, Chile.

research study, a method has also been developed for monitoring four nitrofuran metabolites including 5-methylmorpholino-3-amino-2-oxazolidinone (AMOZ), 3-amino-2-oxazolidone (AOZ), 1-amino-hydantoin (AHD)

and semicarbazide (SEM) in aquaculture products. The validated method was successfully applied to detect four nitrofuran metabolites in total 460 samples including 319 fish samples and 141 shellfish samples, which were randomly collected from the local markets of Guangdong Province, southern China. The occurrence of SEM in shellfish will be further investigated since natural occurrence of SEM is possible. Re-analysis will be done after peeling the shellfish and a washing step to consider tissue-bound SEM vis-a-vis free SEM. A similar approach may be applied to the investigation of AOZ and AMOZ.

Additional work under the CRP is also ongoing on (a) Research on Antibiotics at RIKILT - Hair and feathers; new matrices for antedating the use of antibiotics"; (b) "Optimization and primary validation of screening tests for the detection of residues of antibiotics and chemotherapeutics in fish and aquaculture; (c) Acceptance Criteria for Confirmation of Identity of Chemical Residues using Exact Mass Data; (d) Validation of radio receptor assay techniques for residues in selected fish such as carp (Cyprinus Carpio), silurid (Clarias gariepinus), tilapia (Oreochromis niloticus) and associated matrices.

Second RCM of CRP D52038 on Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety, Rabat, Morocco, 3–7 October 2016

Scientific Secretary: Simon Kelly

Meeting Participants outside the laboratory facilities at the Centre national de l'Énergie, des Sciences et des Techniques Nucléaires (CNESTEN), Rabat, Morocco.

The second RCM of CRP D52038 on "Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety" was hosted by the Centre National de l'Énergie, des Sciences et des Techniques Nucléaires (CNESTEN) and held in Rabat, Morocco, 3–7 October 2016. All 10 research contract holders were represented at the meeting and 3 agreement holders attended with Ms Federica Camin in attendance as a meeting consultant to provide special input on the implementation of isotopic techniques to control the authenticity of products within the dairy industry. Mr Simon Kelly was the scientific secretary and Mr Russell Frew chaired the meeting with Ms Tricia Hoffman as rapporteur. The RCM was formally opened by Mr Moncef Benmansour, Head of the Environmental Laboratory, CNESTEN, who in his opening remarks highlighted the importance of CRP D52038 in developing Morocco's food traceability and safety systems. He emphasised that traceability is a key component of food safety, not only providing consumer protection but also enhancing trade.

The meeting included research progress presentations from each of the contract holders and technical presentations from each of the agreement holders. The agreement holders and consultant's technical presentations were on a range of topics of relevance to the contract holders. 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. Additional seminars were given Mr Gabriel Bowen and Mr Jose Almirall. These covered the use of ARC-GIS software to generate an isoscape (isotope map) and an introduction to chemometrics, respectively.

Group sessions in the "world café" format were then held to evaluate the current status of the project implementation, to combine outputs and outcomes and to identify gaps and solutions to problems encountered. Each research contract holder's phase 2 workplan was reviewed by the consortium using the world café session to ensure that high scientific standards and the objectives of the CRP are maintained. The subsequent feedback and discussions led to the identification of common problems and barriers to progression for the entire group. On the basis of these extensive discussions, the contract holders' workplans for the next phase of the project were reformulated to strengthen the development of analytical techniques, improvement of datasets/database and networks, and outlining publications and SOPs for optimizing impacts and fulfilling the objectives of the CRP. The list of common barriers identified in the world café exercise were then reviewed in an open group session to identify solutions that were formatted into an 'action table' assigning tasks and deadlines to all project members.

To ensure that a primary objective of the CRP, to populate a database with high-quality data from authentic-origin, is met it was agreed that the core methods developed and used by the contract holders will be presented as SOP's with appropriate validation data. A book, currently in preparation, that compiles the accepted procedures for sampling and stable isotope analysis of milk needs to be finalized as soon as possible. This will be produced as a

resource for the participants and later for all Member States. Furthermore, it was proposed that methodology and statistical training exchanges should be incorporated into the programme of activities. This could also include on-line tutorials and a session added to future coordination meetings.

The meeting concluded that, despite the delayed second RCM, good progress had been made by all participants in collecting authentic milk samples and initiating programmes of isotopic and trace element measurement. In addition, the participants recognized that CRP D52038 had initiated useful collaborations between laboratories of different Member States and that it provides information that can have a regulatory impact, e.g. the detection of milk whose chemical parameters do not comply with that from the claimed origin may be an indication of fraud.

The focus of the next phase of the project is to ensure, sufficient sampling, consistency of methods and data quality between participants so that the ultimate goal of generating a sustainable database and maps of the spatial variability in dairy isotopic parameters can be achieved. It was recommended by the meeting that the IAEA should consider the possibility of hosting and maintaining the milk powder database from this CRP to ensure its sustainability and legacy in a similar way to the "Water Isotope System for data analysis, visualization and Electronic Retrieval (WISER)" maintained by the Water Resources Programme. All participants emphasized the need to communicate regularly and recommended that the IAEA and the FAO should support raising awareness of the CRP activities through a final workshop that could potentially be associated with an appropriate food authenticity conference.

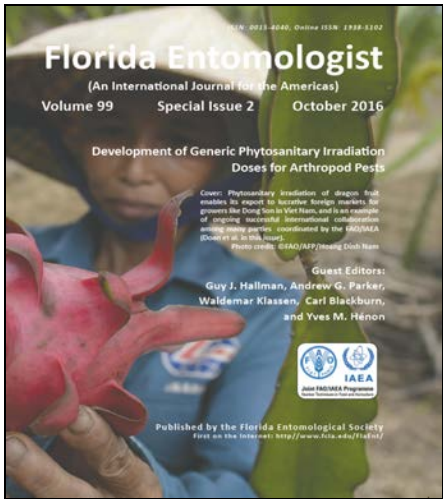
Publication of the Results of a Coordinated Research Project (CRP) on Developing Generic Irradiation Treatments for Quarantine Treatments (CRP D62009)

Carl Blackburn, Guy Hallman, Yves Henon, Andrew Parker

The major research results of CRP D62009 are now available, published as a special issue of the scientific journal *Florida Entomologist*. This publication is freely available online [2] and is a major contribution to the development of phytosanitary irradiation (PI) treatments.

The overall objective of the CRP was to develop generic PI treatments. A PI treatment is termed generic when it establishes a minimum treatment dose that is effective at controlling groups of regulated pest species. In developing generic dose treatments, research also established minimum treatment doses for specific species. New data were generated for 34 species in 10 families of insects, three families of mites and one family of snails. Several large-scale confirmatory tests using large numbers of pests were also undertaken and support PI doses with a high degree of confidence, this is important for regulatory approval. When the CRP commenced in 2009, there were eight PI treatments in the International Standards for Phytosanitary Measures (ISPM) of the International Plant Protection Convention (IPPC). These were largely due to our earlier CRPs in this area. This CRP has increased this to Sixteen PI treatments available in ISPM 28 *Phytosanitary treatments for regulated pests* [3].

This issue of Florida Entomologist will fuel further applications to the IPPC for new and revised PI treatments in ISPM28, including generic ones for moths and butterflies, mealybugs and weevils.



The CRP has helped to establish irradiation as a viable alternative to restricted chemicals and physical treatments that damage fruits. The talents CRP participants were guided by technical officers from both the Food and Environmental Protection Section and Insect Pest Control Section. We would like to thank all the CRP participants for their endeavours and persistence. Good research practices were disseminate, lessons were learned from perceived issues and problems that occurred with previous research, such as the importance of reporting dosimetry and indication actual doses received, the use of artificial infestation techniques, ensuring performance was supported by non-irradiated controls, and including large-scale confirmatory testing. New treatments in international standards will continue to support the growing commercial use of irradiation as a mean of ensuring the phytosanitary security of fresh produce in traded products. This is a good example of a nuclear related technique that is being used to enable trade.

[2] The publication is Special Issue 2 (October 2016) and is online here: http://journals.fcla.edu/flaent/issue/archive

3 https://www.ippc.int/en/core-activities/standards-setting/ispms/

Technical Cooperation Projects

Country/Region	Project No.	Title	Technical Officer
Bahrain	BAH5001	Determining Pesticide and Mycotoxin Residues in Water and Food	B.M. Maestroni
Bangladesh	BGD5031	Strengthening Capacities to Monitor and Control Veterinary Drug Residues in Foods of Animal Origin	J.J. Sasanya
Belize	BZE5007	Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority	B.M. Maestroni
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	J.J. Sasanya
Benin	BEN5009	Monitoring Safe Food Supply through Total Diet Studies and the Application of Nuclear and Complementary Analytical Techniques	C.M. Blackburn J.J. Sasanya A.R.R. Pitois (NAEL)
Botswana	BOT5014	Enhancing the Use of Nuclear and Isotopic Analytical Techniques in Monitoring Chemical Food Contaminants	J.J. Sasanya Z. Ye
Colombia	COL5025	Improving Capacity to Diagnose Residual Pesticides and other Contaminants in Exotic Tropical Fruits to Make Food Exports More Acceptable on the International Market	J.J. Sasanya Z. Ye
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	J.J. Sasanya
Costa Rica	COS5033	Assessing and Implementing Biochar Use in Climate Smart and Environmentally Friendly Pineapple Production Using Isotopic Techniques	C.M. Blackburn A. Cannavan M. Zaman
China	CPR5022	Implementing the Stable Isotope Technique for High Quality Agro-product Traceability and Authenticity	A. Cannavan S. Kelly
Cuba	CUB5019	Strengthening National Capacity for Monitoring Heavy Metals to Improve Soil and Food Quality Using Nuclear and Related Techniques	C.M. Blackburn

Country/Region	Project No.	Title	Technical Officer
Dominica	DMI5001	Enhancing Capacity to Monitor Agrochemical Residues in Foods and the Environment	J.J. Sasanya
Ecuador	ECU5028	Consolidating Food Security and Environmental Sustainability in Palm Oil Production Using Nuclear Applications	B.M. Maestroni A. Cannavan
Egypt	EGY5026	Establishing a National Reference Laboratory Applying Nuclear/Isotopic and Related Techniques in the Analysis of Food Contaminants	J.J. Sasanya
El Salvador	ELS7006	Building Capacities to Minimize Environmental Contamination and to Protect the Health of the Rural Population by Strengthening Research Capabilities and Laboratory Infrastructure	B.M. Maestroni
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	B.M. Maestroni
Haiti	HAI5006	Increasing Productivity and Exportability in the Agricultural Sector through Soil and Water Management and Food Safety Monitoring	C.M. Blackburn
Inter-Regional	INT5154	Improving Food Safety through the Creation of an Interregional Network that Produces Reliable Scientific Data Using Nuclear and Isotopic Techniques	J.J. Sasanya
Iraq	IRQ5021	Developing Food Safety and Assurance System Using Nuclear and Other Related Technologies	J.J. Sasanya A. Cannavan S. Kelly
Libya	LIB5012	Using Nuclear and Complementary Techniques for Monitoring Agrochemical Residues in Food Products and the Environment	J.J. Sasanya
Malaysia	MAL5030	Strengthening National Technical Capability in Food Traceability of Edible Birds Nest through the Application of Nuclear and Related Technologies	A. Cannavan S. Kelly Z. Jandric

Country/Region	Project No.	Title	Technical Officer
Marshall Islands	MHL7001	Developing a National Radioactivity monitoring Capacity	I. Osvath (NAEL) V. Harms (NAEL) J.J. Sasanya I.Tolosa Bertral (NAEL)
Mauritius	MAR5024	Building Capacity to Analyse Veterinary Drug Residues and Related Chemical Contaminants in Animal Products	J.J. Sasanya
Mauritania	MAU5005	Strengthening of Laboratory Capacity to Monitor Natural, Chemical and Microbial Food Contaminants	J.J. Sasanya
Mongolia	MON5019	Assessing and Enabling the Implementation of Food Irradiation Technologies	J.J. Sasanya A. Cannavan
Morocco	MOR5034	Improving Veterinary Drug Residue Detection and Animal Disease Diagnosis with Nuclear and Molecular Techniques	I. Naletoski J.J. Sasanya
Morocco	MOR5036	Valorizing and Improving the Quality of Food Products by Using Irradiation Techniques	C.M. Blackburn
Mozambique	MOZ5006	Building Laboratory Capacity for Food Safety Using Nuclear/Isotopic and Complementary Analytical Techniques	J.J. Sasanya Z.Ye
Namibia	NAM5013	Assessing the Spatial Distribution of Lead, Cadmium and Selected Pesticide Residues in Livestock Farming	A. Cannavan J.J. Sasanya
Niger	NER5020	Building Capacity at the Central Laboratory (LABOCEL), Niamey, for Control of Food Products of Animal Origin	J.J. Sasanya
Nigeria	NIR5039	Enhancing Dietary Exposure Assessment of Chemicals in Food	J.J. Sasanya
Oman	OMA5003	Strengthening National Capabilities in Food Safety and Food Traceability	B.M. Maestroni
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	B.M. Maestroni

Country/Region	Project No.	Title	Technical Officer
Panama	PAN5024	Developing Analytical Capabilities for the Detection of Chemical Contaminants in Food and the Quality of Agrochemicals	B.M. Maestroni
Panama	PAN5025	Expanding and Strengthening the Phytosanitary Surveillance System for Fruit Fly, Emphasizing Exotic Species of Quarantine Importance, and Exploring the Use of Nuclear Techniques for Post-Harvest Treatment as a Complementary Action	W.R. Enkerlin Hoeflich C.M. Blackburn
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	J.J. Sasanya B.M. Maestroni
Senegal	SEN5038	Strengthening Laboratory Capabilities for Analysing Veterinary Drug Residues and Contaminants in Food	J.J. Sasanya A. Cannavan
Sierra Leone	SIL5016	Strengthening Laboratory Capabilities to Evaluate and Monitor Levels of Mycotoxins, Toxic Metals and Related Contaminants in Foods	J.J. Sasanya
Sri Lanka	SRL1008	Providing Technical Support for Smooth, Safe and Sustained Operation of the Multipurpose Gamma Irradiation Facility	S. Sabharwal (NAPC) C.M. Blackburn
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	J.J. Sasanya A. Cannavan
Syria	SYR5023	Enhancing Analytical Capacities of Major Pesticide Residues	B.M. Maestroni
Syria	SYR5024	Enhancing Capabilities to Monitor Naturally-Occurring and Synthetic Anabolic Hormones and other Veterinary Drug Residues in Foods	J.J. Sasanya
Uganda	UGA5034	Strengthening National Capacity for Testing and Monitoring of Drug Residues in Animal Feeds and Animal Products	J.J. Sasanya
Uganda	UGA5039	Enhancing the Monitoring of Veterinary Drug Residues, Related Chemicals and Natural Food Contaminants	J.J. Sasanya

Country/Region	Project No.	Title	Technical Officer
Tanzania	URT5033	Establishing the Feasibility of an Irradiator Facility	C.M. Blackburn
Zambia	ZAM5030	Establishing a National Mycotoxins Monitoring Programme	J.J. Sasanya
Africa	RAF1006	Facilitating the Commercial Application of Irradiation Technologies	G.J. Hallman S. Sabharwal (NAPC) C.M. Blackburn
Africa	RAF5067	Establishing a Food Safety Network through the Application of Nuclear and Related Technologies	J.J. Sasanya A. Cannavan
Africa	RAF5078	Establishing a Food Safety Network through the Application of Nuclear and Related Technologies, Phase II	J.J. Sasanya
Asia	RAS5071	Strengthening Adaptive Climate Change Strategies for Food Security through the Use of Food Irradiation (RCA)	C.M. Blackburn
Asia	RAS5078	Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants	J.J. Sasanya
Asia	RAS7026	Supporting the Use of Receptor Binding Assay (RBA) to Reduce the Adverse Impacts of Harmful Algal Toxins on Seafood Safety	M.Y. Dechraoui Bottein (NAEL) A. Cannavan
Latin America	RLA5065	Improving Agricultural Production Systems Through Resource Use Efficiency (ARCAL CXXXVI)	B.M. Maestroni L.K. Heng
Latin America	RLA5066	Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food	C.M. Blackburn
Latin America	RLA5069	Improving Pollution Management of Persistent Organic Pollutants to Reduce the Impact on People and the Environment (ARCAL CXLII)	J.J. Sasanya B.M. Maestroni
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)	B.M. Maestroni E.T. Vasileva-Veleva (NAEL)

Project BGD5031 Supporting a Food Safety Laboratory in Bangladesh

James Sasanya

The officer traveled to Ganakbari Savar, Bangladesh, 20–23 November 2016, to provide technical assistance to a food safety laboratory at the Institute of Food and Radiation Biology, Bangladesh Atomic Energy Commission. The laboratory is strengthening its human resource and instrumental capabilities, so as to better contribute to national food safety control and related research programmes. In addition to Agency support through the above TCP, Government is implementing a nationally funded laboratory modernization project in which new state-of-the-art analytical instrumentation is being procured and human resource development to be enhanced and food safety programmes sustained. Continued technical support and guidance from FEP/IAEA will nevertheless be required.

Young Scientists working with the technical officer to improve performance on an analytical instrument and associated method in Ganakbari Savar, Dhaka.

Providing Assistance on Food Safety and Risk Assessment, Sofia and Hissar, Bulgaria, 24–25 October 2016

Britt Maestroni

In response to a request from the Bulgarian Nuclear Regulatory Agency, Ms Maestroni undertook a technical mission, funded under TCP BUL/5/014, to give a presentation on risk assessment and food safety, to provide expertise on the implementation of technical requirements for food safety in Bulgaria and to identify gaps and opportunities for improvement in food contaminant analysis to target food safety in Bulgaria.

Ms Maestroni visited the Central laboratory for Veterinary Expertise and Ecology (CLVEE) which belongs to the Risk Assessment Centre of the Bulgarian Food Safety Agency located in Sofia, and was shown the facilities routine analytical work flow of the laboratory. An intensive discussion session with the Head of the Bulgarian Food Safety Agency followed, to clarify and analyse the situation as regards the Bulgarian food control system. To date Bulgaria has incorporated all EU requirements for food control and adapted national legislation to comply with European legislation. A discussion on possible collaboration with the Food and Environmental Protection Laboratory (FEPL) of the Joint FAO/IAEA Division focussed on food traceability and contaminants in matrices such as honey and milk.

Ms Maestroni also gave a presentation on risk assessment and food safety at the 9th Scientific Conference of the Bulgarian focal point of EFSA in Hissar. The presentation helped to introduce the technical themes of the conference, on safety of the food chain and epizoology and epidemiology. The presentation was well received.

Ms Maestroni provided advice and guidance on issues critical to maintaining or increasing laboratory capacity, including the purchase of consumables and reagents, replacement of analytical equipment and identification of new equipment needed, training and retention of staff and sustainable funding.

Meeting at the Central laboratory for Veterinary Expertise and Ecology (CLVEE) in Sofia, Bulgaria.

Food Authenticity, Safety and Traceability (FAST) Awareness Training, Vienna, Austria, 5–9 September 2016

Marivil Islam, Aiman Abrahim, Zora Jandric, Simon Kelly, Britt Maestroni, Johannes Corley, Carl Blackburn and Andrew Cannavan

A one-week training course was developed and organized as a group scientific visit to raise awareness of issues and analytical methodologies to address current challenges in Food Authenticity, Safety and Traceability (FAST). The training course was attended by laboratory managers and senior researchers from Iraq, Libya, Syria, Kuwait and the Marshall Islands. The course content was delivered through 12 lectures covering veterinary drug and pesticide residue analysis; persistent organic pollutants; naturally occurring contaminants; food authentication using stable isotope and metabolite analysis; food traceability; food irradiation, detection of irradiated food; and analytical method development, validation and quality control. Lectures were delivered by technical officers from the Food and

Environmental Protection Section (FEPS) and Laboratory (FEPL) and included four world café interactive sessions to help the delegates identify and design proposals to address the major FAST issues in their respective Member States. The course also included a one day seminar at the Seibersdorf laboratory to cover the specifics of setting up and maintaining gas chromatography-mass spectrometry, liquid chromatography- mass spectrometry and isotope ratio-mass spectrometry facilities and infrastructure. The course was very well-received by the delegates and achieved an overall "excellent" rating from feedback questionnaires. The intention is to make the course more widely available in the future through Technical Cooperation.

Trainees at the Food Authenticity, Safety and Traceability (FAST) awareness raising course after receiving their certificates of attendance.

Regional (AFRA) Food Safety Training, Blantyre, Malawi, 5–9 September 2016

James Sasanya

The training course was implemented to enhance application of nuclear/isotopic and complementary techniques in veterinary drug residue analysis as well as other contaminants in food and environmental samples, and also expand effective use of the techniques in a number of African countries. The event attended by 29 laboratory scientists from around Africa, was locally organized by the Malawi Bureau of Standards (MBS). Besides the hands-on training and knowledge exchange through group discussions, analytical instrumentation at MBS was also strengthened through acquisition and installation of a radio receptor assay tool and kits. Part of these were used in the training and the rest are now being applied to residue testing in the country.

Safeguarding Consumers Through Building Capacity in Analytical Method Development and Validation In Food Safety Laboratories

James Sasanya

A regional training course was held at the Laboratoire central de contrôle de la sécurité sanitaire des aliments (LCSSA) in Benin, 19-23 September 2016, to enhance and widely disseminate knowledge on analytical method development and validation for food and environmental safety laboratories in Africa. The training scope included hands-on experiments, demonstrations, lectures, and experience sharing by participants through group discussions.

The event which is part of a project aimed at enhancing the application of nuclear/isotopic and complementary techniques in food safety, and expanding a regional network of food safety laboratories involved in national residue/contaminant monitoring programs, was officially opened by the Benin Minister of Agriculture, Republic of Benin, Mr. Delphin O. Koudande. While welcoming the participants, the Honorable Minister thanked IAEA for supporting such capacity building activities, and advised that it was important for laboratories safeguarding foods and consumers, to be competent and that this can only be achieved through such focused training. The 30 participants who benefited from the event are expected to have better understanding of principles and application of analytical method development and validation processes in a routine food safety laboratory following the training. The will also train other colleagues in their respective countries and the region in general.

Food safety laboratory scientists at a training in Benin.

Coordinating African Regional Food Safety Project Activities and Enhancing Laboratory Networking, Accra, Ghana 25–29 July 2016

James Sasanya

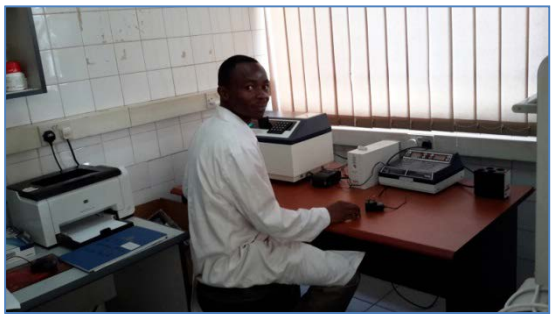
The final and first coordination meetings for technical cooperation projects RAF5067 and RAF5078, respectively, were held in Ghana, relevant activities, results were shared and reviewed, and strategies for effective implementation of new activities agreed upon. One of the main strategies agreed upon by the meeting participants as a way to promote closer cooperation and greater sharing of knowledge/experience including inter-laboratory comparisons, was increasing scientific exchanges among Member States. This will be achieved in part through several reciprocal Scientific Visits.

The concluding project RAF5067 has greatly improved food control laboratories and systems in Africa through the application of nuclear/isotopic and suitable complementary techniques. Participating Member States either initiated or strengthened residue/contaminant testing and/or national residue monitoring. The food safety network built through these projects and through which analytical techniques, knowledge and experiences are shared is growing. Over 25 countries are involved.

Enhancing Food Safety in Uganda

James Sasanya

Institutional capacity to conduct routine food safety tests, especially for chemical residue monitoring has been enhanced in Uganda through two technical cooperation projects UGA5034 and UGA5039. Equipment was provided, including a radio receptor assay tool and core staff from the Uganda National Bureau of Standards (UNBS) and Ministry of Agriculture Animal Industry and Fisheries, were trained.



A UNBS staff trained under an IAEA TCP applying a radio receptor assay tool for residue testing.

The technical officer visited the country in July 2016 and witnessed the effective application of the capacity built thus far. Relevant food safety institutions in the country are keen on further modernization of their analytical capabilities to meet national and international standards. Continued Agency/FEP support and technical guidance is required in this regard.

Closer collaboration among national institutions associated with food safety continues to grow and this will further the sharing of relevant resources and experiences, and better showcase the benefits and impacts of FEP supported projects in the country. The officer provided technical advice and support during the visit, including the troubleshooting of an analytical instrument.

Project RLA/7/019 on Developing Indicators to Determine the Effect of Pesticides, Heavy Metals and Emerging Contaminants on Aquatic Ecosystems, Panama, 6–8 June 2016

Britt Maestroni

Technical cooperation project RLA/7/019 aims to provide risk maps to local authorities and other stakeholders for monitoring the impact of agricultural production on water resources in Latin America and the Caribbean. The project started in 2014 and has 11 participating countries.

Participants in the mid-term project coordination meeting for RLA/7/019 in Panama.

Ms Maestroni participated in the mid-term project coordination meeting as project technical officer, to provide assistance in the preparation of the next two-year work plan and advise participants on analytical aspects of the project. The meeting collated and organized the outputs achieved to date by each member state: intensive sessions were held to effectively collect all data and information in only 3 days.

The meeting had 25 participants. On the first day of the meeting Ms Maestroni gave introductory remarks, in the presence of some official authorities of Panama, focusing on the role of analytical laboratories in the efficient control of water resources affected by intensive agricultural production. A presentation was also given on technical issues encountered in implementing the project, focusing on the concept of quality data as an essential input to risk assessment models. Four working groups were organised to consolidate progress in the areas of biological monitoring,

chemical monitoring, modelling and communication. The results of the group discussion were used to draft the meeting report and to prepare an amended project work plan. An ad-hoc meeting was convened with Ms Loewy and Mr Masis from the RALACA board, at which It was agreed that the RALACA committee on biomonitoring would hold a webinar on the achievements to date. This was held on June 23rd.

Panama provides an example of optimal national coordination and integration. The presence of the Ministry of Agriculture at the mid-term meeting was very much appreciated and motivated the representative of each participating member state to implement better communication and promote increased collaboration among national institutions.

Bahrain and the IAEA, Working Together in Food Safety and Security

Johannes Corley

Food safety and security are very high priorities for Bahrain. The IAEA, through project BAH5001, has been working with the Public Health Laboratories (PHL), cooperating in food safety monitoring using nuclear, isotopic and related techniques. An expert mission earlier in 2016 established monitoring programme requirements. Bahrain subsequentlyd developed methods of pesticide residue analysis using a new GC-MS-MS. These methods are being validated. Othr methods are also being developed for use with an LC-MS-MS instrument.

In November 2016 the Technical Officer conducted a training on sampling strategy and techniques, FAO guidelines on sampling and creating a sampling plan and program to meet Bahrain's food safety needs.

After lectures and discussions, the participants were divided into 4 groups and each group was tasked with developing a detailed Standard Operating Procedure for different types of food commodities. The groups developed SOPs for the sample collection of the following commodities:

- Small fruit (unit wt. < 25g) titled, "Sample Collection of Small Fruit less than 25 gm (e.g. Dates, Tamarind, Cherry and cherry tomatoes)" Developed by Group 1.
- Large fruit and vegetables (unit wt. > 250g) titled, "Sampling Large Vegetables – (Farm)" Developed by Group 2.
- Spices titled, "Sampling of Spices from (Bulk and Prepacked, Raw and powdered) for Pesticides and Heavy Metal analysis" Developed by Group 3.
- Grains and seeds titled, "Sample collection and records for sampling of grains and seeds" Developed by Group 4.

Following SOP development, discussion and refinement, the team applied the SOPs in actual sampling exercises in the following real-life situations:

- Wholesale market (sampled dates as small fruit and sunflower seed)
- Farm (sampled squash as large fruit)
- Spice Processing Factory (sampled packed spices)

Sampling sunflower seed in a wholesale market.

At each scenario, the SOPs were followed in detail and all information documented including deviations. At the end of the two-day practical sampling exercise, the groups reconvened and discussed the applicability of the SOPs to the sampling scenarios and amended them accordingly to fit the purpose. The TO stressed that the aim of the workshop was not just to develop SOPs but to provide an understanding of the SOP development process and using the guidelines to meet Bahrain's food safety monitoring needs. The groups (from the various agencies) were urged to work together to develop sampling plans and use the correct strategy as part of a routine food safety monitoring program in Bahrain.

Several procurements have been made to significantly enhance the DPH's residue and contaminant analysis capacity and a separate EM has been planned for the end of December to develop and validate residue analysis methods at DPH in Bahrain. Cooperation between the various departments and agencies in Bahrain is essential for the success of a comprehensive food safety monitoring program in Bahrain. The CP Dr. Amjad Ghanem is well qualified and with strong support from the Director of the Public Health Directorate, is working on building joint working inter-departmental/agency teams to support and advise on the development and operations of the much needed comprehensive food safety monitoring program in Bahrain.Additionally, there is a need for a regional network of laboratories to support a comprehensive food safety program across GCC countries and also the region as a whole.

Developments at the Food and Environmental Protection Laboratory

A Non-Targeted Approach for Discrimination of Sri Lankan Teas by UPLC-Qtof/MS and Chemometrics

Zora Jandrić& Marivil Islam

Tea is one of the main export products grown in Sri Lanka, which ranks as the world's fourth-largest producer of tea. The selection of specific cultivars, the humidity, cool temperatures, and the rainfall patterns of the country's central highlands provide a climate that favors the production of high-quality tea, which is well known as Ceylon tea. Ceylon tea reportedly contains many compounds beneficial to health. Because of the widespread consumption of Ceylon tea, the quality control and safety of the tea are extremely important. Its popularity and value make Ceylon tea a common target for fraud. As a continuation of the preliminary research on the differentiation of tea varieties discussed in the previous issue of the newsletter, an untargeted metabolomics approach was developed to investigate the possibility of distinguishing Sri Lankan teas from different geographical origins, as well as differentiating between treated and untreated black tea samples. Authentic tea samples were obtained directly from four production sites in Sri Lanka (green (Talawakelle, Hanatana, Ratnapura, and Passara) and black (Talawakelle)), and analysed by ultra-performance liquid chromatography – quadrupole time of flight mass spectrometry (UPLC-QToF MS) with multivariate data analysis (MVA).

The qualitative models generated using unsupervised principal component analysis (PCA) allowed segregation between samples of the same cultivar grown in four different regions in Sri Lanka. Examples are given in Fig. 1A/B for cultivars TRI 2025 and 4052.

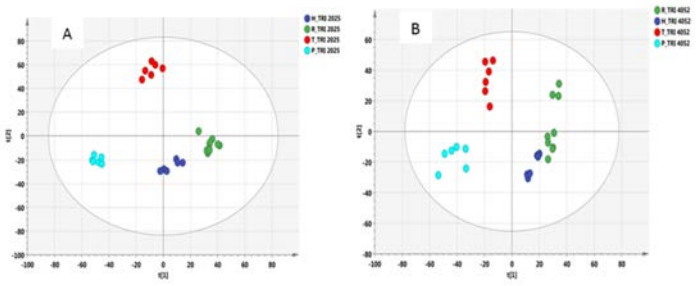


Figure 1. Principal component analysis performed on two tea cultivars grown in Talawakelle, Hanatana, Ratnapura, Passara: (A) TRI 2025; (B) TRI 4052.

Reliable differentiation was also obtained between various cultivars grown in the same region. As an example, the PCA models were generated for 5 cultivars grown in the Hanatana and Ratnapura regions (Fig. 2 A/B).

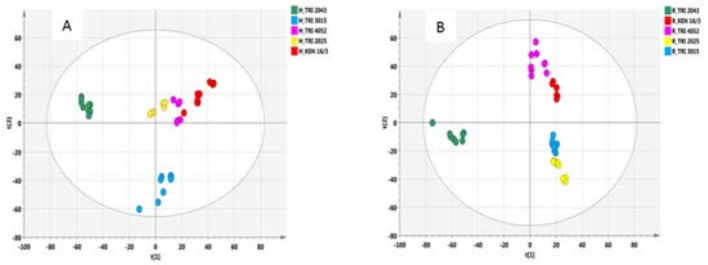


Figure 2. Principal component analysis performed on various tea cultivars (TRI 2015, 2043, 4052, 3015 and EN 16/3) grown in: (A) Hanatana; (B) Ratnapura.

Black tea accounts for about 95% of local consumption in Sri Lanka. Black tea is a fully fermented tea that can be chemically treated to enhance the flavour. Orthogonal partial least squares discriminant analysis (OPLS-DA) was used to validate the observed differentiation between treated and untreated black teas (Fig. 3A). An S plot was generated and used to help to identify the metabolites contributing significantly to the differentiation (Fig. 3B**).**

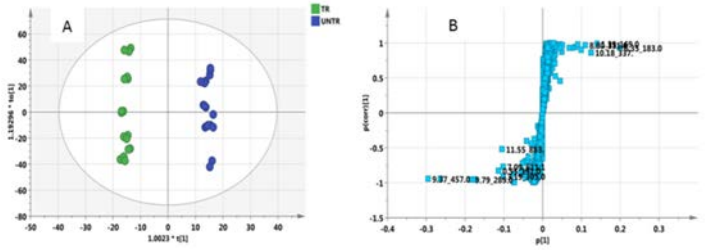


Figure 3. (A) OPLS-DA scores plot of treated and untreated black teas; (B) S-plot for marker identification.

The next stage of this work will be to attempt to identify specific chemical markers that would enable the differentiation of tea varieties and their points of origin using a cheaper, more convenient targeted analytical method. As reported previously, both untargeted and targeted metabolomics are included in the suite of methods, with other techniques such as stable isotope analysis, spectroscopic and trace element profiling, that are being developed to support authenticity testing and food traceability systems.

DNA barcode for genetic traceability of Nile Perch and Nile Tilapia[4]

Valeria Avossa

Lake Victoria is Africa's single most important source of inland fishery production. It makes a significant contribution to employment by providing jobs to over 3

[4] This work was carried out in collaboration with the FAO/IAEA Animal Production and Health Laboratory.

million people and attracts investments of around 9% of total exports. In addition, the fish caught in the Lake Victoria are a rich source of animal proteins for consumption by the local population, providing around 60% of their total animal protein intake.

The two main commercial species of fish from Lake Victoria are:

- Nile perch (Lates niloticus), which was introduced to Lake Victoria in the 1950s and 1960s and is exported, mainly to Europe, the US and the Middle East;

- Nile tilapia (Oreochromis niloticus), which was also introduced to the lake in the 1950s and 1960s, contributing to food security as well as income and employment.

As well as their food value, the fish species have been widely studied from an evolutionary point of view. The identification of species, or the confirmation of their claimed identity, is a fundamental requirement to ensure high quality standards not only for food export, but also for food traceability, safety and security

In this context, we used the DNA Barcode technique to genetically identify species of Nile Tilapia and Nile Perch and to investigate the applicability of this method for the identification and traceability of seafood. The DNA Barcode barcode is based on the extraction of DNA from samples and on the amplification of a short mitochondrial DNA fragment, COI (cytochrome c oxidase), which is conserved at the species level. The relevant segment of the COI mitochondrial gene is amplified by single locus polymerase chain reaction (PCR) technique and then sequenced by bioinformatics software, in order to screen the unknown result against a reference sequence available in a public database such as BOLD (www.boldsystem.org). The database permits a species assignment to be made against one of the species in the reference library (see the steps below in Figure 1).

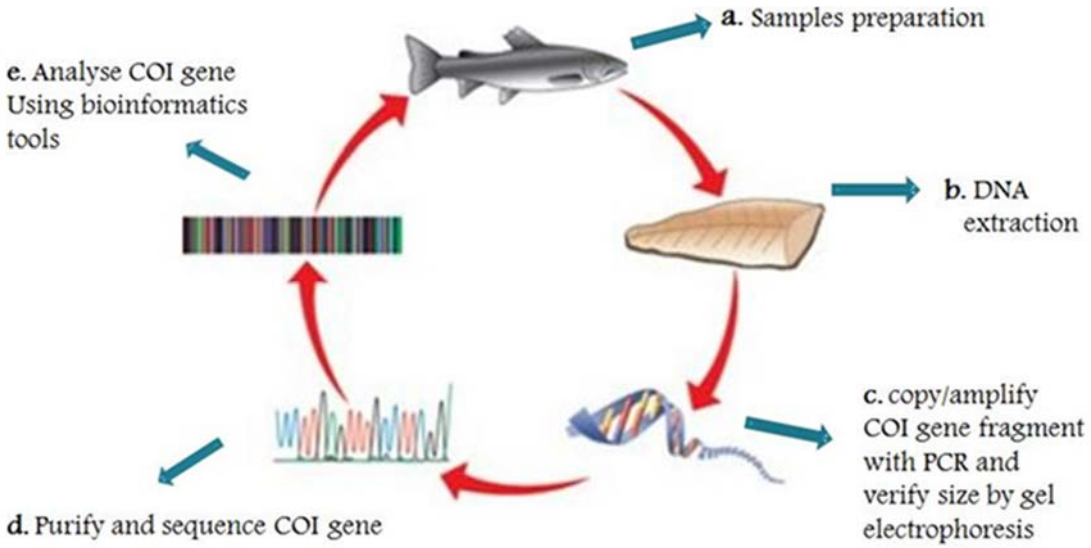


Figure 1. Steps to generate a DNA barcode and identify fish species.

For this study, mitochondrial DNA was extracted from 55 fish samples (26 Nile Perch Samples and 29 Nile Tilapia Samples collected from 3 different Ugandan regions of Lake Victoria. In order to optimize the PCR method, we also extracted DNA from two other different fish samples: one from Italy and one from a Viennese market. The COI gene was amplified using universal primers (COI2, COI3, cocktails of 8 and 4 primers respectively) shown in Table1. After the amplification step, the amplicons were analysed using gel electrophoresis , in order to establish that the set primers worked well in the samples. Figure. 2 shows the positive results of an agarose gel electrophoresis analysis with the PCR amplicons (amplicons length ~700pb).

After the analysis of DNA amplicons, the DNA positive fragments for COI were sequenced and then the DNA results obtained were aligned using bioinformatics software. We used Codoncode software to assemble and align the sequence of nucleotides and to create a consensus sequence. The consensus sequence created was compared with DNA barcode sequences already present in the BOLD Identification Database (Barcode of Life System)

that identifies the fish DNA sequences and provides information about the species from which the sequences came. Comparing with the BOLD Database, the results show that all the sequences of Nile Tilapia were matched to Oreochromis niloticus and all the sequences of Nile Perch have were matched to Lates Niloticus (Nile Perch) except one sample which was mislabelled as Perch, but identified as a Tilapia by the BOLD System (Figure 3).

Table 1. Primer Forward and Reverse used for the amplification of COI-2 and COI-3 segments

COI-2 C_VF1LFt1–C_VR1LRt1
LepF1_t1 1 (TGTAAAACGACGGCCAGTATTCAACCAATCATAAAGATATTGG) 6446–6471)
VF1_t1 1 (TGTAAAACGACGGCCAGTTCTCAACCAACCACAAAGACATTGG) 6446–6471)
VF1d_t1 1 (TGTAAAACGACGGCCAGTTCTCAACCAACCACAARGAYATYGG) 6446–6471)
VF1i_t1 3 (TGTAAAACGACGGCCAGTTCTCAACCAACCAIAAIGAIATIGG) 6446–6471)
LepRI_t1 1 (CAGGAAACAGCTATGACTAAACTTCTGGATGTCCAAAAAATCA) 7155–7130)
VR1d_t1 1 (CAGGAAACAGCTATGACTAGACTTCTGGGTGGCCRAARAAYCA) 7155–7130
VR1_t1 1 (CAGGAAACAGCTATGACTAGACTTCTGGGTGGCCAAAGAATCA) 7155–7130
VR1i_t1 3 (CAGGAAACAGCTATGACTAGACTTCTGGGTGICCIAAIAAICA)
COI-3 C_FishF1t1–C_FishR1t1
VF2_t1 1 (TGTAAAACGACGGCCAGTCAACCAACCACAAAGACATTGGCAC) 6448–6474
FishF2_t1 1 (TGTAAAACGACGGCCAGTCGACTAATCATAAAGATATCGGCAC) 6448–6474
FishR2_t1 1 CAGGAAACAGCTATGACACTTCAGGGTGACCGAAGAATCAGAA) 7152–7127
FR1d_t1 1 CAGGAAACAGCTATGACACCTCAGGGTGTCCGAARAAYCARAA

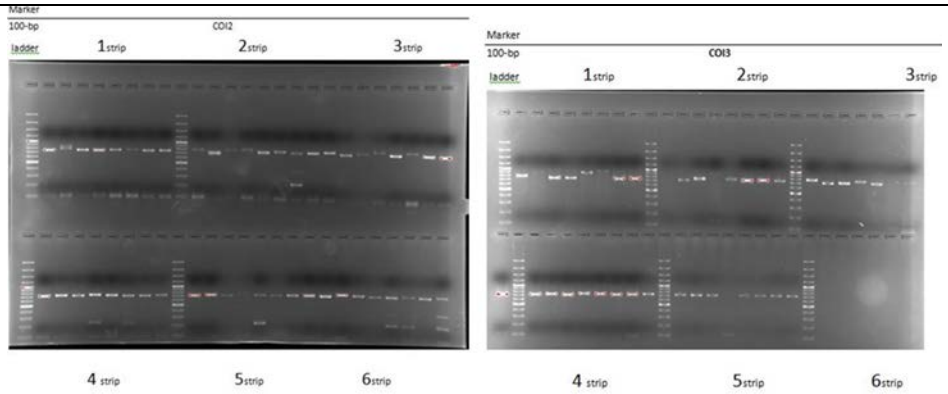


Figure 2. Results of gel electrophoresis of COI2 and COI3 set cocktail primers.

After the analysis of DNA amplicons, the DNA positive fragments for COI were sequenced and then the DNA results obtained were aligned using bioinformatics software. We used Codoncode software to assemble and align the sequence of nucleotides and to create a consensus sequence. The consensus sequence created was compared with DNA barcode sequences already present in the BOLD Identification Database (Barcode of Life System) that identifies the fish DNA sequences and provides information about the species from which the sequences came. Comparing with the BOLD Database, the results show that all the sequences of Nile Tilapia were matched to Oreochromis niloticus and all the sequences of Nile Perch have were matched to Lates Niloticus (Nile Perch) except one sample which was mislabelled as Perch, but identified as a Tilapia by the BOLD System (Figure 3).

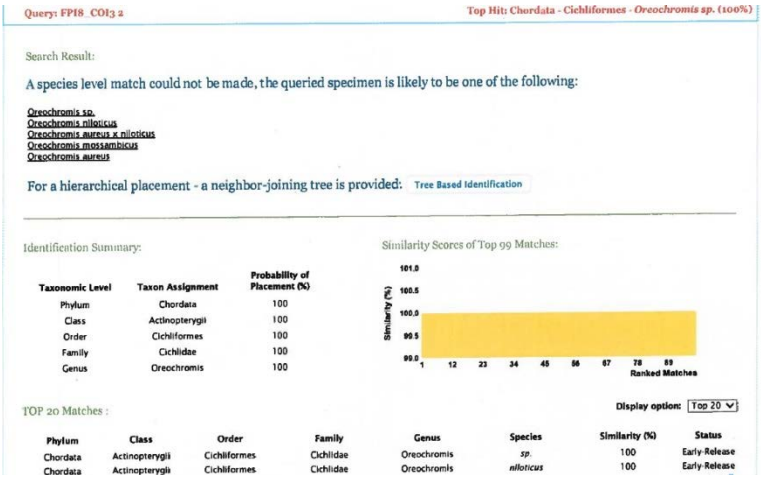


Figure 3. The BOLD database shows the DNA sequence of the sample FPI8 (Fish Perch n 8) belonging to Nile Tilapia (Oreochromatis niloticus). It is an example of sample mislabelled.

Starting from the information obtained through BOLD, we created a phylogenetic tree to show the evolutionary relationship among the Tilapia species (in blue) and the Perch species (in red) connected through a central branch (Figure.4). In the Nile Tilapia species, the mislabelled sample of Nile Perch can be clearly seen in red. The research concluded that DNA barcoding can be used to reliably authenticate Nile Perch and Talapia fish species from Lake Victoria. This method can also be considered as a molecular tool for the implementation of genetic traceability based on taxonomic identification of other species.

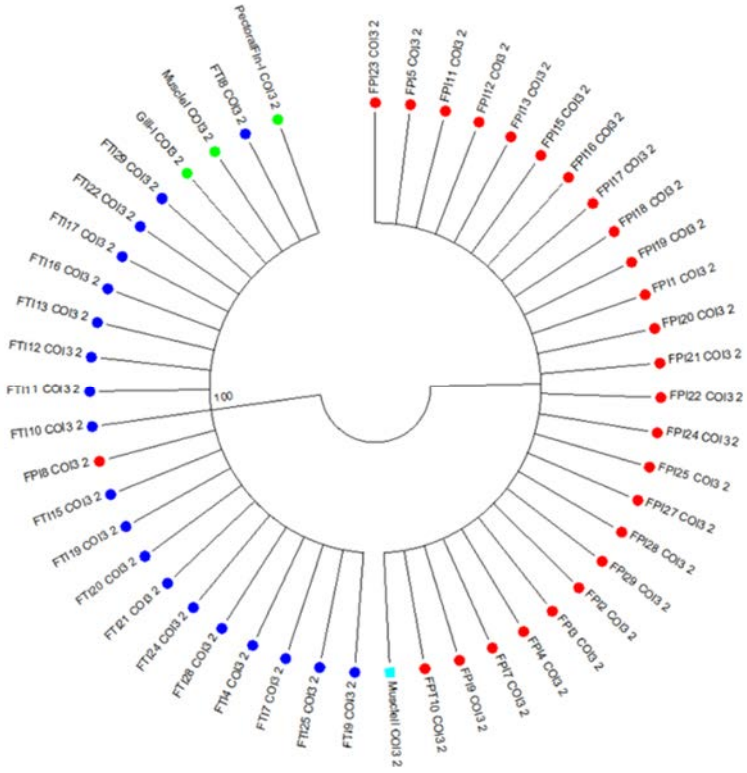


Figure 4. Phylogenetic tree shows the relation among the two different species of fish.

FEP Laboratory Staff

We belatedly welcome Mr Simon Kelly to the FEPL team. Simon joined FEPL from the University of East Anglia, UK, as a Food Safety Specialist (Traceability) and brings a wealth of experience and expertise in a broad range of topics related to food analysis, food authenticity, determination of the geographical origin of foodstuffs and testing to support food traceability. He is an internationally recognized expert in the field of stable isotope measurements, and in his first year in post has already made his mark in taking on a number of coordinated research, technical cooperation and extra-budgetary projects, as well as driving stable isotope and related research and development in FEPL.

FEP Laboratory Interns and Fellows

In November, Ms Valeria Avossa completed a one-year internship in FEPL. Valeria gained experience in a number of techniques related to food authenticity, traceability and contaminant control during her internship, notably in a collaborative project with the Joint Division's Animal Production and Health laboratory on DNA sequencing techniques for the genetic traceability of fish species. A report summarising Valeria's excellent work in this field is included in this issue of the newsletter. Valeria leaves FEPL on completion of her internship to perform further research and study for a PhD in Italy. We wish her all the best, and hope for future collaboration and interaction in projects of shared interest.

Mr Sharif Shawky completed a two–month internship in FEPL in August. Mr. Shawky, an undergraduate student of environmental science and sustainability at Colorado State University, USA, gained experience in various analytical techniques for food contaminant control and traceability during his internship.

In October, FEPL welcomed three Malaysian scientists for 2-month fellowships under TCP MAL5030, Strengthening National Technical Capability in Food Traceability of Edible Birds Nest through the Application of Nuclear and Related Technologies. Ms Salmah Moosa and Ms Syahidah Almal Binti Muhammad from the Analytical Biochemistry Research Centre, University Sains Malaysia, undertook training on metabolomics using UPLC QToF MS and related screening methods using vibrational spectroscopy for authentication of edible bird's nest under the tutelage of Ms Zora Jandrić. Mr Mohd Noor Hidayat Adenan from the Malaysian Nuclear Agency undertook training in authentication of edible birds nest by isotope ratio mass spectrometry under the supervision of Mr Simon Kelly.

In May, FEPL welcomed a Syrian scientist for a three-day scientific visit under TCP SYR5023, Enhancing Analytical Capacities of Major Pesticide Residues. Mr Iyad Ghanem from the Atomic Energy Commission of Syria, actively participated in a round table discussion on possible analytical options including sample preparation for the analysis of pesticides in food of vegetal origin. In addition Mr Ghanem observed a modified QuEChERS method for analysis of organophosphates in potato being implemented in the laboratory.

FEPL interns Sharif Shawky and Valeria Avossa (front and right) with Marivil Islam and Britt Maestroni.

Announcements

Special Issue of "Food Control"

A special issue of the Elsevier journal, "Food Control", focusing on selected manuscripts prepared from presentations at the FAO/IAEA Symposium "Food Safety and Quality: Applications of Nuclear and Related Techniques", Vienna, 10–13 November 2014, and from follow-up work discussed at the symposium and completed over the subsequent year, is due to be published in February 2017. Twenty-nine manuscripts on various aspects of food safety and control were accepted through the journal's stringent peer review process. The special issue will be available online with free access for one year from the publication date, and a limited number of hard copies will be available from the Food and Environmental Protection Subprogramme upon request.

A special issue of the Elsevier journal, "Food Control"

Publications

2017

Blackburn C. (2017) Preparing for and Responding to a Nuclear or Radiological Emergency. Averting Risks to the Food Chain, FAO Rome, ISBN 978-92-5-109539-3, 100-103 http://www.fao.org/3/b-i6538e.pdf

Cannavan, A., Jandrić, Z. and Sasanya, J. (Eds.) (2017) FAO/IAEA International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10–13 November 2014. Food Control, 72, Part B (published on line Dec 2016). http://www.sciencedirect.com/science/journal/09567135/72/part/PB

Jandrić, Z. and Cannavan, A. (2017). An investigative study on differentiation of citrus fruit/fruit juices by UPLC-QToF MS and chemometrics. Food Control, 72, Part B, 173-180 (published online Dec 2016). https://pubag.nal.usda.gov/pubag/article.xhtml?id=5431195

Jandrić, Z., Islam, M., Singh, D.K. and Cannavan, A. (2017). Authentication of Indian citrus fruit/fruit juices by untargeted and targeted metabolomics. Food Control, 72, Part B, 181-188 (published online Dec 2016). https://pubag.nal.usda.gov/pubag/article.xhtml?id=5431192

Jandrić, Z., Frew, R.D., Fernandez-Cedi, L.N. and Cannavan, A. (2017). An investigative study on discrimination of honey of various floral and geographical origins using UPLC-QToF MS and multivariate data analysis. Food Control, 72, Part B, 189-197 (published online Dec 2016). https://pubag.nal.usda.gov/pubag/article.xhtml?id=5431190

Ben Mansour. A., Bakke, M.J., Guerbej, H., Berriche, Z., Samaali, M., Shaikh, B., Sasanya, J., Horsberg, T.E. (2017). Disposition of 14C-flumequine in sea bream (Sparus auratus) after single intraperitoneal administration. Food Control,72, Part B, 198-204 (published online Dec 2016).https://pubag.nal.usda.gov/pubag/article.xhtml?id=5266395&searchText=subject_term%3A%22half+life%22&searchField=

Chen, T., Chen, G., Yang, S., Zhao, Y., Ha, Y. and Ye, Z. (2017). Recent developments in the application of nuclear technology in agro-food quality and safety control in China. Food Control, 72, Part B, 306-312 (published online Dec 2016) https://pubag.nal.usda.gov/pubag/article.xhtml?id=5431187

2016

Cannavan, A., Kay, J.F. and Jandrić, Z. (2016). Method validation and quality assurance/quality control approaches for multiresidue methods. In: Chemical Analysis of Non-antimicrobial Veterinary Drug Residues in Food, Kay, J.F., MacNeil, J.D. and Wang, J. (Eds). Wiley, NJ, USA, 549-574.

Cannavan, A. (2016). International efforts to combat food fraud. New science for food safety: an international conference on regional perspectives of food science developments in Asia in support of the International Food Safety Authorities Network (INFOSAN), Nanyang Technical University, Singapore, 7-10 November 2016, 33.

Maestroni, B.M. and Cannavan, A. (2016). Risk assessment and food safety. Summary of the scientific output presented at the 9th Scientific conference of the Bulgarian focal point of European Food Safety Authority(EFSA), Hissar, Bulgaria, 24-25 October 2016, 12-13.

Chen, T., Zhao Y., Zhang, W., Yang, S., Ye, Z. and Zhang, G. (2016). Variation of the light stable isotopes in the superior and inferior grains of rice (Oryza sativa L.) with different geographical origins. Food Chemistry, 209 (2016), 95–98

Jandrić, Z., Waduge, V., Abeysinghe, S.B. and Cannavan, A. (2016). A non-targeted approach for discrimination of Sri Lankan teas by UPLC-QToF/MS and chemometrics. Book of abstracts of the Max Rubner Conference 2016, Food Metabolomics, Karlsruhe, Germany, 10-12 October 2016, 33.

Kanarat, S., Tangsirisup, N., Nijthavorn, N., Elliott, C. and Cannavan, A. (2016). Application of an isotope dilution method to investigate the possible natural occurrence of chloramphenicol in poultry litter. IAEA-TECDOC-1800, Development of Radiometric and Allied Analytical Methods and Strategies to Strengthen National Residue Control Programmes for Antibiotic and Anthelmintic Veterinary Drug Residues, 99-105.

Fodey, T., Murilla, G., Cannavan, A. and Elliott, C. (2016). Characterization by enzyme linked immunosorbent assay and biosensor technologies of antibodies to chloramphenicol produced in camel, donkey and goat. IAEA-TECDOC-1800, Development of Radiometric and Allied Analytical Methods and Strategies to Strengthen National Residue Control Programmes for Antibiotic and Anthelmintic Veterinary Drug Residues, 141-145.

Wesonga, J.O., Murilla, G.A., Guantai, A.N., Elliott, C.T., Fodey, T and Cannavan, A. (2016). Development of an enzyme-linked immunosorbent assay for chloramphenicol in serum. IAEA-TECDOC-1800C, Development of Radiometric and Allied Analytical Methods and Strategies to Strengthen National Residue Control Programmes for Antibiotic and Anthelmintic Veterinary Drug Residues, 146-149.

Granja, R.H., Montes Niño, A.M., Rabone, F., Montes Niño, R.E., Cannavan, A. and Salerno, A.G. (2016). Radioimmunoassay screening method for anilinic and phenolic beta-agonists in bovine liver. IAEA-TECDOC-1800, Development of Radiometric and Allied Analytical Methods and Strategies to Strengthen National Residue Control Programmes for Antibiotic and Anthelmintic Veterinary Drug Residues, 165-170.

IAEA-TECDOC-1788, Criteria for Radionuclide Activity concentrations for Food and Drinking Water, FAO/IAEA Division of Nuclear Techniiques in Food and Agriculture, IAEA, WHO. ISSN 1011-4289; no. 1788, IAEA (April 2016).

http://www.pub.iaea.org/MTCD/Publications/PDF/TE-1788_web.pdf

Guy J. Hallman, Yves M. Hénon, Andrew G. Parker, and Carl M. Blackburn (Oct. 2016): Phytosanitary irradiation: An overview. Florida Entomologist, Vol 99, Special Issue 2, 1-13. http://journals.fcla.edu/flaent/article/view/88667

Maestroni, B.M. (2016). Practical Experiences with Agilent's GC/MS/MS Pesticide Analyzer. Sep Science webinar, 21 July 2016, Available at: http://ll4.workcaststr.net/10311/0279275158671341/10311_20160722131641923_ondemand.mp4

Cannavan, A., Jandrić, Z. and Kelly, S. (2016). Food authenticity – fighting food crime. Proceedings of the 2016 International Symposium and Annual Meeting of the Korean Society of Environmental Agriculture, Integrated Management of Agricultural Environment for Food Security, Busan, Republic of Korea, 7-9 July 2016, 7-8.

Sasanya, J., and Cannavan, A. (2016). Development and Strengthening of Radio-Analytical and Complementary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products. Proceedings of the EuroResidue VIII Conference on Residues of Veterinary Drugs in Food, Egmond aan Zee, The Netherlands, 23–25 May 2016, 776-779.

Sasanya, J., Lee, H-S., Maqbool, M., Chiew, P. Enhancing food safety laboratory capabilities and establishing a network in Asia to Control veterinary drug residues and related chemical contaminants. Proceedings of the EuroResidue VIII Conference on Residues of Veterinary Drugs in Food, Egmond aan Zee, The Netherlands, 23–25 May 2016, 887-889.

Maqbool, U., Ahmad, R., and Sasanya, J. J. In-House Standardization and Validation of Radio-Receptor Assays for Chloramphenicol Residues in Bovine Milk and Meat. In: 2016 Annual Meeting Abstract Supplement, Society of Toxicology, 2016. Abstract no. 3790.

Cahill, S.M., Desmarchelier, P., Fattori, V. and Cannavan, A. (2016). Global perspectives on antimicrobial resistance in the food chain. Proceedings of the EuroResidue VIII Conference on Residues of Veterinary Drugs in Food, Egmond aan Zee, The Netherlands, 23–25 May 2016, 59-65.

Maestroni, B., Leuseur, C, Akkermann, W.G.M., Goos, P.,Cesio, V, Avossa, V., Heinzen, H., Riener, J. and Cannavan A. (2016). A comparison of two approaches for the robustness testing of an analytical method. Book of abstracts of the 11th European Pesticide Residues Workshop, Limmasol, Cyprus, 24–27 May 2016, 73.

Zhu, Z., Liu, G., Wang F., Sasanya J.J., and Cannavan, A. (2016). Development of a liquid chromatography tandem mass spectrometric method for simultaneous determination of 15 aminoglycoside residues in porcine tissues. Food Analytical Methods, in press, published on line: doi 10.1007/s12161-016-0446-1.

Hallman, G.J.; Blackburn, C.M. Phytosanitary Irradiation. Foods, (January 2016), Vol 5, Article 8 the link is http://www.mdpi.com/2304-8158/5/1/8

2015

The Fukushima Daiichi Accident, Technical Volume 3 Emergency Preparedness and Response, 65-71, IAEA (2015), ISBN 978-92-0-107015-9.

Manual of Good Practice in Food Irradiation: Sanitary, Phytosanitary and other Applications. Technical Report Series No. 481 STI/DOC/010/481. ISBN 978-92-0-105215-5, IAEA, Vienna (2015).

Y. Henon, Research in Phytosanitary Irradiation: The Role of The International Atomic Energy Agency and The Joint FAO/IAEA Division, Page 59-2in the Proceedings of the 2015 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions, San Diego, USA, 9−11 November 2015. https://mbao.org/static/docs/confs/2015sandiego/papers/59henony.pdf

Sasanya, J.J., Blackburn, C. M. and Cannavan, A. 2015. Final Report of the Fourth Research Coordination Meeting for 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.

P. B. Roberts and Y. M. Hénon, Consumer response to irradiated food: purchase versus perception, Stewart Postharvest Review, September 2015, Vol. 11 (3:5), ISSN: 1745-9656. www.stewartpostharvest.com

Jandrić, Z., Frew, R.D. and Cannavan, A. (2015). Differentiation of Manuka and kanuka honeys by mass spectrometry and chemometrics. Book of abstracts of the 7th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic, 3−6 November 2015, 187.

Maestroni, B., Riener, J., Krukle, A. Abrahim, A., Besil, N., Cesio, V., Heinzen, H., Faye, T and Cannavan, A.

(2015). Method validation for selected pesticides in potato by gas chromatography coupled to single quadrupole and triple quadrupole mass spectrometry. Book of abstracts of the 7th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic, 3−6 November 2015, 410.

Maestroni, B., Besil, N., Bojorge, A., Heinzen, H. and Cesio, V. (2015). Modified QuEChERS method coupled to GC QQQ MSMS for the determination of pesticide residues in a herbal, Boldo, its leaves and their infusion and the resulting transference to the brew. Book of abstracts of the 7th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic, 3−6 November 2015, 391.

Jandrić, Z., Haughey, S.A., Frew, R.D., and McComb, K., Galvin-King, P., Elliott, C.T. and Cannavan, A. (2015). Discrimination of honey of different floral origins by a combination of various chemical parameters. Food Chemistry, 189, 52-59.

Maestroni, B., Ochoa V. and Cannavan A. (2015). Method validation for pesticide residue testing: are there still issues and challenges to tackle?. Book of abstracts of the 5th Latin American Pesticide Residue Workshop, Santiago, Chile, 10−13 May 2015, 67.

Holder, P.W., Frew, R. and Van Hale, R. (2015). The geographic origin of an intercepted biosecurity pest beetle assigned using hydrogen stable isotopes. Journal of Economic Entomology (DOI: 10.1093/jee/tou097)

Cannavan, A., Frew, R. and Jandrić, Z. (2015). Chemical measurement techniques to support food traceability and authenticity. Book of abstracts of the FERA Science Conference, Sand Hutton, UK, 27 January 2015, 2-3.

2014

Pillai S., Bogran, C. (Texas A&M University, USA) and Blackburn, C. (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.

Cannavan, A., Frew, R., Abrahim, A. and Jandrić, Z. (2014). The application of chemical measurement techniques to support systems for food traceability and authenticity. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 117.

Jandrić, Z., Cannavan, A., Islam, M., and Singh, D. (2014). Authentication of Indian citrus fruit/fruit juices by untargeted and targeted metabolomics. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 121.

Jandrić, Z., Cannavan, A. and Frew, R. (2014). Metabolomics; an approach to control food authenticity. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 122.

Maestroni, B., Ochoa, V. and Cannavan, A. (2014). The use of analyte protectants and matrix matched calibration in gas chromatographic analysis for pesticide residues in potatoes. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 156.

Maestroni, B., Ochoa, V., Rathor, N., and Cannavan, A. (2014). Validation of a gas chromatographic method for several pesticides in potatoes. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 157.

Maestroni, B., Ochoa, V., Rathor, N., Caceras, T., and Cannavan, A. (2014). Nuclear techniques applied to the generation of input data for first tier risk assessment. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 158.

Islam, M., Jandrić, Z., and Cannavan, A. (2014). A multiresidue method for the determination of antimicrobials in meat. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 171.

Frew, R., and Abrahim, A. (2014). Stable isotope deltas – nature's own traceability system for verifying food authenticity. Book of abstracts of the International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques, Vienna, Austria, 10−13 November 2014, 69.

Sutcliffe, O.B., Skellern, G.G., Araya, F., Cannavan, A., Sasanya, J.J., Dungu, B., van Gool, F., Munstermann S. and Mattioli, R.C. (2014). Animal trypanosomosis: making quality control of trypanocidal drugs possible. OIE Scientific and Technical Review, 33, 813-830.

Cannavan, A., Frew, R. and Jandrić, Z. (2014). Application of stable isotope measurements and metabolomics for traceability and authenticity of milk, fruit juices, and honey. Book of abstracts of the 248th American Chemical Society National Meeting and Exposition, San Francisco, USA, 10−13 August 2014, abstract no. 75.

Maestroni, B.M., Carazo, E., Nario, A., Loewy, M.R. and Cannavan, A. (2014). Integrated analytical approaches to assess indicators of the effectiveness of pesticide management practices at a catchment scale. Book of

abstracts of the 248th American Chemical Society National Meeting and Exposition/13th IUPAC International Congress of Pesticide Chemistry, San Francisco, USA, 10−13 August 2014, abstract no. 779.

Chin, J.S., Carazo, E.R., Aguilar, P.M., Nario, A., Parada, A.M., Videla, X., Vieira, E., Ferreira, R.C.B., Luchini, L.C., Loewy, M., Savini, M.C., Parolo, E., Maestroni, B.M., Cáceres, T., Payes, J.E. (2014). Comparison of estimated Kd and Koc for pesticides using pure active ingredient and formulated product in soils from Latin America and Europe using radiometric techniques. Book of abstracts of the 248th American Chemical Society National Meeting and Exposition / 13th IUPAC International Congress of Pesticide Chemistry, San Francisco, USA, 10−13 August 2014, abstract no. 656.

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.

Reports

2016

Sasanya, J.J. (2016). Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture relevant to Codex Work (CCRVDF 23). 23rd Session of the Codex Committee on Residues of Veterinary Drugs in Foods, Houston,Texas, United States of America, 17-21 October 2016; Available at: http://www.fao.org/fao-whocodexalimentarius/shproxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FMeetings%252FCX-730-23%252FWD%252Frv23_03Add1e.pdf

Ye, Z. (2016). Information on Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture Relevant to Codex work (CAC39_07e). 39th Session of the Joint FAO/WHO Codex Alimentarius Commission, Rome, Italy, 27 June-1 July 2016; available at: http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FMeetings%252FCX-701-39%252FINF%252Fif39_07e.pdf

Sasanya, J.J. (2016). Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (CX/CF 16/10/4). 10th Session of the Codex Committee on Contaminants in Foods, Rotterdam, The Netherlands, 4-8 April 2016.

Corley, J.S. (2016). Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (CX/PR 16/48/4). 48th Session of the Codex Committee on Pesticide Residues, Chongqing, China, 25–30 April 2016.

Blackburn, C.M.; Hallman, G.J. (2016) Phytosanitary Irradiation. Foods 2016, 5, 8.http://www.mdpi.com/2304-8158/5/1/8

Blackburn, C.M. Statement of the Joint FAO/IAEA Division, Reports from International Organizations, Item 9.1, 41st Meeting of the Radiation Safety Standards Committee (RASSC) Vienna, Austria, 21-23 November 2016. IAEA, Vienna, Austria.

Blackburn, C. M. Food and Agriculture Organization of the United Nations, Reports from International Organizations, Item 8.2a, 3rd Meeting of the Emergency Preparedness and Response Standards Committee (EPReSC), 29 November - 1 December 2016, IAEA, Vienna, Austria.

2015

Blackburn, C.M. (2015). Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (CAC/38 INF/7) 38th Session of the Joint FAO/WHO Codex Alimentarius Commission, Geneva, Switzerland, 6-11 July 2015.

Sasanya, J.J. (2015). Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (CX/RVDF 15/22/4-Add.1). Twenty-second Session of the Codex Committee on Residues of Veterinary Drugs in Foods, San José, Costa Rica, 27 April–1 May 2015.

Corley, J.S. (2015). Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (CX/PR 15/47/4-Add.1). 47th Session of the Codex Committee on Pesticide Residues, Beijing, P.R. China, 13−18 April 2015.

Sasanya, J.J., Cannavan, A. and Blackburn C. M. (2015). Activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (CX/CF 15/9/4). 9th Session of the Codex Committee on Contaminants in Foods, New Delhi, India, 16–20 March 2015.

2014

Corley J.; Sasanya, J.J.; Cannavan, A. (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.

Sasanya, J.J.; Cannavan, A.; Blackburn, C. M. (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, The Netherlands, 31 March−4 April 2014.

Impressum

Food and Environmental Protection Newsletter Vol. 20, No. 1, January 2017
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, January 2017

17-0193