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. 21, No. 2, July 2018

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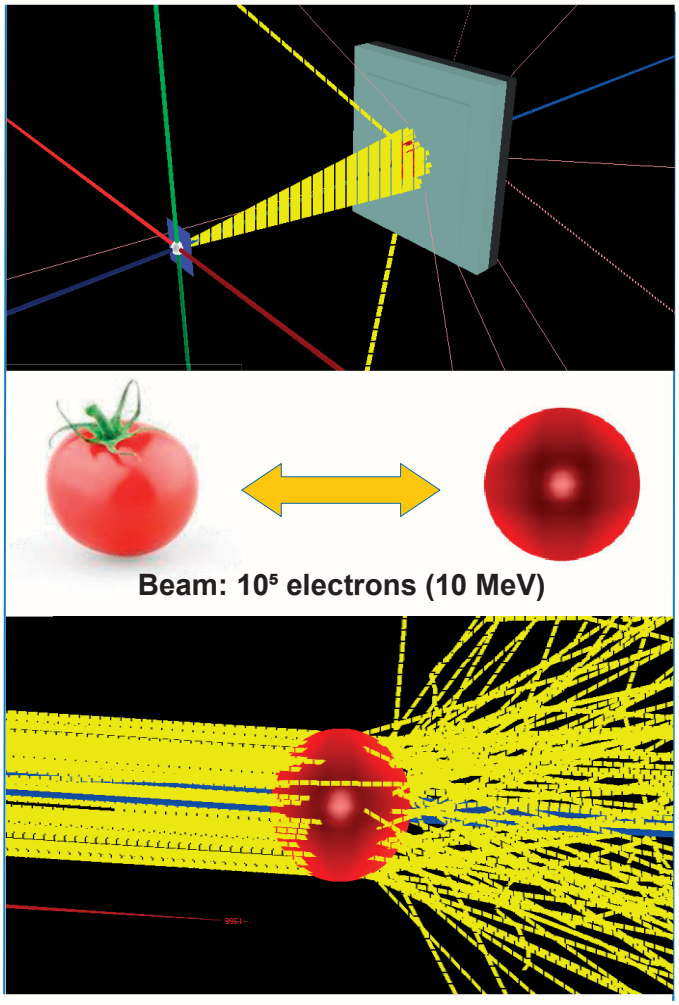
# To Our Readers

The Food and Environmental Protection (FEP) Subprogramme of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture continues to support the efforts of both the FAO and IAEA Member States to improve their food safety and control systems by providing technical support and training to accelerate and expand the contribution of nuclear technologies to food security and safety. These activities primarily relate to the use of ionizing radiation; the development and application of nuclear/isotopic and nuclear-related analytical techniques to control food contaminants; and the implementation of traceability systems to combat food fraud, as well as the management of nuclear and radiological emergencies affecting food and agriculture.

In doing so, the FEP works especially through our Coordinated Research Projects (CRPs) and Technical Cooperation Projects (TCPs). A consultant meeting on "Implementation of Nuclear and Related Techniques to Confirm the Authenticity of Foods with High Value Production Chains and High Value Food Property Labelling Claims" was held in Vienna on 14–18 May 2018 to design a new CRP for the application of nuclear analytical techniques to determine food authenticity, especially for high value food commodities. Very positive feedback was received from the consultants and will be incorporated into the proposal for this new CRP. The third Research Coordination Meeting (RCM) of CRP D52039 on "Radio Analytical and Complementary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products" and CRP D61024 on "Development of Electron Beam and X-ray Applications for Food Irradiation" successfully held in Pretoria, South Africa from 30 May to 6 June 2018, and Bangkok, Thailand on 11–15 June 2018, respectively, and achievements and work progress were reported by participating institutions as detailed in this issue by our respective project officers.




*Modelling food irradiation for optimum effects.*
*Aadapted from Dr. S. Cabo Verde, University of Lisbon.*

One of our Feature Articles in this issue provides an update on food irradiation, including a new design for a self-shielded X-ray system (Mevex, Canada), a new facility located in McAllen, Texas (ScanTech, USA) and a new e-beam irradiation facility developed for phytosanitary purposes (Nuctech, China). The revision of the European Commission food irradiation directives and new approvals of food items that may be irradiated and traded in Canada is also discussed. A second feature article highlights the FEP Laboratory's work that was featured at the annual exhibition of Long Night of Research, which is an Austria-wide event held every two years and that attracts many interested visitors from our host nation.

As one of our key mandates, we continue to assist Member States in their implementation of international standards, guidelines and recommendations for the production of safe and quality-assured foods, with the overall aim of safeguarding consumers and strengthening international trade. We actively participated in activities and meetings of the Codex Alimentarius Commission and relevant committees on behalf of the Joint FAO/IAEA Division, including the Codex Committee on Contaminants in Foods (CCCF 12, Netherlands), the Codex Committee on Residues of Veterinary Drugs in Foods (CCRVDF 24, USA) and the Codex Committee on Methods of Analysis and Sampling (CCMAS 39, Hungary). In addition, an information paper was provided to the Codex Committee on Pesticide Residues (CCPR 50, China). Valuable technical contributions were also provided through the electronic working group (eWG) on maximum levels for cadmium in chocolate and cocoa products and technical input was provided to the discussion paper on maximum levels for hydrocyanic acid and mycotoxin contamination in cassava and cassava-based products.

Support to TCPs has remained one of our key activities with a focus on the transfer of knowhow and new technologies developed from our subprogramme to our counterparts in Member States. This part of our work includes not only the timely implementation of on-going TCPs but also technical assistance in the assessment of new concept notes that will subsequently aid the design of new TCPs for the 2020–2021 TC Programme cycle. The FEP is currently providing technical support to 52 TCPs, including 1 inter-regional, 9 regional and 42 national projects. An tabulated list of these TCPs is included in this newsletter as are several articles on recent work progress and events of specific TCPs. The news relates to activities such as the enhancement of food safety laboratory capacity in Namibia, Cambodia and Bangladesh; supporting food safety laboratory capabilities in Nigeria; strengthening food safety networking in the Asia-Pacific region; regional training on analytical methods for agrochemical residues in animal products in Africa; and training courses in Colombia and Turkey. One of the new developments in this area is the formal commencement of the Regional Cooperative Agreement project RAS5081 on "Enhancing Food Safety and Supporting Regional Authentication of Foodstuffs through Implementation of Nuclear Techniques", a TCP that held its first coordination meeting in Vienna on 5–9 February 2018; details of this meeting and its outputs are reported in this issue.

As previously announced, a workshop aimed at enhancing the African food safety network (AFoSaN) and sharing knowledge on food safety matters of interest to the African continent was held in Pretoria, South Africa. It was attended by some 240 delegates from 54 countries, including several high-profile scientists and stakeholders and was a huge success. Participants were primarily from Africa, but substantial numbers also came from Asia, Europe and the Americas. See the report in this newsletter for more details.

As regards the research and development activities of our FEP Laboratory, this newsletter reports further research results and exciting developments, including on homogeneity of sample processing for verification of pesticide analytical methods; rapid screening techniques for extra virgin olive oil authentication; and the development of a screening method to detect formaldehyde adulteration of liquid milk using portable Raman spectroscopy.

Finally, I would like to take this opportunity to express my sincere thanks to you and to all of our readers for the continued support and encouragement that we receive in our endeavours.

Sincerely,

***Zhihua Ye***
***Head, Food and Environmental Protection Section***

# 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 |
| Daniela Battaglia | Food and Feed Safety Specialist | D. Battaglia@iaea.org | 21695 | Vienna |
| Kyoko Narikawa | Team Assistant | K. Narikawa@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 |

Food and Environmental Protection Section
Vienna International Centre, PO Box 100, A-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
A-2444 Seibersdorf, Austria
Tel.: (+) 43 1 2600 + Extension; Fax: (+) 43 1 26007; Email: Official.Mail@iaea.org

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# Feature Articles

## Technical Developments in Food and Phytosanitary Irradiation

Carl Blackburn

In the spirit of a news round-up, this feature article aims to highlight some technical developments in food and phytosanitary irradiation.

As the observant reader will notice from our Announcements Section, the Joint FAO/IAEA Division now has two food irradiation videos available freely on the internet, both are short, informative and free of jargon. We hope that the newest "infographic" will be as popular as the original. The author was very happy to see both infographics feature in the February edition of Food Irradiation Update[1], the famous monthly email round-up of food irradiation news produced by Ron Eustice.


*New video "infographic": Food Irradiation and the Changing Climate. https://youtu.be/ivl8qIGaRG0*

The Joint Division has helped many Member States purchase equipment and devices for radiation applications. This sometimes includes small scale irradiators. For example, in 2014 the IAEA commenced a procurement exercise for three self-shielded gamma irradiators destined for institutions in China, Mauritius and Costa Rica. As regards research and development irradiators as well as the majority of commercial scale food irradiation facilities, it is gamma rays from cobalt-60 that is the dominant technology. However, there is a steady and growing interest in technologies that do not rely on radionuclides to generate the ionizing radiation. Therefore, in response to the demand from our Member States and partly to stimulate the development of in-line or small-scale electron beam (EB) and X-ray equipment, a Coordinated Research Project (CRP) on the Development of Electron Beam and X-ray Food Irradiation Technologies (CRP D61024) was initiated. In 2014, at the outset of the CRP we invited many irradiation and food technology companies to join us at a meeting in Vienna and these included representatives from Bühler, COMET, Mevex and NucTech.

In 2015 the Swiss food-engineering group Bühler and COMET, another Swiss company, forged a strategic partnership to develop new EB applications. This partnership has developed a novel approach to dried food and food ingredient decontamination using low-energy EB technology. Bühler views this as one of the most promising non-thermal technologies for decontamination of dry foods. For selected products, low-energy EB provides gentle surface decontamination of foods without impacting the quality of the inner food matrix and have developed a compact and portable EB machine that can be easily integrated in the processing lines of small and large food processors. The Project Officer understands that several have been installed at different spice processors world-wide and are being evaluated.

Mevex[2], is a worldwide EB and X-ray company with its headquarters in Canada. Following our initial meeting in Vienna, Mevex have been keen to keep in touch with the progress of the CRP and to work to develop "The Mevex X-ray Box", a compact self-shielded X-ray system for research or for limited production of high value products. The irradiator is now available with energies up to 2 MeV and is designed to deliver high dose rates. The first unit will have an irradiation chamber allowing it to irradiate products up to 40 cm high, on a 40 cm diameter turning table. The design is flexible and different chamber sizes are available on request. The irradiator footprint, including the shielding, is approximately two square meters.

NucTech is based in China and has developed a Quarantine Irradiation System specifically designed for large scale phytosanitary applications and using conventional EB technology coupled with operation management systems designed to handle a very large throughput of product, for example at points of import entry. A system has been installed on a major trading route with Viet Nam and a new facility is being commissioned at a second location in China. NucTech, in collaboration with the Institute For Security Detection Technology at Tsinghua University, China, is developing a novel mass thickness detection tool that can be used to examine, validate and possibly dose map products prior to irradiation processing. The device relies on X-ray technology linked to Monte-Carlo modelling codes. Prototypes are being pilot tested in EB facilities, so that the system can be further refined. However, early results are very encouraging [3] and the

[1] http://campaign.r20.constantcontact.com/render?m=1107025842578&ca=92f2e869-157b-49ef-ba69-55282a44105c

[2] http://mevex.com/

[3] Huaili Qin *et al.* Concept development of X-ray mass thickness detection for irradiated items upon electron beam irradiation processing. Radiation Physics & Chemistry. 2017, V143, 8-13

accuracy of the dose prediction maps when compared against actual measurements is impressive. In Viet Nam, the Vinagamma Research and Development Centre has also developed a new density detection system but based on the attenuation of collimated gamma rays. The system has been designed and manufactured to quickly validate and determine the area density of cartons of product before irradiation. Tests in irradiation facilities are part of an on-going series of experiments to measure the densities of typical products and are being carried out in commercial facilities. The results are very impressive and the system will be a valuable addition to the tool-kit available to irradiation facilities in the future. Both NucTech and Vinagamma are participating in CRP D61024 and their research is pushing new frontiers with these new devices, so much so that these new applications could revolutionize dosimetry practices at irradiation facilities in the coming years.

*The ScanTech Sciences, Rio Grande Valley ECP™ Center, located in McAllen, Texas.*

Phytosanitary irradiation and trade with the USA across plant-pest quarantine boundaries is continuing to increase. To meet the growing demand more capacity is needed to irradiate fresh produce. For example, ScanTech Sciences, Inc., a leading designer, builder and operator of EB technology (the so called Electronic Cold-Pasteurization™, or ECP™ food treatment) is nearing completion of its first facility: the Rio Grande Valley ECP™ Center, located in McAllen, Texas. The facility will use a proprietary form of EB to treat fresh produce crossing the USA/Mexico border for pest sterilization, pathogen reduction and shelf-life extension. In April of this year, ScanTech Sciences received the "Best in Show" and "Most Innovative Product Solution - Food Safety" awards at the 2018 USA Viva Fresh Produce Expo.

ScanTech Sciences' new 100 000 sq. ft. climate-controlled cross-dock facility features five temperature zones and a high-density push-back system to store products in proper cold chain requirements. The pallets moving through the facility are managed through voice technology to allow for faster loading, storage, retrieval and finishing services for efficient through-put. With processing speeds between 120–160 cases of produce per minute, the system can safely process 30 pallet loads at the case level in less than 40 minutes. Operations are scheduled to begin later this year. Future facilities are planned in other USA ports of entry, key distribution markets and strategic international agricultural gateways.

## The Long Night of Research, Vienna International Centre, Vienna, Austria, 13 April 2018

Andrew Cannavan

The Long Night of Research (Lange Nacht der Forschung) is an Austria-wide event held every two years and coordinated by several Austrian government ministries, that aims to spark interest in science and research. In 2018, Vienna International Centre (VIC) opened its doors for this event for the second time, to participate in the eighth Long Night of Research. The VIC was one of around 250 exhibit locations across the country, and had approximately 1600 visitors to the exhibition.


*The FEPL team at their Long Night of Research exhibition booth.*

From 5pm until midnight, stations and displays in the VIC Rotunda to showcased the science and research of the IAEA and several other UN organisations to the general public, staff members and their families and friends. IAEA scientists hosted more than a dozen exhibition booths, including displays by the five laboratories of the Joint FAO/IAEA Division. The Joint Division's booths gave visitors the opportunity to learn about the wide variety of nuclear applications in various fields of food and agriculture. The exhibition had more than 1000 external visitors and several hundred staff members of the VIC-based organizations.

The Food and Environmental Protection Laboratory (FEPL) exhibition booth focused on testing for food authenticity, posing the question "is my food safe and am I getting what I paid for?". Food is an essential part of our daily lives. We all want our food to be safe and we want to be able to trust that a jar contains what its label says. This is important not only to individual consumers, but also to global trade. Melamine in milk powder, horse meat in beef lasagne – these are only two recent examples of food fraud.

Visitors had the chance to see how new hand-held and portable, bench-top devices can be used to test food authenticity, and learn more about contaminants and food safety.

Nuclear and related techniques can be used to control food safety and to fight food fraud – the deliberate mislabelling of food products. For example, by determining the ratio of stable isotopes, such as hydrogen, oxygen and carbon, in various foods, scientists can extract information on where a food product comes from and what it contains. However, the instruments used are often costly and require significant expertise to operate and to interpret the results. Continuous development and miniaturisation of analytical instruments has opened up the potential for access to a new level of practical testing in our Member States. Cost-effective and easily used screening tools are being developed using small hand-held devices and bench-top laboratory instruments to provide first tier testing which complements the advanced techniques such as stable isotope analysis. This is important not only to individual consumers, but also to global trade.

Seven members of the FEPL team manned the booth, providing information to the visitors and giving hands-on demonstrations of hand-held and bench-top spectrophotometric instruments for which applications are being developed in FEPL to provide screening tests for the authenticity of foods, or detection of adulteration. Visitors were invited to 'blind' inspect (visually and by smell) an authentic extra-virgin olive oil sample, and olive oil samples adulterated with other oils in FEPL, and to choose which they thought was the authentic sample. They could then test the samples with a hand-held infra-red spectrophotometer connected to a smart phone or tablet, to match the spectrum with a spectral library of the authentic oil, and confirm the result by testing on another bench-top infra-red spectrophotometer. The demonstration included automatic interpretation of the results using a simple '3 step' analysis – place a drop of oil on the instrument, take the measurement and read the result. A similar hands-on demonstration was available for honey samples of different floral/geographical origin.

*Hands-on demonstrations of some food authenticity screening methods for the public.*

The authenticity demonstrations were very well attended, with queues forming frequently for the hands-on testing, and queries and discussion with FEPL staff in front of the exhibition booth. There were visitors from a broad range of backgrounds and experience, including students, university professors, scientists, school children (including large groups of pupils from Vienna International School) and other interested members of the public, and a keen interest in the subject. The hands-on demonstrations fostered discussion around food authenticity, and in many cases there was healthy competition between participants, for example to find out who had picked the correct, authentic sample of olive oil. Visitors were also informed about some of the other areas of FEPL's work in food safety, authenticity, support for traceability systems, and contaminant control through a rolling video display, which included presentations by FEPL staff members, animated graphics and slide shows. Participation of the IAEA and the Joint Division's Agriculture and Biotechnology Laboratories in The Long Night of Research provided a unique opportunity to showcase the peaceful uses of nuclear energy and nuclear applications.

# Forthcoming Events

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

Fourth Research Coordination Meeting 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-4), 3−7 September 2018, Ljubljana, Slovenia.

Second Research Coordination Meeting on Field-deployable Analytical Methods to Assess the Authenticity, Safety and Quality of Food. (D52040-CR-2), 12−16 November 2018, Colombo, Sri Lanka.

## International Meetings/Conferences

International Symposium on Communicating Nuclear and Radiological Emergencies to the Public, 1–5 October 2018, IAEA Headquarters, Vienna, Austria. https://www.iaea.org/events/cnrep2018


Annual meeting FAO and International Feed Industry Federation (IFIF), 4–5 October 2018, Rome, Italy.

7th Meeting of the Emergency Preparedness and Response Standards Committee (EPReSC), 30 October–2 November 2018, Vienna, Austria.

5th International FoodIntegrity Conference, 14–15 November 2018, Nantes, France.

45th Meeting of the Radiation Safety Standards Committee (RASSC), 19–23 November 2018, Vienna, Austria.

# Past Events

## Second International MoniQA Symposium on Food Fraud Prevention and Effective Food Allergen Management, Vienna-Vösendorf, Austria, 7–8 June 2018

Andrew Cannavan

MoniQA, the International Association for Monitoring and Quality Assurance in the Total Food Supply Chain, was launched in 2011 as a result of a successful EU-funded networking project. It is an international and interdisciplinary network of professionals from institutions working in food research, regulatory bodies and trade, providing solutions to promote a safer and secure food supply worldwide. MoniQA facilitates international research collaboration to enable services and products for food safety and quality assurance, progress and validation of analytical methods, training and continuous professional development, consultancy and socio-economic impact assessment.

The 2nd International MoniQA Symposium on Food Fraud Prevention and Effective Food Allergen Management was held in Vienna-Vösendorf, Austria, 7–8 June 2018. The symposium attracted 77 delegates from 18 countries, representing all aspects of the agrifood sector. The event was organised by Roland Poms, Secretary General, MoniQA Association, Austria, and his team along with Richard Cantrill, President, MoniQA Association, Canada. The speakers represented the United Nations' Joint FAO/IAEA Division, International Featured Standards (IFS), the Laboratory of the Government Chemist (LGC), the United States Pharmacopeia (USP), the MoniQA Association, and industry including Nestlé, the Swiss Quailty Testing Service (SQTS), Imprint Analytics, as well as law firms, food research institutions, regulators, academics and nongovernmental organizations.

The keynote speaker was Andrew Cannavan, Head of the Joint FAO/IAEA Division's Food and Environmental Protection Laboratory. Mr Cannavan discussed the global perspective of food fraud and a 'systems' approach to dealing with it, with examples drawn from the Joint Division's international research projects and capacity building in the developing world. The focus of these projects is mainly on the development and application of analytical methods for food authenticity to underpin food traceability and increase confidence that food commodities reaching local consumers, and those destined for international trade, are safe and authentic. Mr Cannavan's concluded, *inter alia*, that developing positive criteria for enforcement helps lead to good analytical methods, and he advocated using the simplest methods that are fit for purpose and validated alongside advanced confirmatory techniques.


*Andrew Cannavan, FEPL Head, giving the keynote presentation at the MoniQA Symposium.*

The conference continued over two days with presentations and discussion sessions covering cutting edge science with examples of litigation and enforcement. Strategies and methods for detecting and combating food fraud were presented as well as discussion of food allergy and coeliac condition, including precautionary allergen labelling, thresholds, laboratory accuracy and class action litigation.

The MoniQA symposium was a very successful event which facilitated discussion and exchange of ideas and information, and fostered collaboration, including public-private partnership opportunities. The 3rd International MoniQA symposium in this series will be held in the latter half of 2019.

## African Food Safety Workshop, Pretoria, South Africa, 4–8 June 2018

James Sasanya

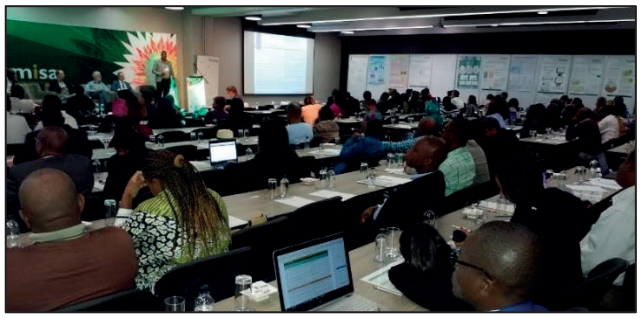
A workshop aimed at enhancing the African food safety network (AFoSaN) and sharing knowledge on food safety matters of interest to the African continent was held at the Capital Menlyn Maine, Pretoria. This attracted 238 delegates from 54 countries mostly from Africa as well as several high-profile Scientists and stakeholders from Asia, Canada, Europe, Latin America and United States of America.

The event was co-organized with the National Metrology Institute of South Africa (NMISA) supported by the National Institute of Metrology, China; Bureau International des Poids et Measures and Physikalisch-Technische Bundesanstalt (PTB), Germany.

Food and Environmental Protection subprogramme was represented by the Officer and Mr Simon Kelly. Topics addressed included mycotoxins, veterinary drug and pesticide residues, food authenticity and microbiology among others. Several members of the private sector especially 18 instrument vendors and suppliers of food safety testing materials actively participated.

Other key participants included Ms Renata Clarke FAO Rome; representative of the African Union and Partnership for Aflatoxin Control in Africa; USDA and FDA staff as well as a team supported by an EU food integrity project. Participants of the 3rd Research Coordination Meeting (RCM) on aquaculture products played an active role sharing knowledge and experiences, including several oral presentation and a couple of posters.

Residue data, analytical techniques as well as common challenges and solutions were shared among the AFoSaN network members and their guests. Capabilities on regular analysis of residues; training of fellow laboratory personnel; collaboration on analytical services nationally and regionally as well as strategies for production and supply of reference materials and proficiency testing materials were addressed.




*African food safety workshop in session with a CRP participant presenting.*

The workshop was very well appreciated by the local/regional participants and their guests alike. One of the main targets met was: reaching out to food safety stakeholders in metrology laboratories and institutions in Africa; food testing laboratories (analysts and managers); research and academia; industry (e.g. instrument vendors and food manufacturers and distributors etc); international and Non-Governmental Organizations; professional associations; and others such as the interested general public and civil society.

Some of the workshop's resolutions and conclusions included: (a) consideration of the workshop as a biennial event, to further enhance cooperation, information sharing and showcasing work-done on the continent; (b) more focus on providing, producing and supplying reference materials and proficiency testing materials for all common food contaminants; (c) greater involvement of and partnership with research and academia to strengthen risk analysis among others.

The author (and network representatives) also held discussions on future cooperation with FAO, Rome; AU; AOAC and; USDA's Foreign Agricultural Services among others.

## RALACA Update

Britt Maestroni

The Red de Latino America y el Caribe (RALACA) is a non-profit network, established with the assistance of the FAO/IAEA Joint Division, that brings together analytical laboratories to enhance regional capabilities for food safety and environmental sustainability. RALACA has the particular objective of strengthening the technical capabilities of the laboratories in the region, promoting scientific cooperation among the countries involved in the network, and fostering communication between all national stakeholders, including decision makers. Information sharing is key to enhancing regional opportunities. Meetings are held regularly either online, through webinars, or as side events of technical meetings and/or training events. The network has held two general meetings, the 1st in 2015 in Chile and the 2nd in 2017 in Costa Rica on the occasions of the 5th and 6th Latin American Pesticide Residue Workshops. The next general

meeting is planned in Brazil in 2019 with the 7th Latin American Pesticide Residue Workshop (5–9 May 2019).

To date RALACA consists of more than 54 Institutions in 21 countries. RALACA is organized into a managing board, administration secretaries, a number of committees and independent advisory scientists. The committees are at the heart of RALACA, and are established by the board based on country needs and trends in the analytical community. Each committee has a responsible Coordinator, a Secretary and an Assistant Secretary. The basis for functioning of the committees is a strong commitment to cooperate in the specific thematic area to drive forward and build on collaborative work. RALACA activities are funded through resources from member countries, technical cooperation funds from international organizations and non-governmental organizations, funds from donor organizations and private industry that are formalized on a case-by-case basis by means of agreements and in-kind donations by its members and subject to the agreement of the board. The Food and Environmental Protection Laboratory (FEPL) of the Joint FAO/IAEA Division has, over the years, contributed with capacity building and additional resources to target sustainable development objectives in the RALACA laboratories.

Since its start, RALACA through its associated members has published 29 articles in scientific journals, 74 posters in scientific conferences, 32 oral presentations, 9 online webinars, 7 book chapters and 16 analytical methods for food safety. RALACA has also organized and held 26 meetings with decision makers, participated in 14 radio interventions, 5 TV programmes and prepared 10 brochures for scientific dissemination of RALACA topics.

Outcomes planned through the RALACA are enhanced networking between food safety laboratories, resulting in improved monitoring capability for chemical contaminants such as pesticides and veterinary drug residues in food; enhanced "south-south" collaboration through twinning missions between network member institutes to raise the baseline capacity for food contaminant control; and ultimately strengthened food safety control systems. Working with RALACA enabled the Joint FAO/IAEA Division to provide training to more than 450 food specialists in 2017, with the help of counterparts in member countries and various Technical Cooperation Projects.

Three webinars were held so far in 2018, on participative biomonitoring initiatives, modelling using AQUATOX software and modelling using SWAT software. The presentations are freely available on the RALACA web page. Planned upcoming webinars will target scientific communication, fish and bees as biomonitoring organisms to evaluate agro-systems, bioremediation to mitigate contaminated areas, discussion of the SANTE guidelines on quality control for pesticide residues, multiresidue methods for contaminants in meat products, and others.

In 2018 RALACA laboratories also participated in a round of a proficiency testing for pesticides and emerging contaminants in water organized by the European Union Reference Laboratory.

News and announcements, such as webinars, proficiency testing, call for projects, vacancies, etc. are regularly posted on the RALACA webpage[4].

*Participants from RALACA Institutions attending a training course on "Data quality for decision making" in San José, Costa Rica, May 2017.*

## Networking Strategies to Ensure Food Safety and Environmental Quality in Latin America and the Caribbean

Britt Maestroni

Nine Latin American countries met in Mendoza in 2006 under the auspices of the Food and Agricultural Organization (FAO) and the International Atomic Energy Agency and set the basis of a long-lasting collaboration that grew with time and is still expanding under the framework of the Red Analitica de Latino America y El Caribe (RALACA) and the Regional Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL) regional projects (RLA).

The first of these projects, "Strengthening Laboratory Capacity to Assess the Implementation of Good Agricultural Practices in the Production of Fruit and Vegetables in Latin America (RLA 5050)" was coordinated by Costa Rica covering the years 2006–2008. The objective of this project was the improvement of regional laboratory analytical capacities, with a special focus on the human resources. The following project, for the period 2009–2011, was on "Implementation of a Diagnosis System to Assess the Impact of Pesticide Contamination in Food and Environmental Compartments at a Catchment Scale in LAC Region (RLA 5053)". The project, led by Chile, enhanced the laboratory analytical capacities while introducing concepts of validation and harmonization of analytical methodologies focusing on targeted analytical monitoring in relation to food and environmental samples. The number of participating countries increased substantially including institutes from the Caribbean region. The necessity to demonstrate the quality of

[4] www.red-ralaca.net

analytical results brought to the planning and implementation of the next project on "Supporting Quality Management for the Assessment and Mitigation of Impacts of Contaminants on Agricultural Products and in the Environment (RLA 5061)", during the years 2012–2013 under the leadership of Argentina. Under this project many laboratories of the region obtained accreditation, and several started the accreditation process. Finally, in 2014, the regional laboratory counterparts took part in a project on "Developing Indicators to Determine the Effect of Pesticides, Heavy Metals and Emerging Contaminants on Continental Aquatic Ecosystems Important to Agriculture and Agroindustry (RLA7019)", under the leadership of Costa Rica. The project built in integrated analytical approaches, with the inclusion of chemical, biological and modelling components, while strengthening national and regional networks of stakeholders including decision makers. Communication was strongly linked to the technical components of the project, and this resulted in a successful delivery of risk maps to the community. This modular structure demonstrates the importance of adopting strategic alliances and multidisciplinary competences as well as team oriented approaches to solve regional challenges and ensure food safety and environmental sustainability in the LAC region.


*The establishment of the Red Analitica de Laboratorios de Latino America Y el Caribe (RALACA stand in the photo) is the result of networking strategies to ensure food safety and environmental quality in Latin America and the Caribbean.*

The collaborative work in the region resulted in the creation of a formal network of analytical laboratories, RALACA, that will ensure sustainability in the long term and open new opportunities for regional improvements and collaboration. The FEPL has, over several years, contributed with capacity building and additional resources to target sustainable development objectives in the RALACA laboratories.

## Belfast Summit on Global Food Integrity, Belfast, UK, 28–31 May 2018

Andrew Cannavan

The Belfast Summit on Global Food Integrity (ASSET 2018) brought together approximately 600 food security experts from 48 countries, spanning academia, industry, agriculture, NGO's and regulators. The Chairperson of the Summit was Professor Chris Elliott, Pro-Vice-Chancellor of Queen's University Belfast, who conducted the UK Government's inquiry into the "horsemeat scandal" of 2013. Experts and participants at this high level, international Summit discussed the problems of feeding a growing population whilst maintaining the integrity of the food supply, taking into account issues such as pollution, climate change, food fraud and food terrorism.


*Professor Chris Elliott opening the Belfast Summit on Global Food Integrity.*

The Summit covered four themes: theme 1 – deliberate contamination of food; theme 2 – the threat from pathogens to the food system; theme 3 – human exposure to chemical cocktails present in foods; and theme 4 – delivering the nutritional needs for the global population in the 21st century. The programme took an innovative approach, focusing mainly on discussion sessions with expert panels who approached the topics from different angles, and included audience participation through direct questions and questions posed electronically using the Sli-Do app. The final day included summaries from all four parallel themes.

Mr Cannavan, Head of the Food and Environmental Protection Laboratory (FEPL), chaired a panel discussion session on the state of the art in the control of food fraud, within Theme 1, which focused on understanding the growing threat to the integrity of the global food system from food fraud and food terrorism. The discussion panel comprised five internationally recognized experts in the field, and discussion was lively and informative. Questions were fielded from the audience as well as within the panel. The outputs of the theme discussions will be used to formulate a call for action to build a robust global food defence system.

Mr Cannavan also presented two posters in the Theme 1 poster session, on research performed in the FEPL; "Rapid screening techniques for extra virgin olive oil authentication" (Cannavan, A., Jandrić, Z., Islam, M. and Kelly, S.) and "Rapid isotope analysis of non-exchangeable hydrogen in sugar molecules derivatised with MBTFA, using GC-chromium/high-temperature-conversion-IRMS" (Cannavan, A., Abrahim, A. and Kelly, S.). The poster on screening for authentication of extra virgin olive oil was

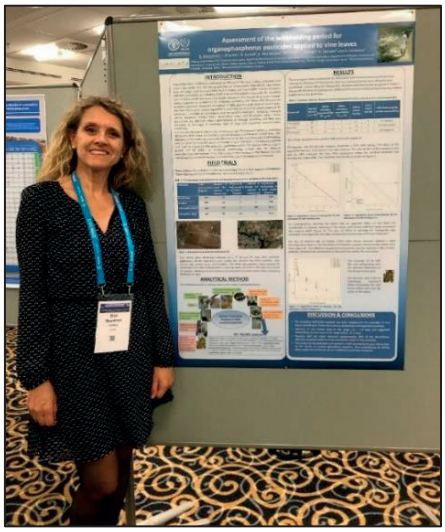
awarded second prize in theme "deliberate contamination of food".

The Belfast Summit was a highly successful, bringing together many threads related to future food security and integrity. The session chairpersons and panel members will continue to work on the session outputs to draft a White Paper of policy recommendations. This document will be of interest to Member States and will potentially inform future decision making in food security and integrity projects and issues.

## 12th European Pesticide Residue Workshop, Munich, Germany, 21–25 May 2018

Britt Maestroni

The 12th European Pesticide Residue Workshop (EPRW) took place on 21–25 May 2018 in Munich under the patronage of the Bavarian health and food safety authority. The workshop was attended by more than 560 participants from more than 42 countries. A total of 30 plenary lectures and 202 posters were presented at EPRW 2018, including two posters presented by Ms Maestroni.



*Britt Maestroni presented a poster on "Assessment of the withholding period for organophosphorus pesticides applied to vine leaves" authored by B. Maestroni, I. Ghanem, R. Correll, A. Alnaser, M. Islam, V. Cesio, H. Heinzen and A. Cannavan.*

The EPRW is recognized worldwide as a platform that covers the latest concepts and developments in the field of pesticides in food and drink. Topics presented at the conference included pesticides applied according to good agricultural practices, risk analysis including communication, environmental contamination as a route of entry of pesticides to food and feed, residues in organic production, pesticide-relevant compounds, pesticide residue analytical technology (including sample processing), and high-tech instrumentation and regulations for MRLs. Details of these topics were covered in oral presentations that targeted risk communication from pesticide residues, bees and pesticides, the threshold of toxicological concern concept (a widely accepted tool for low level residues in food and feed), the EFSA PRIMo deterministic risk assessment model (used for setting MRLs and post marketing dietary risk assessment from residues measured in pesticide from monitoring programmes), exposure and risk from cumulative effects of pesticides, analytical strategies in pesticide exposure assessment through human biomonitoring (an emerging strategy especially nowadays that high resolution and accurate mass instruments allow tentative detection of pesticide biomarkers), insights on formulations of plant protection products, pesticide relevant compounds originating from sources other than pesticide use, analysis of glyphosate, phtalimide and fipronil, pesticide residues from grape to wine, supercritical fluid chromatography coupled to tandem mass spectrometry, use of orbitrap and quadrupole time of flight mass spectrometry, assessment and benefits of different calibration techniques and pesticide residue analysis in super-foods.

The theme of the third day of the EPRW was on residues in organic products. The main points were that the organic production process cannot be tested in end products, but rather as a process based technology, residues above a fixed level may trigger a case by case investigation on whether production rules have been violated, residues in organic agriculture are a political issue going beyond analytics, and references and monitoring of the environmental pesticides in soil, air and water is needed and the issue of pollution from the environment needs to be addressed in horizontal policies. Metabolomics might be an interesting tool to meet some of the challenges in organic food authentication provided a comprehensive database of organic samples is available. Legislation on plant protection products, good agricultural practices and liability rules are the starting point for addressing organic agricultural production challenges. Pesticide residue testing in organic production is a suitable tool to identify issues related to pesticide residues and Member States authorities should consider implementing clear instructions regarding the sampling procedures, which should be appropriate to identify spray drift of pesticides from neighbouring plots, and specify the requirements for the methodology and scope of laboratory analysis to facilitate the reliable detection and quantification of the presence of substances not authorized for organic production while implementing clear instructions on the interpretation and follow up of residue detections. A new EU organic regulation was adopted by the EU Council on 22 May 2018 and will apply from 1 January 2021. In addition, crop leaves and soil can be considered as good temporal tracers of the misuse of pesticides. Therefore, to overcome some of the challenges in organic production it is advisable to implement integrated approaches in analytics and to aim at harmonizing different regulations on pesticides, organic agriculture, baby foods, drinking water, etc.

The EPRW also provided an excellent platform for the exchange of information and experience. The EPRW represented an excellent opportunity to learn about current technology, challenges and opportunities in Europe and worldwide. There were interests in the work of the Agency in capacity building, including opportunities for potential collaboration with several partners. Participation in the EPRW was of direct benefit to the work of FEPL and, ultimately, to the Member States.

## 39th Session of the Codex Committee on Methods of Analysis and Sampling, Budapest, Hungary, 7–11 May 2018

Simon Kelly

The 39th Session of the Codex Committee on Methods of Analysis and Sampling (CCMAS) took place in Budapest, Hungary from the 7–11 May 2018.


*Simon Kelly at the 39th Session of the Codex Committee on Methods of Analysis and Sampling.*

Mr Kelly attended the meeting as an IAEA observer and provided a full information paper and gave a verbal summary presentation in the first plenary session. The paper presented covered the Joint FAO/IAEA Division's technical cooperation activities in Latin America, the Caribbean region, Africa and the Asia-Pacific region. It also covered coordinated research activities and work in support of Codex and relevant committees in the areas of analytical methods, pesticide residues, veterinary drugs, contaminants in food and feed, and food origin and authenticity. The main areas of work conducted by the committee were revision of the Recommended Methods of CODEX standard 234 (on methods of analysis and sampling); review and update of the preamble to CODEX standard 234; Criteria for endorsement of biological methods used to detect chemicals of concern; endorsement of the proposal to amend the Guidelines on Measurement Uncertainty (GL 54-2004) and endorsement of the proposal to amend of the General Guidelines on Sampling (GL-50-2004). CCMAS thanked the IAEA representative for the useful information provided at the session and for the future continued cooperation with the Codex Alimentarius and its committees. The Secretariat also expressed its thanks for IAEA and the joint FAO/IAEA sub-programme's support in relation to methods of analysis and sampling. During the report on the Inter-Agency Meeting on Methods of Analysis, led by the U.S. Pharmacopeia, the involvement and information paper provided by the IAEA was welcomed as a model for other international organisation's contributions in the future.

## Technical Meeting on Natural Radioactivity in Aquaculture Products, IAEA HQ, 7–9 May 2018

Carl Blackburn

As part of the on-going FAO, IAEA and WHO initiative to develop technical guidance on radionuclides in food, there is a focus on levels of natural radionuclides in food. For example, polonium-210 (Po-210) is a naturally occurring radionuclide and in some fish and shellfish levels tend to be relatively high compared to other naturally occurring radionuclides, and compared to Po-210 in other foods. Although assessments show that typical radiation doses from consuming natural radionuclides in food and drinking water are low[5] they also indicate the importance of Po-210 in seafood.

The levels of natural radionuclides in food will not have altered significantly over the years. However, more data becomes available each year and aquaculture ("fish farming") has become more prevalent. The purpose of the consultants meeting was therefore to consider naturally-occurring radionuclides in aquaculture and fisheries products and the implications for radioactivity concentrations in the final food products.

Over the last 30 years, the aquaculture industry has grown from producing less than 20 Mt to approximately 80 Mt in 2016. Over the same period, commercial landings (e.g. from fishing boats, normally referred to as "capture production") has remained relatively steady at around 90 Mt per year. Today, aquaculture represents about half of the world supply of fishery products. Demand is projected to further increase in future due to population growth and it is anticipated that farmed production (aquaculture production) will continue to increase to meet the growing demand whereas capture production will remain steady.

There is a limited amount of published data on naturally-occurring radionuclides in aquaculture. However, where farmed species are not actively reared using feed, it is expected that radionuclide concentrations will be similar to those observed in captured species (e.g. to those in the

[5] For example, ranging from 0.2 to 0.8 milliseiverts per year in the comprehensive assessment published in the 2000 report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) http://www.unscear.org/docs/publications/2000/UNSCEAR_2000_GA-Report.pdf

wild). For farmed species reared through feeding, concentrations of natural radionuclides, including Po-210, would be expected to be considerably lower – reflecting radionuclide levels in the feed. The Consultants' Meeting made several recommendations, including on the need for further information on naturally-occurring radionuclides in aquatic farmed products.

## Supporting Codex Activities: 24th Session of the Codex Committee of Residues of Veterinary Drugs in Foods, Chicago, USA, 22–27 April 2018

James Sasanya

The author represented the Joint FAO/IAEA Division at the 24th session of the international meeting for risk managers on veterinary drug residues in foods (CCRVDF) and presented activities of the Joint Division including participation in discussions. He also interacted with various Member States, addressing questions and creating more awareness about activities of the Division.


*Plenary session of the 24 CCRVDF meeting (Photo courtesy of James Sasanya).*

The author reported several capacity development activities in various countries through national, regional and interregional Technical Cooperation (TC) Projects where residue testing and monitoring capabilities have been established or strengthened. He also reported on relevant activities on aquaculture and mixed contaminants, and indicated possible interest in prospects of a new project on residue depletion studies to support standards setting.

Following the author's intervention several Member States including Cameroon, Chile, Botswana, Burkina Faso, Ghana, Morocco, Mozambique, Nigeria, Uganda and Zimbabwe etc, thanked the IAEA (Joint Division) for the support in the area of food safety, and how this has made significant difference in their countries. Four conference room documents were submitted by the Member States to record their appreciation of the IAEA. Their oral and written interventions included pledges for continued cooperation and but also need for more support.

The author interacted one-on-one with several delegates who also sought guidance on how to benefit from TCPs and CRPs. The countries met or assisted included among others, Argentina, Brazil, Costa Rica, El Salvador, Ghana, Guyana, Honduras, India, Indonesia, Kazakstan, Morocco, Mozambique, Nicaragua, Nigeria, Panama, Peru, Philippines, South Africa, Togo, Thailand, Trinidad and Tobago, Uganda, United Republic of Tanzania and Zimbabwe.

Delegates from Argentina, Costa Rica and Uruguay expressed great interest in Agency support on generating residue data to enable them to contribute to standards setting.

The author also held stakeholder-discussions to explore collaborative opportunities about the prospective CRP on radiological-based animal studies. This is an area if considered soon, would help address a major challenge Member States encounter, namely lack of toxicological/residue data to support evaluation of drugs by JECFA for setting of maximum recommended residue limits (MRLs). Some of the stakeholders met included, Health-for-Animals and Zoetis, the world's largest producer of animal medicines and vaccinations.

Activities of interest to Member States that the Joint Division should take note of include among others: (1) Priority list of veterinary drugs requiring evaluation or re-evaluation by Joint Expert Committee on Food Additives (JECFA); (2) Submitting data on establishment of standards to JECFA including, information in a dossier; format used for submission to JECFA; completed packet etc; (3) Generic veterinary drugs: Overview of the generic veterinary drug industry; how the generic drug industry can work with CCRVDF.

Some areas that Member States require support to establish MRLs include: (a) Amoxicillin in goats and poultry; (b) Ampicillin in cattle, pig, horse, goats, sheep, fish, and poultry; (c) Diminazene (and related substances) in sheep and goats; Imidocarb in horse; (d) Ivermectin in horse, goats, camel, and poultry; as well as (e) Oxytetracyline in bees, camel, horse, and goats.

## Training to Enhance Risk Assessment for Food Safety, Bogota, Colombia, 9–20 April 2018

James Sasanya

The national training on risk assessment was held to enhance food and environmental safety, better safeguard consumers and boost trade where applicable, in Colombia. This included lectures, demonstrations and discussions on the following:

(a) Hazard identification and pesticide registration and administration; (b) Effective exposure assessment and systematic occurrence data collection; (c) National (or regional) standards and guideline settings, including Maximum Residue Limits (MRLs) for pesticides in food;

(d) A robust multi-institutional national residue monitoring program for local and export commodities; (e) Review of regional pesticide registration and risk-assessment – its relevance to Colombia; (f) A gap analysis of existing analytical/regulatory capabilities.

The event drew 31 participants from the Universidad Nacional de Colombia (UNC), Laboratorio Nacional de Vigilancia de Medicamentos y Alimentos (INVIMA), Ministry of Health, and Laboratorio Nacional de Insumos Agricolas (LANIA), Instituto Colombiano Agropecuario (ICA). These were joined by two resource persons and one of whom was cost-free from Oregon State University supported by the USDA/FAS. This was in two sessions: one on GAPs, Pesticide Maximum Residue Limits, Pesticide Residue Monitoring Program, and Pesticide Risk Assessment Training (11–13 April 2018) and another on: Advanced Pesticide Hazard, Exposure, Risk Assessment, and Pesticide Risk Management Training (16–17 April 2018).

*Participants at risk assessment and residue monitoring training in Bogota, Colombia (Photo courtesy of Dr Luis Fumio Suguiyama).*

The participants learned how to identify chemical hazards in food, assess exposure and characterize risk. Information was also acquired on establishing surveillance and monitoring of residues at the national level.

## 2018 Meeting of the United Nations Inter-Agency Task Force on Chernobyl (IATF). The United Nations Development Programme (UNDP) Headquarters in New York, USA, 11 April 2018

Carl Blackburn

The author participated by video link. The IATF was chaired by Mr Achim Steiner, UNDP Administrator and UN Coordinator of International Cooperation on Chernobyl, and Ms Cihan Sultanoğlu, UNDP Director. The purpose of the yearly IATF meeting is to review progress made on Chernobyl-related activities and to brief stakeholders on the plans made following the adoption of the latest General Assembly resolution on Chernobyl of 8 December 2016 on the “Persistent legacy of the Chernobyl disaster” which has defined the vision for post-2016 international cooperation on Chernobyl.

The Joint FAO/IAEA Division reported on FAO Technical Cooperation Projects in Belarus and Ukraine providing support in the area of food and agriculture and the FAO Liaison Office in Moscow that further coordinates activities in the region. The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has worked on: Information exchange on remediation of radioactive contamination in agriculture; information management for response and remediation; normative standards and guidance, including those related to radioactivity in food.

Statements from the Deputy Minister of Foreign Affairs of Belarus, the Deputy Permanent Representative of the Russian Federation to the United Nations, and the representative of the Permanent Mission of Ukraine to the United Nations highlighted issues related to the three most affected countries of Belarus, Russia and Ukraine. Remarks from the pertinent UN Country Teams, and relevant UN agencies and partners showed that there is continued interest in capturing the progress made on Chernobyl recovery, and in sharing those experiences widely.

## Final Meeting of the European Horizon 20-20 Project “Food Authenticity Research Network (Authent-NET) " and associated CEN Workshop Agreement (CWA) Consensus Meeting to Define Food Authenticity Related Terminology in the Food and Feed Chain, Brussels, Belgium, 22–23 March 2018

Simon Kelly

On the 22 March 2018 Mr Kelly provided input into the drafting of the low-level European voluntary standard CEN (Comité Européen de Normalisation) Workshop Agreement 86 (CWA-86) called "Authenticity in the feed and the food chain - General principles and basic requirements". The meeting was attended by representatives from various Member State designated competent authorities including Belgium, Czech Republic, France, Iceland, Ireland, Italy, Norway, Netherlands and the United Kingdom. The meeting participants generated consensus-based recommendations for definitions of key terms and concepts related to food authenticity and provided recommendations for "best practice” underlying future communication and work related to food authenticity. The CWA does not represent the level of consensus and transparency required for a European Standard (EN). However, it is designed to provide relevant stakeholders with a flexible and timely tool for achieving a technical agreement where there is no prevailing desire or support for a standard to be developed. The meeting resulted in a revised version of CWA-86, which is intended to be finalised in a conclusive physical consensus meeting during the Belfast Summit on Global Food Integrity

(28–31 May 2018). The final CEN publication, which reflects the consensus of only the registered participants responsible for its contents, could include the FAO/IAEA Joint Division as a co-author of the inputs, subject to authorisation by the IAEA Publications Committee. The CWA is a major output from the European Horizon 2020 Food Authenticity Research Network (Authent-NET) project.

*Participants at the CEN workshop consensus meeting to define terms relating to authenticity and fraud in the food and feed chain.*

On the 23rd March 2018 Mr Kelly provided input into the final meeting of the Authent-NET project. Discussions were held regarding the on-line information system for Research Funding organisations – Food Authenticity Research Network Hub (FARNHub) available here (http://farnhub.authent.cra.wallonie.be/); the CEN Workshop Agreement on defining terminology related to Food Authenticity; the Authent-NET website and communication tools (http://www.authent-net.eu); the Authent-Net project sustainability and strategic research needs; the development of a white paper on Food Authenticity strategic research needs and future European Framework 9 funding opportunities. The Authent-NET project has resulted in closer links between the FAO/IAEA Joint Division and other European organisations that fund applied research into food authenticity. This is beneficial as it offers a route to align activities such as Coordinated Research and Technical Cooperation projects with European research projects to provide 'added value' to Member States. Furthermore, the FARNHub web-based portal provides registered users with an overview of currently available resources related to food authenticity. This includes papers and documents (scientific or other), ongoing projects, online databases, an overview of funding bodies with contact points, news stories and regulations on food authenticity. Discussions regarding the sustainability of the FARN were led by Dr Victor Aguilera from the United Kingdom's Department for Environment, Food and Rural Affairs. Although an ERA-NET was originally envisaged, due to lack of funding, the consensus was that the FARN was needed and should continue and that an EU Cost Action would be the best vehicle to pursue this goal.

# 12th Session of the Codex Committee on Contaminants in Foods (CCCF-12), Utrecht, Netherlands, 12–16 March 2018

Carl Blackburn

The author coordinated a written report from the Food and Environmental Protection Subprogramme and gave remarks during the CCCF-12 meeting. The committee was informed of joint FAO/IAEA programmatic activities concerning: nuclear and related techniques for the analyst of food contaminants; an initiative to develop technical guidance on the control of radioactivity in food, and; the management of nuclear and radiological emergencies.

*The 12th Session of the Codex Committee on Contaminants in Foods (Photo courtesy of C. Blackburn).*

There was a good deal of interest in the development of Technical Guidance on Radionuclides in Food and Drinking Water. An IAEA General Conference Resolution has added considerable weight to the development of guidelines for radioactivity in food. The IAEA Safety Standards require radioactivity in food and radioactivity in drinking water to be less than "about" 1 millisievert per year. The WHO Drinking Water Guidelines provide guidance to national authorities in terms of radionuclide concentrations (becquerels per kilogram) in drinking water, but there is no equivalent guidance for radionuclide concentrations in food. The IAEA is collaborating with FAO through the Joint FAO/IAEA Division and with WHO in a project to develop such guidelines.

The Joint FAO/IAEA Division continues to work in cooperation with Codex Committees regarding international standards and in particular concerning technical guidance on radioactivity in food as well as with food contaminant work relating to methods of analysis and sampling for contaminants.

## Technical Meeting on the Draft International Nuclear and Radiological Event Scale (INES) User's Manual, IAEA Headquarters, Vienna, Austria, 23–27 Feb 2018

Carl Blackburn

The purpose of the meeting was to review, as well as to discuss with representatives of Member States and relevant international organizations, the draft text of the revised INES User's Manual. The revisions made to the manual were technical in nature and concern the methodology for rating events associated with sources of radiation by using INES, as well as the arrangements for communicating the safety significance of such events and their INES rating to the public. In order to capture the broader views of Member States and relevant international organizations, the draft was reviewed paragraph by paragraph, and areas that needed to be further improved were identified and discussed.

The meeting was chaired by Ms Patricia Milligan, Nuclear Regulatory Commission, USA, and was attended by 62 participants from 52 IAEA Member States and a number of experts from international organizations (European Commission, FAO and IAEA).

The next steps to be taken and the way forward were presented at the end of the meeting. The draft manual will be reviewed by the IAEA Secretariat, taking into account the inputs received from this technical meeting and further comments received from INES National Officers. The meeting successfully completed all agenda items.

# Coordinated Research Projects

| CRP Reference Number | Ongoing CRPs | Project Officer |
|---|---|---|
| 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<br>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<br>A. Cannavan |
| D52041 | Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods | J.J. Sasanya<br>Z. Ye |
| D61024 | Development of Electron Beam and X-ray Applications for Food Irradiation (DEXAFI) | C.M. Blackburn |

## Third Research Coordination Meeting (RCM) on the Development of Electron Beam and X-ray Applications for Food Irradiation (CRP D61024), Bangkok, Thailand, 11–15 June 2018

Carl Blackburn

This third RCM was kindly hosted in Bangkok, by the Thailand Institute of Nuclear Technology (TINT). Members from all 16 participating institutions were in attendance representing organizations in 13 countries (China, Egypt, France, Indonesia, Japan, Republic of Korea, Pakistan, Poland, Portugal, Syrian Arab Republic, Thailand, USA, Viet Nam).

Exciting new approaches have been developed and publicized by participants, for example, new concepts of electron beam and X-ray machines have been customized for food irradiation. Research in the USA is developing a mobile X-ray facility for phytosanitary irradiation. Research in Korea is developing the use of a low energy X-ray cabinet to irradiated food for special purposes, such as for hospital patients. Work in Poland in collaboration with Japan is researching surface irradiation using low energy electron beams. As with any research that is developing new applications, there is also a need to ensure that dosimetry is available and appropriate to any new system, hence improved dosimetry protocols for low energy X-ray food irradiation and validating existing dosimetry systems is also important and this research is taking place in France. As regard research at the higher energy levels technologically available for X-ray

irradiation, research is using nuclear data and advanced Monte Carlo simulations to study the fundamental effects of X-ray irradiation above the 5.0 MeV threshold with a view to provide additional data to support the revision of the Codex Alimentarius General Standard on Irradiated Food. New imaging tools are also being developed in China and in Viet Nam, these tools aim to help ensure that products are within specification prior to irradiation and also support dose mapping for heterogenous products. The meeting also received several research reports on case studies of pilot scale testing and full-scale demonstrations of electron beam and X-ray irradiation of food in collaboration with the food industry. Two researchers are also studying phytosanitary irradiation with the aim of making comparisons between the efficacy of gamma, electron beam and X-ray treatments.

This Coordinated Research Project is proving to be a successful venture involving work in several different areas, but all focusing on the use of electrically generated ionizing radiation.

## Third Research Coordination Meeting of the Coordinated Research Project on Aquaculture Products (CRP D52039), Pretoria, South Africa, 30 May–6 June 2018

James Sasanya

The event was organized at the Agricultural Research Council (ARC) Headquarters in Hartfield, to review and plan for activities of the CRP D52039 "*Development and Strengthening of Radio-Analytical and Complementary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products*" now in its final phase. Onderstepoort Veterinary Research of the ARC was the local organizer in close coordination with the Scientific Officer (the author) and the FEP administrator Ms Malgorzata Rydeng. Dr Misheck Mulumba, Senior Manager Research, OVR addressed the participants from Argentina, Belgium, Brazil, Cameroon, Canada, China, Ecuador, Lebanon, Netherlands, Nigeria, Singapore, South Africa, Turkey, Uganda and the United States of America.

Programme of work done or planned discussed included, among others: radio receptor assays techniques for testing agrochemical residues in aquaculture and sea food; novel analytical approaches harnessing the power of high resolution mass spectrometry and stable isotopes; trace metal analysis using various techniques including neutron activation analysis; techniques for testing prohibited pharmacologically active substances in aquaculture; persistent organic and related pollutants as well as generating residues in fish and Identification of anthropogenic impact on fish production using nitrogen isotope as chemical markers.

Progress has been made with a number of papers published or in the process of publication and standard operating procedures prepared. The CRP members also participated in an African food safety workshop held in Pretoria where they presented their work (oral and/or posters) to 240 participants, a good number of them in the Technical Cooperation Programme. This is a practical mechanism for technology transfer, knowledge sharing and enhancing networking.

*Participants of the third RCM of CRP D52039 on aquaculture, in Pretoria, South Africa.*

## Consultants' Meeting : Implementation of Nuclear Techniques for Authentication of Foods with High-Value Labelling Claims (INTACT Food), Vienna, Austria, 14–18 May 2018

Simon Kelly and Andrew Cannavan

The Joint FAO/IAEA Division is developing a proposal for an international CRP to apply and adapt stable isotope and nuclear methods for the authentication of foods with high-value labelling claims. On 14–18 May 2018, five consultants and three cost-free experts (CFEs) were invited to the IAEA Headquarters to review a draft proposal and formulate a project which, if approved, will start in early 2019. The consultants and CFEs worked with FAO/IAEA Staff to critically review and evaluate the methodological state of the art, food commodities, food authenticity issues and the relevance of the CRP to the Member States.

Numerous foods are sold at premium prices because of high-value labelling claims related to specific production methods, unique characteristics and origins. These claims include agricultural, geographic, religious, ethical and nutraceutical labelling specifications that add value to the products. In order to protect consumers from fraud, and potential unintended food safety issues, standardized analytical methods are required to confirm such claims. Several nuclear, isotopic and related techniques have proven suitable for confirming a wide range of high-value labelling claims such as free-range, organic, natural/synthetic etc. The overall objective of this proposed CRP is to enable developing countries to protect and

promote food products with high-value labelling claims by development and application of nuclear and related techniques. The project thereby aims to safeguard consumers and reputable producers; ensure regulatory, religious and ethical compliance; stimulate domestic markets.

*Simon Kelly, Project Officer, explaining the background to IAEA coordinated research activities to the consultants at the start of the meeting.*

The consultants agreed that premium foods with added value chains are the most susceptible to economically motivated adulteration and fraud because they are typically sold at higher prices. However, high-value food property labelling claims are also providing opportunities for the local food producers to take advantage of domestic and global markets (e.g. Madagascan Vanilla, Chinese herbal medicine, South African organic avocados, Indian organic rice etc.). Labelling claims are not only focusing on the high monetary profits but the food characteristics have to comply with the plethora of agricultural, religious, ethical, natural and geographic labelling specifications that add value to the products. A recent study by the FAO on food products from nine different Member States has demonstrated the positive economic impact of strengthening sustainable food systems through geographical indications (GIs).

Currently, the following developing countries and products are already mentioned in the European Database of Origin and Registration "DOOR"[6]: Cambodia (pepper), China (e.g. asparagus, peaches), Colombia (coffee), Dominican Republic (coffee), Indonesia (coffee), Thailand (spices), Turkey (baklava), and Viet Nam (fermented fish sauce). Other GIs already exist outside of these databases, e.g. Blue Mountain coffee in Jamaica or Darjeeling tea in India. The most promising analytical methods for verification of GIs include stable isotope analysis (wine), multi-element analysis (cheese) and NMR profiling (olive oil). Furthermore, there is a recommendation from the European Commission that newly registered GIs should contain a reference to a suitable analytical procedure to verify the provenance and/or essential qualities of the product.

Discussions during the Consultants' meeting highlighted a number of specific research areas of importance to developing countries to protect and promote food products with high-value labelling claims. The following focus areas were identified: i) organic products, ii) religious compliance, iii) free-range, ethical, wild versus farmed productions, iv) natural versus synthetic and, v) geographic indication. Furthermore, the experts recognized that a number of existing methods are relatively well established for verifying high-value labelling claims and some are already used on a routine basis in developed countries. However, their current implementation in developing countries is limited due to lack of capacity including the required knowledge, infrastructure and authentic sample reference databases.

The proposed CRP on the implementation of nuclear and related methods for verifying high-value labelling claims in developing countries will - increase the analytical capacity of Member States, using consensus-based harmonised analytical methodologies; improve capabilities to interpret data using statistical tools to verify labelling claims based on complementary analytical techniques and methods; improve the capability of Member States to ensure product authenticity and identify fraudulent practices; improve the information exchange and cooperation among Member States and sharing of intelligence on food fraud trends globally and enhance consumer confidence in food safety and quality and promote the integrity of important export food commodities, thus reducing barriers to international trade.

*Participants of the Consultants' Meeting on 14–18 May 2018.*

[6] http://ec.europa.eu/agriculture/quality/door/list.html

# Technical Cooperation Projects

| Country/Region | Project No. | Title | Technical Officer |
|---|---|---|---|
| Algeria | ALG5030 | Contributing to the Implementation of the National Agricultural Development Programme Through Strengthening Soil, Water and Nutrient Management Practices Including Food Safety Using Nuclear and Related Techniques | J.J. Sasanya |
| Angola | ANG5014 | Upgrading Laboratory Services for Control of Food Quality for Human and Animal Consumption | J.J. Sasanya<br>Z. Ye |
| Bahrain | BAH5001 | Determining Pesticide and Mycotoxin Residues in Water and Food | J.J. Sasanya<br>Z. Ye |
| Bahrain | BAH5002 | Establishing a National Quality Control Standard for Foodstuffs and Fishery Products | J.J. Sasanya<br>Z. Ye |
| Bangladesh | BGD5031 | Strengthening Capacities to Monitor and Control Veterinary Drug Residues in Foods of Animal Origin | J.J. Sasanya |
| Bangladesh | BGD5032 | Building Capacity in Improving Food Safety Using Nuclear and Other Complementary Analytical Techniques | S. Kelly<br>Z.Ye |
| Benin | BEN5011 | Strengthening National Capabilities to Improve the Safety and Competitiveness of Exportable Food Products | J.J. Sasanya |
| Botswana | BOT5017 | Enhancing Capabilities for Inter-institutional Monitoring of Chemical Food Contaminants Using Nuclear/Isotopic and Complementary Analytical Techniques | J.J. Sasanya<br>A. Cannavan |
| Cameroon | CMR5023 | Strengthening Laboratory Capabilities to Monitor Contaminants in Fisheries Products | J.J. Sasanya |
| China | CPR5022 | Implementing the Stable Isotope Technique for High Quality Agro-product Traceability and Authenticity | A. Cannavan<br>S. Kelly |
| 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 |

| Country/Region | Project No. | Title | Technical Officer |
|---|---|---|---|
| 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<br>A. Cannavan<br>M. Zaman |
| Costa Rica | COS5036 | Improving Analytical Capacity to Monitor Food Contaminants and Veterinary Drug Residues Using Nuclear/Isotopic and Complementary Techniques | J.J. Sasanya |
| Cuba | CUB5019 | Strengthening National Capacity for Monitoring Heavy Metals to Improve Soil and Food Quality Using Nuclear and Related Techniques | C.M. Blackburn<br>J.J. Sasanya<br>S. Kelly |
| Cuba | CUB5022 | Promoting Food Safety through the Mitigation of Contaminants in Fruits for Human Consumption | C.M. Blackburn<br>J.J. Sasanya |
| 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<br>A. Cannavan<br>J.J. Adu-Gyamfi |
| Ecuador | ECU5030 | Reducing Post-Harvest Losses of Native Potatoes and other Fresh Foods by Irradiation | C.M. Blackburn |
| Egypt | EGY5026 | Establishing a National Reference Laboratory Applying Nuclear/Isotopic and Related Techniques in the Analysis of Food Contaminants | J.J. Sasanya |
| Fiji | FIJ5002 | Increasing Trade and Export Capacities of Selected Value Chains Within the Agro-Food Sector Through the Adoption of an Appropriate Quality Infrastructure | C.M. Blackburn<br>Z. Ye |
| Guatemala | GUA0010 | Building Capacity and Enhancing Nuclear Technology | C.M. Blackburn |

| Country/Region | Project No. | Title | Technical Officer |
|---|---|---|---|
| Haiti | HAI5006 | Increasing Productivity and Exportability in the Agricultural Sector through Soil and Water Management and Food Safety Monitoring | C.M. Blackburn<br>J.J. Adu-Gyamfi |
| Iraq | IRQ5021 | Developing Food Safety and Assurance System Using Nuclear and Other Related Technologies | J.J. Sasanya<br>A. Cannavan<br>S. Kelly |
| Cambodia | KAM5004 | Strengthening National Capability for Food and Feed Safety | D. Battaglia<br>J.J. Sasanya |
| 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<br>S. Kelly<br>Z. Jandric |
| Marshall Islands | MHL7001 | Developing a National Radioactivity monitoring Capacity | J.J. Sasanya<br>I. Osvath (NAEL) |
| Mauritius | MAR5024 | Building Capacity to Analyse Veterinary Drug Residues and Related Chemical Contaminants in Animal Products | J.J. Sasanya |
| Mongolia | MON5024 | Enhancing Food Safety Analytical Capabilities for Veterinary Drug Residues and Related Contaminants Using Isotopic Techniques | J.J. Sasanya<br>D. Battaglia<br>Z. Ye |
| Montenegro | MNE5004 | Strengthening Technical and Institutional Capacities of the National Reference Laboratory for Food and Feed Control | Z. Ye<br>A. Cannavan<br>Z. Jandric |
| Morocco | MOR5037 | Enhancing Control of Chemical Food and Feed Contaminants, Animal Disease Diagnosis and Trade in Fresh Fruits | D. Battaglia<br>J.J. Sasanya<br>C.M. Blackburn |
| Namibia | NAM5015 | Developing Capacity of the National Standard Institution and Agro-Marketing and Trade Agency in the Areas of Food Safety | B. Maestroni<br>A. Cannavan |
| Niger | NER5020 | Building Capacity at the Central Laboratory (LABOCEL), Niamey, for Control of Food Products of Animal Origin | J.J. Sasanya |

| Country/Region | Project No. | Title | Technical Officer |
|---|---|---|---|
| Niger | NER5022 | Strengthening Nuclear / Isotopic and Complementary Laboratory Capabilities for Monitoring Contaminants in Food, Feed and Water | D. Battaglia<br>J.J. Sasanya |
| Nigeria | NIR5039 | Enhancing Dietary Exposure Assessment of Chemicals in Food | J.J. Sasanya |
| T.T.U.T.J<br>of Palestinian<br>A. | PAL5010 | Strengthening Capability to Monitor Contaminants in Food and Related Matrices through Nuclear and Complementary Analytical Techniques | J.J. Sasanya |
| Oman | OMA5003 | Strengthening National Capabilities in Food Safety and Food Traceability | B.M. Maestroni<br>J.J. Sasanya<br>Z. Ye |
| 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<br>C.M. Blackburn |
| Senegal | SEN5038 | Strengthening Laboratory Capabilities for Analysing Veterinary Drug Residues and Contaminants in Food | J.J. Sasanya<br>A. Cannavan |
| Seychelles | SEY5010 | Strengthening Laboratory Capabilities to Enhance Food Safety Using Nuclear and Complimentary Analytical Techniques | J.J. Sasanya<br>Z. Jandric |
| 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 | SRL5048 | Strengthening National Capability for Food and Feed Safety | A.Cannavan |
| 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<br>A. Cannavan |

| Country/Region | Project No. | Title | Technical Officer |
|---|---|---|---|
| Sudan | SUD5039 | Enhancing the Capacity to Monitor Pesticide and Veterinary Residues in Food Using Nuclear and Complementary Techniques | J.J. Sasanya |
| Syria | SYR5024 | Enhancing Capabilities to Monitor Naturally-Occurring and Synthetic Anabolic Hormones and other Veterinary Drug Residues in Foods | J.J. Sasanya |
| Thailand | THA5056 | Strengthening Food Safety Laboratory Capacities | J.J. Sasanya<br>D. Battaglia |
| Uganda | UGA5040 | Strengthening Multi-Sectoral Food Contaminant Monitoring Programmes Through the Effective Use of Nuclear, Isotopic and Complementary Techniques | D. Battaglia<br>J.J. Sasanya |
| Tanzania | URT5033 | Establishing the Feasibility of an Irradiator Facility | C.M. Blackburn |
| Viet Nam | VIE5022 | Promoting Interlaboratory Comparison and Accreditation in Testing Chemical Contamination for Food Safety | B.M. Maestroni<br>Z. Ye |
| Zambia | ZAM5030 | Establishing a National Mycotoxins Monitoring Programme | J.J. Sasanya |
| Zambia | ZAM5032 | Strengthening and Expanding Analytical Capacity to Monitor Food Contaminants using Nuclear/Isotopic and Complementary Tools | J.J. Sasanya |
| Africa | RAF1006 | Facilitating the Commercial Application of Irradiation Technologies | S. Sabharwal (NAPC)<br>C.M. Blackburn |
| Africa | RAF5067 | Establishing a Food Safety Network through the Application of Nuclear and Related Technologies | J.J. Sasanya<br>A. Cannavan |
| Africa | RAF5078 | Establishing a Food Safety Network through the Application of Nuclear and Related Technologies, Phase II | J.J. Sasanya<br>D. Battaglia |
| 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<br>D. Battaglia<br>G. J. Viljoen |

| Country/Region | Project No. | Title | Technical Officer |
|---|---|---|---|
| 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)<br>A. Cannavan |
| Asia | RAS5081 | Enhancing Food Safety and Supporting Regional Authentication of Foodstuffs through Implementation of Nuclear Techniques (RCA) | S. Kelly<br>Z. Ye<br>Z. Jandric |
| Latin America | RLA5066 | Increasing the Commercial Application of Electron Beam and X-ray Irradiation Processing of Food | C.M. Blackburn<br>J.J. Sasanya |
| Latin America | RLA5069 | Improving Pollution Management of Persistent Organic Pollutants to Reduce the Impact on People and the Environment (ARCAL CXLII) | B.M. Maestroni<br>J.J. Sasanya |
| 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<br>D. Battaglia |

## Enhancing Food Safety in Namibia

Britt Maestroni

In 2018 the IAEA started a Technical Cooperation Project TCP NAM 5/0/15 with Namibia. The project counterparts are the Regulatory and Consumer Protection Business Unit of the Namibian Standards Institution (NSI) and the Food Safety and Standards Unit of the Agro-Marketing and Trade Agency (AMTA). The focus of the project is on strengthening sampling and inspection with a possible accreditation; enhancement of the laboratory capacity for heavy metals measurements in fishery and poultry products (NSI) and mycotoxins in agricultural produce (AMTA), and to collect existing analytical data and carry out a first risk assessment for cadmium in oysters (NSI) and mycotoxins in grains (AMTA) in 2019.

### NSI

The NSI is a state owned enterprise that is mandated to, amongst other things, manage and coordinate the implementation of the national quality policy and promote quality in society, develop, adopt and publish Namibian standards in compliance with World Trade Organization requirements, provide training to external stakeholders on selected standards, conduct inspection on canned fish and beef products and provide food safety technical support to fishing and maricultural industries, and to provide reliable testing services mainly on fish and fishery products, shellfish, potable water, sea water and wastes to aquaculture, fishing and other industries through its chemistry and microbiology laboratories. The NSI testing laboratories are located in Walvis Bay, Namibia and the NSI Chemistry Section laboratory currently has a total of 10 staff. Since 2012 the laboratory has accredited several methods with the South African National Accreditation Body (SANAS) and in 2016 renewed its accreditation. Currently the laboratory is working towards obtaining the accreditation certificate from the Southern African Development Community Accreditation Services (SADCAS), a regional accreditation body located in Botswana, recognized as such in 2017 by the International Laboratory Accreditation Cooperation (ILAC). The chemistry laboratories at Walvis Bay expanded the scope of accreditation to include the analysis of mercury for the benefit of the fishing industry. The trio of heavy metals, mercury, lead and cadmium, can now be fully analyzed at NSI, and this is necessary for testing regulatory samples for the national fishing industry. Routine testing of these heavy metals is a challenge for the laboratory due to aging instrumentation, which it is seeking to replace with updated techniques. This is set as a priority for the national project under the current year. In addition, the laboratory is keen to procure additional instrumentation to enhance the scope of testing, for example to arsenic and its speciation, to be able to provide increased services for the imported meat, poultry, pork industry and to provide export certificates.

In 2018 the testing laboratory of NSI will be focusing the resources on sampling aspects, particularly the accreditation of the sampling step. This is a very important responsibility that the laboratory is taking onboard especially for environmental sampling (water, swabs) and ready to eat foods. Accreditation is essential for NSI to answer to regulatory needs and to sell services that can pay off the investments.

In 2018 the chemistry section of NSI will also focus on the establishment of methods for heavy metals in poultry and meat products, to provide services for the Central Veterinary Laboratory. The NSI is also acting as the EU competent authority for fish and fish products in Namibia, and in this respect an audit is planned for 2018–2019 by the EU's Food and veterinary Office (FVO). The testing laboratory is also participating in the IAEA regional Technical Cooperation Project RAF/5/067 on "Establishing a Food Safety Network through the Application of Nuclear and Related Technologies". NSI has demonstrated its competence for heavy metals analysis through successful participation in proficiency testing (PT) organized by FAPAS and Progetto Trieste. The Technical Officer visited the laboratory premises in Walvis bay and can confirm that the NSI laboratory is a regional center of excellence and a reference laboratory for the Erongo region, the coastal region of Namibia.

*From right to left, Ms Paloma Elittson, laboratory manager at NSI, Mr Solomon Tsanigab, Unit manager at AMTA, Ms Britt Maestroni, IAEA, and Ms Jessica Mbaumba, AMTA laboratory development officer at the NSI laboratories, located at Walvis Bay, a recognized testing center in the Orongo region.*

**AMTA:**

The AMTA is a specialized agency of the Namibian Ministry of Agriculture and Water Forestry, established in 2014, with the objective to coordinate and manage the marketing and trade of agricultural produce in Namibia. Among its mandates, AMTA must ensure standards compliance of all import and exports in relation to food safety and quality, while carrying out inspection and providing certification. The Food Safety and Standards Unit of AMTA is delegated with analytical testing with a focus on pesticide residues, heavy metals residues and mycotoxins However, the construction of AMTA's analytical laboratory has been delayed, therefore all analytical testing from the national monitoring program (for example mycotoxins in cereals and pesticide residues in grapes) is either outsourced to accredited laboratories in South Africa or nationally to NSI or other institutions. It was discussed that AMTA will start setting up rapid screening methods for mycotoxins at seven Namibian border control facilities. Samples that are screened positive for mycotoxins will be sent to an accredited laboratory for confirmatory tests.

Since Namibia has prolific uranium mining, it is important to test a large range of heavy metals in a range of commodities to protect local consumers and ensure export markets. Cost-sharing between IAEA and the Namibian government is being discussed, to procure an inductively coupled plasma mass spectrometer (ICP-MS) which could expand the scope of testing for heavy metals. NSI has plans in the future to increase the range of commodities tested and the range of contaminants (heavy metals, mycotoxins, pesticides).

*The warehouse managed by AMTA in Windhoek. Food products are brought to the capital of Namibia and fair-trade practices are ensured by AMTA.*

The focus of the project is on strengthening sampling and inspection with a possible accreditation; enhancement of the laboratory capacity heavy metals measurements in fishery and poultry products (NSI) and mycotoxins in agricultural produce (AMTA), and to collect existing analytical data and carry out a first risk assessment for cadmium in oysters (NSI) and mycotoxins in grains (AMTA) in 2019.

The regulatory framework for food safety in Namibia is currently being revised and by 2018–2019 all past acts, and local ordinances by municipalities, will be substituted by a Food Safety Act of Namibia which will set the basis for a completely renewed regulatory infrastructure for food safety.

The FEPL will be assisting Namibia in its sustainable development through this project.

## Supporting Food Safety Laboratory Capabilities at the National Agency for Food and Drug Administration and Control (NAFDAC) and Sister Institutions, Lagos, Abuja, Nigeria, 14–18 May 2018

James Sasanya

The Technical Officer undertook a mission to support food safety work at NAFDAC including enhancing dietary exposure assessment of chemicals. Technical and administrative assistance was provided on analysis of mycotoxins, veterinary drug and pesticide residues as well as toxic metals at the Agency's laboratory complex in Oshodi, Lagos.

Guidance was provided on optimum use of various techniques and tools including radio-receptor assays, chromatography and spectrometry. Current challenges including troubleshooting and maintenance of these tools; access to quality laboratory consumables and laboratory information management system (LIMS) were addressed. NAFDAC is now set to establish a LIMS that will greatly enhance the capabilities and operation of the food laboratory. This will also be extended to cover drug/pharmaceutical section.

Further guidance was provided on plans to establish inter-agency supported monitoring of contaminants. This would potentially include institutions such as but not limited to Federal Institute of Industrial Research (FIIRO); Standards Organization of Nigeria (SON) and Federal Ministry of Agriculture. The Technical Officer visited these institutions and held discussions on the matters, drawing very good response.

Advice was also provided on NAFDAC's plans to set up of mobile laboratories to facilitate rapid tests for instance at ports of entry, filed and markets, and to assist Small and Medium Enterprises with timely and cost-effective analysis of foods and drugs, and ensure prompt certification. Furthermore, plans are now under way for NAFDAC to establish more sensitive analytical instrumentation for both food and drug analysis.

*A veterinary drug residue testing laboratory at NAFDAC visited and advised by Technical Officer (Photo courtesy of James Sasanya).*

Awareness of IAEA support over the years was enhanced among top managers including DG NAFDAC and several Directors, as well collaborating institutions. Conversations were also held on possible cooperation with the African Union's Partnership for Aflatoxin Control in Africa.

## Technical Officer's visit to the Bangladesh Atomic Energy Commission (BAEC) Laboratories, 22–26 April 2018

Simon Kelly

Bangladesh has a rapidly growing agriculture-based economy. However, the problem of food adulteration persists at every level of production in the food chain. Consequently, verifying food authenticity is a high priority for Bangladesh; not only to protect consumers from fraud, but also to protect them from unintended food safety issues that are derived from the use of adulterant materials that are unfit for human consumption or clandestine food production activities in unlicensed and/or unsanitary conditions. In 2014, Transparency International Bangladesh (TIB) disclosed that at least 4.5 million people were directly affected by the consumption of "tampered foods". The Technical Cooperation Project BGD5032, which started at the beginning of 2018, is fully aligned to the Country Programme Framework and the 6th Bangladeshi national development 5-year plan under priority areas – Food & Agriculture. This framework calls for the adoption of quality and safety standards along the food supply chain. The project aims to introduce nuclear and related techniques for improving food quality and security and the use of modern technology for authenticity and traceability including building up the required human resource capacity.

In April 2017, the Technical Officer (TO) visited the Bangladesh Atomic Energy Commission (BAEC) Laboratories to discuss and review the planned fellowship and scientific visit activities and the purchase and installation of molecular biology equipment for species identification in meat products. Mr Simon Kelly and Chief Scientific Investigator (CSI), Ms Roksana Huque, visited the laboratory that will be used to house the new equipment, procured under CPR5022, to assess the suitability of the location and infrastructure, which were found to be satisfactory.

On the second day of the visit, discussions were held regarding the planned intensive group Fellowship training in stable isotope and trace element analysis and Scientific Visitor training in implementation of National food authentication surveillance and traceability systems. It is anticipated that training of Fellows and Scientific Visitors would be provided along with a strong emphasis on rapid screening method development for food adulteration in collaboration with the Food and Environmental Protection Laboratory. In the following days several additional

meetings were arranged with the CSI's colleagues and collaborators including the Department of Genetic Engineering and Biotechnology, (Dhaka University) and the BAEC Research Reactor team and discussion on its previous and potential use for food authentication studies e.g. neutron activation analysis. In addition, a meeting was held with staff at the local Food and Agriculture Organization offices and with the Chairman of the Bangladesh Food Safety Authority (BFSA), Mr Mohahammad Mahfuzul Hoque, to discuss the pathway to impact for the food fraud detection methods being developed at BAEC with the assistance of the IAEA. This is essential to ensure that developed methods and capacity can be meaningfully implemented and used within the Bangladesh food control regulatory framework.

The mission concluded with a one and half hour lecture by the TO to staff and students at BAEC on the use of stable isotope and trace element profiling to verify the authenticity and origin of food. The TO mission proved to be extremely valuable in cementing the final training and procurement details for the Technical Cooperation Project and reinforcing collaborative links between FEPL and BAEC and exploring new areas for collaboration in applied and adaptive research aimed at the use of nuclear techniques in food traceability and authentication to enhance food safety for consumers in Bangladesh and facilitate international trade.

*Simon Kelly with BAEC researchers outside the Institute of Food and Radiation Biology laboratory facilities.*

## Regional (African) Training on Analytical Methods for Agrochemical Residues in Animal Products, Kampala, Uganda, 16–20 April 2018

James Sasanya

The event was attended by 35 participants from Algeria, Benin, Botswana, Burundi, Cameroon, Chad, Egypt, Ghana, Lesotho, Madagsacar, Malawi, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Senegal, Seychelles, Sudan, Tunisia, United Republic of Tanzania, Zambia as well as the host Uganda. Areas of work included screening of agrochemicals drug residues using Charm II radio receptor assay technique and application of LC-MS/MS and related equipment in testing and confirmation of a range of agrochemical residues in foods and related inputs, among others.

The event held at the Uganda National Bureau of Standards (UNBS) was co-organized by the UNBS and the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) and involved participation of two cost-free of application scientists from Educational Scientific & Technical Company (ESTEC), the laboratory solutions company and local agent of Shimadzu in East Africa.

In additional to hands-on work on analytical methods (screening and confirmation), participants received exposure to effective operation, basic maintenance and troubleshooting as well as Calibration of LC-MS/MS and introduction to effective use of the LC-MS/MS software among others.

The event was also an opportunity to strengthen the African food safety network. A number of participants shared their experiences including common instrument challenges and solutions. These were then deliberated on as a group. Some participants were resource persons to the event, an indication that capacity built over the years has been put to good use and can be transferred.

Among others, participants shared on: role in the laboratories (current, recent or future) in the relation to the subject of the training; status of their laboratories and what tests they have been doing or plan to do; other people doing similar work at your institution or sister institution; previous training, gap in knowledge and how you hope to use training experience. Benefits of recent support, additional areas of need and collaboration with sister institutions in the country (and others in the region) were shared.

Several local stakeholders and end users (of laboratory services) at the event included Kyambogo University, Uganda Industrial Research Institute, National Drug Authority, Diary Development Authority, Kampala Butchers Association and MAAIF.

The State Minister for Trade, Industry and Cooperative, Hon Frederick Ngobi Gume attended the closing ceremony and highlighted the importance of cooperation among African countries to ensure safety of consumers and promote trade.

*Members of the African Food Safety Network at a regional training on food contaminants in Kampala, Uganda (Photo courtesy of Mr Aziz Mukota).*

# Interregional Training on Residues in Honey and Aquaculture Products, Izmir, Turkey, 13–17 April 2018

James Sasanya

The training was held at Bornova Veterinary Control Institute, Izmir and attended by 22 food contaminant analysts from Argentina, Benin, Bolivia, Botswana, Cameroon, Chile, Costa Rica, Cuba, Ecuador, Egypt, Honduras, Lebanon, Mongolia, Morocco, Mozambique, Nigeria, Pakistan, Seychelles, United Republic of Tanzania, Tunisia, Uganda and Uruguay as well as the host Turkey. This was in the framework of an IAEA interregional capacity building project (INT/5/154).

The purpose of the event was to among others, enhance analytical and regulatory capabilities for obtaining reliable data to support national or international food safety standards for veterinary drug residues (including some related pesticides) using perspectives from different regions in the project and the experience of the host country.

Areas of work included: radio receptor assays and confirmatory (LC-MS/MS) analysis of malachite green in fish muscle; quinolones and macrolides in honey; tetracyclines in fish muscle as well as sulphonamide residues in honey. All included sample preparation and data analysis.

The participants also benefited from lectures and discussions on: Legislation and monitoring for residues of veterinary drugs (EU's experience); residues of veterinary drugs in honey; validation of screening tests for the detection of antimicrobial residues – primary and transfer validation with the focus on fish and aquaculture products as matrix; example of a validation study (multiplex screening test for antimicrobials and aflatoxin M1 and melamine in milk) among others.

*Some of the participants in the interregional training course on contaminants in honey and aquaculture in Turkey (Photo courtesy of Mr Ridvan Uysaler, Bornova Veterinary Institute).*

# Strengthening Networking in Asia-Pacific (the Food Safety Asia Network), Ho Chi Minh City, Viet Nam, 26–30 March 2018

James Sasanya

A meeting/training to enhance capacity building through the Food Safety Asia networking was organized in the framework of a regional Asia-Pacific project on food contaminants including veterinary drug residues and other contaminants. Areas of work at the meeting included sampling, analytical methods and residue monitoring.

Forty participants from 19 countries including two cost-free experts from the United States Department of Agriculture (USDA), Agricultural Marketing Services (AMS) on secondment by the USDA Foreign Agricultural Service (FAS) attended. Both project counterparts (leaders) and implementers from each participating country had the opportunity to learn together and share knowledge across Member States. Understanding and good practices on sampling and monitoring programmes was enhanced, using systematic country-wide pesticide residue programmes commonly employed in the USA and other network members as examples.


*Members of Food Safety Network and a regional (Asia-Pacific) at a meeting/training in Viet Nam (Photo courtesy of James Sasanya).*

Progress made in networking was assessed and ways to enhance such collaboration discussed. It was noted that the network is helping with information, knowledge and expertise sharing. Members of the network namely, Bangladesh, Indonesia, Jordan, Lao P.D.R., Lebanon, Malaysia, Mongolia, Oman, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, Syrian Arab Republic, Thailand and Viet Nam have played an active role thus far, while others also keen on networking namely, Bahrain, China, Myanmar and Republic of Korea can also tap into available opportunities in future. Bahrain has shared their experiences including laboratory reports while the Republic of Korea recently supported the counterpart institute in Philippines on the laboratory analyses.

Counterparts feel they have established lasting and meaningful contacts among themselves, helping each other build or improve food safety capabilities. A participant from

Papua New Guinea said about networking "*I learned a lot of things from everyone, the challenges we all face and the struggles we all go through in each of our institutions and economies; but with this corporation and networking, I feel so at ease that at least we have friends out there somewhere in Pakistan, Lebanon, Viet Nam or elsewhere who can assist when we send an SOS*". Another counterpart added "*although we hope to get a second phase of this project, if we fail to get, we have built chemistry that will last forever*".

The networking project has helped countries improve analytical capabilities and testing programmes with more institutions now involved in monitoring programmes. Relevant data has been generated including baseline information on veterinary drug residues and other contaminants.

The networking has also facilitated training and sharing of experiences on effective use of instrumentation, a major challenge for some countries. QUATEST 3, the network's counterpart in Viet Nam, for instance, reported on how they deal with instrument maintenance and troubleshooting. This was well received by the participants and as such a plan was initiated for QUATEST 3 or a counterpart in Pakistan to travel to Papua New Guinea and assist the local counterpart National Agricultural Research Institute fix some troublesome instruments.

Limitations of the food safety laboratory in Lao P.D.R. another network member were also noted and one of the network participants from Thailand is now scheduled to travel to Laos and assist them with residue testing. The same was agreed upon for Jordan where, a more experienced network member from Lebanon will also travel to Jordan Food and Drug Agency to share their experience in residue testing. More of such exchange programmes among counterparts will be undertaken henceforth.

Several network members have contributed methods of analysis in form of standard operating procedures (SOPs) that have been uploaded to the network's web platform for others including non-network members to access and apply to improve the laboratories.

The group is benefiting from ASEAN's experience such as their work on harmonization of analytical methods and regular implementation of targeted group training. Singapore through Agri-food and Veterinary Agency for instance (using their own resources) organized a training on drug residues where 19 participants from the region were benefited.

The network recognized the importance of intra-agency cooperation as being critical to meaningfully realizing national food safety goals. Deliberate efforts have now been undertaken to cultivate more collaborations among local institutions as a building block for a stronger and more inclusive regional network.

Besides collaboration among themselves, the group now has an opportunity for multilateral or bilateral cooperation with the USDA. This has started with the involvement of the cost-free USDA experts who supported the meeting/training in Viet Nam where they shared knowledge, experience and information on several analytical methods, sampling, national monitoring programmes, good practices among others, for residues in foods. The Technical Officer is interacting with the USDA/ASM and FAS staff for possible future collaboration with the network.

## TC Project KAM5004 Strengthening National Capability for Food and Feed Safety in Cambodia, Phnom Penh, Cambodia, 19–23 March 2018

Daniela Battaglia

In Cambodia, livestock production has been increasing as the human population grows and the country progresses from poor and low-income status. This growth has been achieved through intensification of animal production, which has increasingly relied on the use of compound feed. The country imports up to 55% of animal and aquaculture feed, most of the veterinary drugs/substances and the bulk of its meat. Livestock products should be safe and of good quality. Improper application of veterinary drugs, use of antibiotics as growth promoters, use of animal feed contaminated with chemical substances such as mycotoxins or microbiological pathogens are all examples of how the safety of meat, milk and eggs can be compromised and conduce to public health emergencies, economic shortfalls and trade and market losses.

Cambodia is a member of the Association of Southeast Asian Nations (ASEAN) and the World Trade Organization (WTO) and supports free market and trade agreement allowing the free flow of goods including animals and animal products. However, often trade may be associated with transfer of feed and food contaminant, diseases and pests.

Agrochemical use should therefore be well regulated or controlled. The levels of residues/hazards monitored through a systematic national residue monitoring programme underpinned by well-functioning laboratories. The issuing of hygiene certification and permits is currently very challenging in the country, due to the limited laboratory capacity to analyze drug quality and residues and contaminants in animal products and feed to prove that they are of good quality, free of residues and contaminants. A residue monitoring system has never been set up in Cambodia, hence the need for this project. The Cambodian Strategic Planning Framework for Livestock Development 2016–2025 identifies food safety as a key issue and stipulates that "the uncontrolled production of medicines and chemicals for processing meat products, the use of

prohibited drugs, improper use of drugs, and the use of growth promoting substances for feed are the causes of high drug residues in animals and animal by-products". Therefore, the establishment of reliable residue monitoring programmes supported by functional and reliable testing laboratories is a top priority for the country.

Furthermore, the proper monitoring of antimicrobial drugs and their residues in feed and food of animal origin is of paramount importance for antimicrobial use and resistance surveillance and control. Increasing global Antimicrobial Resistance (AMR) is a major threat to human and animal health. It endangers modern human and veterinary medicine and undermines the safety of our food and environment. Antimicrobials play a critical role in the treatment of diseases of farm animals. However, their misuse, associated with the emergence and spread of antimicrobial-resistant micro-organisms, places everyone at great risk. Cambodia is undergoing a huge effort towards the achievement of long term and sustainable containment of AMR. Multi-sectorial and cross-sectorial efforts and engagement of all relevant sectors are essential to generate an effective response, within a One-Health approach. This project could validly contribute to these efforts by enabling NAHPRI laboratories to proper monitor antimicrobial drug residues in food.

The National Animal Health and Production Research Institute (NAHPRI) is responsible for ensuring the safety of animal products, and control the proper use of veterinary drugs and animal feed before the official issue of certificates of hygiene for animals, livestock products, drugs and feed. Supported by an Asian Development Bank-Sanitary and Phytosanitary project which ended in mid-2017, NAHPRI established a laboratory to test veterinary drug residue in foods. This project has provided basic equipment including, enzyme-linked immunosorbent assay (ELISA) and liquid chromatography–tandem mass spectrometry (LC-MS/MS) and trained technical staff. However, continued capacity development and laboratory upgrading is imperative and IAEA support is fulfilling this necessity.

The IAEA project should therefore enhance national residue and contaminant surveillance/monitoring programmes and the setting up of appropriate protocols. The project involves use of stable isotopes to enhance the precision and robustness of chromatographic and mass spectrometric tools and techniques. The IAEA plays a role in the procurement and delivery of the laboratory materials and in the provision of technical guidance.

The visit of the Technical Officer to NAHPRI in March allowed to analyze in detail the need for training of the laboratory personnel and laboratory equipment and material.

The visit was also an opportunity to meet with the some of the members of the Cambodian Technical Working Group on Antimicrobial Resistance and of the team responsible for the UK Fleming Fund and United States Agency for International Development (USAID) financed FAO project addressing AMR in the country. The aim of the meeting was to analyze how synergies between the IAEA financed project and the other national activities addressing AMR should be effectively pursued and developed.

The visit, finally, provided the possibilities to inform relevant Cambodian authorities on forthcoming IAEA and FAO events (e.g. the 6th Global Feed and Food Congress that will take place in March 2019 in Bangkok), on networking opportunities (e.g. the FAO Livestock Technical Network) and information resources (e.g. the FAO-hosted Global Feed Safety Platform).

## Final Meeting of ARCAL Project RLA7019, Santa Clara, Panama 5–9 March 2018

Britt Maestroni

Ms Maestroni, the Technical Officer (TO), participated in the final coordination meeting of project RLA/7/019 on 5–9 March 2018 in Santa Clara, Panama. The objectives of the meeting were to assess outputs and outcomes, to identify current challenges and lessons learned and to contribute to the drafting of a project report.

The meeting was attended by 31 people from 12 countries. The official opening of the meeting was hosted by the Panamanian authorities which included Mr Darío Gordón, Director of the Servicio Nacional de Sanidad Vegetal of the Ministry of Agriculture (MIDA), Mr Marco Mendizábal, Autoridad de Recursos Acuáticos de Panamá (ARAP) and Mr Reynaldo Lee, Panama ARCAL coordinator. The IAEA representatives welcomed the participants, and emphasized the importance of the built-in communication component in the project being pioneering in this regard as the results will be very valuable for future IAEA projects. The TO contributed to and coordinated the discussion sessions, including a presentation on RALACA, and the assignments for the preparation of the project report while providing substantial technical contribution to the writing up of the draft project report.

The regional project coordinator, Mr Mario Masis from Costa Rica, presented project antecedents, objectives, expected results and workplan. During the first and second day each participating national project coordinator presented the main achievements (outputs and outcomes) of the project in their specific country with a focus on difficulties and lesson learned. During the third and fourth day, the participants were divided into two main groups, the technical counterparts and the communication focal points, and into subgroups within these, to discuss and extrapolate national outputs into a project report having a regional focus.

The communication group elaborated inputs to the regional report specifically on communication aspects. A draft regional project report for TCP ARCAL RLA7019 was prepared, which will be further consolidated and officially submitted to the IAEA by the regional project coordinator. It was noted that the outcomes of the project are more sustainable when the leading coordinator is either part of a decision-making body, e.g. a Ministry, or has actively managed strong interaction and linkages. The communication component was built into the project from the design phase. Since the outputs of the projects were produced only at the end of the fourth year, in the first three years the communication activities were rather general and focussed on the general public, the local authorities and the communities around the study areas. The main messages were on the activities and the project objectives only. Only after project closure can the communication channels be really activated and strong messages about project outputs disseminated. The project counterparts have declared their commitment in this regard and a RALACA communication committee will try to ensure the transfer of information to the appropriate decision makers, according to the objectives of the project.

The RALACA network of analytical laboratories was further enhanced within the framework of this project and it will play a vital role in ensuring sustainability of analytical activities in the region and help the transfer of information, data, analytical tools and methodologies to the entire Latin American and Caribbean region.

*Participants of the final meeting of project ARCAL RLA7019.*

## Enhancing Food Safety and Supporting Regional Authentication of Foodstuffs through Implementation of Nuclear Techniques (RAS5081), Vienna, Austria, 5–9 February 2018

Simon Kelly

The first Coordination Meeting of the Regional Cooperative Agreement “Enhancing Food Safety and Supporting Regional Authentication of Foodstuffs through Implementation of Nuclear Techniques” (RAS 5081) took place in Vienna on 5–9 February 2018. It was attended by 18 representatives from 18 participating countries; Australia, Bangladesh, Cambodia, China, Fiji, India, Indonesia, Lao P.D.R., Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Philippines, Singapore, Sri Lanka, Thailand and Viet Nam.

The meeting was opened with remarks by Mr Rui Cardoso Pereira acting as Director of the FAO/IAEA Joint Division of Nuclear Applications in Food and Agriculture. He extended his greetings and warmly welcomed all participants to the meeting and acknowledged the IAEA Technical Cooperation Programme in selecting this project for funding to address the important issue of combatting food fraud. Mr Zhihua Ye, Head of the Food and Environmental Protection (FEP) Section welcomed the participants and recognized the contributions from participants who had been involved in the previous regional food traceability project RAS5062. Mr Ye stressed the importance of the regional project to the sub-programme and wished the group success in the kick-off meeting. The Technical Officer, Mr Simon Kelly also welcomed delegates and emphasized the importance of establishing links with relevant food control competent authorities in each participating country to ensure there would be a path to impact for the nuclear and complementary methods applied and developed within the framework of the regional project.

The meeting’s introductory session began with a presentation from the Project Monitoring Officer. Mr Van Hoang who presented an overview of the RCA framework for research development and training and the roles and responsibilities of the Lead Country Coordinator (LCC) and the National Project Coordinators (NPCs). The LCC then introduced the project concept background and described the barriers to implementation of nuclear and isotopic techniques such as the limited number of open-access reference databases and the lack of standardized tools for interpretation. Mr Simon Kelly gave an overview of analytical techniques that compliment nuclear and isotopic methods in food authenticity and traceability. His presentation also included an overview of other relevant projects, networks and information sources relating to food authenticity and traceability. Each of the 17 NCPs then went on to present the baseline status of food authenticity regulatory frameworks, testing capabilities, national surveillance and any reported incidences of food fraud in their respective member state. These presentations formed the basis of the next meeting session to develop the individual country initial workplans using the interactive “World Café” method.

Group sessions in the "World Café" format were then held to establish country workplans for the first phase of the project related to the common agricultural products being studied – rice, honey, tea and dairy. The interactive session permitted participants to combine outputs and outcomes

and to identify gaps and solutions to anticipated problems and barriers to progress. Each NCP's workplan was then presented and reviewed by the consortium using a feedback session to ensure that high scientific standards and the objectives of the RCA were 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 NCP's workplans for the first phase of the project were reformulated to strengthen the development of analytic techniques, identify training needs at the national and regional level, establish datasets/databases and networks, and outline required methods and SOPs for optimizing impacts and fulfilling the objectives of the project. 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.

The resultant focus of the first phase of the project is to ensure targeted basic and advanced training is provided to the appropriate member states and that there is consistency of methods and data quality between participants such that the ultimate goal of generating a sustainable regional network of practitioners and adequate reference databases, for food fraud detection, can be achieved. It was recommended by the meeting that IAEA should consider the possibility of hosting and maintaining databases from the new regional project 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 should support raising awareness of food adulteration and fraud, and its potential to impact on food safety, through tailored expert missions targeted at members states with little or no background in this area.

*RAS5081 Meeting Participants at the Vienna International Centre.*

# Enhancing Food Safety Laboratory Capabilities Gonakbari/Dhaka, Bangladesh, 10–15 December 2017

James Sasanya

A mission was undertaken to the Institute of Food and Radiation Biology, Bangladesh Atomic Energy Commission (BAEC) in Gonakbari to assist with: training on analysis of food contaminants, including method optimization and application; data analysis and interpretation; instrumentation; providing relevant technical advice; preparations for a second week of training on radio receptor assays.

The Technical Officer (TO) worked with laboratory staff on use of chromatographic techniques for analysis of veterinary drug residues and mycotoxins in various food products. Method optimization including preliminary validation, for analysis of tetracyclines in meat for human consumption, as well as associated data analysis, was conducted. Relevant technical guidance was provided and literature shared. A photochemical derivation cell was installed for use by the analysts. Another technique was also set up and optimized for analysis of common veterinary drug residues such as the avermectins.

The TO also worked with six laboratory staff on two LC-MS/MS instruments for confirmatory analysis. On a QTRAP 4500, ten sulphonamide drugs were infused and MS parameters established. These were then run through analytical columns to ensure separation. Isotope labelled drugs were also infused and run. The two instrument operators are now continuing with further analysis.

On the second LC-MS/MS with greater sensitivity, several analytes from two groups of drug residues, the tetracyclines and avermectins was infused and then analyzed by flow injection to establish separations. Samples extracted and analyzed on the HPLC-DAD/FLD were also analyzed and data processing and interpretation discussed. Different method development and validation approaches were discussed and a working template provided.

The TO interacted with Ministry of Agriculture staff and provide technical advice and guidance on a national project to establish a Quality Control laboratory for livestock inputs and products. The TO reviewed the project document and advised on missing links and possible areas to strengthen.

*Technical Officer and lab staff during a training on residue testing in Bangladesh (Photo courtesy of James Sasanya).*

# Developments at the Food and Environmental Protection Laboratory

## Homogeneity of Sample Processing

Britt Maestroni and Marivil Islam

The Food and Environmental Protection Laboratory (FEPL) has been focusing much of its research on different aspects of method validation, which is the process of characterising the performance to be expected from a method in terms of its scope, specificity, accuracy sensitivity, repeatability and within laboratory reproducibility, amongst other characteristicss, or in other terms defined as the process to assess the method's fitness for purpose. As part of this process, one often neglected aspect is the validation of the sample processing, that ensures homogeneity of the analytes in the processed commodity using a defined analytical portion. Sample processing is defined as the procedure (e.g. cutting, grinding, mixing) used to make the analytical sample acceptably homogeneous with respect to the analyte distribution, prior to removal of the analytical portion (1). The FEPL, as part of the method validation studies for pesticides residues in vine leaves and in collaboration with the Syrian Atomic Energy Commission, Syria, and the GACT, Uruguay, initiated a study on the verification of the homogeneity of the analytical portions at 2 g level, which is the analytical portion that is solvent-extracted and analyzed using the validated analytical procedure to quantify/identify the pesticides included in the method scope. Two different approaches were adopted to verify that the analytical portion was homogeneous enough to ensure that the sub-sampling uncertainty was acceptable.

*Mr Amer Alnaser from Syrian Arab Republic is processing blank samples using liquid nitrogen and a mortar and pestle.*

**Approach 1:**

The first approach consisted of analysing, in a single batch, all analytical portions deriving from a naturally contaminated sample. In this case the variability deriving from the analysis of pesticide residues in the sample can be approximated to the variability of sample processing as all other factors are kept constant.

**Approach 2:**

The second approach consisted of evaluating differences arising from spiking experiments using blanks. Spiking was done on the blank vine leaves before sample processing and compared to spiking in individual analytical portions after homogenization. The difference between the two procedures can be approximated to the variability arising from sample processing as all factors were kept as constant as possible during the analytical procedure.

The spiking procedure involved placing the entire vine leaves on clean aluminium foil and carefully spiking using a Hamilton syringe with mixture of pesticides at 0.1 µg/kg. After waiting for 30 minutes to allow absorption of residues into the surface, the vine leaves were carefully transferred to a mortar, and using a pestle and liquid nitrogen, cryogenically processed to a fine powder.

A portion (2 g) of the homogenized vine leaves were extracted with acidified ethyl acetate (4 mL) after soaking the samples with 4 ml of Milli Q water (4 mL) for 30 min. The extraction tubes were shaken vigorously by hand for 1 minute and then for 30 min on a horizontal shaker. After this step a first salt mixture (0.3334 g $NaHCO_3$ + 2 g $NaSO_4$) was added, the tubes were hand-shaken vigorously and the contents were thoroughly homogenized using an ultra-turrax homogenizer at maximum speed for 1 min. The homogenates were centrifuged for 5 min at approximately 12 600 g. Two mL of the organic supernatant were cleaned up in an Eppendorf tube of 15 mL by adding a second salt mixture (50 mg PSA + 300 mg $MgSO_4$), and intensively agitated on an orbital vortex mixer at maximum speed for 5 min. After centrifugation for 5 min at approximately 12 600 g, the extracts were filtered, yielding a 0.5 g /mL sample extract and injected into a GC-MS/MS triple quadrupole system for pesticide residue analysis.

The naturally contaminated sample used to study the sample processing homogeneity according to the first approach was found to be positive for chlorpyrifos residues. Chlopyrifos was therefore selected as the study pesticide for the spiking experiments and included in the spiking mixture according to the second approach.

Codex guideline CAC/GL 59-2006 on the estimation of uncertainty of results provides for the statistical background and the principle of estimating sample processing from spiking experiments, according to approach 2. According to CAC/GL 59-2006, $CV_L$ is the relative uncertainty of the laboratory phase of the determination which may derive from the sub-sampling,

sample preparation, sample processing and analytical steps. $CV_{SP}$ is the relative uncertainty of the preparation of test portion including sub-sampling, sample preparation and sample processing and $CV_A$ relative uncertainty of the analysis including extraction, cleanup, evaporation, derivatisation, instrumental determination.

Preliminary results of the sample processing experiments are summarized in Table 1 for the pesticide chlorpyrifos according to the two approaches.

Table 1. Preliminary summary results for chlorpyrifos obtained from experiment aiming at verifying the sample processing homogeneity according to two approaches, described in the text.

| Approach 1 | |
|---|---|
| nr samples | 25 |
| average residue (µg/kg) | 93 |
| $CV_{SP}$% | 6 |

| Approach 2 | |
|---|---|
| nr samples | 9 |
| average residue (µg/kg) | 95.7 |
| $CV_A$ (%) | 2.2 |
| $CV_L$(%) | 3.4 |
| $CV_{SP}$ (%) | 2.7 |

According to table 1 both approaches account for less than 10% of variability deriving from the sample processing step. This result allows us to conclude that processing of vine leaves using liquid nitrogen with a mortar and pestle is giving an acceptably homogeneous sample, and that the sub-sampling variability is within acceptable levels. On the contrary if this would have not been the case, the use of larger analytical portions should have been considered to obtain a better estimate of the true value.

## Rapid Screening Techniques for Extra Virgin Olive Oil Authentication

Zora Jandrić

As a natural product that is produced by mechanical pressing of olive drupes, olive oil is protected by various regulations and institutions such as Codex Alimentarius and the EU Regulations. Due to its increasing popularity, it has always been a target for fraudulent practices such as substitution fraud with cheaper oils (blends).

Previous research in the Food and Environmental Protection Laboratory (FEPL) investigated a method for the detection of adulteration of extra virgin olive oil with rapeseed and sunflower oil using a hand-held 'SCIO' infra-red detector and Fourier transform-infrared spectroscopy with attenuated total reflectance accessory (FTIR-ATR). In a continuation of this study, to test the methodology with a broader scope of adulterants, tests were carried out for detection of other possible adulterants such as corn, soybean, walnut, grapeseed, sesame and peanut oil. Blends of EVOO/adulterant were prepared, ranging from 0 to 30% and analyzed by FTIR-ATR. The data produced were analyzed qualitatively and quantitatively. A software package called 'Adulterant Screen', which is available for the Perkin Elmer Spectrum Two FTIR, and partial least squares (PLS) methods were used for building the qualitative and quantitative models, respectively. Figures 1 and 2 show data for EVOO/walnut oil blends. The result for adulterated samples (down to 2%, the detection limit for walnut oil) were 'fail' indicating the presence of adulterant, while a 'pass' result was generated for pure olive oil and adulterated samples at 0.5 and 1% level (Figure 1). Using a PLS targeted method, it was possible to detect EVOO adulteration with walnut oil at 0.5% (Figure 2).

| Sample Name | Adulterant | Level | Unidentified Compon | Adulterant Screen Pass/Fail |
|---|---|---|---|---|
| Walnut oil_0.5%_01 | No adulterants | - | Unlikely | Pass |
| Walnut oil_1%_01 | No adulterants | - | Unlikely | Pass |
| Walnut oil_2%_01 | Mean_Walnut | 0.02125 | Possible | Fail |
| Walnut oil_10%_01 | Mean_Walnut | 0.09692 | Possible | Fail |
| Walnut oil_15%_01 | Mean_Walnut | 0.15225 | Possible | Fail |
| Walnut oil_20%_01 | Mean_Walnut | 0.20190 | Possible | Fail |
| Walnut oil_25%_01 | Mean_Walnut | 0.24868 | Possible | Fail |
| Walnut oil_30%_01 | Mean_Walnut | 0.29769 | Possible | Fail |
| EVO oil_100%_01 | No adulterants | - | Unlikely | Pass |

*FIG. 1. Screenshot of 'Adulterant Screen' results for test samples (blends of EVOO/Walnut and pure EVOO).*

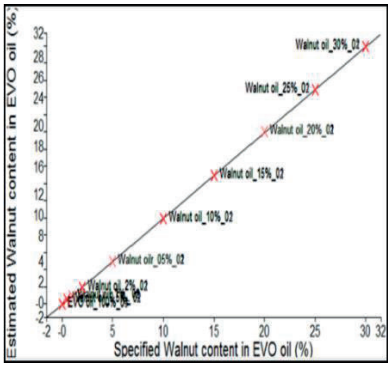



*FIG. 2. Screenshot of a PLS calibration model for EVOO/Walnut oil.*

When a suspicious sample is scanned, the Adulterant Screen algorithm first compares its spectrum to a PCA model generated from the reference (authentic) materials. This model is then augmented with each of the adulterant spectra in turn. If including a given adulterant in the model greatly increases the fit of the sample spectrum, it is likely that the adulterant is actually present in the sample. Figure 3 shows the residuals observed from the analysis of blends of olive oil adulterated with 10% walnut oil. The spectral residuals are significantly decreased by fitting the spectrum of the pure walnut oil indicating the presence of that adulterant in the sample.

The 'Adulterant Screen' algorithm correctly identified the adulterant, and this method also gives an estimated level of that adulterant without the requirement for running quantitative calibration (PLS). This method is simple to use (fast '3 step' sample analysis with Spectrum Touch is shown in Figure 4), requires only the collection of the spectra (authentic samples and the known adulterants) and does not require any additional statistical analysis. Therefore, it has the potential to be easily used for routine analysis as a rapid screening technique.

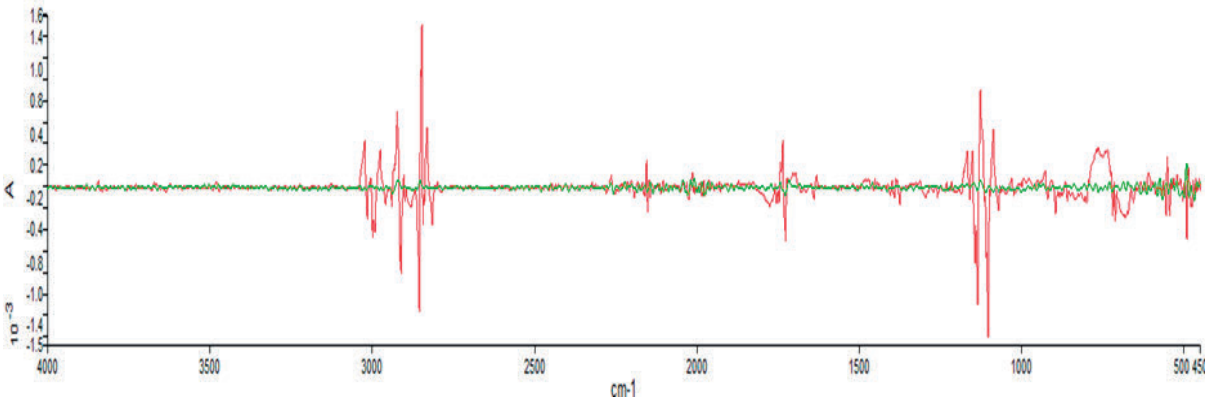



*FIG. 3. Spectral residuals before (red) and after (green) fitting adulterants.*

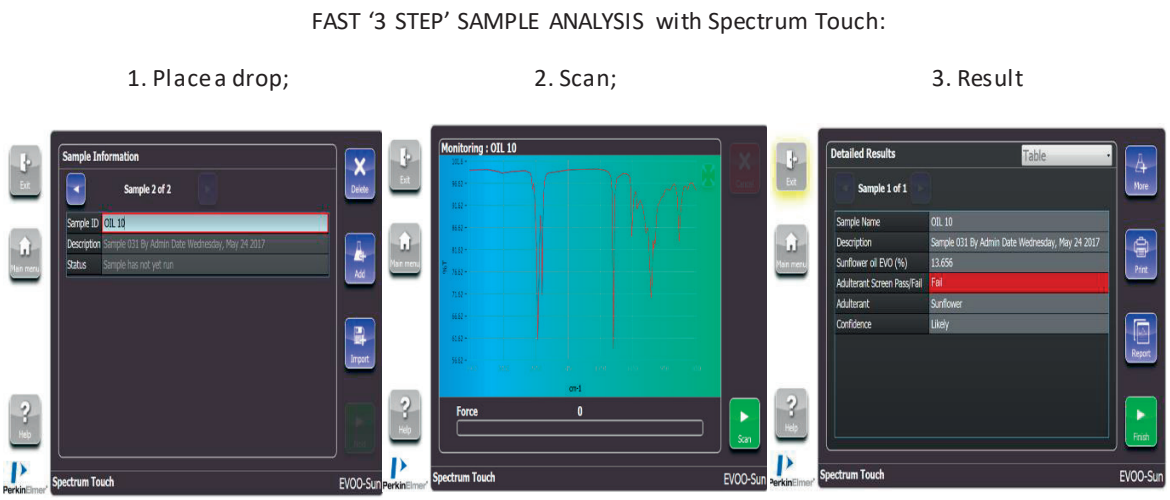



*FIG. 4. Fast '3 Step' sample analysis.*

# Feasibility Study into the Development of a Screening Method to Detect Formaldehyde Adulteration of Liquid Milk Using Portable Raman Spectroscopy

Intern: Amber Vaughan

Milk is a primary source of nutrients for many consumers around the world and with a growing population, there is an increasing demand for its production. To satisfy this demand and increase profits, milk may be artificially extended through dilution or adulterated to increase nitrogen (apparent protein) or fat content and increase shelf life. One recent example is the adulteration of milk in Brazil, where commercially available UHT milk was reported to contain formaldehyde, hydrogen peroxide and chlorine. As guidelines are established that define the maximum content of certain adulterants, there is a continued demand to develop rapid detection techniques that can keep up with constantly evolving and more sophisticated milk adulteration methods.

Authentication and assessment of milk quality may be completed by various targeted chemical methods, which confirm that the product quality meets technical and regulatory requirements. Typically, this analysis demands relatively labour-intensive sample preparation and time consuming sequential analytical measurements. An alternative approach is to conduct an untargeted quick, relatively cheap, and often non-destructive spectroscopic measurement with subsequent data processing by means of chemometrics. The majority of suitable methods may be considered as joint procedures including a spectrometric mesurement and an appropriate chemometric method for the analysis of the measured signal. However, we need to be sure that the spectra do carry important information, which as a rule is not always immediately obvious by visual inspection. Consequently, an appropriate chemometric procedure is essential to identify and extract the features of interest from the acquired spectrum, especially when the adulterants are of a similar chemical nature. An example of such a rapid and portable screening method is Raman spectrometry. The Raman measurements are rapid, simple and also need no sample preparation. Raman spectroscopy measures vibrational, rotational, and other low-frequency modes in molecules and is commonly

used to create a structural 'fingerprint' of the chemicals present. This fingerprint can be used to identify and quantify chemicals present in a sample. The Raman spectrum region 800–900nm, in particular for milk, is able to identify important components and the absorption bands are sensitive to the physical and chemical states of individual constituents.

Within the framework of Coordinated Research Project "Field-deployable analytical methods to assess the authenticity, safety and quality of food" (D52040/G42007) a study into the use of a portable Raman spectrometer was undertaken to demonstrate the feasibility of field-based testing of liquid milk to detect the presence of the toxic and carcinogenic preservative formaldehyde. Raman spectra were obtained using the Portable StellarCASE-Raman Instrument and SpectraWiz software. Data was assessed using Data-Driven Soft Independent Modelling by one-Class Analogy (DD-SIMCA) with 'chemometrics add-in for Excel' software. Whole liquid ultra-heat treated (UHT) milk, with a 3.5% fat content, was used as a blank for liquid samples. To this, a 36.5–38% formaldehyde solution was added to create 3 millilitres (mL) mixtures. Artificial fortification levels ranged between 0.2–10% v/v for formaldehyde. Liquid samples were frozen and only defrosted when required for Ramana spectroscopic measurement.

Portions (3 mL) of liquid milk sample were simply placed into a glass vial and scanned 12 times. This was done over multiple days to assess the repeatability of the procedure. The spectra, ranging between 794–1200 nm, were collected using an integration time of 5000 ms and an average of 4 scans in low resolution % transmittance mode. Before measuring a new sample, a dark scan was taken to correct the baseline. Each Raman spectrum was normalised by Single Normal Variate pre-processing before modelling using DD-SIMCA, where 83% of milk blanks were used for training and the remaining 17% to create a test set. Artificially adulterated milks and pure adulterant were compared to the model separately and the suitability of the model was assessed against a target sensitivity and specificity rate of 95%, both with a significance level of p=0.01. Averaged typical Raman spectra are shown in Figure 1.

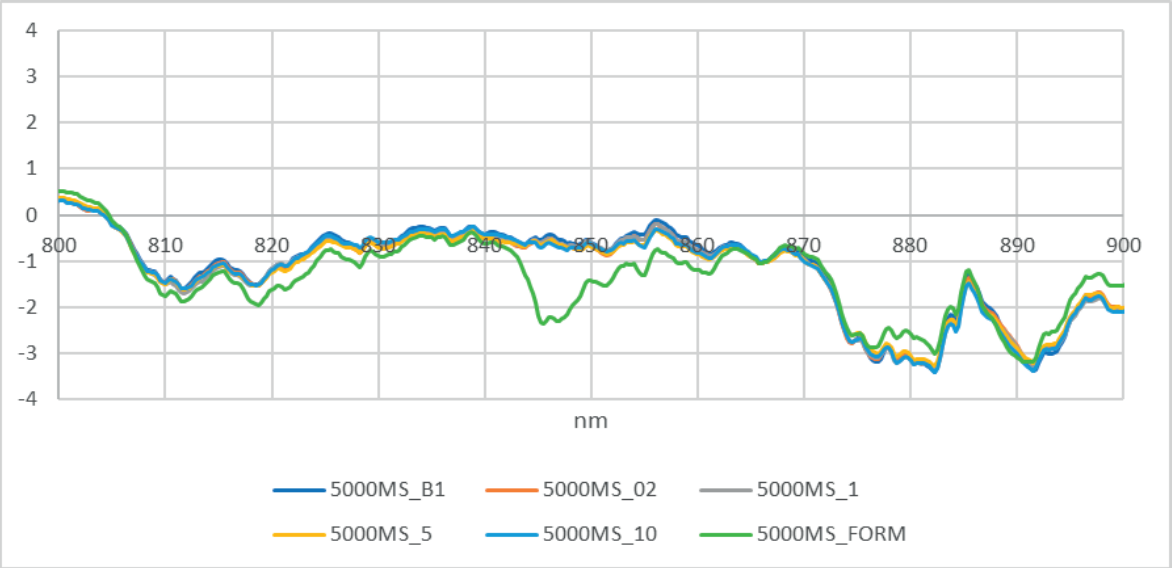



*FIG. 1. Single Normal Variate transformed Raman spectra over distinct fingerprint region (800–900nm) averaged from 2 days for each spiking level.*

DD-SIMCA model results show that the detection of formaldehyde is possible at 0.2% v/v adulteration using Raman analysis (Figure 2). This is well below concentrations of formaldehyde that are typically used to preserve milk, as the previously mentioned Brazilian UHT milk example contained 44% formaldehyde. Additional work is currently underway using another rapid screening technique, infra-red spectroscopy, to detect adulteration of liquid milk with formaldehyde and a range of other adulterants including, boric acid, detergent, melamine, urea, sugar, salt and others.

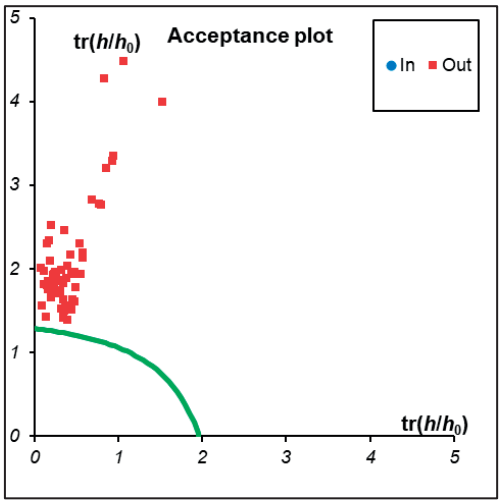



*FIG. 2. Application of DD-SIMCA to the analysis of milk fortified with 0.2–10% formaldehyde. The quality of the unadulterated milk acceptance area was estimated by testing with data from unadulterated samples that were not included in the training set (or target class) samples. With α = 0.05 the specificity and sensitivity were 100%, i.e. the type 1 error rate (of wrong rejections) of the untargeted screening method was 0%. (B) With α = 0.01 the sensitivity was 100%, i.e. the type 1 error rate was 0% with no wrong rejections of the authentic EBN test set, specificity for fortified samples at α = 0.01 was 95%.*

Due to the limited number of samples studied here these results can be considered only as preliminary. Nevertheless, the application of Raman spectroscopy, combined with DD-SIMCA data processing, for the detection of low concentrations of the toxic and carcinogenic preservative formaldehyde in whole liquid milk has been successfully demonstrated.

This technique is accessible, non-destructive, fast and direct, requiring no sample preparation. The method combines good sensitivity and specificity. Development of reliable non-targeted screening methods based on DD-SIMCA and one target class classification are extremely important in identifying and preventing evolving fraudulent trade of adulterated liquid milk and also to reduce the possibility of unintended side-effects and health risks posed by addition of ingredients unfit for human consumption. With the rapidly growing demand for unadulterated milk and milk products in developing countries the requirement for screening methods is clear. Further work is required to validate the approach for a wider range of adulterants and increase the database of authentic whole milks.

# FEPL Internship

Ms Valentina Centonze completed a 3-month internship in the FEPL in December 2017. During this time, Valentina's research focused on applying spectroscopic and mass spectrometric molecular fingerprinting techniques and chemometrics in order to discriminate between oranges of different varieties, and also to research the discrimination of different geographical origins of production. The results of the work done in the FEPL contributed towards Valentina's research studies as part of her Ph.D. studentship at the Department of Chemistry of the University of Bari "Aldo Moro" in Italy. We wish Valentina all the best in completing her studies and for her future career.

# Announcements

## A New On-line Video Explaining Food Irradiation

A new online film is available to help explain food irradiation and its importance for food security in a world where climates are changing. It is available for anyone to use in outreach activities and can be found online at this link:

https://www.iaea.org/newscenter/multimedia/videos/food-irradiation-and-the-changing-climate

This short film is available in Arabic, English, French and Spanish. It builds on the success of an earlier film: "Using Nuclear Science in Food Irradiation", that seems to be a favourite and remains online here:

https://youtu.be/pe6AKh_tLys

## International Congress of Crop Protection Chemistry, Ghent, Belgium, 19–24 May 2019

Ms Britt Maestroni (FEPL) is the leader of Theme 6 – Food Quality and Safety.


# Publications

## 2018

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Maestroni, B., Ghanem, I., Correll, R., Alnaser, A., Islam, M., Cesio, V., Heinzen, H. and Cannavan, A. (2018). Assessment of the withholding period for organophosphorus pesticides applied to vine leaves. Book of abstracts of the 12th European Pesticide Residue Workshop, Munich, Germany, 21–25 May 2018, 204.

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## Impressum

**Food and Environmental Protection Newsletter Vol. 21, No. 2, July 2018**
The FEP Newsletter is prepared by the Food and Environmental Protection Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and FAO/IAEA Agriculture & Biotechnology Laboratory, Seibersdorf.

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, July 2018

18-03251