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Nuclear Techniques in Food and Agriculture

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To Our Readers

It is my great pleasure to report on the Food and Environmental Protection (FEP) subprogramme's continued efforts to support the development and application of nuclear and related techniques in Member States to improve food safety and control systems. Over the past six months since our last newsletter, major activities include work on Coordinated Research Projects (CRPs), technical support to national and regional Technical Cooperation Projects (TCPs), organization of workshops, participation in international conferences and meetings as well as R&D activities at the Food and Environmental Protection Laboratory (FEPL). You will find many details in this issue of the Food and Environmental Protection newsletter and, of course, we also keep our website up to date with key information.

Currently we are working on five CRPs and it has been an interesting six months, with three Research Coordination Meetings (RCMs) in the first half of the year. Inside this issue you will find reports of each RCM, but let me mention a little about them here: Two inaugural RCMs were held at the IAEA Headquarters in Vienna, Austria, to initiate new CRPs. One was for the new CRP (D52040) on Food Authenticity and Traceability that is a joint initiative of both the Joint FAO/IAEA Division and the IAEA Division of Physical and Chemical Sciences. The second new CRP (D52041) is an FEP subprogramme initiative that focuses on the Development of Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods. In addition to these, an RCM was held at one of our Collaborating Centres in Strasbourg, France. This was the second RCM of the CRP to develop electron beam and X ray applications for food irradiation.

The feature article in this issue of our newsletter introduces general considerations and our perspective on research and development of integrated techniques based on application of nuclear and related analytical methods to monitor mixed contaminants and residues in food commodities, especially agrifood products.

Photo courtesy of J. Sasanya

We are currently providing support to the implementation of fifty-six TCPs, including ten regional and one interregional project. Some highlights of our activities in this area include: field visits and on-site technical assistance and progress evaluation of food safety and control activities in Mauritius and Mauritania; pre-project planning on the feasibility of an irradiation facility in Fiji; pre-project planning on the safety of food of animal origin in Sri Lanka; regional training courses on analytical methods for residues of selected pesticides in Uruguay and for basic maintenance and troubleshooting of food safety analytical instrumentation in Singapore; technical assistance for an ongoing project to build food laboratory capacity and the design of a new project under the 2018−2019 cycle for Niger; inter-institutional support for

food safety capacity building and strengthening of food control systems in Africa; and technical guidance for the implementation of stable isotope techniques for high quality agro-produce traceability and authenticity in China. Meanwhile, technical support and input has also been provided to develop some thirty new project designs for the 2018−2019 biennium.

Eight workshops and training courses were organized in the first half of this year. For sample, the Regional Workshop on Radioactivity in Food, Drinking Water and Commodities was held in Buenos Aires, Argentina, with the joint efforts of the Joint FAO/IAEA Division, colleagues in the IAEA, the Pan American Health Organization and the World Health Organization. A Training Workshop on Data Quality for Decision Making was held in San José, Costa Rica, in conjunction with the sixth Latin American Pesticide Residue Workshop (VI LAPRW). The LAPRW, attended by almost 500 people from 44 countries, brought together regional and international experts related to pesticide residue work, while the training focused on pesticides residue analysis. Others include trainings in Sudan, Benin, South African, Singapore and Thailand. Detailed reports of these workshops and or traning courses are included in this issue too.

The FEP subprogramme has also actively participated in and contributed to regional and international meetings in order to advance our objectives. These have included: a key note speech at the Annual Symposium of the International Life Sciences Institute Europe in Brussels, Belgium; a lecture on the application of stable isotope analysis for the confirmation of organic and halal food authenticity at the ISO-FOOD Exploratory Workshop on Isotopic Techniques in Food Characterization in Ljubljana, Slovenia; participation in the 22nd Meeting of the UK Department for Environment, Food and Rural Affairs independent Authenticity Analytical Methods Working Group, London, UK, the annual conference of the EU 'FoodIntegrity' project and an annual meeting and workshop of the EU Horizon 20-20 research project Authent-Net. These activities were in response to requests from Member States and international/regional organizations.

The FEP subprogramme of the Joint FAO/IAEA Division has continued in its efforts to provide technical support and inputs to the Codex Alimentarius Commission and its committees. A successful side event on "Radionuclides in Food: Standards, New National Guidance and Recent Developments" was held at the 11th Session of the Codex Committee on Contaminants in Foods in Rio de Janeiro, Brazil, and technical comments on draft guidelines on performance criteria specific for methods of analysis for the determination of pesticide residues were provided at the 49th Session of the Codex Committee on Pesticide Residues. More detailed information on our participation in Codex meetings is also reported in this issue.

The ReNuAL project to renovate the IAEA's nuclear applications laboratories at Seibersdorf has gathered pace. In this project, four of the FAO/IAEA Agriculture and Biotechnology Laboratories will be re-housed in purpose-built laboratories. Construction work has now begun on the flexible modular laboratory, which will house the FEPL along with two other laboratories of the Joint FAO/IAEA Division.

Analytical method development at FEPL to support food authenticity and traceability included work on the detection of adulteration and verification of geographical origin of Malaysian edible bird's nest. A rapid screening method for adulterants was developed using mid-infrared attenuated total reflectance (MIR-ATR) spectroscopy combined with chemometric analysis by data driven soft independent modelling of class analogy (DD-SIMCA), and metabolite profiling with DD-SIMCA was used for geographical origin classification by region of Malaysian edible bird's nest samples. Method development for food contaminant control at FEPL included a method for the determination of pesticide residues in vine leaves in collaboration with a fellow from Syria and the RALACA food safety laboratory network.

Our most important resource is our staff; my colleagues and I are pleased to welcome back, Ms Tamara Wimberger. Tamara returns as a team assistant at the FEPL after a four-year family break. Our thanks and best wishes go to Ms Stephanie Beckham, who temporarily fulfilled this role.

In closing, I would like to thank collaborators, counterparts and staff for your continued support and to express my appreciation for your enduring dedication and contributions to the subprogramme and to our Member States.

Sincerely,

Zhihua Ye
Head, Food and Environmental Protection Section

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Feature Article

A Five Year International Research Project "Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods" launched, Vienna, Austria, 19–23 June 2017

James Sasanya and Zhihua Ye

This article introduces a Coordinated Research Project (CRP) that aims at strengthening national food control systems to better safeguard consumers in Member States from the risk of exposure to a wide array of contaminants and/or residues in the food chain.

Food consumers worldwide can be exposed to mixed contaminants and/or residues in what they eat. Potential exposure may be attributed to inevitable use of agricultural inputs, residues of which may co-occur with incidental contaminants such as mycotoxins, persistent organic pollutants and harmful adulterants. Open air agricultural production also predisposes food commodities to different and possibly unsafe levels of contaminants or residues and related toxicants.

Appropriate risk assessment is therefore necessary and in this regard the food industry and governmental regulatory institutions require multi-analyte/class methods for simultaneous analysis of the diverse food contaminants. Application of multi-contaminant methods is thought to be a very good strategy for monitoring and control of food hazards as the practice would help laboratories deal with high demands for analytical service and associated high costs. An emerging trend in analysis of these contaminants and/or residues is the development of appropriate generic methods, which however, presents considerable analytical challenges due to differences in physico-chemical characteristics of the hazards. Thus, diligent investigations are needed to develop tailored extraction, clean-up, and analyte separation techniques to aid efficient and robust multi-hazard analyses.

While some R&D programmes on mixed contaminant analysis in agri-foods have been initiated in certain Member States, there are increasing demands by others for assistance to initiate their own R&D projects and facilitate systematic hazard monitoring and control programmes targeting 'cocktails' of contaminants. Improving reliability of the analytical methods is still challenging in both categories of Member States and this can be overcome by leveraging the advantages of nuclear/isotopic techniques.

A new CRP has been thus established as an FEP subprogramme initiative that focuses on the development of integrated radiometric and complementary techniques for mixed contaminants and residues in foods. The main objectives of the CRP are to enhance food and environmental safety control system, and risk assessment programmes. This will be achieved through improving laboratory capabilities in Member States. The specific capabilities targeted is the ability to gather reliable data on mixtures of contaminants and residues in foods. This also includes data pertaining to antimicrobial resistance (AMR). The specific objectives therefore includes:

(1) Research on the development, optimization/adaptation, and validation of analytical methods for mixed contaminants or residues in foods and associated matrices;

(2) Development of innovative generic sample preparation (including improved environmentally friendly sample preparation) techniques for mixed contaminants or residues in foods and associated matrices;

(3) Investigation on the effective application of newly researched methods in the routine surveillance of mixed contaminants or residues in foods and associated matrices, and where possible establishment of base/reference "fingerprints" of food matrices that may contain a mixture/cocktail of contaminants and/or residues;

(4) Investigation on the development, optimization, adaptation, validation and application of sensitive and selective multi-antimicrobial analytical methods useful for monitoring residues of substances associated with development of AMR.

Meanwhile，a number of outputs are expected, including but not limited to: New optimized, adapted, developed and validated analytical methods for mixed chemical and natural contaminants and/or residues in foods of animal and plant origin as well as associated matrices; Protocols for mixed chemical and natural contaminants and/or residue methods developed and transferred to Member States; Relevant laboratory personnel trained (and workshops conducted) on use of methods for mixed chemical and natural contaminants and/or residues; Tailored analytical methods based on inter-laboratory test reports; Multi-antimicrobial method(s) for monitoring the use of critically or highly important antimicrobials and their residues, associated with the development of AMR; Peer review publications; Analytical method database update; Research network; and Reports to risk managers and standards/guidelines setting bodies and institutions (e.g. Codex Alimentarius Commission).

This CRP is expected to result in the establishment of integrated cost effective analytical technologies in the different countries and it was important that the researchers meet, for joint planning, fine-tuning and streamlining of respective programmes of work, in addition to getting acquainted, hence the first technical meeting held in

Vienna, Austria from 19 to 23 June 2017. The following Member States were represented: Benin, Botswana, China, Colombia, Ecuador, Macedonia FYR, Nicaragua, Pakistan, Papua New Guinea, Peru and Uganda. Others included Italy, Republic of South Africa, Spain, the Netherlands and the United States of America.

Scientists from these countries as well as IAEA staff, discussed and developed strategies for research on the development, optimization or adaptation, and validation of relevant analytical methods; innovative generic and 'green' sample preparation techniques; investigating effective method application to routine surveillance, and possible establishment of base or reference "fingerprints" of food matrices associated with mixed contaminants and/or residues. Sensitive and selective multi-antimicrobial analytical methods useful for monitoring residues of substances associated with antimicrobial resistance were also discussed. Other topics addressed included radiotracer studies to develop and validate multi-class veterinary and pesticide residues as well as mycotoxins, and scope of priority analytes and matrices including various animal and plant products as well as related matrices such as water and feed.

Strategies for collaborative research among the CRP participants were reviewed and programmes of work for the first phase fine-tuned. Mechanisms to transfer developed technology to other Member States not involved in the CRP, such as through the Technical Cooperation Programme were also elaborated.

The meeting participants were addressed by the Section Head, Research Contracts Section at the IAEA, Ms Nathalie Colinet, who among others created awareness about Agency Coordinated Research Activities and a better understanding of administrative requirements including recent changes.

The following Chief Scientific Investigator institutions were represented in one way or the other: AGROCALIDAD, Agencia Ecuadoriana, de Aseguramento de la Calidad de agro, Ecuador; Botswana National Veterinary Laboratory; Central Laboratory for the Control of Food Safety (LCSSA), Benin; Departamento de Quimica, Universidad Nacional de Colombia; Division of Residue Chemistry, Office of Research, Centre for Veterinary Medicine, Food and Drug Administration of the United States of America; Facultad de Ciencias Veterinarias y Pecuarias (FAVET), Universidad de Chile; Faculty of Veterinary Medicine, Ss. Cyril and Methodius University, Macedonia, FYR; Institute of Quality Standards & Testing Technology for Agro-products, Chinese Academy of Agricultural Sciences; NARI Prof. John Kola Chemistry Laboratory, Papua New Guinea; National Research Council, Institute of Sciences of Food Production, CNR – ISPA, Italy; Nuclear Institute for Agriculture and Biology (NIAB), Pakistan Atomic Energy Commission; RIKILT Wageningen University & Research, The Netherlands; Servicio Nacional de Sanidad Agragria, Peru; Uganda National Bureau of Standards; Universidad Centroamericana/Instituto (CIDEA), Nicaragua; University of Almeira, Spain; University of South Africa.

Participants and staff at the first Research Coordination Meeting of the Project on Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods

Forthcoming Events

Research Coordination Meeting (RCM) of FAO/IAEA Coordinated Research Project (CRP)

Third RCM on the Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety. (D52038-CR-3), 9−13 October 2017, Vienna, Austria.

International Meetings/Conferences

Technical Panel on Phytosanitary Treatments of the International Plant Protection Convention (IPPC) (D2-TM-1700743), 17−21 July 2017, Vienna, Austria.

40th Session of the Joint FAO/WHO Codex Alimentarius Commission, 17−22 July 2017, Geneva, Switzerland.

19th Inter-Agency Committee on Radiation Safety (IACRS), 12−14 September 2017, Washington, DC, USA.

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

Past Events

FAO/IAEA Training Workshop on "Data Quality for Decision Making", San José, Costa Rica, 18−19 May 2017

Britt Maestroni

The FAO/IAEA Food and Environmental Protection Laboratory (FEPL) in collaboration with IAEA Technical Cooperation Project RLA/7/019 and the Centro en Contaminacion Ambiental (CICA), an IAEA collaborating centre, organized a training workshop on "Data Quality for Decision Making" in San José, Costa Rica, from 18 to 19 May 2017, immediately after the sixth Latin American pesticide residue workshop . The workshop was part of the post congress capacity building events, and targeted pesticides residue analysis. The purpose of the workshop was to present and share analytical and statistical strategies for the generation of accurate and reliable results for decision making processes, and to provide a forum for interdisciplinary networking between stakeholders in the farm-to-fork food chain.

The workshop was attended by 44 participants from 12 countries (Argentina, Brazil, Chile, Colombia, Costa Rica, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Spain and Uruguay). It focused on measures that should be implemented in an analytical laboratory to ensure quality of data for decision making. Lectures and round table discussions targeted quality assurance and quality control measures, method validation, uncertainty measurements, emerging contaminants guidelines for water quality, and statistics for the analytical laboratory.

Participants and staff in the FAO/IAEA training workshop on "Data Quality for Decision Making", held in San José, Costa Rica, 18−19 May 2017

The workshop was opened by the Technical Officer, followed by a round table introduction of the participants and their expectations from the workshop. Prof. Antonio Valverde, from the University of Almeria, Spain, discussed the European guidelines for analytical quality control in pesticide residue analysis (document SANTE/11945/2015) and the practical guidelines for estimation of measurement uncertainty in pesticide multi-residue analysis. Prof. Igor Olivares, from Sao Paulo University, Brazil, described the essential statistical concepts for successful data analysis and presented a statistical template for analysis of data from method

validation and for uncertainty estimation. Prof. Amadeo Fernandez-Alba, Director of the European Union Reference Laboratory for Pesticide Residues in Fruit and Vegetables, Spain, presented lectures on instrumental analysis and quality of the data obtained by gas chromatography and liquid chromatography coupled to tandem mass spectrometry, time of flight and orbitrap mass spectrometry. Prof. Horacio Heinzen, from the University of Uruguay, presented lectures on quality control for reliable results in pesticide residue analysis. Dr Maria Dolores Hernando, from the National Institute for Agricultural and Food Research and Technology (INIA) and Agrifood Research in Spain, presented case studies and a manual prepared for the determination of emerging contaminants in water and other environmental samples. Prof. Veronica Cesio, from University of the Republic, Uruguay, gave a presentation on validation and analytical performance and follow-up. Prof. Miriam Loewy, from Comahue University, Argentina, gave a short presentation of the work of the Red Analitica de Latino America y el Caribe (RALACA) committees.

All of the lecturers participated in open and round table discussions on calibration, preparation and storage of analytical standards, instrumental quality control, validation issues and procedures for reliable analytical data. The companies Thermo Fisher Scientific and Agilent also contributed topics on: Ion chromatography for analysis of polar pesticides, given by Dr Richard Fussell and Dr Sergio Guazzotti, and Retention time locking and backflush in gas chromatography coupled to mass spectrometry, given by Dr Leazar respectively. Statistical exercises were assigned to participants by Prof. I. Olivares as 'homework', with follow-up discussion on the second day of the workshop, which was well appreciated.

The FAO/IAEA workshop created an excellent opportunity to interchange experiences, methodologies and practical applications with respect to the generation of accurate and reliable data for decision making. The group discussions helped to identify current issues and challenges to improving the technical competence of analytical laboratories. The participants were satisfied with the training: 67% indicated that the discussion sessions were excellent and 27% that they were good; 58% indicated that the scientific content of the workshop was excellent and 33% that it was good, and had met their objectives.

Dr Richard Fussell and Dr Sergio Guazzotti at the FAO/IAEA workshop discussing ion chromatography for analysis of polar pesticides

Sixth Latin American Pesticide Residue Workshop (VI LAPRW), San José, Costa Rica, 14–17 May 2017

Britt Maestroni

The sixth LAPRW was held in San José, Costa Rica, from 14 to 17 May 2017. The congress was attended by almost 500 people from 44 countries. The LAPRW brought together regional and international experts in different areas related to pesticide residue work. In the area of monitoring, surveillance and environment different topics were discussed such as monitoring of pesticide residues in fresh fruits and vegetables, organic farming and milk-derived products, passive samplers for air and water, monitoring of herbicides, and water quality in cane sugar plantations and rivers. About 90% of the abstracts in this area of work were from Latin American researchers using simple or relatively advanced analytical equipment such as liquid chromatography or gas chromatography coupled to tandem mass spectrometry. However, none of the FAO/IAEA Latin American counterparts has currently access to high resolution and accurate mass technology.

123 posters were presented; four of which were selected as the best posters - of these two were from RALACA (Red Analítica de Latino America y el Caribe, see RALACA article) members. The best poster was awarded to the Uruguayan counterparts with the poster on "Multiresidue method for the determination of pesticides in Odonate Nymphs as ecosystem biomonitors" by Ms Florencia Jesus et al. , Universidad de la República UdelaR, Uruguay.

Mr Edwin Samir Barbosa from ICA, Colombia, presenting the technical study for the establishment of the maximum residue level of spinetoram in avocado

Another important topic covered during the LAPRW was the establishment of Maximum Residue Limits (MRLs) and the harmonization of the process in the LAC region. Colombia presented a complex study involving field trials that led to the establishment of MRLs for pesticides in avocado. Several plenary lectures from European and American speakers, including vendors, covered advancements in analytical technology such as orbitrap and time of flight technology for the analysis of pesticide residues in multiresidue and single residue methods as well as co-extractives analysis. Sample processing was also

discussed at length by several speakers as an important step in residue analysis. 48 posters dealt with method development and validation, 13 of these are from RALACA members. The plenary lectures and round table discussions around risk assessment were well attended and demonstrated the need for capacity building in the LAC area. In addition the risk evaluation is carried out in different ways in the different countries, demonstrating that more harmonization is needed. An example is risk assessment for glyphosate, where coadjuvants are not included in the assessment.

The LAPRW represented an excellent opportunity to learn about current technology, challenges and opportunities in the LAC region and a forum for interdisciplinary networking between stakeholders in the farm-to-fork food chain. The LAPRW provided an effective forum for creating awareness of the activities of the Latin American participants in food safety and contaminant analysis, for keeping abreast of technical and regulatory developments, and for the interchange of information and ideas.

Second General Meeting of Red Analítica de Latino America y el Caribe (RALACA), San José, Costa Rica, 15 May 2017

Britt Maestroni

The second general meeting of RALACA[1] took place on 15 May 2017 in a plenary session during the VI Latin American pesticide residue workshop (LAPRW2017) in San José, Costa Rica. RALACA had a stand at the LAPRW vendor venue where the assembly was promoted throughout the Congress.

More than 150 workshop participants attended the RALACA meeting. The purpose of the meeting was to present the aim and vision of RALACA, the structure of the organization, the work carried out by its committees, some accomplishments and administrative issues. The session comprised seven short presentations that covered what RALACA is, how it works by Ms M Loewy, by Mr P. Henriquez, an example of work flow as carried out by one of its committees (the Biomonitoring Committee) by Mr P. Macchi, the bank of analytical standards by Ms V. Cesio, the relationship of the RALACA work with two current regional IAEA TC projects (ARCAL RLA 7019 and 5068) by Ms P Gatti and Mr M. Masis and a view into the future by Ms B. Maestroni.

The meeting was concluded with a lottery, where three newly enrolled RALACA members received a RALACA t-shirt, and sample preparation consumables kindly donated to RALACA for this event by the company Scharlab, S.L, in the person of its General Manager Dr Pere Gallego.

RALACA will start producing an annual newsletter as of September 2017 which will be posted on the web page. RALACA will pursue the goal of becoming a legal entity in the form of an association with legal address in Panama. In addition, RALACA will start holding regular monthly webinars for its members on a range of the different topics. For more information, readers are directed to the RALACA web page.

Prof. Miriam Loewy presenting the development of RALACA over the years and the specific objectives of the work of RALACA

The meeting was well received and provided an excellent forum for interdisciplinary networking between RALACA and stakeholders in the farm to fork food chain. At the RALACA stand several brochures relating to the committees, photos, project materials, copies of the posters and information about RALACA were distributed and presented to congress visitors. RALACA's work is progressing and the network is being recognized worldwide. Two RALACA posters were awarded best poster presentations:

1) Use of an Ecotoxicological Model and Bioindicators for the Management of Aquatic Systems in Agricultural Basins in Latin America and Caribbean by Ana Cecilia Dufilho; Pablo Macchi; Luis Medina; Rodrigo Palma Troncoso; Verónica Cesio; Silvina Niell, Jorge Cuadra Leal, and Elisandra Hernandez Hernandez. RALACA participants are from Argentina, Chile, Uruguay and Guatemala. The poster was the summary of the results achieved under project RLA/7/019, the product of the monitoring work of these countries in their own basins and the formative and collaborative instances on modelling, implemented during the project.
2) Multiresidue method for the determination of pesticides in Odonate Nymphs as ecosystem biomonitors by Florencia Jesús; Ricardo Hladki; Natalia Gérez; Natalia Besil, Silvina Niell; Grisel Fernández; Horacio Heinzen and Verónica Cesio. RALACA participants are from Uruguay. The poster presents the result of the advances on ecotoxicological work obtained in the frame of TCP RLA/7/019 merged with the analytical aspects.

The RALACA second general meeting was an important milestone in the process of gaining international recognition. 62 new applications to join RALACA have

[1] www.red-ralaca.net

been received from Institutes in Latin America, indicating that the network is dynamic and expanding. In the meeting it was stated that RALACA invites analytical laboratories and associated institutions in the Latin America and Caribbean countries to join the network. RALACA also invited recognized analytical laboratories and associated institutions in other areas of the world to participate in its advisory group in each of the specific committees. Finally RALACA welcomed the support of the private sector and donor and/or technical cooperation agencies to be able to generate viable research proposals for the region and address local challenges through an integrated and sustainable strategy.

The team present on stage at the second general meeting of RALACA. From left to right Dr P. Henriquez from CChen, Chile, Ms B.Maestroni, FAO/IAEA, Austria, Prof. M. Loewy, University Comahue, Argentina, Dr P.Macchi, CITAAC, Argentina, Dr P.Gatti, INTI, Argentina, Prof. V Cesio, Udelar, Uruguay and Dr M.Masis, CICA, Costa Rica

A considerable number of individuals who had previous or current interactions with the FEPL through Technical Cooperation Projects, Coordinated Research Projects, RALACA, or as participants in training workshops were present at the LAPRW. There was considerable interest in the work of the Agency in capacity building, including opportunities for potential collaboration with several partners. Participation in the LAPRW was of direct benefit to the work of FEPL and, ultimately, to the Member States.

Authent-Net Mid-Term Conference, Parma, Italy, 11−12 May 2017

Simon Kelly and Andrew Cannavan

Authent-Net is a two-year European Horizon 2020 project, it has been built to facilitate sustainable cooperation between national and international research funding bodies. It works in the area of food authenticity and aims to improve competitiveness in the food supply chain and maintain consumer confidence, by means of better-coordinated, cost-effective R&D.

Information on Authent-Net is available on its website[2], the consortium consists of 19 partners from 12 countries and has considerable expertise in various aspects of food authenticity. The Food and Environmental Protection Laboratory is a partner in the project.

It is acknowledged that historically anti-food fraud capability within Europe has not been consolidated and lacks the coordination and support structures available to those working in food safety. There are various initiatives underway to redress this balance, e.g. DG Sante's Food Fraud network, DG Research's FoodIntegrity project, as well as numerous national programmes and industry initiatives. One pivotal area that still needs to be addressed is bringing together national research funding bodies to facilitate the development of transnational research programmes. Authent-Net will address this need by mobilising and coordinating relevant research budget holders in order to facilitate the eventual development of a transnational European funding vehicle that will allow EU Members States (MS) to jointly fund anti-fraud research.

The mid-term Authent-Net conference was held in Parma from 11 to 12 May 2017, with approximately 30 participants representing 19 project partners. The objectives of the meeting were to track the progress of project, ensuring that the overall aims and objectives are being met, to form further synergies and collaborative networks and to get feedback from Member State funding organisation representatives on how the project outputs are addressing their needs. The EU Commission's Project Officer also attended the meeting to evaluate progress. To date, Authent-Net Partners have collated, analysed and summarised the state-of-the-art in relation to knowledge base, existing initiatives and capabilities on food authenticity which are aimed to tackle food fraud in Europe. The group of experts have identified a range of existing resources, including national and international projects, reports, papers, publications, databases, standards, regulations; and from it they have developed 11 National status reports which detail commodity and country profiles in respect to food authenticity, integrity and traceability.

The kick-off meeting for the standardization process "Authenticity in the feed and the food chain - General principles and basic requirements" was held to start the process of creating consensus-based recommendations for definitions of key terms and concepts related to food authenticity, and to provide recommendations for "best practice" underlying future communication and work related to food authenticity, which will be compiled in a Low-level European voluntary standard (CWA). During the meeting, the terms to be defined were selected, and this information was passed on for transmission by a project partner to the Codex Alimentarius Commission to promote harmonisation of the guidelines at an early stage in their development.

[2] http://www.authent-net.eu/

Fourth FoodIntegrity Conference, Parma, Italy, 10–11 May 2017

Simon Kelly and Andrew Cannavan

The FoodIntegrity Conference is the annual meeting of the EU-funded project FoodIntegrity - Assuring quality and authenticity in the food chain, in which the Food and Environmental Protection Laboratory (FEPL) is a partner. The aim of the project is to build capabilities to fight food fraud and to assure the authenticity, safety and quality of European food. It involves producers, industry, retailers, public administration, control bodies, NGO's, analytical laboratories and researchers. The theme for the 2017 conference was 'Turning science into solutions and everyday practices'. The conference included sessions on 'Food fraud – stakeholder implications and mitigation', 'New solutions for identifying emerging risks', 'Rapid and confirmatory analytical solutions', a 'Fast science' session on first outcomes from the new work packages introduced in 2016, including presentations from six young FoodIntegrity scientists, and a workshop on 'Good risk management requirements, trust in labels-claims and best practices'. There were also poster sessions and a number of vendor workshops. The conference had approximately 350 participants from all over the world.

Mr Kelly participated in the organisation and implementation of an interactive exercise within the 'Good risk management requirements' workshop, focusing on the economic importance, promotion and protection of protected designation of origin (PDO), protected geographical indication (PGI) and organic foods.

Moderators in the interactive FoodIntegrity workshop

The fourth annual meeting of the FoodIntegrity project consortium was held in conjunction with the conference. The FEPL is active in work packages 1 (Food Integrity Newtork), 2 (Knowledge Base), 10 (Industrial Integration) and 11 (Dissemination and Knowledge Transfer). In discussions surrounding the consortium meetings, it was decided to ask Mr Kelly to take over as leader of work package 1 for the remainder of the project, considering his previous involvement in the design of the project and significant contributions to the various work packages to date. Mr Kelly accepted this role.

Participants in the interactive FoodIntegrity workshop

The FoodIntegrity Conference was a very successful event, demonstrating the widespread interest in the topics of food authenticity, integrity and safety. The project is progressing as planned, with many outputs already demonstrable or approaching completion, as presented in several lectures and posters at the conference. The connection of the European network to countries outside Europe, via the FEPL involvement, will benefit FAO and IAEA Member States in the near future.

More information on the FoodIntegrity project can be found on the project web pages[3].

49th Session of the Codex Committee on Pesticide Residues (CCPR49), Beijing, China, 24–29 April 2017

Zhihua Ye

The Technical Officer represented the IAEA, provided information and participated at the CCPR49. In doing so, he participated at all Committee sessions, including a side event on "Codex Maximum Residue Levels (MRLs): the Need and Initiatives of Increasing the Capacity of the Joint FAO/WHO Meeting on Pesticide Residues (JMPR)".

The Food and Environmental Protection Section (FEP) of the Joint FAO/IAEA Division has been very active in Codex related activities and continued its efforts to work with member countries to support and improve food safety and control systems through the application of nuclear and related analytic technologies. Key items of interest to the CCPR were the analysis and control of various chemical residues in agricultural products by applying nuclear and isotopic analytical methods. As a part of our subprogramme on Improvement of Food Safety and Food Control Systems, FEP continues to support member countries in their application of Codex food safety standards and we also encourage the adoption of Codex MRLs as part of national and regional food control systems.

[3] https://secure.fera.defra.gov.uk/foodintegrity/index.cfm

On the representation of the IAEA, an updated information (see the Report on page 39) paper on the recent activities of the Joint FAO/IAEA Division relevant to the work of CCPR, including coordinated research, technical cooperation, networking, technology transfer and training on food safety analysis.

Based on the information paper, the Technical Officer made a report at the *Plenary Session of Matters of Interest Arising from Other International Organizations*, and provided highlights on development and application of analytical methods for pesticide residues with nuclear and related techniques, especially a new Coordinated Research Project on *Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods.* This new project was designed and planned in 2016 and is being initiated this year, with its first Research Coordination Meeting scheduled to take place from 19 to 23 June 2017, at the IAEA Headquarters in Vienna, Austria. An international network of participant laboratories and institutions is being selected for collaboration. The research network will develop systematic programmes for measuring mixtures of contaminants and residues and develop necessary multi-class analytical methods.

At this meeting, the Joint FAO/IAEA Division provided technical support to the CCPR Working Group (EWG) on Performance Criteria Specific for Methods of Analysis for the Determination of Pesticide Residues. Detailed comments and suggestions on amendment of the *Draft Guidelines on Performance Criteria for Methods of Analysis for the Determination of Pesticide Residues in Food* were submitted to the Working Group and 16 out of the 19 comments/suggestions were accepted by the Committee of CCPR at its 49th Session.

Mr Zhihua Ye giving highlights of recent activities of the Joint FAO/IAEA Division relevant to the work of CCPR

The Technical Officer was happy to report that the Joint FAO/IAEA Division will continue to support, develop and promulgate the standards of the CCPR and to work with member countries to enhance food safety and control systems.

Several delegations, especially from African countries such as Uganda and Kenya, expressed their appreciation to the IAEA and the Joint Division for continued support and contribution to capacity building of food safety analysis in the developing countries as a top priority.

The Chairman of CCPR 49 on behalf of the Committee also expressed his appreciation to the Representative of the IAEA for the useful information provided on the remarkable activities and continued support to capacity building and Codex work of CCPR member countries.

22nd Meeting of the Defra Authenticity Analytical Methods Working Group (AMWG), London, UK, 19 April 2017

Simon Kelly

The 22nd Meeting of the UK's Department for Environment Food and Rural Affairs (Defra) – Food Authenticity Analytical Methods Working Group (AMWG) took place in Defra's Headquarters in London on 19 April 2017. This is a peer review committee that advises on the science and methodology commissioned by Defra and provides a quality assurance function to ensure methods being developed are relevant and fit for purpose. The group is comprised of representatives from the UK National Competent authorities (Defra and the Food Standards Agency), food industry, enforcement bodies, consumer organisations and academia to ensure balance and focus. Mr Simon Kelly sits on the working group to advise on stable isotope methodology and to provide general input into the review of food authenticity analytical methods, quality control procedures, standard operating procedures sampling protocols, the direction of research requirements and intelligence on food fraud. The meeting reviewed a number of important issues and projects including:

- future food authenticity priorities and emerging technical challenges,
- the development of isotopic fingerprinting techniques to verify the production origin and geographical origin of food and feed,
- development of metagenomic methods for determination of origin,
- evaluation of quantitative molecular biology methods,
- liquid chromatography targeted mass spectrometry method to determine the animal origin of gelatine - transfer to a high throughput, low cost platform with single lab validation.

The meeting also gave rise to a number of useful strategies that could potentially be adopted by the FEPL in the areas of food authenticity sampling protocols, standard methods and project reviewing procedures. Discussions with the

working group members during the meeting also gave rise to a number of potentially beneficial collaboration opportunities.

Codex Committee on Contaminants in Foods (CCCF), Rio de Janeiro, Brazil, 3–7 April 2017

Carl Blackburn

Representing the Joint FAO/IAEA Division at the 11th CCCF meeting involved presenting a report[4] on the Joint FAO/IAEA Division activities relevant to the committee, contributing tehnical input to a number of standards and also providing a side-event.

The Joint FAO/IAEA Division has been keeping IAEA radiation safety standards committees and the Codex Alimentarius informed of developments related to radionuclides in food. For example, this has included the new IAEA Technical Document entitled *Criteria for Radionuclide Activity Concentrations for Food and Drinking Water* (IAEA-TECDOC-1788)[5].

In the light of the considerable interest expressed at a previous meeting of this Codex Committee on Contaminants in Foods a side event was provided at this meeting in Brazil. The event was entitled "Radionuclides in Food: Standards, New National Guidance and Recent Developments". It was arranged by the Joint FAO/IAEA Division and the presenters were experts from international organizations; the IAEA; the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD); and the Joint FAO/IAEA Division.

This side event was attended by over 60 delegates and subsequent feedback has been very positive with many participating countries seeking copies of the presentations. The Joint FAO/IAEA Division will participate at this year's meeting of the Codex Alimentarius Commission and will offer to arrange a similar side event at a future Commission meeting.

The 11th CCCF Meeting

[4] Written report available as item 4 at http://www.fao.org/fao-who-codexalimentarius/meetings-reports/detail/en/?meeting=CCCF&session=11

[5] http://www-pub.iaea.org/MTCD/publications/PDF/TE-1788_web.pdf

Food Safety as a Vital Component of Food Security, Brussels, Belgium, 30–31 March 2017

Britt Maestroni

The Technical Officer presented a key note speech at the International Life Sciences Institute (ILSI) annual symposium 2017.

The ILSI annual symposium was attended by over 100 international participants, it was opened by Professor. Alan R. Boobis, ILSI Europe, Belgium. He explained that ILSI is an organization that fosters collaboration among scientists from across industry, academia and intergovernmental bodies in order to produce the best research in food safety and nutrition sciences.

The ILSI currently runs 20 different research projects in different scientific domains ranging from food safety, toxicology, microbiology and nutrition to consumer behaviour. The annual symposium provided the attendees with a multidisciplinary perspective on the societal and scientific challenges of the current food safety, microbiological and nutrition status.

Ms B. Maestroni presenting a key note speech on Food Safety as a vital component of food security at the ILSI annual symposium 2017

The key note speech on "Food Safety as a vital component of food security" highlighted the central role played by analytical laboratories in providing end product testing and advice in the context of food control systems and ensuring food security. Speakers included Dr Ana Canals Caballero from AECOSAN, Spain, who discussed food safety, risk assessment, consumers and sustainability. Dr Bert Popping, Scientific Advisor, Previously of Institut Mérieux, France, discussed 'Personalisation – New Tools' in the area of food safety, and Prof. Lynn Frewer of Newcastle University spoke about 'Food Safety and Consumers'. A second session on healthy ageing featured Prof. Mark Hanson, University of Southampton and Prof. Louise Dye, University of Leeds. Prof. Hannelore Daniel spoke about microbiota. Prof. Philip Calder, University of Southampton, discussed ILSI Europe's work on markers.

Authent-Net Meeting & Workshop, European Joint Research Centre, Geel, Belgium, 15−16 March 2017

Simon Kelly

It is acknowledged that historically anti-food fraud capability within Europe has not been consolidated and lacks the coordination and support structures available to those working in food safety. There are various initiatives underway to redress this balance e.g. DGSanté's Food Fraud network, DG Research's FoodIntegrity project, as well as numerous national programmes and industry initiatives. One pivotal area that still needs to be addressed is bringing together national research funding bodies to facilitate the development of transnational research programmes. Authent-Net is a two-year European Union Horizon 20-20 research and innovation project addressing the gap in transnational food authenticity research programmes. The Joint FAO/IAEA Division's Food and Environmental Protection Laboratory (FEPL) is a partner in this project providing the international dimension to the European partners. The meeting at the European Joint Research Centre in Geel was designed to enhance the cohesion between national funding bodies and to obtain Member State funding body feedback on Authent-Net progress and key outputs. The Member State representatives were asked to provide information on their willingness to collaborate; their views on the National and commodity food fraud status reports produced by the consortium; their 'end user' needs for the Food Authenticity Research Network Hub (website); their views on the proposed secure space for national funding bodies to exchange confidential information on food fraud and the proposal for a European funding platform (ERA-NET) proposal to the European Commission.

The Jack Pearce Memorial Lecture, Belfast, UK, 24 February 2017

Andrew Cannavan

Jack Pearce (1942–2016) was Professor of food science at Queen's University Belfast (QUB), UK, a past President of the Institute of Food Science and Technology (IFST) and a leading member of the team handling radiological food safety in the UK in the aftermath of Chernobyl, providing specialist advice to the UK and European administrations on remedial action, testing and countermeasures to protect meat and milk production. Prof. Pearce was widely recognised as an outstanding scientist and strategic thinker. He collaborated with the IAEA in a number of fields, notably in the follow-up to Chernobyl, and in food irradiation.

On 24 February 2017, as part of the Northern Ireland Science Festival, the Royal Chemical Society (RSC) and the IFST hosted a memorial lecture in QUB to celebrate Prof. Pearce's life and work. Mr Cannavan, Head of the Food and Environmental Protection Laboratory, was invited to give the lecture.

Prof. Maureen Edmondson, IFST President, welcomed a capacity audience of over 100, including Prof. Pearce's widow Edith, her son Ian, and many of the professor's friends and former colleagues and paid tribute to Prof. Pearce on professional and personal levels. Mr Cannavan then presented the lecture, which was entitled 'Food Integrity – the Nuclear Option'. The lecture interwove aspects of the work of Prof. Pearce and his colleagues with modern developments related to the application of nuclear techniques to food authenticity and safety. Acknowledging that the public is often suspicious of issues related to radiation, Mr Cannavan emphasized the beneficial contributions of nuclear sciences and technologies, including food irradiation and nuclear and related analytical techniques, to food safety. The multiple crises faced by the Japanese government following the earthquake, tsunami and nuclear accident at Fukushima in 2011 were described, as well as the experiences of the Joint FAO/IAEA Food Safety Assessment Team, led by Mr Cannavan, which visited the area shortly after the incident and the ongoing roles of the IAEA and the FAO. The complex subject of food authenticity was addressed, with examples of its subversion through food fraud. Examples were presented of FAO/IAEA capacity building and research in the application of stable isotope ratio analysis, metabolomics, vibrational spectroscopy and other techniques in combination with chemometrics, for example to origin studies in poultry and authenticity studies for fruit juices, honey and edible birds nest.

Left to right: Maureen Edmondson, Ian Pearce, Edith Pearce, Paul Stevenson, Andrew Cannavan

The talk drew many varied questions – from the science of the experiences in Japan to what consumers could do to avoid being duped by food fraud. Take-away messages included looking forward to the deployment of hand-held devices to 'fingerprint' food and compare with spectral libraries in 'the cloud' via smart phones to check nutrition,

safety and authenticity, and the well curated databases needed for such a vision.

Prof. Paul Stevenson, Chair RSC NI Section concluded the event, recalling Prof. Pearce's contributions to RSC amongst his other achievements.

Exploratory Workshop: Isotopic Techniques in Food Characterization, Jožef Stefan Institute, Department of Environmental Sciences, Ljubljana, Slovenia, 7–9 December 2016

Simon Kelly

This exploratory workshop was dedicated to the exploration of new directions and emerging topics in the field of isotope ratio mass spectrometry (IRMS) and its application to food science. The aim was to bring together experts from various backgrounds including public research institutes, universities, and the private sector, but all devoted to the study of isotopic techniques for the origin and authenticity characterisation of food. Mr Simon Kelly from the Joint FAO/IAEA Division's Food and Environmental Protection Laboratory was invited to give a lecture on the application of stable isotope analysis to the confirmation of organic and Halal food authenticity. This is an emerging area of food production claims that places a significant burden of proof on producers and suppliers for ethical and religious reasons.

Simon Kelly presenting applied research on the application of stable isotope analysis to confirm the authenticity of organic and Halal food

The presentation was well received by the delegates and stimulated a great deal of debate about the challenges of authenticating a multi-faceted labelling claim such as 'organic'. The workshop was organized as a series of plenary lectures, oral and poster communications designed to create a platform for sharing of knowledge, experiences, good practices and cooperation among experts and aimed to define the state-of-the-art in instrumentation, methodologies and applications in isotope ratio mass spectrometry in food authentication, traceability and fraud detection.

Coordinated Research Projects

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

First RCM of Joint CRPs (D52040 and G42007) on "Field-Deployable Analytical Methods to Assess the Authenticity, Safety and Quality of Food", Vienna, Austria, 15–19 May 2017

Simon Kelly, Andrew Cannavan and Iain Darby

The Joint FAO/IAEA Division, in collaboration with the Division of Physical and Chemical Sciences, held the inaugural Research Coordination Meeting (RCM) for an international Coordinated Research Project (CRP) to exploit and adapt portable atomic and molecular spectroscopic screening technologies for front-line food fraud detection at the IAEA Headquarters from 15 to 19 May 2017. The meeting participants comprised eight contract holders (from China, India, Malaysia, Morocco, Russian Federation, Singapore, Sri Lanka and Uganda), five agreement holders (from Austria, Belgium, Sweden, United Kingdom and the United States of America) and five observers representing the UN Food and Agriculture Organisation (Italy), the European Joint Research Centre (Belgium), Perkin Elmer (USA), Queen's University Belfast (N. Ireland) and the Semenov Institute of Chemical Physics (Russian Federation).

This joint CRP (Coordinated Research Project) strives to close the gap between instrumental capabilities found in research labs and technologies that can be easily used by various national gate-keepers in developing countries, such as national customs authorities and food regulators. The opportunity to accomplish this ambitious goal stems from a rapid and on-going reduction in analytical equipment price and a rapid increase in portability. Throughout the last decade the analytical tool industry has delivered new families of handheld, portable and transportable tools. Previously portable devices that have become handheld include Near Infra-Red, Raman, X Ray Fluorescence and Laser Induced Breakdown spectrometers and previously bench-top laboratory instruments that have become 'field' transportable include low-field Nuclear Magnetic Resonance, Mass Spectrometers and Multi-Spectral Imaging equipment. Nuclear techniques such as Ion-Mobility Spectrometry, wildly used to detect drugs and explosives by the security services, also have the potential to be deployed to detect food authenticity and safety issues such as the onset of mould in grains, pulses and nuts. The danger caused by economically motivated adulteration (EMA) of food varies according to the scale, nature and severity of the particular food extension or substitution. Whilst criminality that results in physical harm to consumers will always remain of the greatest concern, financial detriment and barriers to international trade are more likely scenarios. Nevertheless, gross adulteration of foods in developing countries is often accompanied by a significant unintended risk to human health. Recent examples include excessive methanol in spirit drinks and harmful substances in dietary supplements.

The first joint RCM was formally opened by Mr Zhihua Ye (Section Head of the Food and Environmental Protection Section) who stressed the importance of developing rapid and cost-effective methods for developing countries to screen food for adulterants and contaminants that could pose a risk to human health. Mr Ye also stressed the significance of the joint CRP, between the Food and Environmental Protection Laboratory (FEPL) and the Nuclear Sciences Instrumentation Laboratory (NSIL), bringing together significant expertise from within the Agency to fulfill a challenging goal of implementing field-based testing methods in food authentication and safety. Supporting introductory comments were also made by Mr Iain Darby (Acting Laboratory Head of the NSIL) and Mr Andrew Cannavan (Head of the FEPL). Mr Jose Almirall chaired the meeting with Mr Gabriel Kasozi acting as Rapporteur. Mr Simon Kelly acted as Scientific Secretary and introduced the background, scope and objectives of the CRP to the participants.

The meeting included previous relevant research and the proposed workplan presentations from each of the contract holders and technical presentations from each of the agreement holders. The Agreement Holders and observer's technical presentations were on a range of topics of relevance to the contract holders. These presentations reinforced understanding of the principles of food authentication using rapid laboratory and field-based screening techniques as well as providing case studies of how the data generated can be applied in actual food authentication situations. The insights provided by the Agreement Holders helped the Contract Holders re-formulate their own workplans for the first phase of their respective projects. Additional seminars were given Mr Anders Nordgard and Mr Pierre Dardenne about the challenges of authentic food sampling for food spectroscopic studies.

Group sessions in the "World Café" format were then held to evaluate and refine the original workplans and to identify gaps and solutions in sampling, analysis and interpretation. Each Research Contract Holder's phase 1 workplan was reviewed by the consortium using the World Café session to ensure that high scientific standards and the objectives of the CRP 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 contract holders' workplans for the next phase of the project were reformulated to strengthen the development of sampling plans, analytical techniques, improvement of datasets/databases and networks, and outlining SOPs for optimizing database construction and statistical analysis to

fulfill the objectives of the joint Coordinated Research Project. The list of common barriers identified in the Word 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. Additional brain-storming sessions were held on portable lab design and the information and meta-data required for sampling and database construction.

The focus of the first phase of the project is to ensure, sufficient sampling, consistency of methods and data quality between participants so that the ultimate goal of generating a sustainable database in vegetable oil and milk powder atomic and molecular spectroscopic parameters can be achieved. It was recommended by the meeting that the IAEA should consider the possibility of hosting and maintaining the vegetable oil and milk powder database from this CRP to ensure its sustainability and legacy in a similar way to the "Water Isotope System for data analysis, visualization and Electronic Retrieval (WISER)" maintained by the Water Resources Programme. All participants emphasized the need to communicate regularly and recommended that the IAEA and the FAO should support raising awareness of the CRP activities through appropriate channels and place extra resources into funding these activities.

RCM participants in the courtyard of the Vienna International Centre

Second RCM of CRP (D61024) on the Development of Electron Beam and X ray Applications for Food Irradiation (DEXAFI), Aérial, Illkirch, near Strasbourg, France, 27–31 March 2017

Carl Blackburn

The second Research Coordination Meeting (RCM) of the Coordinated Research Project (CRP) on the Development of Electron Beam and X ray Applications for Food Irradiation (DEXAFI) was held at Aérial, located in the Innovation Park, at Illkirch near Strasbourg. Aérial[6] was founded in 1985 with applied research programs on food irradiation, it is a not for profit Technology Resource Centre and Technical Institute for Food Industry. The organization is also an IAEA Collaborating Centre. The meeting was held to review and discuss progress of each participating institution and of the CRP as a whole; to review the results of the dosimetry inter-comparison exercise that Aérial had coordinated and implemented, and; plan for the next phase of research. The meeting was chaired by Dr Alain Strasser (Director of Aérial), with Florent Kuntz (Aérial) as deputy chair and Peter Follett (USDA-ARS) was the meeting rapporteur.

An introductory presentation was provided by Mr Nicholas Menenses of the Swiss food-engineering group Bühler. He provided a presentation on the company's approach to dried food & food ingredient decontamination using low-energy EB. For selected products, low-energy EB provides gentle surface decontamination of foods without impacting the quality of the inner food matrix. Bühler have developed a compact and portable EB machine that can be easily integrated in the processing lines of small and large food processors. A prototype will be installed in April 2017 at a spices processor in Germany. This is viewed as one of the most promising non-thermal technologies for decontamination of dry foods.

RCM participants at Aérial, Strasbourg, France

After the opening session, the meeting received and reviewed reports from CRP participants. Progress reports from fifteen of the sixteen participating institutions were presented and discussed. It was concluded that there is increasing world-wide interest in the use of low and high energy electron beams and also X rays in food technology. It was noted that commercial applications are beginning to emerge; for example the use of low energy electron beams for surface decontamination at a spice company in Germany.

Research is progressing in five main areas of: Microbiological effects of low energy electron beams (including their use as surface treatments); phytosanitary irradiation issues (including the Effects of electron beams on insect pests and host products); modelling studies (e.g.

[6] http://www.aerial-crt.com/en.html

for optimal configuration, real-time density mapping and also assessment of induced radioactivity); development of irradiation protocols, and; improved dosimetry methods for low energy electron beams and X rays.

The research network has been firmly established and participants are working towards the common goal of meeting the objectives of the CRP to accelerate research and development to facilitate the implementation of practical techniques using electron beams and X rays to unlock the potential of "machine source radiations" for treatments of agricultural and food products.

The Aérial, and its accredited Dosimetry Laboratory also provided RCM participant institutes with an opportunity to confirm or improve their dosimetry practices. This initiative was generously taken forward by Aérial in their capacity as an IAEA Collaborating Centre. In this regard, Aérial provided a dose inter-comparison exercise and also held practical dosimetry exercises. This was very much appreciated by the participants who expressed their gratitude at the meeting.

Technical Cooperation Projects

Country/Region	Project No.	Title	Technical Officer
Bahrain	BAH5001	Determining Pesticide and Mycotoxin Residues in Water and Food	J.J. Sasanya Z. Ye
Bangladesh	BGD5031	Strengthening Capacities to Monitor and Control Veterinary Drug Residues in Foods of Animal Origin	J.J. Sasanya
Belize	BZE5007	Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority	B.M. Maestroni G. J. Viljoen
Benin	BEN5009	Monitoring Safe Food Supply through Total Diet Studies and the Application of Nuclear and Complementary Analytical Techniques	J.J. Sasanya
Botswana	BOT5014	Enhancing the Use of Nuclear and Isotopic Analytical Techniques in Monitoring Chemical Food Contaminants	J.J. Sasanya
Central African Republic	CAF5007	Enhancing Laboratory Capacity to Control Chemical and Bacteriological Hazards in Foodstuffs of Animal Origin	J.J. Sasanya
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
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

Country/Region	Project No.	Title	Technical Officer
Costa Rica	COS5033	Assessing and Implementing Biochar Use in Climate Smart and Environmentally Friendly Pineapple Production Using Isotopic Techniques	C.M. Blackburn A. Cannavan M. Zaman
China	CPR5022	Implementing the Stable Isotope Technique for High Quality Agro-product Traceability and Authenticity	A. Cannavan S. Kelly
Dominica	DMI5001	Enhancing Capacity to Monitor Agrochemical Residues in Foods and the Environment	J.J. Sasanya
Ecuador	ECU5028	Consolidating Food Security and Environmental Sustainability in Palm Oil Production Using Nuclear Applications	B.M. Maestroni A. Cannavan J. Adu-Gyamfi
Egypt	EGY5026	Establishing a National Reference Laboratory Applying Nuclear/Isotopic and Related Techniques in the Analysis of Food Contaminants	J.J. Sasanya
Guatemala	GUA7004	Developing Capabilities to Evaluate the Transfer and Fate of Water Pollutants to Improve the Management of Major Basins and the Safety of Agricultural Products	B.M. Maestroni
Haiti	HAI5006	Increasing Productivity and Exportability in the Agricultural Sector through Soil and Water Management and Food Safety Monitoring	C.M. Blackburn J. Adu-Gyamfi
Inter-Regional	INT5154	Improving Food Safety through the Creation of an Interregional Network that Produces Reliable Scientific Data Using Nuclear and Isotopic Techniques	J.J. Sasanya
Iraq	IRQ5021	Developing Food Safety and Assurance System Using Nuclear and Other Related Technologies	J.J. Sasanya A. Cannavan S. Kelly
Libya	LIB5012	Using Nuclear and Complementary Techniques for Monitoring Agrochemical Residues in Food Products and the Environment	J.J. Sasanya
Malaysia	MAL5030	Strengthening National Technical Capability in Food Traceability of Edible Birds Nest through the Application of Nuclear and Related Technologies	A. Cannavan S. Kelly Z. Jandric

Country/Region	Project No.	Title	Technical Officer
Marshall Islands	MHL7001	Developing a National Radioactivity monitoring Capacity	J.J. Sasanya I. Osvath (NAEL)
Mauritius	MAR5024	Building Capacity to Analyse Veterinary Drug Residues and Related Chemical Contaminants in Animal Products	J.J. Sasanya
Mauritania	MAU5005	Strengthening of Laboratory Capacity to Monitor Natural, Chemical and Microbial Food Contaminants	J.J. Sasanya
Morocco	MOR5036	Valorizing and Improving the Quality of Food Products by Using Irradiation Techniques	C.M. Blackburn
Mozambique	MOZ5006	Building Laboratory Capacity for Food Safety Using Nuclear/Isotopic and Complementary Analytical Techniques	J.J. Sasanya
Namibia	NAM5013	Assessing the Spatial Distribution of Lead, Cadmium and Selected Pesticide Residues in Livestock Farming	A. Cannavan J.J. Sasanya
Niger	NER5020	Building Capacity at the Central Laboratory (LABOCEL), Niamey, for Control of Food Products of Animal Origin	J.J. Sasanya
Nigeria	NIR5039	Enhancing Dietary Exposure Assessment of Chemicals in Food	J.J. Sasanya
Oman	OMA5003	Strengthening National Capabilities in Food Safety and Food Traceability	B.M. Maestroni J.J. Sasanya 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 C.M. Blackburn
Senegal	SEN5038	Strengthening Laboratory Capabilities for Analysing Veterinary Drug Residues and Contaminants in Food	J.J. Sasanya A. Cannavan

Country/Region	Project No.	Title	Technical Officer
Sierra Leone	SIL5016	Strengthening Laboratory Capabilities to Evaluate and Monitor Levels of Mycotoxins, Toxic Metals and Related Contaminants in Foods	J.J. Sasanya
Sri Lanka	SRL1008	Providing Technical Support for Smooth, Safe and Sustained Operation of the Multipurpose Gamma Irradiation Facility	C.M. Blackburn
Sudan	SUD5035	Establishing a Laboratory for Monitoring Veterinary Drug Residues and Prohibited Substances in Livestock and Livestock Products through Application of Nuclear and Related Techniques to Protect Public Health	J.J. Sasanya A. Cannavan
Syria	SYR5023	Enhancing Analytical Capacities of Major Pesticide Residues	B.M. Maestroni 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
Uganda	UGA5034	Strengthening National Capacity for Testing and Monitoring of Drug Residues in Animal Feeds and Animal Products	J.J. Sasanya
Uganda	UGA5039	Enhancing the Monitoring of Veterinary Drug Residues, Related Chemicals and Natural Food Contaminants	J.J. Sasanya
Tanzania	URT5033	Establishing the Feasibility of an Irradiator Facility	C.M. Blackburn
Zambia	ZAM5030	Establishing a National Mycotoxins Monitoring Programme	J.J. Sasanya
Africa	RAF1006	Facilitating the Commercial Application of Irradiation Technologies	G.J. Hallman S. Sabharwal (NAPC) C.M. Blackburn
Africa	RAF5067	Establishing a Food Safety Network through the Application of Nuclear and Related Technologies	J.J. Sasanya A. Cannavan
Africa	RAF5078	Establishing a Food Safety Network through the Application of Nuclear and Related Technologies, Phase II	J.J. Sasanya
Asia	RAS5071	Strengthening Adaptive Climate Change Strategies for Food Security through the Use of Food Irradiation (RCA)	C.M. Blackburn

Country/Region	Project No.	Title	Technical Officer
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 G. J. Viljoen
Asia	RAS7026	Supporting the Use of Receptor Binding Assay (RBA) to Reduce the Adverse Impacts of Harmful Algal Toxins on Seafood Safety	M.Y. Dechraoui Bottein (NAEL) A. Cannavan
Latin America	RLA5065	Improving Agricultural Production Systems Through Resource Use Efficiency (ARCAL CXXXVI)	B.M. Maestroni L.K. Heng J. Adu-Gyamfi
Latin America	RLA5066	Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food	C.M. Blackburn
Latin America	RLA5069	Improving Pollution Management of Persistent Organic Pollutants to Reduce the Impact on People and the Environment (ARCAL CXLII)	J.J. Sasanya B.M. Maestroni
Latin America	RLA7019	Developing Indicators to Determine the Effect of Pesticides, Heavy Metals and Emerging Contaminants on Continental Aquatic Ecosystems Important to Agriculture and Agroindustry (ARCAL CXXXIX)	B.M. Maestroni E.T. Vasileva-Veleva (NAEL)

Regional Asia-Pacific Training on Basic Maintenance and Troubleshooting for Food Safety Analytical Instrumentation, Singapore, 20–24 May 2017

James Sasanya

The training event was hosted by the Agri-food and Veterinary Authority (AVA) and attended by thirty participants from Bangladesh, Lao PDR, Lebanon, Malaysia, Mongolia, Oman, Papua New Guinea, Philippines, Sri Lanka, Singapore, Thailand and Viet Nam. The aim of the training arranged under the framework of the non-agreement regional project RAS5078 "*Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants*" was to develop and/or enhance capabilities for effective and optimum use of analytical instrumentation in Member States. Both the Ministry of Foreign Affairs, Singapore and AVA played a central role in the organisation, co-funding and implementation of the training and this is highly commendable.

Participants benefitted from lectures to improve practical knowledge on: diagnosis, troubleshooting and basic maintenance as well as better handling of costly instrumentation; capability to solve less complicated problems and improving instrument longevity. Mechanisms for identifying common causes of instrument troubles, and whether an instrument-related problem is real, perceived, inevitable or self-inflicted, were also addressed. Software issues and analytical sample preparation in the context of instrument troubleshooting and maintenance were also presented and possible solutions provided.

The participants also received training from four instrument vendors (Thermo Scientific, Waters, Agilent and AB Sciex) in Singapore through hands-on, demonstrations and lectures on specific instrument maintenance and troubleshooting issues. Analytical instruments at the vendors' sites and AVA were used. The presence of engineers and application scientists from these vendors provided an opportunity for face-to-face interactions with the course participants. Laboratory staff often find it challenging to access such personnel and instrument manufacturer infrastructure. This event was therefore well appreciated by the participants and they called for more of such.

The participants also received some training on a radio-receptor-assay tool at AVA, procured under RAS5078. This training was led by two local laboratory personnel who had earlier been trained as part of the instrument procurement package. The Technical Officer (TO) provided additional advice during discussion of the test results. The capability of the local personnel to train others at the course, demonstrates relevance of a train-the-trainer approach to human resource development and information sharing.

The TO held talks with management of instrument vendors, to explore the possibility of future hands-on training for various food safety laboratories in the region. Some companies expressed willingness to cooperate on such instrument-user training at national and/or regional level, at no cost. They suggested starting with any ongoing project activities such as in Viet Nam and Indonesia if contacted and in time. Training at vendor sites would be an option. Thus an opportunity for future public-private (instrument vendors) partnership has been created through this course, and followup consultations may be considered. This will complement Agency support for capacity development in Member State food safety laboratories in the region.

RAS5078 participants at a training course on analytical instrumentation in Singapore

The participants also discussed how to strengthen networking among food safety laboratories in the region, as another way to enhance capacity for effective and longer term use of analytical tools.

Strengthening Inter-Institutional Cooperation and Support for Food Safety Capacity Building and Food Control Systems in Africa, Accra, Ghana, 10–12 April 2017

James Sasanya

The Technical Officer (TO) traveled to Accra, Ghana from 10 to 12 April 2017 to promote collaboration among food safety stakeholders, as a way to strengthen food safety programmes in Africa. Various food safety interests in the region, laboratory capacity building and networking through a regional IAEA Technical Cooperation Project were discussed with relevant FAO staff at the regional and country offices, including the Regional Strategic Programme Coordinator, the Senior Policy Office and other colleagues in charge of food security.

Activities discussed included joint training, exchange and/or twinning of laboratory staff, local production of material to facilitate proficiency testing and inter-laboratory comparisons. Most deliberations were in the context of the Regional Initiatives for Africa (especially I and II) and networking. Discussions were held and information shared on regional professional associations as well as the Partnership for Aflatoxin Control in Africa (PACA) which the African Food Safety Network the Joint FAO/IAEA Division supports, cooperates with. The TO also discussed opportunities for partnership with academia as another way to enhance networking in Africa and promote sustainable capacity building as well as regional risk assessment programmes. Capacity building on antimicrobial use, residues and resistance (AMR) in Ghana was also addressed.

The TO visited Ghana Food and Drug Authority (GFDA), counterpart for the AFRA project RAF5078, to discuss and evaluate project implementation and needs. Laboratory staff at GFDA have been trained on a radio-receptor assay tool recently procured under the project and data generated from the instrument was shared with the TO who provided additional advice. In a separate meeting with the Ag. Deputy Chief Executive Officer, Food Inspectorate Division, GFDA, the TO discussed risk based management of food contaminants in Ghana and ways to enhance networking in Africa beyond laboratories. The TO also visited the Ghana Standards Authority (GSA), held discussions with the national Codex contact person, the head of the testing laboratory, GSA as well as staff in the inorganic testing laboratory, and evaluated their analytical capacity and needs. This was to help enhance their capacity to collect occurrence data for food contaminants such as methyl mercury in fish and inorganic arsenic in rice. The visit was complementary to the FAO/WHO Codex Trust Fund initiative that supports capacity building to promote meaningful participation in Codex standards and guidelines setting process, including collection of occurrence data.

Ghana food and drug authority and Ghana Standards Authority support food safety programmes in the country

A number of capacity building needs identified at GFDA and GSA are now being addressed in collaboration with the

FAO, Rome and Ghana FAO country office. For instance two GSA staff have been helped to join an interregional training course in South Africa on basic maintenance and troubleshooting of analytical instrumentation for food contaminants (29 May−19 June 2017). The exposure gives the GSA staff an opportunity to enhance their analytical knowledge and network with compatriots in Africa and around the world, and have face-to-face interaction with instrument vendors, engineers and application scientists.

Regional (AFRA) Training Course on Food Microbiology Testing, Khartoum, Sudan, 9−14 April 2017

James Sasanya

This regional capacity building event was held at the Department of Radioisotopes, Central Veterinary Research Laboratory Centre (CVRL) and attended by 36 participants from Angola, Benin, Botswana, Burundi, Cameroon, Chad, Egypt, Ghana, Lesotho, Mauritania, Morocco, Mozambique, Mauritania, Namibia, Senegal, Sudan, Tunisia, Uganda, UR Tanzania, Zambia and Zimbabwe. The training was organised under the framework of the AFRA project RAF5078 "*Establishing a Food Safety Network through the Application of Nuclear and Related Technologies, Phase II*".

The participants were trained in qualitative and quantitative method analysis for microbial food hazards. They also gained knowledge in antimicrobial inhibition testing; preparation and storage of microbiological culture media; maintenance and verification of reference cultures; calibration, maintenance and verification of equipment; method quality control procedures and counting as well as reporting of results, among others. The training was another opportunity for enhancing laboratory networking for knowledge sharing and problem solving in the area of food safety in Africa.

Building Food Safety Laboratory Capacity, Niger, 6−7 April 2017

James Sasanya

The Technical Officer (TO) visited Niger from 6 to 7 April 2017 to support the implementation of a food safety project hosted by the Central Livestock Laboratory (LABOCEL), Ministry of Livestock. The TO worked with three staff in the chemistry laboratory to set up and test certain analytical tools. A specific technique was demonstrated to the laboratory staff, who thereafter analyzed some food samples collected from a major abattoir, for residues of veterinary drugs under the officer's guidance and supervision. More of such tests have now be conducted and the staff are sharing knowledge gained with colleagues in the laboratory.

The TO gave a lecture to the local project team and other laboratory personnel on requirements and challenges of food contaminant testing; laboratory safety and a common analytical technique. Promoting linkages between national and a regional food safety projects and therefore cooperation with institutions such as the University of Tillaberi was also discussed.

Continued support is needed for Niger. Therefore a newly designed project was reviewed by the TO, the main counterpart (at the Ministry of Livestock and LABOCEL), and collaborating institutions represented by the University of Tillaberi and the National Agricultural Research Institute, Niger (INRAN). The team then reported outcome of the review meeting and the TO's mission in general, to the National Liaison Officer who expressed strong support for food safety capacity development in the country as well as networking and teamwork among various sister institutions in the country.

LABOCEL staff conducting qualitative food safety tests

Building Food Safety Laboratory Capacity, Mauritania, 2−4 April 2017

James Sasanya

The Technical Officer (TO) undertook a mission to Mauritania from 2 to 4 April 2017 under the framework of the Technical Cooperation Project MAU5005, and reviewed project activities at the Office National de Recherches et de Developement de l'Elevage (ONARDEL). Procurement and specific training needs were discussed and prospective trainees interviewed. The TO inspected a new laboratory under construction and advised the counterpart site- and installation preparation for an Atomic Absorption Spectrometer and liquid chromatography, as well as related accessories. The TO worked with laboratory staff to among others, set up, arrange or re-arrange certain laboratory materials and equipment.

The TO met stakeholders at the Institute National De Recherches en Sante Publique (INRSP), that are instrumental in the implementation of Agency supported food safety projects as well as planned establishment of a residue/contaminant testing programme in the country. The TO reviewed INRSP's analytical capabilities and needs as

well as areas of common interest with ONARDEL. For instance (the TO advised that) prior to certain ONARDEL staff undertaking fellowship training outside the country, they could received basic exposure to analytical tools at INRSP for a couple of weeks. This was found agreeable.

INRSP and ONARDEL staff collaborate to build food safety testing capabilities in Mauritania

The mission helped the TO to provide technical guidance on-site and support project implementation. ONARDEL management and staff are committed to launching the first residue and contaminant testing programme for food and related matrices this year. Also ONARDEL and INSRP are keen of closer cooperation through activities under the national and regional (networking) projects, MAU5005 and RAF5078, respectively. Also following the visit, mechanisms to help INRSP address some needs the TO identified, such as operationalization and use of two analytical instruments, as well as targeted training are now under evaluation.

TC Project CPR5022 Implementing the Stable Isotope Technique for High Quality Agro-Product Traceability and Authenticity: Technical Officer's Visit to the Institute of Quality Standards and Testing Technology for Agro-Products (IQSTAP), Beijing, China, 27–31 March 2017

Simon Kelly

Verifying food authenticity is a high priority for China; not only to protect consumers from fraud, but also to protect them from unintended food safety issues that are derived from clandestine food production activities in unlicensed or unsanitary conditions. This Technical Cooperation Project aims at providing a solution to the problem of inferior agro-products being passed off as high quality products in the Chinese domestic and export markets. Such practices carry inherent food-safety risks; lead to the erosion of consumer confidence and potentially reduce international market access for Chinese food products. The Joint FAO/IAEA Division's Food and Environmental Protection Laboratory (FEPL) has been working with the Chinese Academy of Agricultural Sciences' (CAAS) Institute of Quality Standards and Testing Technology for Agro-Products (IQSTAP) to develop systems utilising advanced stable isotope techniques and an integrated and multidisciplinary approach, to characterise the identity and authenticity of Chinese agro-products - specifically pork, rice and milk.

In March 2017 the Technical Officer (TO) visited IQSTAP to discuss and review the planned fellowship and scientific visit activities and the purchase and installation of a bench top Nuclear Magnetic Resonance spectrometer for species identification in meat products. Mr Simon Kelly and Chief Scientific Investigator (CSI), Mr Gang Chen, visited the laboratory that will house the new bench-top NMR from Oxford Instruments, procured under CPR5022, to assess the suitability of the location and infrastructure, which were found to be satisfactory, meeting the manufacturer's pre-installation specifications.

On the second day of the visit, discussions were held regarding the successful Fellowship and Scientific Visitor training previously hosted by Mr Chen in 2016, which included two Syrian, one Bangladeshi, one Ugandan Fellow and two Syrian Scientific Visitors, in veterinary drug residue analysis. These discussions formed the basis of a meeting with Professor Shuming Yang regarding the possibility of IQSTAP gaining IAEA collaborating centre status. The consensus was that the general area of collaboration should be 'Food Safety and Quality' and that the specifics of the proposed activities should be primarily topic rather than technique based:

- Veterinary drug residue analysis
- Pesticide residue analysis
- Food authenticity and traceability
- Sample collection and preparation
- Chemometric analysis of data
- Method validation, collaborative and ring trials
- Proficiency testing
- Inter-laboratory Comparison Materials and Reference materials

However, the analytical techniques covered would be nuclear e.g. IRMS, NMR and complimentary techniques e.g. infrared spectroscopy. Training of Fellows and Scientific Visitors would be provided along with a strong emphasis on method development in collaboration with the Food and Environmental Protection Laboratory. Prof. Yang confirmed that the proposal for an IAEA collaborating centre had the support of IQSTAP Director General Mr Yongzhong Qian.

Further discussions then took place about the importance of implementing training and developed methods. China has many inspection centers which take responsibility for quality control of different agro-products. If an analytical standard operating procedure is established successfully by an institution (university/research institute/inspection

center), they can apply to the relevant Ministry of the Chinese Government for the method to be transferred to a national standard. If agreed, the Government will provide funding for the method transfer. The SOP needs to be validated by at least three labs, and agreed by standard committee members. After this, the government will publish the method, and all relevant laboratories can adapt this standardized method to their own labs. The author of the method can also organize training courses. For quality control of the inspection centers, the National Reference laboratory will supply anonymous samples to other inspection centers, and collate data after testing. Once the method is established, surveillance takes place by designated control laboratories and testing occurs every year. The results submitted back to the main control laboratory are compiled and analysed for a report. This report goes back to the Government to take action as necessary.

During the TO's mission to IQSTAP a meeting was arranged on the third day with researchers from other CAAS institutes to discuss the possibility of designing a collaborative research project on Chinese tea authenticity, which is an extremely high value domestic and export crop for China. The participants were Prof. Gang Chen (Host, IQSTAP, CAAS); Mr Simon Kelly (TO, IAEA); Dr Yan Zhao (Associate Researcher, IQSTAP, CAAS); Deputy Director Yuwei Yuan (Institute of Quality and Standards for Agricultural Products, Zhejiang Academy of Agricultural Sciences); Deputy Director Youxiang Zhou (Institute of Quality and Standards and Testing Technology for Agro-Products, Hubei Academy of Agricultural Sciences); Prof. Lanzehn Cian (Senior researcher, Bee Product Quality and Safety Risk Assessment Laboratory, Institute of Apiculture, CAAS). Mr Simon Kelly and Mr Gang Chen welcomed the attendees and described the objective of the meeting. Mr Kelly then went on to make a short presentation about the Joint FAO/IAEA Division of Nuclear Applications in Food and Agriculture and the Food and Environmental Protection Section and Seibersdorf Laboratory. He then led a group discussion and knowledge sharing session on authenticity issues related to Chinese green and fermented black tea; existing and potential methods and databases to address the authenticity issues identified; potential projects that could be initiated under existing TC and/or CRP activities or new, goodwill, cost-free activities.

The TO mission concluded with a visit to the Bee Product Quality Supervision and Testing Centre organised and hosted by Prof. Lanzehn Cian. The group met with the Centre's Director, Prof. Li Yi. He explained the centre's activities, which include routine surveillance of over 5000 authentic and domestic retail-market honey samples per year for veterinary drug residues, pesticide residues, microbiological safety, quality (e.g. hydroxy methyl furfural testing) and authenticity analyses (e.g. high fructose corn or cane syrup addition determined by carbon isotope analysis). The facility is designated as both a Ministry of Agriculture national laboratory for testing honey and a CAAS Institute for bee product research.

Group photo of Mr Simon Kelly with Chinese Academy of Agricultural Sciences researchers outside the CAAS Bee Product Quality Supervision and Testing Centre

Prof. Cian went on to explain that the authentic honey samples are gathered each year directly from bee keepers by government officials. She acknowledged that there was a significant problem with honey adulteration in China and that the addition of rice sugar syrup to honey was probably going undetected as well as the mixing of higher grade honeys with lower grade ultra-filtered honeys without pollen.

The TO mission proved to be extremely valuable in cementing collaborative links between FEPL and IQSTAP 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 in China and facilitate international trade.

Regional Workshop: Standards for Radioactivity in Food, Drinking Water and Commodities, Buenos Aires, Argentina, 21–23 March 2017

Carl Blackburn

This regional workshop was hosted by Autoridad Regulatoria Nuclear of Argentina, who held the workshop in collaboration with the TO from the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, and colleagues from the International Atomic Energy Agency, Pan American Health Organization and the World Health Organization. It was implemented within the framework of IAEA technical cooperation project RLA9078.

The main purpose of the workshop was to seek feedback from countries in the Latin America and the Caribbean region on their experience in using the international standards, including the identification of any aspects requiring further clarification or development. Discussions focused on the application of current international standards for managing radioactivity in food, drinking

water and non-food commodities. The emphasis was on normal situations, termed "existing exposure situations" by radiation safety experts. In this context, the meeting did not focus on international standards intended for use during a nuclear or radiological emergency.

There were 46 participants from 18 countries of the Latin America and the Caribbean region (Argentina, Aruba, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Mexico, Paraguay, Peru, St. Lucia, Trinidad and Tobago, Uruguay and Venezuela). The meeting was chaired by an independent expert, Mr Augustin Janssens of Belgium, previously head of the Radiation Protection Unit of the European Commission.

Radioactivity is present in the world around us, including our food, drinking water and non-food commodities. These products may therefore contain both naturally occurring and man-made radionuclides. For this reason, it is important to know the amounts of radionuclides that they contain and, if necessary, levels at which to place controls on their distribution and therefore harmonize national approaches in order to facilitate international trade.

Participants at the workshop recognized the need to further harmonize the international standards in terms of scope, radiation protection criteria and terminology. They considered that the current system was unnecessarily complex, but that at the same time it did not adequately address all the situations that exist in the region.

Regional workshop participants

It was recommended that international radiation safety standards and guidelines should have similar criteria for radioactivity content and address apparent inconsistencies. For example, drinking water guidelines are established for existing exposure situations and give radionuclide activity concentrations equivalent to the 1 mSv dose reference level in international standards. Whereas international food standards also establish a 1 mSv dose reference level for food consumption in the same exposure situation but do not give radionuclide activity concentrations. However there are Guideline Levels (GLs) in Codex Alimentarius standards, which are activity concentrations for several radionuclides. However, these Codex GLs are intended for use in terms of trade in food commodities following a radiological or nuclear emergency.

Participants also discussed the need to collect data on the natural radionuclide content of food produced in the region, both for comparison with radionuclides of artificial origin, and as a first step in considering the inclusion of natural radionuclides in international standards for food.

The workshop participants supported improved harmonization of the standards for radioactivity in food, drinking water and non-food commodities and requested the responsible international organizations to work together to this end.

A number of countries in the region currently do not have programmes for monitoring radioactivity in food and drinking water. The workshop offered these countries an opportunity to learn from the experiences of others on how to design and implement an appropriate and cost-effective monitoring programme, including the management of situations where activity concentrations in the standards are exceeded. The first step in designing such a monitoring programme is to undertake baseline studies describing the situation nationally.

Interregional Training Course on Pesticide Residues in Animal Products, Cotonou, Benin, 13–24 March 2017

James Sasanya

A training workshop was held in Benin under the framework of the interregional food safety project INT5154 "*Improving food safety through the creation of an interregional Network that Produces Reliable Scientific Data Using Nuclear and Isotopic Techniques*''. The event was officially opened on 13 March 2017, by the Minister of Agriculture of Livestock and Fisheries Dr Delphin O. Koudande and attended by the Director of Cabinet, Ministry of Agriculture of Livestock and Fisheries Mr Amadou Barassounon Ali, as well as Ms Françoise Assogba Komlan, the Secretary General, Ministry of Agriculture of Livestock and Fisheries, Benin. The Minister welcomed the participants to Benin and thanked the IAEA for supporting the interregional training course on pesticides with focus on animal products. He noted that it was important laboratories safeguarding a nation's food supply are competent and this can only be achieved through such focused training.

Two regional resource persons supported the training including the delivery of lectures on assuring and maintaining laboratory competence with regard to testing and monitoring of chemical hazards, as well as on analytical method optimization and harmonization. They lecturers also guided the group in discussions and practical sessions including preparation of milk and beef samples, as well instrumentation (GC-MS, GC-MS/MS and isotope based LC-MS/MS). The participants and lecturers also prepared standard operating procedures and helped local staff at the host institute, Laboratoire central de contrôle de la sécurité sanitaire des aliments (LCSSA) to improve their skills on the operation and optimization of the newly

installed LC-MS/MS. Through this group-work and experience-sharing, relevant data was generated on residues of pesticides and veterinary drugs using this instrument.

INT5154 participants conducting tests and discussing analytical method harmonisation and application in Benin

Regional Training Course on "Analytical Methods for Residues of Selected Pesticides", Montevideo, 13–17 February 2017 and Paysandú, Uruguay, 18–24 February 2017

Britt Maestroni

The FAO/IAEA Food and Environmental Protection Laboratory (FEPL) in collaboration with the IAEA Technical Cooperation Project RLA/7/019, the University of la República (UDELAR), Uruguay, Faculty of Chemistry, organized a regional training course in Uruguay on "Analytical methods for residues of selected pesticides" in Montevideo from 13 to 17 February, and in Paysandú from 18 to 24 February 2017. The Technical Cooperation Project RLA 7/0/19 is on "developing indicators to determine the effect of pesticides, heavy metals and emerging contaminants on continental aquatic ecosystems important to agriculture and agroindustry". The training was organized for the countries of Latin American and the Caribbean region participating in project RLA/7/019. 18 participants from Argentina, Brazil, Chile, Costa Rica, Cuba, Ecuador, Guatemala, Panama Paraguay and Uruguay participated in the course.

The main purpose of this training was to develop the skills of the participants in the practical applications of residues analysis of difficult pesticides and to transfer knowledge on the principles of method validation, separation science, method optimization, quality control and quality assurance. The specific purpose was to allow the participants to gain hands-on experience in the analysis of residues of difficult pesticides such as glyphosate, dithiocarbamates, quats and specific multiresidue methods on herbicides and other pesticides of high impact in Latin America.

The workshop was opened by the Technical Officer (TO) of the project, Ms B. Maestroni, followed by an introduction of the participants and the expectations from the workshop. The TO presented lectures on gas chromatography coupled to tandem mass spectrometry (GC-MS/MS), sampling for maximum residue level compliance, method optimization using GC-MS/MS, as well as an introduction to the Latin American network of laboratories, RALACA (see specific article on RALACA). The TO also coordinated group discussions on selected analytical topics under TCP RLA/7/019. The team of Uruguayan professors lead by Prof. Horacio Heinzen and Prof. Verónica Cesio, provided several lectures on herbicides, concepts on multiresidue methods (MRM), MRM amenable pesticides and related topics.

The sessions of the first week of the workshop took place at the laboratory of the GACT, (Grupo de Análisis de Compuestos Trazas) at the Faculty of Chemistry, Cátedra de Pharmacognosys of the University of the Republic (UDELAR) in Montevideo. During the practical laboratory sessions in Montevideo the TO also provided support, together with the local team of experts, in the conduction of a MRM analysis of GC amenable pesticides (OC, OP, Pyretroids and some GC amenable fungicides), the optimization of the parameters on GC and the sample preparation of the selected pesticides on honey bees as ecosystem biomonitors. The participants worked in the laboratory on sample preparation and performed the instrumental analysis using a GC-MS/MS. Finally the TO and the Uruguayan team performed a round table discussion with the whole group about the practical results obtained by the different groups, and discussed the different approaches that each laboratory have as routine in their countries. The knowledge about the physical-chemical properties such as polarity, solubility, instability, ionic character of the ammonium quaternary pesticides (herbicides), as well as the fragmentation pattern in the mass spectrometer were of great importance for the participants to understand the individual methods of analysis for the selected pesticides presented in the second week of the training.

The second week took place in Paysandú, where GACT UdelaR has a second laboratory equipped with an LC-MS/MS. Here, the participants were exposed to theoretical and practical laboratory exercises on single residue methods (SRM) for glyphosate, dithiocarbamates quats and multiresidues method for new polar herbicides. Prof. Horacio Beldoménico from the Universidad del Litoral (UNL), Santa Fe, Argentina gave presentations on the development of methodologies related to sample preparation for SRM and in particular discussed the chemical properties and analytical methodologies for glyphosate and metabolites, toxicological classification, case studies of glyphosate analysis in environmental and food samples. Prof. Beldomenico supported by Ms L. Damonte and the whole Uruguayan team

demonstrated in the laboratory the determination of glyphosate and its main metabolites in water using FMOC derivatization by LC-MS/MS.

Training course participants during the second week in Paysandú

Prof. Dra. Ionara Pizzutti from Universidad Federal de Santa Maria (UFSM), Santa Maria, Brazil, lectured on chemical properties, sample preparation and analysis of dithiocarbamates and quats, with reference to case studies, and multiclass methods for mycotoxins and pesticides in fresh and processed food as well as the Brazilian experience on preparing for ISO17025 accreditation.

A practical MRM method for difficult and modern herbicides in water was performed by the whole group led by Profs Heinzen and Cesio.

Screenshot of an article on the Uruguay university website about the training course

The training course represented an excellent opportunity to exchange experiences, methodologies and practical applications with respect to analytical methods for determination of selected pesticides in food and environmental samples. Overall, the participants' performance was excellent, being very participative both in the implementation of the laboratory practical work and round table discussion sessions. The participants were satisfied with the training: 80% indicated that the scientific content of the workshop was excellent and 20% that it was very good to good, and that had met their objectives. A remarkable product of this training course was the possibility given to all participants to take an on-line proof, after returning to their countries in order to get university credits. Eight young scientists from different countries performed, in an excellent way, the proof that was proposed by the whole team of professors and covering all the topics. The trainng course was supported by Sciex, through its subsidiary Ridaline, and Shimadzu, through Dexin Grupo Químico in Uruguay, through the provision of stationary and consumables.

Interregional Training on Optimization and Harmonization of Radio-Receptor Assay Technique for Analysis of Veterinary Drug Residues and Related Contaminants in Foods and Feeds, Kampala, Uganda, 6–17 February 2017

James Sasanya

Harmonising analytical techniques improves hazard (residue) control programmes as well as collection of occurrence data for contaminants, through a collaborative approach around the world. The above training was therefore organised under the interregional food safety project INT5154 "*Improving Food Safety through the Creation of an Interregional Network that Produces Reliable Scientific Data Using Nuclear and Isotopic Techniques"* to facilitate such collaboration, and 22 laboratory scientists from Botswana, Cameroon, Nigeria, Chile, Costa Rica, Pakistan, Tunisia, Turkey, Uganda and UR Tanzania as well as an expert from Belgium participated. The event was hosted by the Uganda National Bureau of Standards (UNBS).

The country's National Liaison Officer, Ms Sarah Nafuna welcomed the participants and appreciated the relevance of the workshop as well as the techniques to share. She advised participants on the importance of enhancing laboratory capabilities and harmonization of analytical methods, and therefore taking advantage of such international training opportunities to help their respective countries leverage the comparative advantages of their agricultural products. She gave the example of Uganda's pineapple that is very sweet and highly appreciated in a number of countries. Sound laboratories and systematic testing programmes can enhance competitiveness of such products on the international market and benefit farmers as well as the country at large, she concluded.

In his welcoming remarks, the Executive Director, UNBS, Dr. Ben Manyindo noted that harmonization of standards and methods, is among the ways through which regional and international trade can be better facilitated. He thanked the IAEA's for supporting INT5154 and the workshop, in addition to several other capacity building opportunities extended to UNBS and sister institutions in the country and Africa.

The workshop was also graced with the presence of Uganda's Minister of State for Trade and Cooperatives Mr Michael Werikhe. While addressing the participants, the Honourable Minister underscored the importance and

timeliness of the workshop given drastic increase in trade relations as well as corresponding concerns about food safety and security. Such concerns hamper regional and international trade, he added. The Honourable Minister emphasized the role laboratories should play in addressing these challenges and facilitating the collection of data on contaminants for better regulation and control of food and feed safety. Accessing quality data which requires reliable laboratories, provides a powerful negotiating tool to facilitate trade, the Minister added.

Interregional food safety training course participants joined by Uganda's Minister of State for Trade and Cooperatives Mr Michael Werikhe

He therefore joined others in thanking the IAEA for support to the country including procurement of various laboratory analytical tools and materials, as well as human resource development at the UNBS and other stakeholder institutions. The Minister further noted how this support is helping Uganda comply with regional and international trade standards. The capacity built has also enhanced ability to host such interregional events, he concluded.

Pre-Project Planning Mission to Sri Lanka, 30 January–2 February 2017

Andrew Cannavan

Mr Cannavan travelled to Sri Lanka to advise the relevant authorities and counterparts and facilitate the development of a new Technical Cooperation Project (TCP) design on the safety of animal originated food, to commence in the 2018−2019 TC Cycle. Mr Cannavan visited the two counterpart institutes for the project, the Sri Lanka Atomic Energy Board (SLAEB) Laboratories in Colombo and the Faculty of Veterinary Medicine and Animal Science in Peradeniya University. The objectives of the project were discussed in the framework of food safety problems encountered in Sri Lanka, especially with respect to chronic kidney disease, which has unknown aetiology. A major problem is the current lack of baseline data that could be used to support the development of regulations and enforcement actions to enact food safety legislation. At Peradeniya, discussions focused on the necessity to expand the testing capabilities developed under previous TCPs for veterinary drug residues and other chemical contaminants in food. Procurement of a radio-assay instrument for antibiotic and other veterinary drug residue testing is expected to meet current and near future needs in this respect.

A tour of the SLAEB laboratories was undertaken, with emphasis on existing instrumentation that will be used in the project and instruments planned to be procured through the project. Sustainability of operations was discussed, principally focusing on payment by industry for analytical services, along with the increased regulation that would be made possible by project implementation, and that would make testing mandatory.

Mr Cannavan also visited the Sri Lankan Tea Research Institute (TRI) at Talawakelle to investigate possible synergy between the SLAEB and TRI laboratories, which would help to increase and broaden the scope of instrument usage, and therefore enhance the funding for, and sustainability of, the services to be developed. The visit was very successful, with bilateral benefits identified and a collaboration initiated between TRI and SLAEB.

Mr Cannavan with counterpart staff at the Sri Lanka Atomic Enargy Board laboratories

Project SRL2016001 has been well designed to meet some important shortfalls in current food safety control systems in Sri Lanka. The counterparts are committed to the project and to the improvement of food safety, and there is a good working relationship between the University of Peradeniya and the SLAEB laboratories. Broadening of the collaborative scope of the project to include the TRI, though not as a formal counterpart, will increase both the sustainability of the services provided by the laboratories during the project and after its closure, and the impact of the project.

Supporting Food Safety Control, Mauritius, 16–20 January 2017

James Sasanya

The Technical Officer (TO) visited Mauritius from 16 to 20 January 2017 to provide on-site technical support to the Food and Agricultural Research and Extension Institute (FAREI) and sister institutions to strengthen national capacity for testing contaminants in food and related matrices. This was under the framework of the Technical Cooperation Project MAR5024.

Sister institutions visited and where food safety capacity building or enhancement were discussed included the Food Technology Laboratory (FTL), Division of Veterinary Services, University of Mauritius (UoM), Mauritius Bureau of Standards as well as the Ministry of Health.

The TO advised on collaboration and development of a Memorandum of Understanding (MoU) involving FAREI, Division of Veterinary Services and UoM. These institutions have planned to share resources and personnel in order to enhance national residue monitoring, regulate safety and quality of local and imported foods, and large scale training of laboratory staff. The instrumentation to use include a radio receptor assay tool at FTL and complementary liquid chromatography to be setup at UoM. The tools would also benefit University students and relevant research. In this regard the TO assessed the laboratory facilities and space at UoM and provided relevant guidance. The TO and team met and briefed a representative of the Permanent Secretary on planned collaborative activities.

To enhance awareness on food safety control, the TO held a seminar that was attended by 30 participants from different institutions, where he presented on the role of laboratories and other stakeholders in ensuring food safety and promoting trade in food stuff.

Building laboratory capacity ensures such products are safe and of good quality

Developments at the Food and Environmental Protection Laboratory

Screening Malaysian Edible Bird's Nests for Adulterants Using Mid-Infrared - Attenuated Total Reflectance (IR-ATR) Spectroscopy Combined with Chemometric Analysis by Data-Driven - Soft Independent Modelling of Class Analogy (DD-SIMCA)

Simon Kelly

This study into the authenticity of Edible Bird's Nests (EBNs) was undertaken in collaboration with the Malaysian Nuclear Agency as part of Technical Cooperation project MAL5030. Mislabelling and adulteration is a problem in many areas of the food industry. It threatens the livelihood of honest traders and the rights of the consumer and may pose a risk to health if adulteration is carried out with materials that are unfit for human consumption. For most food products the authentic item is distinguished by botanical, cultivar, geographical or production origin or the absence of adulterants. In the case of EBN the economic motivation for adulteration is significant as EBNs rank amongst the world's most expensive animal products for food and medicinal uses. For example, in Thailand the price of white EBN reached 65,000 Baht (US$ 2170) per kilogram and had a total export value of approximately 126 million Baht (US$ 4.2 million) per annum in 2007. The processing of EBN requires washing and cleaning processes to take place before reshaping and drying. This process presents an opportunity to adulterate the EBN in order to change its physical appearance, enhance its organoleptic qualities (e.g. addition of sugar, salt or monosodium glutamate) or add preservatives (e.g. sodium meta bisulphite). One of the most common 'structural adulterants' used in retail bird's nests is karaya gum, which is routinely incorporated during commercial processing. Karaya gum is the dried exudate of Sterculia urens (a member of the cacao family) that absorbs water forming viscous colloids with adhesive properties similar to the nest cement present in the swiftlets saliva. A wide range of other adulterants have also been reported including fungi, egg-white, rice-noodles, sugar, salt, monosodium glutamate and gelatin. Gelatin also presents some further authenticity issues on religious grounds as the majority of commercially available gelatin is derived from porcine tissues, which is Haram and not acceptable to Muslim consumers.

Authentication and assessment of EBN quality may be completed by various targeted chemical methods, which confirm that the product quality meets technical and regulatory requirements. As a rule, this analysis demands relatively labour-intensive sample preparation and time consuming sequential analytical measurements. An Alternative approach is to conduct some untargeted quick, relatively cheap, and often non-destructive spectroscopic measurements with subsequent data processing by means of chemometrics. The majority of suitable methods should be considered as a joint procedure including a spectrometer 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 screening method is the use of mid-infrared (MIR) spectrometry combined with a micro-diamond attenuated total reflectance (ATR) measurement adaptor that permits the EBN sample to be measured without preparation of a potassium bromide disk. The MIR measurements are rapid, simple and also need simple sampling preparation. IR spectroscopy measures the covalent chemical bonds, creating a molecular 'fingerprint' of the chemicals present. This fingerprint can be used to identify and quantify chemicals present in a sample. The IR spectrum region 4000 – 450 cm^{-1} in particular, is able to identify a large number of components and the absorption bands are sensitive to the physical and chemical states of individual constituents.

The samples were dried by lyophilisation for 24 hours, then ground to fine powder form and stored in airtight containers prior to analysis. Adulterant mixtures were prepared gravimetrically at concentrations of 1, 5 and 10% m/m by combining appropriate quantities of adulterants with an authentic EBN sample. Approximately 20 mg of the powdered EBN samples were placed on the ATR crystal and the powder compressed until a transmission of 70% was obtained. Spectra were gathered in transmittance mode between 4000 and 450 cm^{-1} at a resolution of 1 cm^{-1}. The infrared % transmission spectra obtained from authentic Malaysian EBN and for common structural adulterants karaya gum, agar and porcine, bovine and fish gelatin, all at 10% w/w in EBN are shown in Fig. 1, which also shows the spectra obtained for common structural adulterants at 10% (w/w) in EBN and the absorption bands for a range of functional groups.

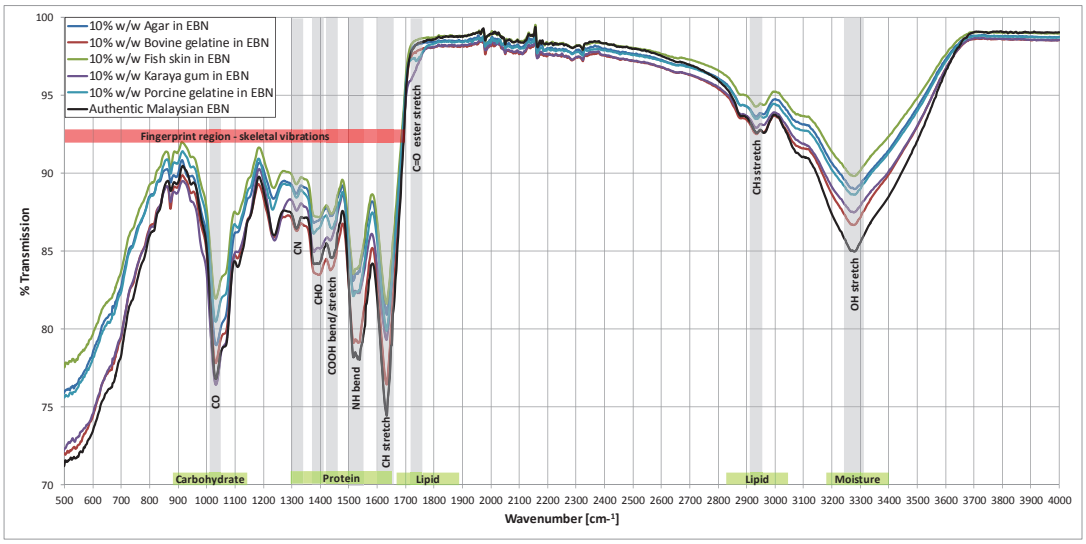


FIG. 1. The infrared % transmission spectra (4000 to 500 cm^{-1}) obtained from an authentic Malaysian EBN using mid-infrared spectroscopy with attenuated total reflectance micro-diamond sampling adapter

The data were analysed using data driven soft independent modelling of class analogy (DD-SIMCA), with 91 authentic EBN samples (the target class) used as the 'training samples' to develop a one-class target classification model. The objective was to build a model using authentic EBN samples from a variety of regions in Malaysia, as representative of Malaysian EBN, against which adulterated or counterfeit samples could be tested. The quality of the authentic Malaysian EBN acceptance area was estimated by testing with data from 12 other authentic EBN samples that were not included in the 91 training or target set samples. The cross-validation sample results are plotted in the acceptance area generated from the 91 EBN samples of the training set in Fig. 2A. Nine of the 12 test samples fell within the authentic EBN acceptance area ($\alpha = 0.05$). Based on this cross-validation test set, the sensitivity was 75%, i.e. the type 1 error rate (of wrong rejections) of the untargeted screening method was 25%.

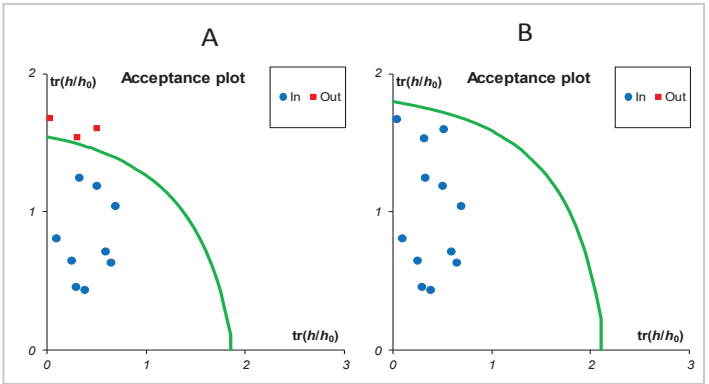


FIG. 2. (A) Application of DD-SIMCA to the analysis of 12 randomly selected 'test samples'. The quality of the authentic EBN acceptance area was estimated by testing with data from 12 other authentic EBN samples that were not included in the 91 training set (or target class) samples. With $\alpha = 0.05$ the sensitivity was 75%, i.e. the type 1 error rate (of wrong rejections) of the untargeted screening method was 25%. (B) With $\alpha = 0.01$ the sensitivity was 100%, i.e. the type 1 error rate was 0% with no wrong rejections of the authentic EBN test set

With $\alpha = 0.01$ for the acceptance area the sensitivity was 100%, i.e. the type 1 error rate was 0% with no wrong rejections of the 12 authentic EBN test set (Fig. 2B).

The model was tested with 18 EBN negative control samples deliberately adulterated in the laboratory, against the target set of 91 authentic EBN samples at the 95% confidence interval.

The overall specificity was 50% with the majority of the EBNs adulterated at the 5 and 10% w/w level identified as 'aliens' and falling outside the 95% confidence boundary shown as a green boundary line in Fig. 7A. This included the common adulterant karaya gum and other adulterants agar, porcine gelatin and 'apparent protein' enhancer melamine. It is expected that the specificity will further increase with the analysis of more samples. DD-SIMCA analysis of the six pure adulterant materials gave a specificity of 100%.

Due to the limited number of samples available and incomplete information available for some of the samples, these results can be considered only as preliminary. Nevertheless, the application of IR-ATR spectroscopy, combined with DD-SIMCA data processing, for the authentication of EBN produced in Malaysia has been successfully demonstrated. This technique is accessible, non-destructive, fast and direct, requiring no significant sample preparation. The method combines good sensitivity with acceptable 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 EBN 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 EBN for both culinary use and traditional medicine the requirement for screening methods is clear. Further work is required to validate the approach for a wider range of adulterants, including flavour

enhancers and preservatives.

Development of a Method for the Determination of Selected Pesticide Residues in Vine Leaves by GC-MS/MS

Britt Maestroni and Amer Abu Alnaser

Vine leaves have been a nutritious food in Greece and the Middle East for centuries and their popularity as healthy food has grown all over the world. As an example, the United States of America Department of Health and Human Services lists grape leaves in the dietary guidelines for healthy food. To protect the crop from various pests and diseases farmers apply a range of regulated pesticide formulations which can sometimes leave residues on the crop. As a raining programme for a TC fellow from Syria (Mr Amer Abu Alnaser, under TCP SYR5023) and with parallel interest from the "Red Analitica de Latino America y el Caribe" (RALACA) network, the FAO/IAEA Food and Environmental Protection Laboratory contributed to the development and validation of a multi-residue method for selected pesticides, including those that are most frequently employed in grape production, in vine leaves. The aim of the study was to develop a method and validate it according to the Codex Alimentarius Guidelines on Good Laboratory Practice in Pesticide Residue Analysis (CAC/GL 40-1993).

For the method to be transferable using the equipment available at the pesticide residue laboratory of the Atomic Energy Commission in Syria (AECS) the first pre-requisite was the extraction using ethyl acetate as a solvent. That allowed direct injection into the chromatographic systems equipped with conventional detectors without the need for solvent exchange. Secondly, the method had to be validated for a range of pesticides as the applications can vary from location to location depending on the availability of the registered pesticide formulations. Therefore a multiresidue gas chromatography–tandem mass spectrometry (GC-MS/MS) method was developed for the analysis of 59 selected pesticide residues in vine leaves.

Method development included the selection of suitable clean-up salt compositions for dispersive solid-phase extraction. Forty seven clean up salt compositions were tested in the laboratory.

Thin layer chromatography was used to screen some of the best performing clean up options. Selection of the optimal clean-up was based on visual evaluation of the TLC plates; fewer and less intensive spots corresponded to fewer potentially interfering matrix elements in the extract (see Figure 1).

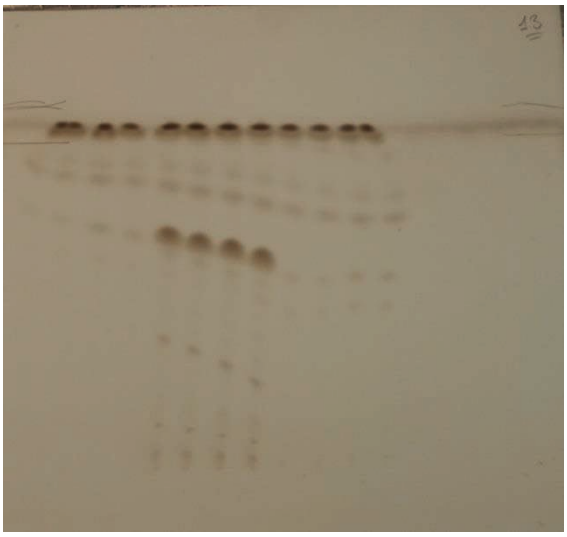
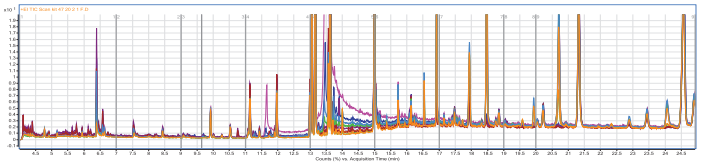
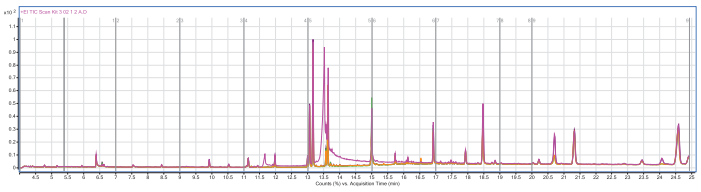


FIG. 1. Example of a set of clean-up salt combinations as applied to blank vine leaves matrix and spotted on thin layer chromatography (TLC) plates

The best clean-up options were further tested using gas chromatography coupled to mass spectrometry (GC-MS) in scan mode, which helped in confirming the efficacy of the optimized clean-up salt composition. Figure 2 shows the GC-MS scan traces used to further confirm the best clean up method. The salt combination giving the least interfering peaks was selected for the multiresidue method.



(A)

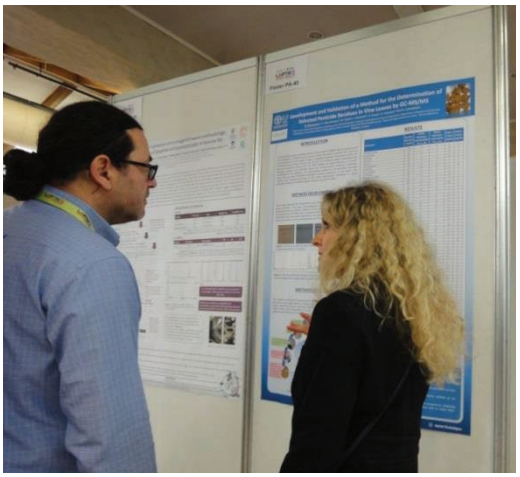


(B)

FIG. 2. (A) GC-MS scan traces for the selected clean-up regimes used to further confirm the best clean up method, which was the orange trace in (B) - salt combination PSA and Mg SO_4.

A modified QuEChERS sample preparation technique previously optimised in FEPL, based on ethyl acetate extraction followed by dispersive solid-phase extraction (d-SPE) clean-up using primary–secondary amine (PSA), was selected. The method was validated (based on Codex MRLs), for 59 pesticides at 10 µg/kg, 50 µg/kg and 100 µg/kg in terms of its scope, specificity, accuracy, sensitivity, repeatability, within laboratory reproducibility and matrix effects. Key performance parameters investigated were linearity, recovery, relative standard deviation (RSD), limit of detection, limit of quantitation and matrix effects. Recoveries for 59 pesticides tested ranged from 60 to 110%, and the RSDs were lower than

20%. Thirteen of the compounds, including omethoate, zoxamide, azinphos methyl, had significant matrix effects. The validated method was applied to the analysis of 27 real samples of vine leaves from Syria, which were found to be contaminated with dimethoate, diazinon, chlorpyrifos and chlorpyrifos methyl.



Ms Maestroni discussing the poster with a participant of the VI Sixth Latin American pesticide residue workshop

The method is simple, cheap and straightforward, with no solvent exchange and proved to be suitable for the routine determination of pesticide residues in vine leaves. As a result of this work a poster was prepared and presented on the occasion of the VI Sixth Latin American pesticide residue workshop by B.Maestroni, A. Abu Alnaser, M. Islam, I. Ghanem, V. Cesio, H. Heinzen and A. Cannavan, entitled: "Development and Validation of a Method for the Determination of Selected Pesticide Residues in Vine Leaves by GC-MS/MS". The poster was well received by the audience. A peer review publication is currently being produced and further details will be published in the next newsletter.

Mr A. Abu Alnaser working in the laboratory on the extraction of vine leaves

Vine leaves were processed using cryogenic milling

Geographical Origin Classification of Malaysian Edible Bird's Nest by Metabolite Profiling and DD-SIMCA

Zora Jandrić and Marivil Islam

Edible bird's nest (EBN) is a widely used health food in South East Asia. There is an increasing market for EBN because of its reported beneficial health effects. It is believed that EBN has positive effects such as anti-ageing, growth promotion and immune-enhancement properties. Trade in EBN increased dramatically from approximately US$ 170 million in 1989 to US$ 380 million in 2004 and it is expected to grow further with rising demands in East Asian countries. The retail value of EBN can be as much as US$ 15 per gram. Because of its high market value, there have recently been a number of reports of fake EBN. It has been reported that adulterants such as agar, white jelly fungus, and isinglass have been added to EBN, and there is a possibility that there are many other adulterants that have not yet been detected. There is a need, therefore for development of analytical methods for EBN authentication. In FEPL, method development was combined with training of TC Fellows from Malaysia, which has a strong interest in ensuring the quality and authenticity of its EBN products.

Untargeted metabolite profiling was performed using ultra-performance liquid chromatography – quadrupole time of flight mass spectrometry (UPLC-QToF MS) with multivariate data analysis (MVA). Authentic samples were obtained directly from processing houses from four different regions in Malaysia. Clear separation between EBN samples from different regions was achieved using orthogonal partial least square discriminant analysis (OPLS-DA. In order to obtain relevant information regarding the metabolic differences between EBN samples, a set of statistically meaningful markers was selected from a loadings plot. Full characterisation of authentic EBN samples and the development of prediction models could

help to identify the origins of EBN samples and verify their authenticity. This set was further analysed using soft independent modelling of class analogy (DD-SIMCA), to develop one class target classification models. The aim of this experiment was to build models for each region using authentic sample from that region, and predict whether the rest of the samples (from all other regions) belonged to that region. The percentage specificity for DD-SIMCA models ranged from 100% down to approximately 77% (Fig. 1).

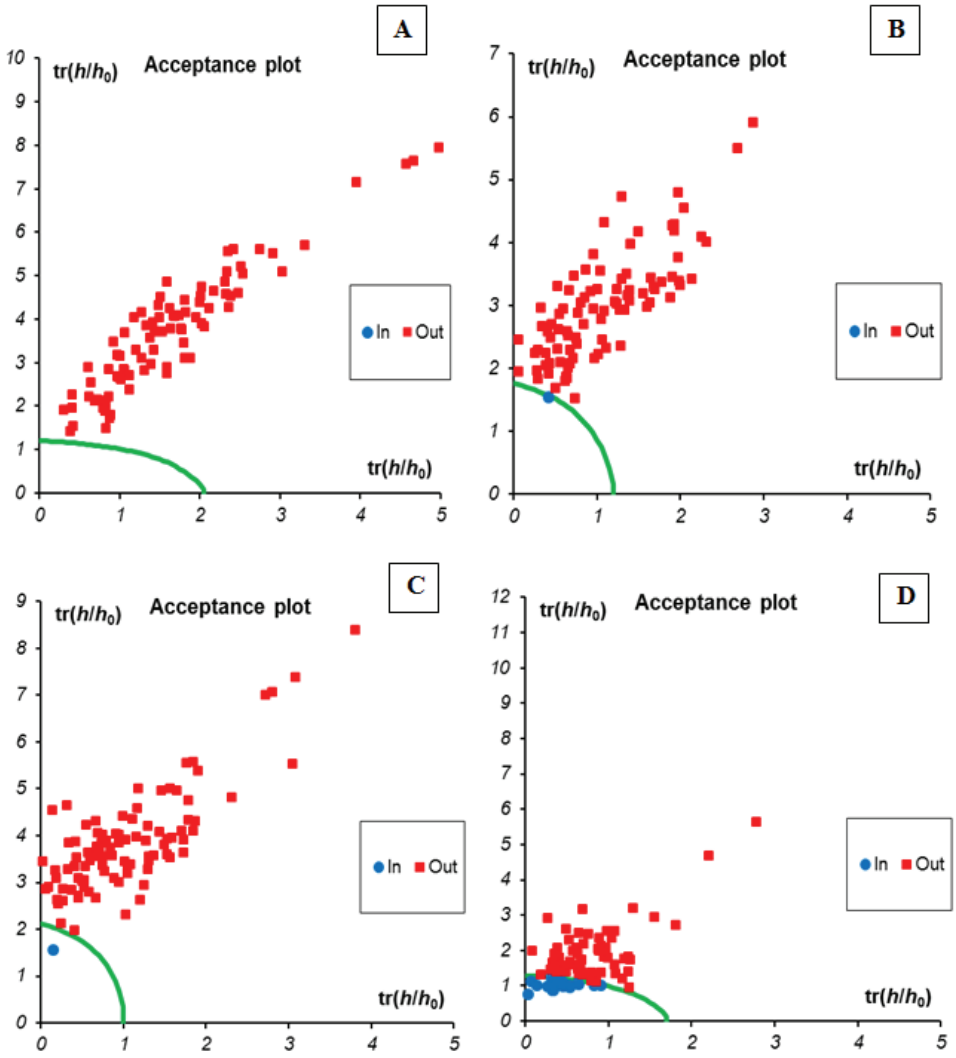


FIG. 1. Example of DD-SIMCA acceptance plots for Malaysian EBN classification by origin for samples from four different regions, designated A, B, C and D

Full characterisation of authentic EBN samples and development of prediction models could help to identify the sources of EBNs and check their authenticity. This methodology shows promise as a tool that regulatory bodies could harness to combat against fraud cases involving EBN.

FEP Laboratory Interns and Fellows

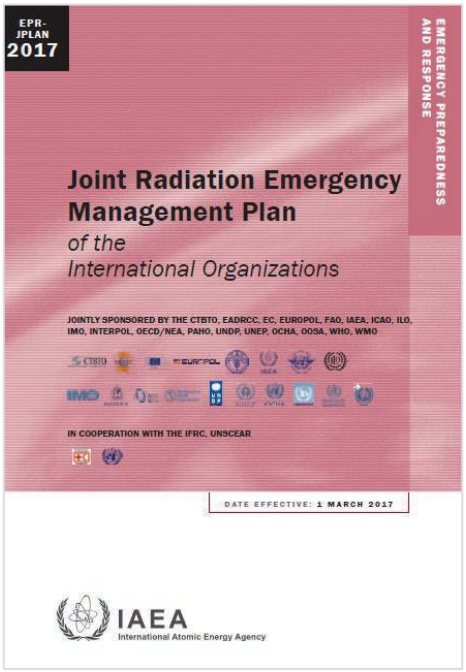
In April, Mr Amer Abu Alnasser completed a three-month fellowship in FEPL under TCP SYR5023, Enhancing Analytical Capacities of Major Pesticide Residues. Amer is the chief technician in charge of pesticide residue analysis in the Syrian Atomic Energy Commission's Biochemistry and Toxicology Division. During his fellowship, Amer worked on the development and validation of a multi-residue method for the detection and quantification of a range of selected pesticides in vine leaves, using gas chromatography – tandem mass spectrometry. Method development was successfully completed and the method was presented as a poster, co-authored by Amer, at the 6th Latin American Pesticide Residues Workshop in Costa Rica, 14−17 May 2017. We wish Amer all the best in validating and implementing the method in his own institute.

Announcements

Revised Joint Radiation Emergency Management Plan

A revised Joint Radiation Emergency Management Plan of the International Organizations (JPLAN) was published earlier this year, and is effective from 1st March 2017. Although a controlled distribution list is maintained for the Joint Plan and any amendments, it is made freely available online. It details how International Organizations will work together during an emergency. This includes the FAO, that work in partnership through the Joint FAO/IAEA Division, with the IAEA and other international organizations within the framework of the Inter-Agency Committee on Radiological and Nuclear Emergencies.

One of the FAO strategic objectives is to "Increase the Resilience of Livelihoods to Threats and Crises"; this includes threats to food production and to people's access to safe and sufficient amounts of food to meet their requirements. In terms of preparing and responding to emergencies, FAO's mission is to help countries govern, prevent and mitigate risks and crises and to provide support. In the area of nuclear and radiological emergency preparedness and response, the Joint FAO/IAEA Division carries out these activities within the context of FAO obligations and as a full party to the IAEA Early Notification and Assistance conventions, and as cosponsor of the JPLAN.



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