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Nuclear Techniques in Food and Agriculture

Food & Environmental Protection Newsletter

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To Our Readers

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The Food and Environmental Protection (FEP) Subprogramme under the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture continues to strengthen our joint efforts with the FAO and IAEA to protect human health and facilitate international agricultural trade by providing technical support and training to develop, accelerate and expand the contributions of nuclear technologies to food security and safety through peaceful uses of atomic energy. These activities are primarily related to the use of ionizing radiation; the implementation of traceability systems; analytical techniques to control food contaminants and the management of nuclear and radiological emergencies affecting food and agriculture.

At the start of the 2016–2017 biannual work plan, the FEP subprogramme continues our efforts on Coordinated Research Projects (CRPs): A consultants' meeting on *Nuclear Techniques and Novel Instrumentation for Low-Z Isotope Analysis in Food Products* has been held in Vienna to identify hand-held and portable spectrometers for use in rapid 'front-line' detection of food adulteration. Very positive responses were received from the group of

consultant experts and these will be incorporated into the proposal for a new CRP on this topic. The final RCM for Project D52037 on *Food Traceability* has recently been approved and will be held in Vienna (Austria) in November to finalize the project. The RCM will be used to prepare outputs such as the technical document (TECDOC), Standard Operating Procedures (SOPs) and to ensure capture of the resources for future work in the traceability area. The second RCMs for Project D52038 on *Technologies for the Verification of Origin of Dairy Products* and Project D52039 on *Radio-Analytical and Complimentary Techniques to Control Residues of Veterinary Drugs and Related Chemicals*, will be held in October in Rabat (Morocco) and Rancagua (Chile), respectively.

One of our feature articles in this issue covers the success story of our side event on "*The FAO-IAEA Partnership for Food Security: Food Safety and Quality Networks in Latin America and the Caribbean*" which took place in Mexico City on 3 March 2016 on the occasion of the 34th FAO Regional Conference for Latin America (LAC). The side event raised the awareness of stakeholders and decision makers about the benefits of the partnership between the FAO/IAEA and Member States in Latin America and the Caribbean to improve food safety and food security in the region. The article describes the facts that the IAEA and its Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture support Member State laboratories and institutions through the leveraging of nuclear/isotopic techniques in the area of food safety and quality in Latin America and the Caribbean. Another article in this newsletter introduces FEPL's work on food authenticity testing that featured at the biannual exhibition of the Long Night of Research, which was enthusiastically received by many visitors.

One of our key mandates is to facilitate Member States in the implementation of international standards, guidelines and recommendations for the production of safe and quality-assured foods, which promotes the strengthening of international trade. We have actively participated in activities and meetings of the Codex Alimentarius Commission and relevant committees on behalf of the Joint Division. A new IAEA TECDOC entitled *Criteria for Radionuclide Activity Concentrations for Food and Drinking Water* has been published by the IAEA and disseminated to delegates of the 10th Session of the Codex Committee on Contaminants in Foods (CCCF) through the Codex Secretariat. The TECDOC is now freely available online. FEP staff also provided valuable technical contributions to the development of Performance Criteria Specific for Methods of Analysis for the Determination of Pesticide Residues at the 48th Session of the Codex Committee on Pesticide Residues (CCPR).

Our subprogramme activities have included continued support to technical cooperation (TC) projects with the focus on the transfer of new technologies developed from this subprogramme to Member States. Currently, we provide technical support to 39 TC projects, including 31 national and 8 regional projects. The current TCPs are listed in this newsletter, followed by articles on specific TCP events. Our technical officers work in conjunction with colleagues in the IAEA Department of Technical Cooperation to implement these TCPs.

The year 2016 marks the fifth anniversary of the accident at the Fukushima Daiichi nuclear power plant (NPP) and the 30th anniversary of the accident at the Chernobyl NPP. On behalf of the joint Division, we are leading a team working on the preparation and organization of a Technical Workshop on the Remediation of Radioactive Contamination in Agriculture. This technical workshop will be held on 17−18 October 2016 in Vienna, Austria, and hosted by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture in collaboration with Japan's National Agriculture and Food Research Organization (NARO). This Technical Workshop aims to promote and share knowledge and experience related to remediation of radioactive contamination in agriculture. It will also support efforts to re-establish agricultural trade from areas currently affected by residual levels of radionuclides. The objectives and the detailed topics of this workshop can be found in the Announcement in this issue of newsletter.

We are also pleased to report the approval of our proposal to establish a new collaborating centre on applications of electron beam and X ray technologies and related dosimetry with Aérial (Association pour l'Etude et la Recherche sur l'Ionisation des Aliments) in France. Aérial is an international centre in the field of radiation processing, dosimetry and the only laboratory accredited in France for high-dose dosimetry. Aérial is also the official French control laboratory for the detection of irradiated food products. It has a multidisciplinary team of scientists and technicians involved in research programmes at the regional, national and international levels. Its facilities including laboratories and an electron beam irradiation plant will bring further strength and benefits to our efforts dedicated to peaceful uses of nuclear sciences and applications.

With regards to personnel news from the Section; we all extend our warmest welcome to our new staff member Ms Malgorzata Rydeng. Ms Rydeng has recently joined the Food and Environment Protection Section as Team Assistant at IAEA Headquarters. We also bid farewell to Ms Stella Attakpah who retired from the Section in March 2016 after more than 20 years of service at the IAEA. We wish Stella and her family all the best for the future.

Finally, I would like to end this column with thanks to all our readers for their continued support and encouragement.

Best wishes,

Zhihua Ye
Head, Food and Environmental Protection Section

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Feature Articles

The FAO/IAEA Partnership for Food Security: Food Safety and Quality Networks in Latin America and the Caribbean, Mexico City, 3 March 2016

Technical Officers: James Sasanya and Britt Maestroni

The side event on "The FAO-IAEA Partnership for Food Security: Food Safety and Quality Networks in Latin America and the Caribbean" took place in Mexico City, on 3rd March 2016 on the occasion of the 34th FAO Regional Conference for Latin America (LAC). The side event helped raise the awareness of stakeholders and decision makers about the benefits of partnership between the FAO/IAEA and Member States in Latin America and the Caribbean to improve food safety and food security in the region.

The IAEA and its Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture supports Member State laboratories and institutions in the area of food safety and quality in Latin America and the Caribbean. For instance, capacity is built and an analytical network of laboratories initiated by transferring relevant technologies, strengthening laboratory functionality and competence through the procurement and supply of relevant equipment, analytical standards, reference materials and the facilitation of proficiency tests.

Capacity building often includes hands-on training, technical advice and mentoring on food safety and risk assessment. Member States have received assistance to establish adequate food control systems with an integrated view of the farm-to-fork supply chain. This is important for the success of national development goals. Support to LAC Member States continues through the IAEA technical cooperation and Coordinated Research Projects as well as activities of the FAO/IAEA Agriculture and Biotechnology Laboratories in Seibersdorf, Austria, where several individual and group training-trainer courses and workshops have been offered to the region. The Coordinated Research Projects have provided avenues for innovation and dissemination of technologies; knowledge transfer regarding national residue monitoring and broader food and environmental control systems.

The comparative advantages of nuclear/isotopic techniques in food safety and quality have been used to help countries realize their food security and development goals. Besides the establishment of national residue monitoring in many countries, the FAO/IAEA support has, among other things, included enabling institutions to meet international standards (ISO, Codex) and increased competitiveness of LAC foodstuffs on international markets. For example, with the IAEA's support, Chile's Laboratory of Environmental Chemistry and Food (QAA) attained, and continues to hold, ISO/IEC 17025 accreditation since 2005. The laboratory has been audited, with successful outcomes, by regulatory authorities from importers of several Chilean foodstuffs such as the EU, the USA and Asian as well as Latin American countries. Such evaluations have maintained international consumer confidence and therefore enhanced Chile's exports. Furthermore, with the IAEA's support, QAA effectively oversees a national network of residue monitoring laboratories, and performs confirmatory analysis on 7−10% of all samples analysed by the network. Without QAA's activities most of these tests would otherwise be outsourced abroad, which can be costly, time consuming and potentially effect food exports.

The FAO/IAEA partnership that was exhibited at the side event, supports the establishment and sustainability of networks among food safety institutions/laboratories resulting in greater efficiency and shared approaches. This enables participating Member States to respond more effectively to emerging and recurrent challenges. Beneficiaries share knowledge and experiences and harmonize analytical techniques to ensure regional food safety and security.

Mr Liang Qu, Director, Joint FAO/IAEA Division of Nuclear Technique in Food and Agriculture addressing the "FAO-IAEA Partnership for Food Security" session organized by the IAEA during the 34th FAO Latin America and Caribbean Regional Conference in Mexico, 29 February−4 March 2016.

The side event was addressed by various speakers including: Mr Liang Qu, Director, Joint FAO/IAEA Division of Nuclear technique in Food and Agriculture; Ms Miriam Loewy, University of Neuquen Argentina and board member, Latin American and the Caribbean network of laboratories (RALACA); Professor Dr Henning Jensen Pennington, Rector University of Costa Rica, Costa Rica; and Dr Nilson César Castanheira Guimarães, Fiscal Federal Agropecuário, Chefe da Divisão Técnica Laboratorial

(DLAB), Ministry of Agriculture, Brazil. He also represented Brazil's national network of laboratories (LANAGRO).

Presentations and discussions at the side event addressed: the role of the Joint Division and its support for LAC Member State laboratories to improve food safety and security in the region; RALACA, its establishment with Joint Division support and the current work/activities; the long term FAO/IAEA partnership with the University of Costa Rica, including the Centre for Research in Environmental Pollution (CICA) and its role in promoting better training in LAC countries; and finally, Brazil's increased access to international markets through improved national capacity to control food contaminants and the LANAGRO-FAO/IAEA collaboration.

A number of success stories resulting from years of collaborative activities between Member States in Latin America and the Food and Environmental Protection Section and Laboratory were presented and were well received by the participants.

Participants at "The FAO/IAEA Partnership for Food Security" Session organized by the IAEA during the 34th FAO Latin America and Caribbean Regional Conference in Mexico, 29 February–4 March 2016.

In conclusion, the IAEA supports development programmes in many Member States such as in LAC, through the application of nuclear/isotopic techniques in areas such as food security and safety. This was extensively demonstrated and widely acknowledged at the 34th FAO regional conference. This kind of support continues in LAC and other regions.

The Long Night of Research, Vienna International Centre (VIC), Vienna, Austria, 22 April 2016

Technical Officers: Zora Jandrić, Aiman Abrahim, Simon Kelly, Andrew Cannavan

On 22 April the IAEA, along with other VIC-based organizations, took part in the biannual Long Night of Research (Lange Nacht der Forschung); an Austria-wide event coordinated by several Austrian government ministries that aims to spark interest in science and research**.** This was the seventh year of the Long Night of Research, and the first time the IAEA was involved. The VIC was one of around 250 exhibit locations across the country. The event gave visitors a chance to learn about the variety of nuclear applications in various fields. The exhibition had more than 1000 external visitors and several hundred staff members of the VIC-based organizations.

Visitors of all ages were interested in food authenticity testing.

From 17:00 until midnight, a number of stations were set up in the VIC Rotunda to showcase the Agency`s science and research to the general public, staff members and their families and friends. IAEA scientists hosted more than a dozen exhibition booths, including displays by the five laboratories of the Joint FAO/IAEA Division.

Hands-on demonstration of authenticity testing for honey, olive oil and milk powder at the FEPL booth.

The Food and Environmental Protection Laboratory (FEPL) exhibition booth focused on testing for food authenticity, posing the question 'is your food what you think it is?'. Food is an essential part of our daily lives. We need our food to be safe and we want to know what we are eating. Nuclear and related techniques can be used to

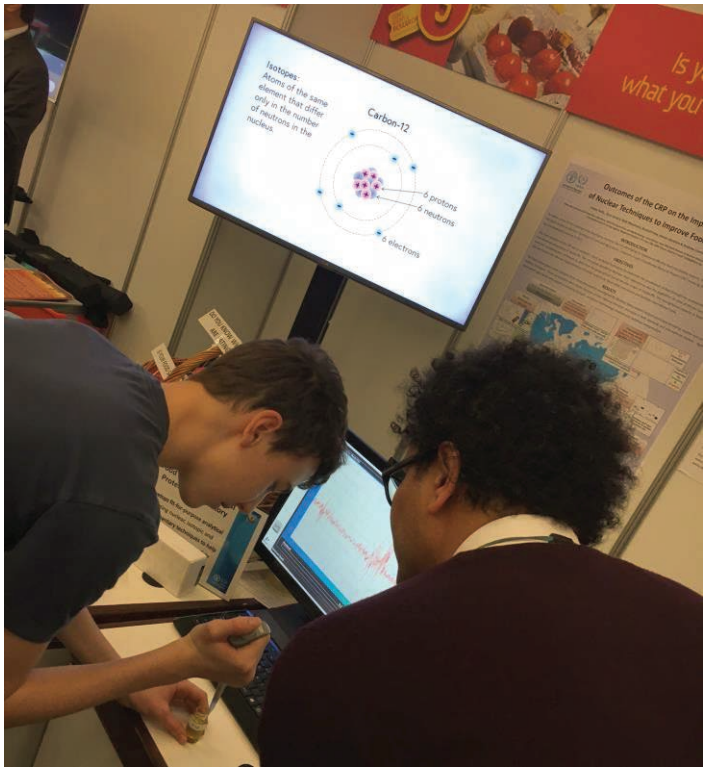
control food safety and to fight food fraud – the deliberate mislabelling of food products. For example, by determining the ratio of stable isotopes, such as hydrogen, oxygen and carbon, in various foods, scientists can extract information on where a food product comes from and what it contains. To enable practical testing in our Member States, other cost-effective and easily used screening tools are being developed using hand-held miniature devices and bench-top laboratory instruments to provide first tier testing which complements the advanced techniques such as stable isotope analysis. This is important not only to individual consumers, but also to global trade.

Four FEPL staff members manned the booth for the entire evening, providing information to the visitors and giving hands-on demonstrations of hand-held and bench-top spectrophotometric instruments for which applications are being developed in FEPL to provide screening tests for the authenticity of foods, or detection of adulteration.

Visitors were invited to inspect (visually and by smell) twelve olive oil samples prepared in FEPL, only one of which was a genuine extra-virgin olive oil, and to choose which they thought was the authentic sample. They could then test the samples with a hand-held infra-red spectrophotometer connected to a smart phone or tablet, to match the spectrum with a spectral library of the authentic oil, and confirm the result by testing on another bench-top infra-red spectrophotometer. Similar hands-on demonstrations were available for honey samples of different floral/geographical origin and for milk powder adulterated with melamine. The demonstrations were very successful, with queues for the hands-on testing constantly from the opening of the event until almost midnight. There was a broad spectrum of visitors, including students, university professors, scientists, school children and other interested members of the public, and a keen interest in the subject. The hands-on demonstrations fostered discussion around food authenticity, and in many cases there was healthy competition between participants, for example to find out who had picked the correct, authentic sample of olive oil.

In addition to the demonstrations, visitors were informed about some of the other areas of FEPL's work in food safety, traceability, authenticity and contaminant control through a rolling video display, which included presentations by FEPL staff members, animated graphics and slide shows.

Participation of the IAEA in The Long Night of Research provided a unique opportunity to showcase the peaceful uses of nuclear energy and nuclear applications.



Young visitors at the FEPL booth testing for authenticity of olive oil using mid infra-red spectrometry.

Forthcoming Events

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

Second 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, 3−7 October 2016, Rabat, Morocco.

Second RCM on the Development and Strengthening of Radio-Analytical and Complimentary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products, 24−28 October 2016, Rancagua, Chile.

Fourth and Final RCM on the Implementation of Nuclear Techniques to Improve Food Traceability, 7−11 November 2016, Vienna, Austria.

Workshop

FAO/IAEA-NARO Technical Workshop on “Remediation of Redioactive Contramination in Agriculture”, 17−18 October 2016, Vienna, Austria.

International Meetings/Conferences

The Korean Society of Environmental Agriculture's International Symposium, 7−8 July 2016, Busan, Republic of Korea.

Food Metabolomics Conference, 10−12 October 2016, Karlsruhe, Germany.

23rd Session of the Codex Committee on Residues of Veterinary Drugs in Foods, 17−21 October 2016, Houston, USA.

18th International Meeting on Radiation Processing, 7−10 November 2016, Vancouver, Canada.

41st Meeting of the Radiation Safety Standards Committee (RASSC), 21–25 November 2016, Vienna, Austria.

EPReSC-3, 28 November–2 December 2016, Vienna, Austria.

Technical Meeting to Review the IAEA's Assessment and Prognosis Procedures for Nuclear and Radiological Emergencies, 28 November–2 December 2016, Vienna, Austria.

Past Events

Joint FAO/IAEA Division's Global Capacity Building Efforts for Food Safety Monitoring Using Nuclear and Related Techniques Recognized by the 48th Codex Committee on Pesticide Residues, Chongqing, China, 25–29 May 2016

Technical Officer: Johannes Corley

Johannes Corley (IAEA/NA/NAFA/FEP) represented the Joint FAO/IAEA Division at the 48th Session of the Codex Committee on Pesticide Residues (CCPR), in Chongqing, China, from 25 to 29 May 2016 and reported on its activities during the past year. These included assisting member nations through coordinated research projects and capacity building in the area of food safety and integrity, assisting Codex/CCPR in developing a document on acceptable performance criteria for methods of analysis and hosting the Food Contaminant and Residue Information System (FCRIS) database.

Representative of the Joint FAO/IAEA Division at CCPR48.

The Food and Environmental Protection Section of the Joint FAO/IAEA Division was very active during the past year, assisting and advising member nations in building capacity to ensure safety of their agricultural produce using nuclear, isotopic and related techniques. The use of nuclear and isotopic techniques greatly enhances data quality making analyses rapid and economical; two very important factors for modern food safety monitoring programmes. Through Coordinated Research Projects (CRPs), member countries benefitted through research and development on the uses of nuclear and related techniques that fosters the exchange of scientific and technical information and brings scientists from both developing and developed countries together to research solutions to food safety related problems. The objective of the research is to produce strategic outputs that can be applied downstream through capacity building Technical Cooperation Projects (TCP).

The FEP continues to provide scientific and technical leadership for over 40 TCPs at national, regional and interregional levels and including training activities at its laboratory in Seibersdorf, Austria. The large number of TCPs associated with pesticides and related chemical contaminants reflects rising awareness among member nations to ensure compliance of their food products with national and international food safety standards as well as implementation of Good Agricultural Practices to both, ensure food safety and protect the environment.

An example of a recent success through the TCP PAR/5/010 in Paraguay, in addition to the procurement of several modern analytical instruments and accessories, training was provided to over 50 scientists in areas of analytical techniques for monitoring foods of animal and vegetable origins for pesticide, veterinary drugs and heavy metal residues. Additional training provided in quality management systems enabled Paraguay's laboratories to either get re-accredited or pursue new accreditation under ISO 17025 thereby enabling wider international acceptance of their food safety monitoring results. As a direct result of the project, a network of 10 food safety monitoring laboratories has been established and at the request of Paraguay's parliamentary commission on health and safety, legislation is being drafted by the five participating institutions to create a food safety programmes in Paraguay to protect the health of her citizens and improve global marketability of their food exports.

Separately, in a new regional project of extremely high priority for the Latin America and the Caribbean region, the FEP is providing technical guidance for a project to better understand pathways for human exposure to persistent organic pollutants (POP) including organochlorine pesticides in the region. Through training and technology transfer, the FEP aims to empower the region's scientists with the tools and expertise needed to study POPs and develop a plan to mitigate the impacts of POPs on human beings and the environment in Latin America and the Caribbean.

The Joint Division provided technical support to the CCPR working group on Performance Criteria Specific for Methods of Analysis for the Determination of Pesticide Residues chaired by the United States of America and co-chaired by China and India leading to the development of the final draft document. The establishment of clear guidelines for performance standards would enable all countries involved in developing food safety programme to have a clearer understanding of method requirements when monitoring for compliance with international food safety standards. After much consultation and discussion, the

committee recommended that the document be forwarded to step 5. If agreed, the 49th CCPR would forward the document to Codex for final acceptance. Several member countries expressed the need for established performance criteria for analytical methods. The chair (of the working group) and several countries expressed gratitude to the Joint Division for its assistance in drafting the document.

The Food and Environmental Protection subprogramme aims to improve food safety and enhance trade by forging sustainable networks of food control laboratories. For example, the Red Analitíca de Latino América y el Caribe (RALACA) network comprising more than 50 laboratories in 21 Latin American & Caribbean countries. Over the past three years, 12 national chemical residue monitoring programmes have been developed and coordinated under RALACA; 15 laboratories worked together to monitor pesticide and veterinary drug residues in foods and feeds; more than 125 analytical methods were developed and validated or re-validated; and over 340 laboratory staff were trained. We are also working to develop similar networks in Africa and Asia.

The Representative also highlighted the response of the Joint FAO/IAEA Division to a request from the Republic of the Marshall Islands for urgent assistance in mitigating toxic chemical residues in foods and developing a food safety programme in their country.

A large part of the CCPR 48 meeting dealt with the acceptance of new Codex MRLs (CXLs) and review of existing CXLs. New crop groups were also proposed by the USA and other member nations for purposes of magnitude of residue data generation for proposing new CXLs, these proposals were either moved forward through the review process or slated for additional review/discussions. A new proposal was introduced by the EU proposing a new IESTI (International Estimated Short-Term Intake) equation for estimating risk associated with acute toxic levels of pesticides. Currently, the highest residue from a controlled study (used to set the MRL/CXL) is used in calculating the IESTI. Under the new proposal, the MRL (which is sometimes significantly higher than the highest residue) would be factored into the equation. Discussion dealt with the statistical meaning of each number and their appropriateness for use in the IESTI calculation. The proposal was sent to an electronic working group for evaluation, a report of which would be discussed at CCPR49.

Several delegations expressed support for the work of the Joint Division and stressed on the need for additional resources to be dedicated to capacity building activities in developing countries. The CCPR concurred and thanked the Joint Division for their excellent work in building much needed food safety monitoring capacity in developing countries and for their contribution to the work of CCPR. The report by the Joint Division representative to CCPR48 can be found by clicking here and the complete report on CCPR48 proceedings can be found by clicking here.

EuroResidue VIII International Conference on Residues of Veterinary Drugs in Food, Egmond aan Zee, The Netherlands, 23−25 May 2016

Technical Officer: Andrew Cannavan

The EuroResidue conferences, held every four years, are amongst the most important meetings in the world focusing on residues of veterinary drugs in food and the environment. The conferences cover aspects such as analytical techniques, pharmacological and toxicological studies, anti-microbial resistance and regulation of veterinary drugs.

Mr Andrew Cannavan giving a presentation on global perspectives of antimicrobial resistance in the food chain.

The eighth in the series of EuroResidue conferences was held in Egmond aan Zee, The Netherlands, from 23 to 25 May 2016. The conference had more than 330 participants from 58 countries world-wide. The opening address was given by Dr Ir. H. Paul, Inspector General of the Dutch Food Safety Authority. The programme included sessions on: antibiotics, residues and resistance; residues and the environment; new techniques and confirmatory analysis; alternative matrices, and; broad screening. There was also a pre-conference workshop on ‘residue analysis for dummies’, a workshop on ‘risk-based approaches for monitoring’ and several vendors’ workshops. Approximately 170 posters were also presented throughout the duration of the event.

The conference attendees included a number of participants in the Technical Cooperation Project RAS5078, ‘Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants’, for which a coordination meeting and workshop was planned in conjunction with the conference. A report on the project activities is included elsewhere in this issue of the newsletter.

Mr Cannavan, Head of the Food and Environmental Protection Laboratory, participated as Chair of the Scientific Committee for the conference. Mr Cannavan gave an oral presentation entitled ‘Global Perspectives on

Antimicrobial Resistance in the Food Chain' in the First session, 'Antibiotics, Residues and Resistance'. The Presentation Summarised FAO's Activities in the control of antimicrobial resistance (AMR), with a focus on the linkages with FAO/IAEA supported technical cooperation and research projects on veterinary drug residues. The possibility was explored of developing residue monitoring plans closely linked with AMR surveillance to provide enhanced information and data on links between antimicrobial use in food-producing animals and the development of resistant bacteria.

As Chair of the EuroResidue VIII Scientific Committee, Mr Cannavan presented the EuroResidue award for lifetime achievement in the field of veterinary drug residues, and the young scientist award, in the closing session.

Of note during the conference, both in oral and poster communications, was the increased interest in methods capable of detecting multiple antibiotics simultaneously. Almost all of the contributions on this topic referred to the development of bacterial resistance against antimicrobials and the steps required to manage this problem as a motivation for the work.

20th Meeting of the Defra Authenticity Analytical Methods Working Group (AMWG), London, UK, 27 April 2016

Technical Officer: Simon Kelly

The 20th 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 27 April 2016. This is a peer review committee that advises on the science and methodology procured by Defra and provides a quality assurance function to ensure methods being developed are 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 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.

International Conference: Thirty Years after Chernobyl, Minsk, Belarus, 25−26 April 2016

Technical Officer: Carl Blackburn

The technical officer represented the FAO at this high-level International Conference and participated in associated events to mark the 30th anniversary of the accident at the former Chernobyl nuclear power plant.

The conference considered the current situation with regard to radioactivity and radionuclide contaminated areas in Belarus, the Russian Federation and Ukraine. Statements were provided by government ministers, ambassadors and representatives of several International Organizations. Awards were also given to a number of key individuals who had significantly contributed to assisting in the post-accident development of Belarus.

Participants agreed a Conference Declaration that marked the anniversary and efforts to overcome the accident since 1986 and stated future needs for sustainable social and economic development of the affected territories. This declaration will feed into the deliberations of the United Nations Inter-Agency Task Force on Chernobyl that involves both the FAO and the IAEA and is being coordinated by the United Nations Development Programme (UNDP). The task force has addressed recovery and development needs since the accident and it is developing a post 2016 strategy to focus on economic development. The lessons from the Chernobyl accident are well documented, but development work still remains to be done and post 2016 initiatives will have a stronger development focus through being linked to the UN Sustainable Development Goals.

Cultural events were also held to mark the 30th year post-Chernobyl and these included a music recital, an art display and an exhibition of photographs and personal stories. A film detailing the efforts of the three most effected countries and collaborations post-Chernobyl was also screened by video.

First Meeting of the Authent-Net Consortium, Prague, Czech Republic, 7–8 April 2016

Technical Officers: Simon Kelly and Andrew Cannavan

The kick-off meeting for the EU Horizon 20-20 project Authent-Net (Food Authenticity Research Network) consortium was held at the Vienna House Diplomat Hotel and Conference Centre in Prague on 7 and 8 April 2016. All 19 partners of the consortium involved in the project were represented; in total 37 delegates attended this closed meeting. 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. EU DG Santé's Food Fraud Network, DG Research's FoodIntegrity project, as well as numerous national programmes and industry initiatives. One pivotal area that still needs to be addressed is bringing together national research funding bodies to facilitate the development of transnational research programmes. Authent-NET will address this need by mobilising and coordinating relevant research budget holders in order to facilitate the eventual development of a transnational European funding vehicle that will allow EU Member States to jointly fund anti-fraud research. Authent-Net comprises a core group of 19 participants from 10 Member States (MS), 1 Non-Governmental Organisation (NGO) and the USA, who are either national research funding bodies; experts in food authenticity, and/or experts in transnational funding mechanisms.

Participants at the First Meeting of the Authent-Net Consortium, Prague, Czech Republic.

The project aims to bring together relevant MS R&D budget holders to coordinate inter-disciplinary research effort and build a cohesive and sustainable network. The partners will undertake stocktaking of existing national research and assess against the international landscape and establish transnational mechanisms and instruments for collating and exchanging information on food authenticity research. The consortium will also develop a high level research and innovation strategy for transnational research and a rationale for a potential ERANET on food authenticity. The two-year project will have the following expected impacts: improved coordination and communication between relevant Member State's research budget holders; enhanced cognisance of existing national research; joint strategy for food fraud R&D; agreed priorities; and capability to deliver transnational European research on food fraud.

Participants thought that they had received a good insight into the project, what was expected of them and where they fit into the project. The breakout sessions on day two were very successful in the planning process of the immediate work that needs commencing in the project. They also gave the funding organisations the opportunity to express their needs from this project and their expectations from the deliverables.

Third Food Integrity Conference, Prague, Czech Republic, 6–7 April 2016

Technical Officers: Simon Kelly and Andrew Cannavan

The third international Food Integrity conference took place in Prague at the Diplomat Hotel on 6 and 7 April 2016. The conference focused on the latest research outputs, developments and strategies in the field of food integrity - safety, quality, authenticity and traceability, from the project consortium and beyond. Sessions covered tools for food integrity assessment; knowledge and methodological gaps in current research topics such as non-targeted analysis, complex foods, transparency along the food chain and screening methods.

Delegates at the plenary lecture of the Food Integrity conference, Prague, 6–7 April 2016.

There was also a demonstration on the European 'knowledge base' on analytical methodology and databases for food authenticity and how it can be exploited by stakeholders. In addition, there was a series of workshops and oral presentation sessions covering food crime, occurrence, motivations and mitigations; industrial perspectives for strategies applied for assuring food authenticity; potential citizen science approaches to food integrity; and a session on the authenticity of herbs and spices.

On-site demonstration of the approaches for food authentication developed by the FoodIntegrity project were also presented, giving a unique opportunity to discuss with experts the latest developments and strategies in the field of food integrity.

FEPL (represented by Mr Andrew Cannavan and Mr Simon Kelly) played an active role in the consortium and work package meetings and continue to play the role of adding insight into activities in the international dimension on food authenticity to the European FoodIntegrity project

consortium. FEPL obtains added value from the FoodIntegrity project through identifying collaborative and training partners for national and regional technical coopration projects on food authenticity.

Mr Simon Kelly speaking at a workshop feedback session on Industrial Perspectives for Strategies Applied for Assuring Food Authenticity.

This year almost 250 scientists, from 37 countries, participated in the conference. There were 43 lectures and 111 posters presented. Five major chemical and instrument supplier companies sponsored the event and 6 media partners participated. The FOODINTEGRITY annual conference continues to grow based on its success and reputation as one of the leading food authenticity and traceability annual events. It is anticipated to reach the 400 delegate mark in 2017.

10th Session of the Codex Committee on Contaminants in Food (CCCF10), Rotterdam, The Netherlands, 4–8 April 2016

Technical Officer: James Sasanya

The technical officer represented the Joint FAO/IAEA Division at the CCCF10 meeting and presented a report on activities relevant to the committee in addition to a detailed paper earlier submitted to the Codex Secretariat.

Representation of the Joint FAO/IAEA Division at the CCCF10.

The TO reported on Agency work related to radionuclides and briefed the delegates on the finalization of a technical document entitled "*Criteria for Radionuclide Activity Concentrations for Food and Drinking Water*". The TO also informed the committee about the Joint Division's capacity building and networking activities (relevant to CODEX standards/guidelines setting and implementation) in various countries.

The TO met various delegations interested in the Joint Division's work and gave a brief talk to representatives of the Codex Committee for Africa present at the meeting. Discussions were also held with delegations from Brazil, Ecuador, Colombia, Ghana, Japan, Nigeria, Singapore and Thailand, among others, on pertinent issues such as maximum limits for Cadmium in Cocoa and its products, radionuclides and mycotoxins, etc. Regional and interregional project activities and opportunities supported by the Joint Division were discussed.

A number of delegations expressed interest in or appreciated the support provided to their national food control systems especially laboratory capacity building through the Joint Division. There was also interest in supporting Member States to collect occurrence data on hazards in various foods in order to contribute to international food standards and guideline setting.

Sixth Annual Opportunities in Irradiation for Fresh Produce, Orange, CA, USA, 23–24 March 2016

Technical Officer: Carl Blackburn

This forum served to stimulate commercial interest in the use of irradiation and increase understanding on irradiation as a phytosanitary treatment to enhance global trade and prevent the spread of invasive pest species. It was co-hosted by the Joint FAO/IAEA Programme, represented by the technical officer, the US Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) represented by Margaret Smither and Professor Anuradha Prakash of Chapman University, Orange CA.

Attended by over 100 participants from many different countries, the discussions included latest developments in the commercial application of phytosanitary irradiation, research, equipment, trade, and regulations. Updates and hands-on-experience in this area were provided by a series of lectures and discussion sessions comprising representatives of regulatory bodies, growers, the food industry, irradiation facility operators and irradiation equipment providers. The USA has one of the most active markets for irradiated food and irradiation as a phytosanitary treatment is increasingly being used to prevent the spread of invasive pests through trade. Consumer acceptance has not proved to be an issue in US stores and this has not gone unnoticed; a number of large grocery retailer chains are interested in selling these

irradiated items nationwide and should this go forward, it would boost demand further.

An irradiation facility in Hawaii irradiates approximately 7000 tonnes of fresh produce annually for mainland USA. However, most USA trade in irradiated fresh produce concerns imports, either irradiated in the country of origin or on arrival in the USA at designated facilities (both must be approved by the USDA-APHIS). A representative from a California-based Company provided an insight into the commercial trade and explained how its range of fresh produce is sourced from many different countries and this has included irradiated produce such as mangoes irradiated in Mexico or Australia and dragon fruit from Viet Nam. Irradiation is used to address USA pest restrictions; however an additional benefit for some products is that the shelf life can also be extended.

Australia also has a phytosanitary irradiation programme mainly due to the Queensland fruit fly. Irradiation treatment is enabling Australian exports to Indonesia, Malaysia, New Zealand and Viet Nam, and very recently the USA. Some irradiated produce is also traded within Australia to meet phytosanitary requirements between the different states and territories. The Steritech facility irradiated over 2000 tonnes of Australian produce per year over the past few years, mainly mangoes, tomatoes, but also capsicum, plums, lychees and table grapes.

There are at least two phytosanitary irradiation facilities in Mexico that are authorised to treat food for export to the USA. A purpose built phytosanitary irradiation facility is responsible for much of this trade; approximately 12,000 tonnes of irradiated produce from this Benebion facility were exported in 2015, mostly guavas but also manzano peppers, sweet limes and pomegranates.

Although China irradiates many different food items, no data are available for phytosanitary irradiation; however a new electron beam facility commenced operation in 2015 at Pingxiang. Located near the border, the ASEAN Pingxiang Fruit Irradiation Processing Centre irradiates fresh produce imported from Viet Nam.

The representative of the HEPRO irradiation facility in South Africa outlined commercial phytosanitary irradiation of produce for the USA market. Unfortunately the HEPRO facility was not designed to handle fruit pallets. However, modest volumes of irradiated table grapes have proved to be successful exports and the company would like to build a new facility for phytosanitary irradiation in order to realize the market potential. Plans are being discussed with the government and growers.

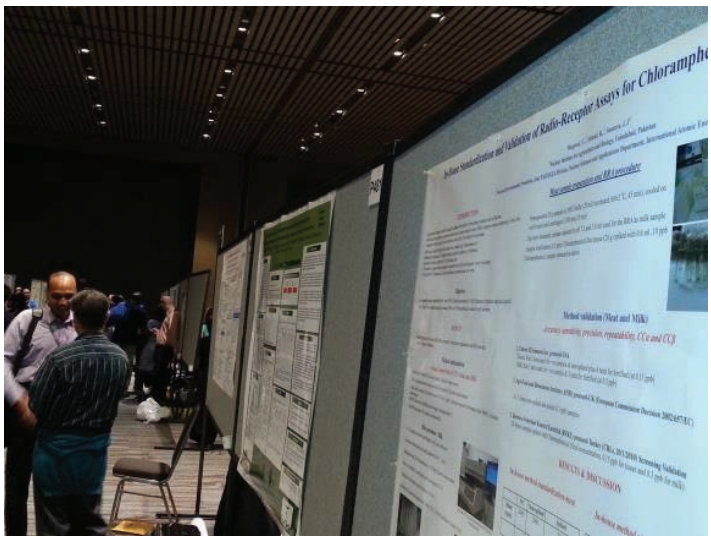
In India, alphonso and kesar mango have been irradiated at the KRUSHAK irradiation facility, located at Lasalgaon, for several years. This year it is anticipated that a second facility in India will also receive US approval to irradiate mango and possibly other fresh produce, also for export to the USA. The country's second irradiation centre is established at Vashi, Navi Mumbai and in addition to fruits it also irradiates onions, spices and grains. The Maharashtra State Agriculture Marketing Board is responsible for treatment at both facilities and has set a target of 400 tonnes of irradiated mangoes for export in 2016, a 21% increase from 2015.

Irradiation is being used commercially to overcome pest restrictions on trade in fresh fruits and vegetables. Not all countries have approved food irradiation facilities but this should not be a barrier. For example, over the past few years, modest volumes of mangoes from Pakistan have been shipped to the USA and irradiated on arrival according to USA rules. The subprogramme collaborating centre at the National Centre for Electron Beam Research, Texas A&M University, USA is approved by the US authorities and in 2015 irradiated approximately 85 tons of mangoes from Pakistan to ensure that they were free of viable pests, meet plant health rules and could therefore be sold to US consumers.

Society of Toxicologists (SOT), New Orleans, Louisiana, USA, 13–17 March 2016

Technical Officer: James Sasanya

The TO attended the SOT 55th Annual Meeting and ToxExpo and participated in continuing education activities including Recent Advances in Safety Assessment, Health and Environmental Impacts on Man-made and Naturally Released Toxicant, Toxicity of Metals among others.



FEP poster presented at the 55th SOT Meeting, New Orleans, USA, March 2016.

The TO also presented a poster entitled "*In-House Standardization and Validation of Radio-Receptor Assays for Chloramphenicol Residues in Bovine Milk and Meat*", one of the products of the IAEA's technical cooperation with the Nuclear Institute for Agriculture and Biology in Pakistan.

IAEA Collaborating Centre: eBeam Technology for Food, Health and Environmental Applications

Technical Officers: Carl Blackburn and Katherine Long

From November 2014 to April 2016 our collaborating centre (CC); the National Center for Electron Beam Research at Texas A&M University, College Station, Texas, has been implementing its work plan. In regard to food irradiation two “Hands-on training” workshops have been held in electron beam irradiation technologies for food processing. The workshop is becoming a very popular annual event and applications are increasing year-by-year. The CC is an ideal venue to learn electron beam irradiation, dosimetry, dose-mapping, and dose distribution patterns. Attendees also have the opportunity to taste some eBeam irradiated food. In 2015, and 2016 participants were from Bolivia, China, Dominican Republic, Ecuador, Mexico, Saudi Arabia, Taiwan and the USA.

The CC is also expanding electron beam and X ray applications in the food industry; primarily in Latin America. With the leadership of its Director, Suresh Pillai, the CC is reaching out and engaging food and fresh fruit and vegetable producers and traders. Attendance at the annual workshop is one of the most cost-effective means for such stakeholders to receive an introduction and experience the technology in action. In addition, the CC hosts visitors from governmental organizations, industry, academia and also interested members of the public. It introduces the technology through meetings and tours of the eBeam facility on the Texas A&M University campus. Also, the CC makes its technical staff available to participate at appropriate meetings to help disseminate information about the technology and support its further up-take and commercialization. As a centre of excellence for eBeam research the CC also works with researchers internationally, collaborating in projects to innovate and develop the application of irradiation technologies to food and also in health and environmental applications.

For example, in 2015 a group of 30 visitors from Mexico met and toured the eBeam facility, these guests comprised growers, exporters, importers and distributors of fresh produce. Also, as part of an IAEA event in Mexico, the CC held in-depth discussions with meeting participants to discuss the adoption of this technology in more countries of Latin America. The CC is approved by the USDA to irradiated fresh produce as a phytosanitary treatment and discussions have focused around business models, as well as US regulations related to imports of irradiated fresh produce or produce imported and then irradiated to ensure phytosanitary security. In Mexico, there is a great deal of interest in the technology and in order to encourage this further, the CC Director has visited the country many times to provide technical input and information; at a meeting in Michoacan he gave a presentation “Encounters in the Orchard - Electron Beam Technology for Increasing Mexico’s Fruit and Vegetable Exports”; at Toluca he participated in a meeting and gave a lecture on “Experience of an eBeam facility with USDA-APHIS Certification”, and in Merida he made a presentation on “Global eBeam Solutions - a strategic partnership for worldwide dissemination of electron beam technology”.

A number of research projects are also underway to develop treatments for high value foods and food ingredients. The focus has been on developing benchmarks to prove the efficacy of eBeam technology for fresh berries, raw milk and space foods. Research is focused on identifying the minimum eBeam dose for raw milk pasteurization, benchmarking the organoleptic and other properties associated with eBeam treatment of raw milk, quantifying the reduction in infection risks when eBeam technology is adopted as well as identifying complementary technologies that can be used along with irradiation. One of their early outcomes is to initiate the commercialization of eBeam irradiated ripe tamarind and other high value foods; this is being taken forward by the company *eFoods, Inc.* Similarly other commercial entities are engaging with the CC and exploring the use of eBeam technology for pasteurizing ingredients for novel foods. NASA is also working closely with the CC as it has also adopted eBeam for sterilizing foods for the space programme.

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

CRP Reference Number	Ongoing CRPs	Scientific Secretary
D52037	Implementation of Nuclear Techniques to Improve Food Traceability	S. Kelly A. Cannavan
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
D61024	Development of Electron Beam and X ray Applications for Food Irradiation (DEXAFI)	C.M. Blackburn
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
CRP at the Planning Stage	**Proposed CRPs**	**Scientific Secretary**
2156	The Use of Irradiation to Prevent Foodborne Parasitic Infections Associated with Fresh Fruits and Vegetables	C.M. Blackburn
2144	Nuclear Techniques and Novel Instrumentation for Low-Z isotope analysis in Food Products	S. Kelly A. Cannavan

Implementation of Nuclear Techniques to Improve Food Traceability (D52037)

Technical Officers: Simon Kelly and Andrew Cannavan

Producing safe and high quality food is a prerequisite to ensure consumer health and successful domestic and international trade, and is critical to the sustainable development of national agricultural resources. Traceability systems play a key role in assuring food safety. Analytical techniques that enable the provenance of food to be determined provide an independent means of verifying "paper" traceability systems and also help to prove authenticity, to combat fraudulent practices, and to control adulteration, which are important issues for economic, religious or cultural reasons. This coordinated research project (CRP) will address some of the challenges that developing countries are facing in ensuring food traceability. In particular, it will help laboratories in member states to establish robust analytical techniques to determine provenance of food through the assessment of the isotopic and elemental composition of foodstuffs using an integrated and multidisciplinary approach. The immediate benefit to laboratories will be the implementation and application of state-of-the-art nuclear measurement techniques to determine the provenance of foodstuffs. These will complement screening methods to detect residues and contaminants in food to provide holistic food safety systems.

Accessible Technologies for the Verification of Origin of Dairy Products as an Example Control System to Enhance Global Trade and Food Safety (D52038)

Technical Officers: Simon Kelly and Andrew Cannavan

This CRP will address some of the challenges that developing countries are facing in ensuring food traceability. It will develop a complete end-to-end system using dairy milk as an example commodity. This system will then be available as a template that can be transferred to other commodities as required.

Development of Electron Beam and X ray Applications for Food Irradiation (DEXAFI) (D61024)

Technical Officer: Carl Blackburn

The majority of food and agricultural products treated by irradiation are processed in facilities using gamma radiation from cobalt-60 as the source of ionizing radiation. Gamma irradiation is a simple, robust and well-established technology. However, as cobalt-60 might become more difficult to obtain in the future, it is necessary to have other technologies ready to ensure the application of irradiation to food over the long term. Electron beam and X ray machines employ electricity to generate ionizing radiation. The effects of electron beams and X rays on food are similar to those of gamma irradiation. However, the use of electrical machine sources for food irradiation on a

commercial scale has thus far been limited. A consultancy meeting held in May 2014 identified the need for internationally coordinated research to stimulate the development of machine sources and to establish the conditions that could broaden the choice of technologies to irradiate food. The aim of this CRP is therefore to coordinate research and development (R&D) activities that are prerequisites for the practical implementation of processes using electron beams and X rays, and to unlock the potential of machine sources for radiation treatment of agricultural and food products. The project will adopt an international and multidisciplinary approach involving cooperative R&D between food scientists, universities, equipment manufacturers, and stakeholders within the agri-food industry.

Development and Strengthening of Radio-Analytical and Complementary Techniques to Control Residues of Veterinary Drugs and Related Chemicals in Aquaculture Products (D52039)

Technical Officer: James Sasanya

Aquaculture practice (fish and seafood farming) is becoming more widespread for the inexpensive and intensive production of protein rich foods. In the period 2000–2012, intensive aquaculture production increased at an average annual rate of 6.2% from 32.4 million to 66.6 million tons1. Inevitably, agrochemical inputs such as veterinary pharmaceuticals and related substances are required to control aquaculture-related diseases and improve yields. Residues of such inputs, plus unintended natural toxins (in aquaculture products and feeds) and contaminants at production sites, pose public and environmental health risks and must be addressed. This calls for robust national regulatory frameworks underpinned by sound laboratories, to among others safeguard consumers and aquaculture production, and enhance international trade in aquaculture products. Research is needed now on analytical methods that will strengthen laboratory performance and nuclear and isotopic techniques can play an important role. Research is also required to better understand the contamination of aquaculture production sites, with potential public and environmental health implications. Through the above mentioned research, this CRP aims at strengthening Member State analytical laboratories and national chemical residue monitoring programs thus contributing to the improvement of food safety, better aquaculture production and management practices as well as enhancement of trade in aquaculture products. New analytical methods will be developed (including improved environmentally friendly sample preparation techniques) validated and transferred amongst Member States laboratories. The CRP will contribute to the knowledge-base on contamination of aquaculture production systems.

Consultants' Meeting for "Nuclear Techniques and Novel Instrumentation for Low-Z Isotope Analysis in Food Products", Vienna, Austria, 18–21 April 2016

Technical Officers: Simon Kelly, Andrew Cannavan and Iain Darby

The joint FAO/IAEA Division, in collaboration with the Division of Physical and Chemical Sciences, is developing a proposal for an international coordinated research project to exploit and adapt portable atomic and molecular spectroscopic screening technologies for front-line food fraud detection. From 18 to 21 April 2016, four consultants and two cost-free industry experts were invited to the IAEA Headquarters to review a draft proposal and formulate a project which, if approved, would start in 2017.

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 risk to human health. Recent examples include excessive methanol in spirit drinks and harmful substances in dietary supplements.

Consultants' Meeting on 18−21 April 2016.

This CRP 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.

The consultants reiterated the challenges of gathering authentic samples and producing realistic adulterated samples that ensure any food adulteration models produced are sufficiently robust for routine screening. In order to maximise the potential of the project it was deemed important for participants to take sufficient authentic samples to permit distribution of sub-samples for analysis by other project participants to maximise information gathering. In this way samples can be screened by all the techniques – nuclear, atomic and molecular spectroscopy and mass spectrometry. It is essential to have a number of complementary analytical techniques within the project to identify the large range of possible food adulteration and food traceability issues. Laboratory techniques also need to be made available to definitively confirm the identity of the adulterant or contaminant in 'abnormal' samples identified using the screening techniques. The consultants also identified the essential requirement to have a technical contract to establish and maintain atomic and spectral libraries that are generated from authentic and adulterated samples within the consortium. A solution to the long-term integrity and sustainability of the library needs to be identified within the life-time of the CRP. It was also agreed that the CRP should conclude with a realistic field-demonstration of the screening methods.

Technical Cooperation Projects

Country/Region	Project No.	Title	Technical Officer
Bahrain	BAH5001	Determining Pesticide and Mycotoxin Residues in Water and Food	J.S. Corley B.M. Maestroni
Bangladesh	BGD5031	Strengthening Capacities to Monitor and Control Veterinary Drug Residues in Foods of Animal Origin	J.J. Sasanya
Belize	BZE5007	Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority	J. S. Corley G. J. Viljoen B.M. Maestroni
Benin	BEN5008	Establishing Enhanced Analytical Capability to Comply with International Standards for the Evaluation and Control of Veterinary Drug Residues in Food of Animal Origin	J.J. Sasanya
Benin	BEN5009	Monitoring Safe Food Supply through Total Diet Studies and the Application of Nuclear and Complementary Analytical Techniques	C.M. Blackburn J.J. Sasanya A.R.R. Pitois (NAEL)
Botswana	BOT5014	Enhancing the Use of Nuclear and Isotopic Analytical Techniques in Monitoring Chemical Food Contaminants	J.S. Corley
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.S. Corley
Costa Rica	COS5032	Enhancing the Capacity to Control Contaminants and Residues of Veterinary Medicines and Pesticides in Foodstuffs of Animal Origin Using Nuclear and Conventional Analytical Techniques	J.J. Sasanya
Costa Rica	COS5033	Assessing and Implementing Biochar Use in Climate Smart and Environmentally Friendly Pineapple Production Using Isotopic Techniques	G. Dercon A. Cannavan J. S. Corley M. Zaman C.M. Blackburn
China	CPR5022	Implementing the Stable Isotope Technique for High Quality Agro-product Traceability and Authenticity	A. Cannavan S. Kelly

Country/Region	Project No.	Title	Technical Officer
China	CPR5023	Strengthening the Regulatory System for the Effective Control of Food Irradiation and Promoting Good Manufacturing Practices(Not Funded)	C.M. Blackburn
Cuba	CUB5019	Strengthening National Capacity for Monitoring Heavy Metals to Improve Soil and Food Quality Using Nuclear and Related Techniques	J.J. Adu-Gyamfi J.S. Corley C.M. Blackburn
Dominica	DMI5001	Enhancing Capacity to Monitor Agrochemical Residues in Foods and the Environment	J.S. Corley J.J. Sasanya
Ecuador	ECU5028	Consolidating Food Security and Environmental Sustainability in Palm Oil Production Using Nuclear Applications	J.S. Corley J.J. Adu-Gyamfi A. Cannavan B.M. Maestroni
Egypt	EGY5026	Establishing a National Reference Laboratory Applying Nuclear/Isotopic and Related Techniques in the Analysis of Food Contaminants	J.J. Sasanya
El Salvador	ELS7006	Building Capacities to Minimize Environmental Contamination and to Protect the Health of the Rural Population by Strengthening Research Capabilities and Laboratory Infrastructure	B.M. Maestroni
Guatemala	GUA7004	Developing Capabilities to Evaluate the Transfer and Fate of Water Pollutants to Improve the Management of Major Basins and the Safety of Agricultural Products	B.M. Maestroni
Haiti	HAI5006	Increasing Productivity and Exportability in the Agricultural Sector through Soil and Water Management and Food Safety Monitoring	J.J. Adu-Gyamfi J.S. Corley C.M. Blackburn
Inter-Regional	INT5154	Improving Food Safety through the Creation of an Interregional Network that Produces Reliable Scientific Data Using Nuclear and Isotopic Techniques	J.J. Sasanya
Iraq	IRQ5021	Developing Food Safety and Assurance System Using Nuclear and Other Related Technologies	A. Cannavan J.S. Corley S. Kelly J.J. Sasanya

Country/Region	Project No.	Title	Technical Officer
Libya	LIB5012	Using Nuclear and Complementary Techniques for Monitoring Agrochemical Residues in Food Products and the Environment	J.S. Corley
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
Marshall Islands	MHL7001	Developing a National Radioactivity monitoring Capacity	J.S. Corley I. Tolosa Bertral(NAEL) A.V. Harms (NAEL) 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
Mongolia	MON5019	Assessing and Enabling the Implementation of Food Irradiation Technologies	J.J. Sasanya A. Cannavan
Morocco	MOR5034	Improving Veterinary Drug Residue Detection and Animal Disease Diagnosis with Nuclear and Molecular Techniques	I. Naletoski J.J. Sasanya
Morocco	MOR5036	Valorizing and Improving the Quality of Food Products by Using Irradiation Techniques	C.M. Blackburn
Mozambique	MOZ5006	Building Laboratory Capacity for Food Safety Using Nuclear/Isotopic and Complementary Analytical Techniques	J.J. Sasanya J. S. Corley
Namibia	NAM5013	Assessing the Spatial Distribution of Lead, Cadmium and Selected Pesticide Residues in Livestock Farming	J.S. Corley 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 J.S. Corley
Nigeria	NIR5039	Enhancing Dietary Exposure Assessment of Chemicals in Food	J.J. Sasanya
Oman	OMA5003	Strengthening National Capabilities in Food Safety and Food Traceability	J.S. Corley B.M. Maestroni

Country/Region	Project No.	Title	Technical Officer
Panama	PAN5022	Determining Pesticides and Inorganic Pollutants in Vegetables and Studying the Adsorption and Migration Through Nuclear Technologies in Zones of High Pollution Incidents to Guarantee Safe Food for Consumers	B.M. Maestroni
Panama	PAN5024	Developing Analytical Capabilities for the Detection of Chemical Contaminants in Food and the Quality of Agrochemicals	B.M. Maestroni J.S. Corley C.M. Blackburn
Panama	PAN5025	Expanding and Strengthening the Phytosanitary Surveillance System for Fruit Fly, Emphasizing Exotic Species of Quarantine Importance, and Exploring the Use of Nuclear Techniques for Post-Harvest Treatment as a Complementary Action	W.R. Enkerlin Hoeflich C.M. Blackburn
Paraguay	PAR5010	Strengthening the National Network of Laboratories Involved in Chemical Risk Analysis to Ensure Food Safety Through the Use of Nuclear and Complementary Non-Nuclear Techniques	J.S. Corley B.M. Maestroni J.J. Sasanya
Senegal	SEN5038	Strengthening Laboratory Capabilities for Analysing Veterinary Drug Residues and Contaminants in Food	A. Cannavan J.J. Sasanya
Sierra Leone	SIL5016	Strengthening Laboratory Capabilities to Evaluate and Monitor Levels of Mycotoxins, Toxic Metals and Related Contaminants in Foods	J.J. Sasanya J.S. Corely
Sri Lanka	SRL1008	Providing Technical Support for Smooth, Safe and Sustained Operation of the Multipurpose Gamma Irradiation Facility	S. Sabharwal (NAPC) C.M. Blackburn
Sudan	SUD5035	Establishing a Laboratory for Monitoring Veterinary Drug Residues and Prohibited Substances in Livestock and Livestock Products through Application of Nuclear and Related Techniques to Protect Public Health	J.J. Sasanya A. Cannavan
Syria	SYR5023	Enhancing Analytical Capacities of Major Pesticide Residues	J.S. Corley B.M. Maestroni
Syria	SYR5024	Enhancing Capabilities to Monitor Naturally-Occurring and Synthetic Anabolic Hormones and other Veterinary Drug Residues in Foods	J.J. Sasanya

Country/Region	Project No.	Title	Technical Officer
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 J.S. Corley
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	RAS5062	Building Technological Capacity for Food Traceability and Food Safety Control Systems through the Use of Nuclear Analytical Techniques	B.M. Maestroni A. Cannavan Z. Jandric Z. Ye S. Kelly
Asia	RAS5071	Strengthening Adaptive Climate Change Strategies for Food Security through the Use of Food Irradiation (RCA)	C.M. Blackburn
Asia	RAS5078	Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants	J.J. Sasanya
Asia	RAS7026	Supporting the Use of Receptor Binding Assay (RBA) to Reduce the Adverse Impacts of Harmful Algal Toxins on Seafood Safety	A. Cannavan M.Y. Dechraoui Bottein (NAEL)
Latin America	RLA5065	Improving Agricultural Production Systems Through Resource Use Efficiency (ARCAL CXXXVI)	B.M. Maestroni J.J. Adu-Gyamfi L.K. Heng
Latin America	RLA5066	Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food	C.M. Blackburn

Country/Region	Project No.	Title	Technical Officer
Latin America	RLA5069	Improving Pollution Management of Persistent Organic Pollutants to Reduce the Impact on People and the Environment (ARCAL CXLII)	B.M. Maestroni J.S. Corley J.J. Sasanya
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)

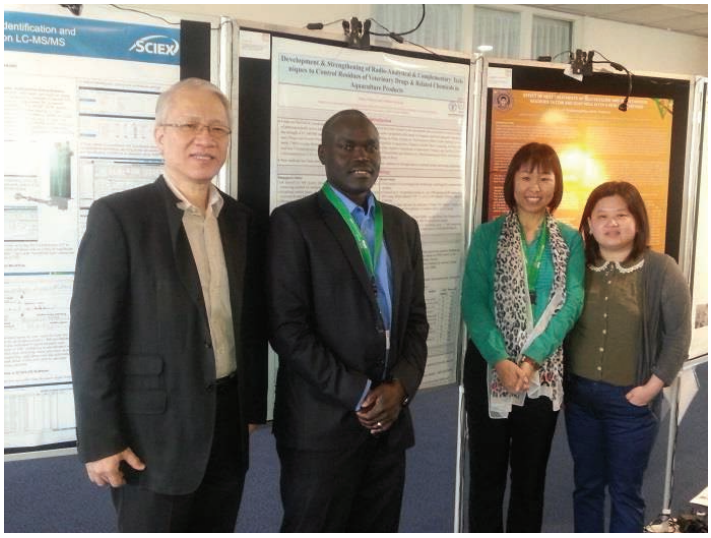
First Coordination Meeting for an Asia Food Safety Project and 8th Euro Residues Conference (ERV III), The Netherlands, 22–27 May 2016 (RAS5078)

Technical Officer: James Sasanya

A regional non-agreement Technical Cooperation Project "*Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants*" has been launched and the first coordination meeting held at RIKILT, Wageningen, The Netherlands from 25 to 27 May 2016. Twenty-seven counterparts from 16 countries namely, Bangladesh, Indonesia, Jordan, Lao P.D.R., Lebanon, Malaysia, Mongolia, Oman, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, Syrian Arab Republic, Thailand and Viet Nam attended. Prior to the meeting, the participants attended the ERV III conference including a pre-conference workshop at Egmond aan Zee from 22 to 25 May 2016.

Participants at the RAS5078 First Coordination Meeting at RIKILT, Wageningen, The Netherlands.

The TO provided technical guidance to the meeting and also presented 2 posters at the conference: "*Development & Strengthening of Radio-Analytical & Complementary Techniques to Control Residues of Veterinary Drugs & Related Chemicals in Aquaculture Products*" and "*Enhancing Food Safety Laboratory Capabilities & Establishing a Network in Asia to Control Veterinary Drug Residues & Related Chemical Contaminants*"



The technical offier and other participants during a poster session at the ERV III at the Hotel Zuiderduin, Egmond aan Zee, The Netherlands, 22–25 May 2016.

Food Safety Stakeholder Awareness Workshop - The Interface with Laboratories, Dar es Salaam, United Republic of Tanzania, 16–20 May 2016 (RAF5067)

Technical Officer: James Sasanya

The above workshop was held at the Tanzania Food and Drugs Authority (TFDA) Headquarters in Dar es Salaam, Tanzania under the AFRA regional project "*Establishing a Food Safety Network through the Application of Nuclear and Related Technologies*"

Thirty-six participants from 11 African countries namely Cameroon, Chad, Egypt, Ethiopia, Mali, Mauritius, Sudan, Tunisia, Uganda, Zambia and the host Tanzania attended, among them stakeholders including inspectors, researchers,

manufacturers, producers/farmers and laboratory scientists. The Permanent Secretary of the Ministry of Health, Community Development, Gender, Elderly and Children, Honourable Dr Mpoki Ulisubisya addressed the participants stressing the importance of networking and information/experience sharing in the region. The FAO Country Representative also attended and addressed the participants on partnership for food safety and quality.

The participants deliberated on learning from each other with regard to food safety control, sharing information and experiences in food safety control among the African countries, identifying shortfalls and opportunities as well as initiatives for control and effective networking among African Member States.

The participants prepared a draft document on strategies for enhancing/sustaining effective food safety programmes in the African region.

Improving Veterinary Drug Residue Monitoring, Rabat, Morocco, 25–29 April 2016 (MOR5034)

Technical Officer: James Sasanya

The FEP has supported capacity building at the Office National de Sécurité Sanitaire des Produits Alimentaires (ONSSA) Rabat, counterpart for the IAEA TCP MOR/5/034, to facilitate the testing and monitoring of veterinary drug residues in animal products. The TO recently visited the counterpart as well as sister ONSSA institutions in Casablanca and Mekness. The TO and CP also visited the FAO Country Office and discussed opportunities for synergies with the country Programme Officers.

Residue analysis is progressing well and the CP is resourceful enough to support the training of personnel from other local and regional food safety laboratories.

The technical officer, ONSSA, Rabat staff and an external expert involved in a National Training on Veterinary Drug Residues.

Final Coordinators' Meeting on Building Technological Capacity for Food Traceability and Food Safety Control Systems through the Use of Nuclear Analytical Techniques, Beijing, China, 25–29 April 2016 (RAS5062)

Technical Officer: Zhihua Ye

The final assessment meeting was held in Beijing, China, from 25 to 29 April 2016. It was attended by 24 participants from 13 participating countries, including Bangladesh, Cambodia, China, Indonesia, Iraq, Kuwait, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Syria and Vietnam. Three experts were invited and present at the final CM: Professor Russell Frew from Otago University of New Zealand, Professor Shuming Yang from IQSTAP-CAAS of China and Ms Yaeko Suzuki from the National Agriculture and Food Research Organization (NARO) of Japan as a cost-free expert. Mr Massoud Malek, the Project Management Officer (PMO) and Mr Zhihua Ye, the technical officer (TO) representing the IAEA, were also present at the final assessment meeting.

The meeting started with the opening and welcome remarks by Ms Feng Dongxin, the Director General of the International Cooperation Department, Chinese Academy of Agricultural Sciences (CAAS), as the local organizer and representative of the host country, China. She extended her greetings, warmly welcomed all participants to the meeting and acknowledged the IAEA in selecting China to be the host of this important meeting. In her remarks, she also highlighted the R&D activities being conducted in CAAS starting from the beginning of this century on crop science, animal science, environment and natural resources, food science, agricultural engineering, agricultural economics and information, etc. She also recognized the application of nuclear science and technology in addressing food traceability issues. On behalf of the participating institute of the host country, Mr Gong Xifeng, the Deputy DG of the Institute of Quality Standards and Testing Technology for Agro-products (IQSTAP), also made some opening remarks and gave an overview of the research being conducted at the Institute on Food Traceability and Authenticity with support from the IAEA and in collaboration with participating laboratories of the TC Project RAS5062. He expressed his wish for a successful meeting and more research cooperation with the IAEA and the counterparts of other participating countries in the region in the future.

Mr Malek gave his welcome remarks and thanked CAAS and Chinese Government for kindly accepting to be the host of the final meeting. The PMO highlighted the

objectives of the meeting and wished every participant a productive meeting. Mr Ye also made brief welcoming remarks and thanked the local organizer. He expressed specific appreciation to all participants for their kind support to and good collaboration with IQSTAP-CAAS when he was the coordinator of China in this project before he joined the IAEA.

Final Coordinators Meeting in Beijing, China.

The group appointed Mr Russell Frew (NZ) to be the Chairperson of the meeting, and Mr Vajira Waduge was tasked to be the Rapporteur.

Mr Malek presented an overview of the RCA including its vision as well as its membership. He informed that RAS (Regional Project for Asia and the Pacific) has 22 participating countries. He also explained the different classifications of regional projects i.e. agreement or non-agreement and, briefly, informed the group of the research project selection mechanism of the RCA. He also introduced a platform network for the maintenance and storage of the data and results of the project. Further communication/networking among existing groups was encouraged to promote the sustainability of project activities and impact monitoring. This was discussed further during the course of the meeting.

Mr Ye gave an overview on the implementation of this regional project RAS5062 since it was kicked off in 2012, including coordinators' meetings, regional training courses and expert missions. He also discussed the regional project's logical framework matrix showing the outcomes, outputs and activities. Likewise, the regional work and the action plan for the one-year extension were presented as well as an overview of the major activities and accomplishments of the project.

Detailed reports of project results and accomplishments were presented with PPTs by each of the 13 participating countries. In order to finalize the achievements of the project, each of the participating countries was required to provide a summary of their project results and accomplishments. Ms Yaeko Suzuki presented the final results and comparative analysis of proficiency tests for rice samples from participating laboratories.

Thereafter, the Chair led a discussion on the Country Report Card (CRC), and a format for country report card was discussed and agreed upon. A template was formulated and distributed for participants to complete. When the updating and corrections to the report card were completed, the participants were requested to provide inputs according to their activities.

As agreed upon at the mid-term meeting, a technical workshop on *development and transfer of nuclear-related analytic technology for food traceability and authenticity* was incorporated with this final coordination meeting. Mr Ye chaired the workshop and all the meeting participants, including invited local participants from local institutes were presented. Mr Russell Frew gave lectures on "Food quality/safety management practices from a traceability perspective", "Analytical techniques currently being used for verification of origin and authenticity of foodstuffs" and "Management and effective use of traceability and authenticity data", respectively, while Mr Shuming Yang gave lectures on "Quality control of analysis for traceability and authenticity by proficiency test" and "Function and application of chemometrics on food traceability and authenticity with a case study". A general discussion was held with participants posing questions about the items presented.

Technical Workshop on Development and Transfer of Nuclear-related Analytic Technology for Food Traceability and Authenticity.

Mr Frew then introduced a draft RCA project proposal on supporting regional authentication of foodstuffs and leading relevant discussions. A discussion was held on establishing Asia-Pacific networking on food traceability and authenticity. Numerous recommendations were developed, particularly to the participants as the members of the network who will need to take responsibility for maintaining its momentum over the next two years.

As concluded in the final meeting, the project has provided a sound platform for participating Member States to begin developing science-based tools for the verification of conventional paper-based traceability systems. Nuclear and isotopic techniques (NITs), together with complementary techniques, provide powerful and effective means for food

safety control issues. All Government participants have made significant progress with their projects. The capability development achieved through the project has been useful to assist countries in developing their national projects. Meanwhile, the project has laid a good foundation and established an effective network for future regional food safety and traceability studies.

Participants of the final coordinators meeting in Beijing, China.

Training on Proper Sampling and Statistics for a Food Safety Laboratory, Gaborone, Botswana, 18–22 April 2016 (RAF5067)

Technical Officer: James Sasanya

The above training was conducted under the AFRA regional project "*Establishing a Food Safety Network through the Application of Nuclear and Related Technologies*" and attended by 23 participants from nine African countries.

Areas of work included among others: Introduction to method validation – key characteristics per ISO 17025: 2005; Principles of sampling and practical implementation of sampling for analysis of chemical contaminants and environmental samples among others.

Africa food safety laboratory personnel and stakeholders at the above training.

The Marshall Islands and IAEA Team Up to Use Isotopic Techniques in Food and Environmental Safety, Marshall Islands, 18–22 April 2016 (MHL7001)

Technical Officer: Johannes Corley

The last leg of my journey, already a day and a half has elapsed and still a long way to go. Flying out of Honolulu, Hawaii out into the Pacific Ocean, the journey seems endless. Five hours since we left Honolulu and still no land in sight. The pilot announces that we are descending and should be landing shortly. Where? "Ten minutes to land, crew, please take your seats" announced the pilot. Is this to be a water-landing? No the Boeing 737 is not equipped for regular water landings. Finally, we see some breakers (white surf of waves crashing) but still no land. As we turn to make our final approach, I look out of the window and see a strip of sand appearing narrower than the wing-span of our airplane.

An arial view of one of the Islands.

My first thoughts were clearly about the Marshallese people and their environment and how strongly interlinked the two are. Even a small rise in ocean levels could completely obliterate the islands and any human activity would directly affect the environment that they live in and almost immediately impact the Marshallese. The Marshallese live off their lagoons and the ocean and fish comprise greater than 90% of Marshallese diets. That is why the government of the Republic of the Marshall Islands (RMI) was alarmed when presented with reports indicating the presence of high levels of oxic contaminants such as poly-chlorinated biphenyls (PCBs), organo-chlorine pesticides (OCs) and toxic metals in fish from one of their lagoons. The Secretary of Foreign Affairs contacted the Director General of the IAEA with a request for assistance in characterizing and monitoring toxic substances detected in fish samples and assistance with

ensuring the safety of their food to protect the health of the Marshallese people.

The lagoons have been, and continue to be, the main source of food for the Marshallese people for thousands of generations. Contaminants and pollutants released by human activity into the environment (PCBs, OCs and metals) leach out into the lagoons where they are ingested by fish and other marine creatures. These substances tend to bio-accumulate in fatty tissue and concentrate up the food chain thus rapidly exposing the Marshallese consumers of lagoon fish to the toxic chemicals. Reports from analysis of both fish muscle and organ-tissue (eye and liver) indicated the presence of PCBs, OCs and metal contaminants and also that the contaminants tended to concentrate in fish liver, a delicacy for the Marshallese people. In order to protect the health of the Marshallese population, local governments have imposed fishing bans on areas of suspected contamination. However, such short term solutions significantly affect the Marshallese way of life and may not be sustainable over the longer term. It is very important to identify problem sites, toxic substances of concern at each site and mechanisms for remedial action to prevent the "sources" from leaching toxic pollutants into the environment.

The Republic of the Marshall Islands (RMI) comprise of a remote group of atolls that lie somewhere between Hawaii, Papua New Guinea and Guam. Atolls are islands that form the tips of massive ancient under-water volcanoes or calderas and stick out of the ocean in a ring-like formation.

RMI scientists accompany the IAEA team around Kwajalein atoll (the largest atoll in the world).

The water mass falling inside the "ring" of islands or atoll is the lagoon, a marine area protected by the ring of islands from the open ocean. The RMI is made up of about 29 separate atolls and five isolated islands spread out over approximately 1.9 million square kilometres (land mass totaling 180 sq km)[1]. Some uninhabited, many sparingly populated and only two, Majuro and Kwajalein with sizeable populations (by Marshallese standards). The islands that make up the atoll are very narrow (no more than 3–5 km at the widest point) with the largest of the islands being about 20 km long lying no more than 2–10 metres above sea level in most places. Some adjoining islands within a lagoon are connected by bridges or land-fills.

Majuro (Majuro atoll) and Ebeye (Kwajalein atoll) are the main population centres of the Marshall Islands accounting for about 70% of the RMI's populations. Majuro has a population of 27–31,000 people and Ebeye has a population of approximately 12,000. Fish constitutes a very large portion of the Marshallese diet (> 90% by some estimates). Coconut (and coconut products), breadfruit, bananas, some tomatoes mostly from home gardening/private production, account for the vegetable portions of the Marshallese diet. Green leafy vegetables, cereals, rice, fruit, milk, meat, poultry products, etc. are mostly imported although there is some home poultry/egg production. There is also some local root vegetable production. There is an agricultural experiment station in the Laura area of Majuro atoll where there is an experimental hog farm and experimentation of crop production under drip irrigation.

Majuro Agricultural Experiment Station with Casava (centre) and Taro (bottom left and upper right).

Potable water is a very precious commodity in the Marshall Islands especially at present where the islands are in a severe drought situation due to the El Niño effect. Some of the crops being produced are bananas, taro, cassava, breadfruit, tomatoes and corn. The soil on most areas of the Marshall Islands is sandy and of high salinity. Only in a few areas is the soil capable of supporting a wider range of crops. Some Marshallese (especially from Majuro) have home gardens where they produce tomatoes and other root and fruiting vegetables. There is a demand for compost to use in home gardens. Most households in the RMI use collection systems for holding rain water which they use to

[1] Source: Wikipedea.com (https://en.wikipedia.org/wiki/Marshall_Islands)

drink. There is a Reverse Osmosis (RO) plant to convert sea water into potable water.

Waste management and disposal continue to pose a serious problem for the Marshall Islands. Anything that comes to the island stays on the island eventually contaminating the environment and ending up in the human food chain, a very toxic and harmful choice for both humans and the environment. Hence the urgent need for implementing more sustainable and less toxic/less environmentally harmful alternatives.

In the main city of Majuro unseparated waste is collected street-side from households. Sometimes, the waste is separated into plastic, metal, aluminium cans and compostable material. Organic matter is composted and later sold to locals who use the compost in home gardens. There is a great demand for compost and the composting programme is growing. Commercially, it is economically feasible to compact aluminium cans and ship them off for recycling. However, recycling plastic in a similar manner is not economically feasible. Auto batteries are also being recycled. Oils are being drained off automobiles and attempts are underway to recycle those oils. However, a majority of the plastic and metal waste stays on the waste site and decomposes there.

Plastic bags bottles and Styrofoam containers appeared to be a major part of the non-recyclable waste along with metal (including automobiles). There is a proposal from the RMI-EPA to ban plastic bags on the Marshall Islands, replacing them with paper and locally made re-useable bags (traditionally made with coconut/pandanus fibre). The proposal is being considered in the RMI parliament. Using locally produced re-useable bags has multiple benefits including supporting the local economy, reducing toxic waste and economically beneficial to vendors (who do not have to pay the cost of bagging their produce). The IAEA along with the UN and other agencies should strongly back the efforts of the RMI government and the RMI-EPA in replacing plastic bags with local environmentally friendly and economically beneficial alternatives.

Some steps that should be considered for waste management throughout the Marshall Islands are:

- Proper separation of different types of waste items.
- Composting organic waste for use in home agriculture and commercial farms in the future.
- Replacing plastic bags with locally produced, re-useable and environmentally friendly products.
- Creation/development of an economically feasible and sustainable waste recycling programme.
- Incorporation of an environmentally friendly and sustainable mechanism for eliminating non-recyclable/ non-compostable waste.
- Better management and disposal of automobile/heavy machinery, batteries, parts and fluids.

The IAEA team meets with the Mayor of Ebeye, the GM of the RMI-EPA and other officials and scientists from the RMI.

Recognizing the close bond between the Marshallese people and the environment that they live in and the direct impact of environmental pollutants getting into the human food chain and adversely impacting human health, the food and environmental protection section working together with the technical cooperation programme, the Marine Environmental Science Laboratory (MESL) and Nutrition and Health-Related Environmental Studies Section (NAHRES) plan to assist the Republic of the Marshall Islands by building capacity in the Marshall Islands in three areas:

a. Training scientists and government officials in the Marshall Islands develop a better understanding of scientific principles and food safety standards so that they can conduct risk and exposure assessments on their own.

b. Building basic laboratory capacity for identifying and monitoring chemical contaminants in food and the environment.

c. Training Marshallese scientists in the application of nuclear and isotopic techniques for analysing food and environmental samples rapidly, reliably and cost effectively.

d. Training the Marshallese on data interpretation and developing plans to mitigate risks posed by food and environmental contaminants.

e. Characterizing human exposure and health risks posed by toxic environmental pollutants.

Through these efforts as well as building coalitions with other organizations and member nations, we hope to assist the Marshallese people and their government to build capacity and better understand the food and environmental situation in their country. The RMI has a good team of scientists, doctors and officials who once trained can

develop solutions unique and tailored to resolving the problems of the Marshall Islands.

Interregional Food Safety Project, Santiago, Chile, 18–22 April 2016 (INT 5154)

Technical Officer: James Sasanya

The new interregional food safety project "Improving Food Safety through the Creation of an Interregional Network that Produces Reliable Scientific Data Using Nuclear and Isotopic Techniques" that FEP supports was launched at the coordination meeting in Chile, from 18 to 22 April 2016, attended by 28 non-local and over 10 local scientists.

Interregional Food Safety Project participants welcomed to Santiago, Chile. Photo courtesy of J. Sasanya.

This five-year project will enhance capacity to contribute to occurrence data collection and build interregional collaboration. The TO was the scientific secretry and also gave a talk on the "Importance of and strategies for interregional food safety partnerships".

Regional Meeting on Emerging Contaminants, Montevideo, Uruguay, 14–18 March 2016 (RLA7019)

Technical Officer: Britt Maestroni

The FAO/IAEA Food and Environmental Protection Laboratory (FEPL) together with the IAEA Technical Cooperation Department organized a regional meeting on emerging contaminants in Montevideo, Uruguay from 14 to 18 March 2016. The meeting was held in the context of the current regional project, TCP RLA 7/0/19, which aims at providing a technical framework for monitoring continental aquatic systems in Latin America and to provide government authorities with an early warning tool for environmental sustainability and food safety management.

The meeting was attended by 36 participants from eight Latin American countries. The purpose of the meeting was to raise awareness about emerging contaminants and the associated emerging risks to be able to evaluate their potential threat to consumers and the environment. Emerging contaminants (EC) can be broadly defined as any synthetic or naturally occurring chemical or any microorganism that is not commonly monitored in the environment but has the potential to enter the environment and cause known or suspected adverse ecological and/or human health effects (USGS). It has become easier to identify these emerging contaminants with the advent of the novel analytical capabilities developed nowadays, such as accurate mass and high resolution mass spectrometry.

Group discussion on meeting recommendations.

The meeting addressed current analytical methodology and instrumentation with a special focus on chemical contamination. Aspects discussed during the meeting related to current knowledge, quality assurance and quality control, sampling and current regulations. Working groups were organized to discuss different areas of work and to learn a risk screening tool for chemical pollutants in water called HERWE (Human and Ecological Risk Screening Tool for Chemical Pollutants in Wastewater Effluents). This tool is a result of two projects funded by the Spanish Ministry of Science and Innovation. Professors M.D. Hernando and A. Fernandez-Alba also provided the participants with a manual on sampling and analytical tools.

Introductory lesson to the Meeting on Emerging Contaminants by Professor A. Fernandez Alba.

The meeting was well received by all participants. Recommendations from the meeting were as follows:

- Continue training on the issue of EC through courses and/or internships with the objective of building similar capacity in all countries involved to provide an analytical response to the EC problem.
- Strive towards harmonization of analytical capabilities in the different laboratories pertaining to TCP RLA/7/019 and also RALACA laboratories.
- Involve competent national agencies in each country and keep them informed on the progress of the project to enhance national commitment.
- Analyse the state of the art with regard to regulations for EC and provide national authorities support material on regulations and lists of priority emerging compounds by the EU and EPA, as discussed and presented in the course by Professor Hernando.
- With a view towards harmonization of methodologies in RALACA member institutes, prepare for an interlaboratory trial to be undertaken in 2017.
- Share analytical techniques and explore ways to procure analytical standards for 10 compounds (diclofenac, ibuprofen, paracetamol, oxytetracycline, atrazine, caffeine, chlorpyrifos, imidacloprid, carbaryl, tebuconazole).
- Explore the possibility of undertaking ecotoxicological testing.

Cuba Modernizes its Analytical Capabilities for Food and Environmental Monitoring, Havana, Cuba, 14–16 March 2016 (CUB5019)

Technical Officer: Johannes Corley

Urban agriculture has become a major component of Cuba's food production. Small farms (< 10 acres) located in urban areas (outskirts) produce vegetables and fruit which are sold in local markets. The urban farms use a lot of compost to produce the vegetables and fruits. Although some farms generate their own compost from animal manure raised through farm animals, many times the source of the compost is unknown. The manure is simply composted in the ground and not externally sterilized. Since animal manure is used to generate compost, additional sterilization would be beneficial to reduce possibility for transmission of diseases especially for root crops. Characterizing the compost and synthetic fertilizers is one of the extremely critical steps needed to ensure food safety in Cuba.

All fertilizers must be registered in Cuba including bio-fertilizers, synthetics and growth stimulants/regulators. About 75% of fertilizers used in Cuba are organic compost and 25% are synthetic fertilizers. There is a lot of research focused on obtaining the best combination of the two.

Cuban scientists Olegario Muniz and Mirelys Rodriguez Alfaro pose with urban farm manager in Havana, Cuba.

The food ministry has tasked CEADEN with the analysis of food and fishery products, sediments and fish/shrimp feed for heavy metals, pesticides and poly-aromatic hydrocarbon analysis. They are ISO 17025 accredited. They currently have limited capacity for organic compound analysis and are looking to strengthen that capacity in the future. Additionally some of the equipment at CEADEN is ageing and needs to be modernized. Through technical cooperation, the Food and Environmental Protection Section (FEP) is working with Cuba to help train scientists in modern analytical methods and also modernize CEADEN's analytical instrumentation.

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IAEA Technical Officer and Cuba's Scientific Team pose for a picture at the end of project planning meetings.

The current project (CUB5019) is focused on analytical capability for heavy metal analysis of food and environmental matrices. Although old, Cuban scientists have managed to keep high tech instruments such as an Inductively Coupled Plasma (circa. 1967) and X Ray

Fluorescence Spectrometer (of similar age) operational and still producing useful data. CEADEN also has an older GC-ECD/MSD, used for analysis of food/bio-tech waste for OC's PCBs, etc. Currently the instrument is in need of spare parts to become fully operational again.

During his visit to Cuba, the technical officer Mr Johannes Corley FEP, worked together with CEADEN, the Cuban Soils Institute to identify several priorities both for training and equipment upgrade or repair. These are being followed through via TC project CUB5019.

Mr Alfredo Montero of CEADEN underwent training for two weeks on analytical techniques for metal analysis in food and environmental samples using Inductively Coupled Plasma coupled with Mass Spectrometry at the IAEA laboratory in Seibersdorf. Ms Angela Niurka Creagh is undergoing similar fellowship training in Brazil. Other training activities have been planned for 2016 and 2017 in addition to ongoing procurement of new instruments as well as replacement parts (for older equipment) to upgrade Cuba's capacity for food and environmental safety monitoring.

Training on Measurement Uncertainty and Microbial Food Hazard Analysis, Walvis Bay, Namibia, 4–8 April 2016 (RAF5067)

Technical Officer: James Sasanya

Under the framework of the AFRA regional project "*Establishing a Food Safety Network through the Application of Nuclear and Related Technologies*" supported by the FEP, the above training was recently implemented. The course attended by 22 non-local and local food safety laboratory personnel was well appreciated and there was request for more in: ISO 17025 Quality Management Systems; Basic statistics; Method validation for microbiology testing laboratories; Quality control and assurance for microbiology laboratories; and Practical training course on different techniques used in microbiology and requirements for laboratory accreditation.

African food safety lab personnel at a training course on Measurement Uncertainty and Microbial Food Hazard Analysis Walvis Bay, Namibia, 4–8 April 2016. Photo courtesy of P. Ellitson.

Ecuador Continues to Enhance their Food and Environmental Monitoring Capabilities in Cooperation with the Food and Environmental Protection Section, Quito, Ecuador, 8–11 March 2016 (ECU5028)

Technical Officer: Johannes Corley

Ecuador has a long history of cooperation with the Food and Environmental Protection Section/Laboratory of the Joint FAO/IAEA Division. Through this cooperation, capacity has been built at both the Food Safety Analytical Laboratory (FSAL) of the Ministry of Agriculture and the Ministry of Renewable Energy Laboratory (MREL) in Ecuador to monitor food and environmental samples for residues and contaminants. Through these cooperative efforts the IAEA has procured several high-tech analytical instruments including a GC-MS-MS, a UPLC and a FTIR (MREL) as well as a LC-MS-MS at the FSAL and scientists at both facilities have been trained in food safety monitoring procedures. Ecuador now has an established food safety monitoring programme.

Ecuador scientists demonstrate the use of their new UPLC purchased by the IAEA.

Through the latest project (ECU5028) the team in Ecuador hopes to study the behavior of pesticides in soil, water and palm oil fruit samples so as to prevent pesticide run-off from contaminating ground and river water sources essential to protecting the health of local populations. Through initial tests conducted by MERL, pesticide residues were detected in water samples taken around palm-oil fruit farms. However, the source of the residues could not be confirmed. By studying the behavior of several representative pesticides Ecuadorian scientists hope to identify sources from where the pesticides leach into the water and then, using good agricultural practice training and education hope to protect their precious water supply from toxic contaminants.

Hand pollinating the palm flower to ensure a good fruit set, a common practice in palm oil fruit production.

Palm oil fruit almost ready for harvest.

The MESL already has or is close to signing memoranda of understanding with FSAL and INIAP (soil laboratory) both of the Ministry of Agriculture. Through training Ecuadoran agriculturalists and farmers on good agricultural practices (GAP) and safe and proper uses of pesticides, the team hopes to convince growers on the economic, health and environmental benefits of incorporating GAPs into all farming practices. Close cooperation between the three laboratories and Ecuador's farmers will significantly enhance capacity to study and mitigate both environmental and food contamination thereby protecting the health of Ecuador's population and her environment and also ensuring the compliance of Ecuador's food exports with international food safety standards to improve global marketability.

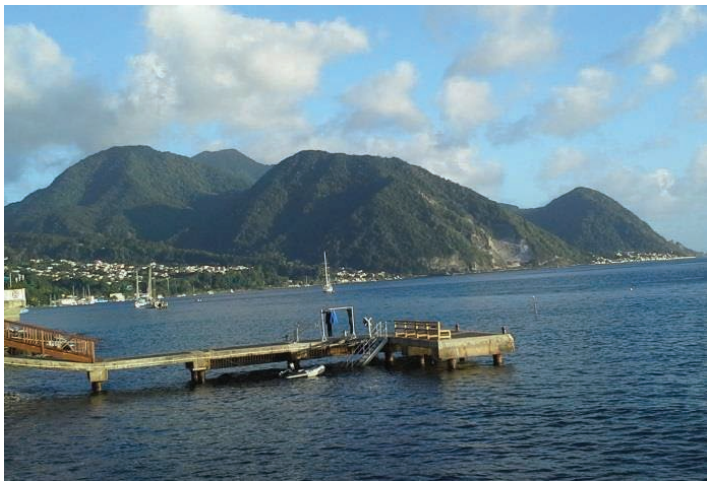
The human and laboratory capacity built through several years of close cooperation between IAEA/NA/NAFA/FEP&L and Ecuador has enabled Ecuador to actively participate in a regional project aimed at accessing the environmental and human health impacts of persistent organic pollutants in the Latin America and the Caribbean region.

The IAEA hopes to assist Ecuador's team of scientists through training in study design and conduct, data analysis and interpretation, GAPs, method development and validation techniques using stable isotopic techniques for measuring pesticide residues in soil, water and oil matrices using GC-MS-MS, using radio-labelled pesticides to study their movement through soil and water and, modelling techniques for elaborating risk maps. Additional training is needed in sampling strategy and techniques so as to assist Ecuador's scientists develop protocols for study conduct. Through all of the above, the IAEA hopes to continue partnering with Ecuador to continue its capacity building efforts while assisting Ecuador meet their goals of reducing risk factors affecting human and environmental health.

Dominica Works with the Food and Environmental Protection Section to Address its Food Safety Needs, Roseau, Dominica, 22–26 February 2016 (DMI5001)

Technical Officer: Johannes Corley

The Commonwealth of Dominica, a new member country of the IAEA has made food safety and building food safety monitoring capacity a priority for the country. Dominica is investing in developing and equipping a laboratory capable of performing food safety monitoring to ensure compliance of food products with national and international food safety standards.



The Island of Dominica.

The National Center for Testing Excellence (NCTE) is currently in the process of upgrading the laboratory and purchasing LC-MS-MS and GC-MS or GC-MS-MS instruments in addition to an atomic absorption instrument and a Fourier Transform Infra-red Spectrometer. Dominica has requested the assistance of the IAEA in building capacity in Dominica including in the area of laboratory

design, advice on equipment purchase and training on modern analytical methods and instruments including the use of isotopic techniques in quantifying residues in food. Previously, at Dominica's request, the IAEA sent a laboratory design expert to assist NCTE in planning and designing the laboratory for conducting food safety monitoring and testing including preparing the laboratory to host the modern analytical equipment that they plan to purchase.

The Commonwealth of Dominica is an island nation located between the islands of Guadeloupe and Martinique with the Caribbean Sea to the West and the Atlantic Ocean to the East. The island hosts a population of a little over 70,000 people in an area of 750 sq km[2]. Most of the island is very mountainous with a lot of natural wonders including waterfalls, thick rain forests inhabited by many species of tropical birds.

Dominica's agriculture is small but diverse. Commercial agriculture mainly consists of banana and coconut plantations. Bananas constitute the major portion of Dominica's agricultural export. The coconut oil (and soap made from coconut oil) industry was currently being revived. There is some vegetable production. Breadfruit and breadfruit processing has some potential along with sugarcane production.

Experimenting with breadfruit production in Dominica.

Dominica is also trying with international assistance to develop a cut-flower and ornamental plant industry. Animal based food production is in the early stages of development. Most meats, milk and dairy products are imported. There is a small poultry industry (eggs and meat) but mainly for local consumption. Through the Agricultural Research Station, there is some swine and bovine/ovine research. Milk production has been low mainly due to climatic conditions (tropical) and difficulties in adapting high milk producing cows from colder countries into the tropical conditions of Dominica.

During his visit to Dominica, the TO discussed with the team the importance of building infrastructure capable of housing the various tasks necessary for food analysis and housing the modern analytical instruments planned to be purchased. Laboratory benches along with fume hoods and adequate ventilation and air conditioning are essential to the proper running of a chemical analysis laboratory, instrument operation, the health and safety of the scientists/staff working in the laboratory and the accuracy and reliability of the results. The NCTE is currently investing in upgrading laboratory infrastructure including fume hoods, benches, plumbing and ventilation/air conditioning.

It was explained that exports of food produce from Dominica were suffering because of the need to comply with International Food Safety Standards but, the lack of monitoring capacity in Dominica. All sectors of the food and agriculture industry stand to benefit by the development of food testing capacity in Dominica. In addition to the NCTE, there are other several institutions involved in food and agriculture. The Produce Chemist Laboratory provides food processing testing (pilot plant) services including scale-up facilities for new food product development. The Citrus Certification Laboratory provides certified citrus plant material and determines phytosanitary status of citrus grafts/transplants before they are sent out into the field. The citrus industry is another developing area of Dominica's agricultural sector. The Plant Quarantine Laboratory provides diagnosis services for all Dominican farmers, in-house analysis of pest problems, IPM implementation and education. They assist with the fruit fly situation. The Molecular Diagnostics Lab provides diagnostic services for plant and animal health. They serve the wildlife, livestock and crop sectors. They do some QMS/GLP and information management systems, proficiency testing. The Environmental Health Laboratory mainly analyses water samples for microbial contamination including e-coli, fecal coliform, etc., food borne pathogens such as salmonella, and staph in poultry. They have some experience with EPA methods for soils and water analysis for pesticide residues.

There is tremendous scope for the use of the facilities planned at the NCTE of the Ministry of Trade by various branches of Dominica's government ministries such as the Ministry of Health and Ministry of Environmental Health and affiliated agencies/sectors including the laboratories discussed above. The various ministries/laboratories are currently working to develop a comprehensive strategy for collaboration for the benefit of Dominica's food, agriculture, environment and health sectors. During his visit, the technical officer discussed the need for establishing a group of Dominican experts/scientists to create and steer a National Food and Environmental Safety Monitoring Programme in Dominica.

Through the TC project DMI5001, the Food and Environment Protection Section (FEP) will be assisting with procurement of laboratory equipment and site preparation to host modern analytical instrumentation. Importantly, FEP hopes to train scientists from Dominica

[2] Source: Wikipedea (https://en.wikipedia.org/wiki/Dominica)

to oversee a food safety monitoring programme through fellowship training and expert missions on modern analytical methodology including the use of nuclear and isotopic techniques. By building capacity in Dominica, the project aims to support the country's efforts in food (and environmental) safety monitoring so as to meet Dominica's goal of ensuring the safety of their food supply, ensuring compliance of their exports with national and international food safety standards. By building a food safety monitoring programme, Dominica hopes to protect the health of their citizens and improve the marketability of their food and agricultural exports.

Commercial banana plantation in Dominica.

Building Laboratory Capacity for Food Safety, Maputo, Mozambique, 21–22 January 2016 (MOZ5006)

Technical Officer: James Sasanya

The FEP subprogramme supports food safety control in Mozambique through an IAEA TCP at the Agriculture Research Institute.

The Technical Officer and the Counterpart meet the FAO Mozambique Country Representative and Programme Officers.

The TO visited the country from 21 to 22 January 2016 and evaluated laboratory capabilities and readiness to test food contaminants. Identified needs are being addressed and a functional chemical hazard testing laboratory should be in place soon. Areas of synergy with the FAO country office were sought when the TO and CP visited with the FAO Country Representative and Programme Officers.

Establishing a National Mycotoxins Monitoring Programme, Lusaka, Zambia, 18–20 January 2016 (ZAM5030)

Technical Officer: James Sasanya

A programme to monitor mycotoxins in foods is ongoing in Zambia with support the Food and Environmental Projection subprogramme through the above Technical Cooperation Project (TCP). The technical officer (TO) visited the country from 18 to 20 January 2016 and discussed food safety activities and plans with various stakeholders including the National Institute for Scientific and Industrial Research the project counterpart (CP), National Food and Nutrition Commission, University of Zambia, Zambia Bureau of Standards, Zambia Agriculture Research Institute and Central Veterinary Research among others.

International Institute for Tropical Agriculture and Dupont staff in Zambia with an interest in mycotoxin testing were also met. Various counterpart institute needs were identified and are being addressed. The TO and CP also met the FAO country representative and his assistant (programmes) to update them on the mycotoxin programme and to explore potential synergies.

The National Institute for Scientific and Industrial Research is leading efforts to strengthen mycotoxin monitoring in Zambia. Photo courtesy of J. Sasanya.

Food and Environmental Protection Laboratory, Seibersdorf

Development and Application of UPLC-QTof/MS Method for the Differentiation between Tea Varieties

Technical Officer: Zora Jandrić

Tea (*Camellia sinensis* L.) is one of the most popularly consumed beverages worldwide. It has been used as a natural medicine for thousands of years, containing many compounds beneficial to health. The two most popular varieties are green (favoured in Asia) and black tea (favoured in the western countries). The different growing season, geographical regions, processing and fermentation methods create many varieties of tea, some of which have premium value compared to the others. The expansion of the consumer market, which has increased demand for "manufactured" food as well as transported "pure" food such as tea, has encouraged adulteration simply because of the prospects for increased profit. The adulteration of tea has become a common problem. Mixing exhausted tea-leaves with leaves of some other plants (e.g. elder, hawthorn, sloe), addition of the dust of the tea leaves and sand, chemical enhancement of green tea (with Prussian blue and sulphate of lime or gypsum) and simply redried and resold tea-leaves, are some of the main examples of tea adulteration. To help address these issues, the Food and Environmental Protection Laboratory (FEPL) applied an untargeted metabolomics approach previously developed for some other commodities (e.g. honey, fruit juices) to investigate the possibility of distinguishing teas from different origins, and detecting varieties that had been adulterated.

Tea samples were obtained from the market (black (China, India, Nepal, Sri Lanka), green (Japan, Kenya), oolong (Taiwan) and rooibos (South Africa)), infused in water and analysed by ultra-performance liquid chromatography – quadrupole time of flight mass spectrometry (UPLC-QToF MS).

Using an untargeted metabolite profiling approach and multivariate statistical data analysis, reliable discrimination was obtained between various tea types (black, green, oolong and rooibos), as well as between black and green teas produced in different countries (Figure. 1A). Some of the metabolites that contribute to discrimination of the sample groups were tentatively identified using a loadings plot (Figure. 1B) and database search.

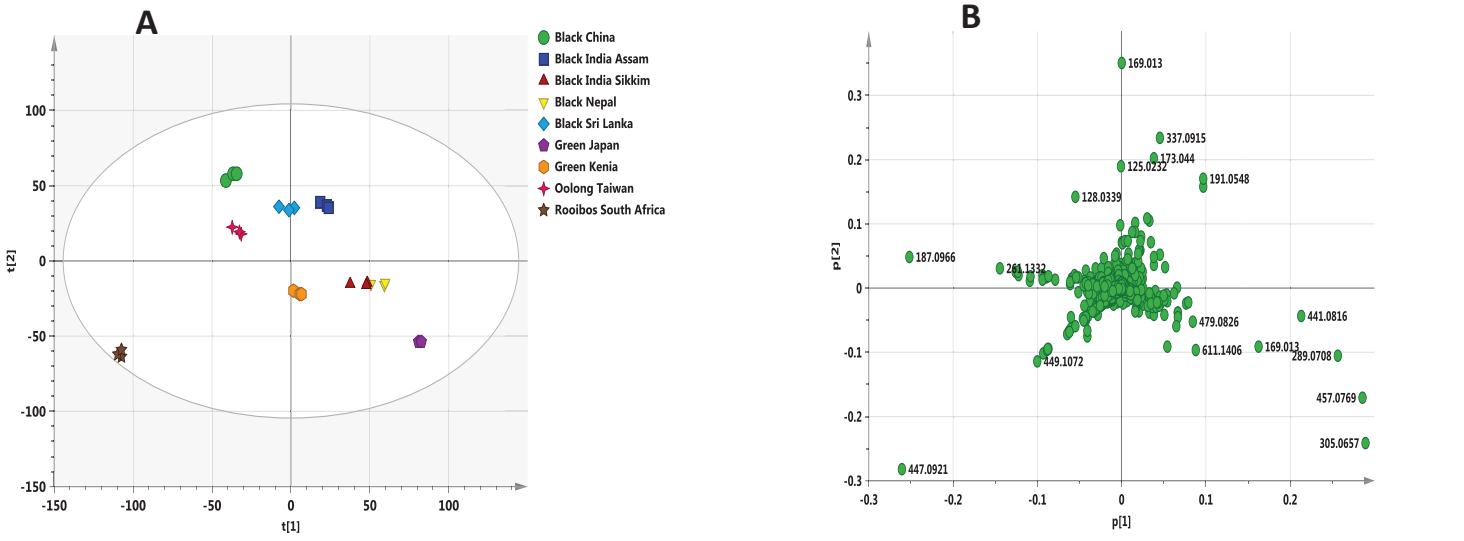


Figure 1. Principal component analysis performed on tea samples: (A) PCA-X plot of various tea samples; (B) loadings plot.

The ability of this methodology to differentiate between different tea varieties and types suggests possible applications of untargeted metabolomics for authentication testing of tea samples. In the near future, the methodology will be applied in FEPL to test tea samples from Sri Lanka as a part of Technical Cooperation Project. Sri Lanka is the world's fourth-largest producer of tea; tea is one of the country's major agricultural products.

We have previously reported the application of this untargeted metabolomics approach for the detection of orange juice adulteration with cheaper citrus juices, with the further development of a cheaper and less complex detection method through the identification of selected markers that can be used to differentiate the authentic and adulterated samples using targeted analysis. We will also attempt to identify chemical markers that would enable the

differentiation of various tea varieties and points of origin using a cheaper, more convenient targeted analytical method. Both untargeted and targeted metabolomics are included in the suite of methods, with other techniques such as stable isotope analysis, spectroscopic and trace element profiling, that are being developed in FEPL to support authenticity testing and food traceability systems.

A Comparison of Two Approaches for the Ruggedness Testing of an Analytical Method

Technical Officer: Britt Maestroni

As part of an initiative under the "Red Analitica de Latino America y el Caribe" (RALACA) network the FAO/IAEA Food and Environmental Protection Laboratory validated a multi-residue method for pesticides in potato. One of the parameters to be assessed was the intra laboratory robustness or ruggedness. The objective of this work was to implement a worked example for RALACA laboratories to test for the robustness (ruggedness) of an analytical method.

There is currently no harmonisation in the definitions of the terms robustness and ruggedness. A review of current international guidelines (see Table 1) shows that the terms are either used as synonyms or as complementary terms. According to the "Proposed draft guidance on performance criteria for methods of analysis for the determination of pesticides residues" by Codex Alimentarius (2015), the ruggedness of an analytical method is the resistance to change in the results produced by an analytical method when minor deviations are made from the experimental conditions described in the procedure. In this study the goal was to test the ruggedness, as defined by Codex, by assessing the degree of intra-laboratory reproducibility of the method under small variations in the conditions of the test. Figure 1 describes the analytical method and the factors (marked 'X' in the figure) that were chosen for the test.

Among the possible statistical experimental designs that are available, the Plackett-Burman design (PBD) and the Definitive Screening design (DSD) were chosen because they are relatively cheap to implement and give substantial information to the analytical chemist on the sources of variability of an analytical procedure. In general the PBD can identify main effects and some two-factor interactions, and was used to study 7 factors using 8 experimental runs; the DSD can estimate main effects, some two-factor interactions, and also some quadratic effects, and was used to study the same 7 factors using 34 experimental runs. Knowing the type of effect caused by a variation in conditions is very important to be able to control the analytical procedure. Linear effects are easier to take into account or compensate for in the method. Quadratic effects are problematic as one cannot know in which direction the change caused by the factor will be and therefore it will be difficult to account for. The analysis of the results using both designs showed that the method was robust (rugged).

In general the choice of the experimental design is a compromise between the statistical significance and the resources one can put into the study. Table 2 provides a summary comparison of the PBD versus the DSD. It is important to note that "ruggedness" of the method should be checked on an ongoing basis, as part of the analytical quality control applied in the laboratory. If additional ruggedness testing is required then the laboratory may opt for a PBD or DSD depending on the available budget. It is important to highlight that the suggested methodology can be very useful when applied in the early stages of method adaptation and development to identify critical steps in the method and possible sources of uncertainty.

As a conclusion to this study, it is evident that there is a need for harmonization of the definition of the terms robustness/ruggedness, the limits, the methodology and the statistical treatment of the generated data. A worked example for RALACA laboratories to test for the robustness (ruggedness) of an analytical method will soon be posted on the RALACA website (www.red-ralaca.net). This study was carried out with collaborators from LVA (Austria), University of Antwerp (Belgium), University of Leuwen (The Netherlands), Universidad de la Republica (Uruguay) and Agilent technologies.

Table 1. Review of current international guidelines

Guideline	Term Used/ Defined	Definition/Criteria
European Commission SANTE/11945/2015 Guidance document on analytical quality control and method validation procedures for pesticides residues analysis in food and feed	Robustness	Average recovery and RSD_{WR}, derived from **ongoing** method validation/verification
Codex Alimentarius- Proposed Draft guidance on performance criteria for methods of analysis for the determination of pesticides residues-2015 –step 4 (CX/PR/14/47/10)	Ruggedness	The ruggedness of an analytical method is the resistance to change in t he results produced by an analytical method when **minor deviations** are made from the experimental condition described in the procedure. The **limits** for experimental parameters should be **prescribed** in the method protocol, and such permissible deviations, separately or in any combination, should produce **no meaningful change** in the results produced. The aspects of the method that are likely to affect results should be identified, and their influence on method performance evaluated by **using ruggedness tests**.
IUPAC (Source: Sector Field Mass Spectrometry for Elemental Isotopic Analysis. Edit by T. Prohaska, J.Irrgeher, A. Zitek, N. Jakubowski)	Robustness and Ruggedness	The relative *robustness* of an analytical method is defined as the ratio of the ideal signal for an uninfluenced method compared to the signal for a method subject to known and unknown operational parameters as studied in an **intralaboratory** experiment. The relative *ruggedness* of an analytical method is defined as the ratio of the ideal signal for an uninfluenced method compared to the signal for a method subject to known and unknown operational parameters as studied in an **interlaboratory** experiment.
Eurachem Second Edition 2014. The Fitness for Purpose of Analytical Methods, A Laboratory Guide to Method Validation and Related Topics	Ruggedness (robustness)	The 'ruggedness' ('robustness') of an analytical procedure is a measure of its capacity to remain unaffected by **small**, but **deliberate variations** in method parameters. Ruggedness provides **an indication of the method's reliability during normal usage**. The ruggedness of a procedure must be established for in-house developed methods, methods adapted from the scientific literature and methods published by standardisation bodies used outside the scope specified in the standard method. Most effectively evaluated using experimental designs. E.g. 7 parameters can be studied in 8 experiments using a **Plackett-Burman experimental design.**
IAS (International Accreditation Service): GUIDELINES FOR FOOD TESTING LABORATORIES - August, 2015	Ruggedness or Robustness	Ruggedness or robustness: The ability of a method to resist changes in test results when subjected to **minor** deviations in experimental conditions of the procedure. Ruggedness testing examines the behaviour of an analytical process when subtle small changes in the environment and/or operating conditions are made, similar to those likely to arise in different test environments.

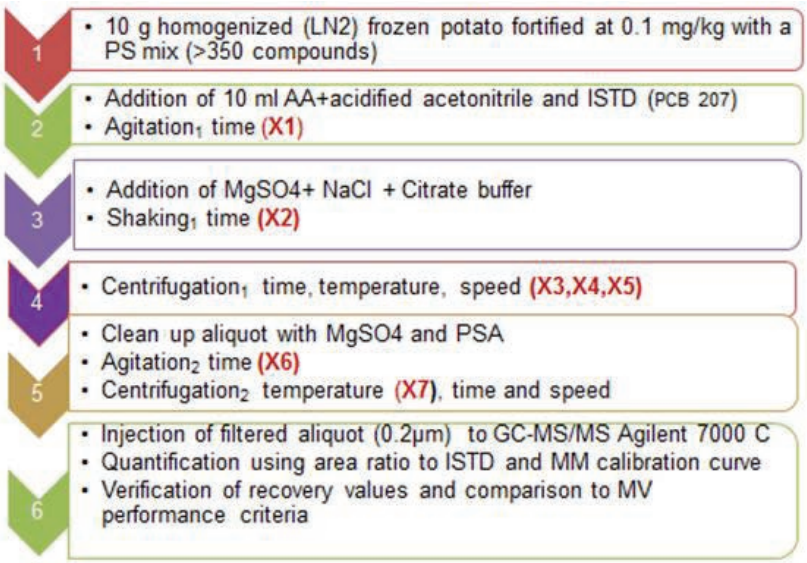


Figure 1. The method used and the X factors

Table 2. summarized comparison of the designs

Type of design	PBD	DSD
Applicability to the analytical laboratory	easy to apply difficult to analyse statistically	easy to apply difficult to analyse statistically
Availability of resources	cheap (7 factors-8 runs)- you can choose also 4 factor designs	more expensive (7 factors-33 runs), however less expensive than other more complex designs (i.e. central composite design)
Statistical significance	linear effects and two factor interactions	linear, quadratic and interactions
Usefulness	useful to apply in the early stages of method adaptation/development to understand the system and identify critical points to be controlled	useful to apply in the early stages of method adaptation/development to understand the system and identify critical points to be controlled

FEP Laboratory staff

In June 2016 Ms Hanna Zakala completed a one-year internship in the Food and Environmental Protection Laboratory. During her time in FEPL, Hanna worked mainly on methods for food authenticity testing, concentrating on untargeted metabolomics profiling using liquid chromatography/high resolution mass spectrometry. She gained experience in sample preparation, sample analysis by ultra performance liquid chromatography – quadrupole time of flight mass spectrometry (UPLC-QToF MS) and data analysis, and contributed to FEPL outputs in this field. Hanna returned to Ukraine in June, and we wish her all the best for the future.

Also in June, Mr Sharif Shawky commenced a two-month internship in the laboratory. Mr Shawky is a senior undergraduate student at Colorado State University, USA, studying environmental science and sustainability, and international development. Sharif will be involved in various aspects of our pesticide residue control work during his internship, which should stand him in good stead in his pursuit of a career in environmental science and sustainability.

Announcements

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

Technical Officers: Zhihua Ye and Carl Blackburn

The Technical Workshop "Remediation of Radioactive Contamination in Agriculture" will be held at the IAEA Headquarters on 17–18 October 2016. The formal announcement, call for speakers, participation form and more detailed information on the technical workshop are now available at the following dedicated web-link, which will be updated regularly:

http://www-naweb.iaea.org/nafa/news/2016-FAO-IAEA-NARO.html

This Technical Workshop aims to promote and share knowledge and experience related to remediation of radioactive contamination in agriculture. An appreciation of developments in this area will greatly improve emergency preparedness related to food and agricultural production in Member States. It will also support efforts to re-establish agricultural trade from areas currently affected by residual levels of radionuclides.

This Technical Workshop is aimed at officials responsible for food and agriculture, nuclear safety or emergency planning and response. Professionals and academics involved in the remediation of radioactive contamination are also welcome to participate.

The two day event will be hosted by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture ("the Joint Division"), in collaboration with Japan's National Agriculture and Food Research Organization (NARO).

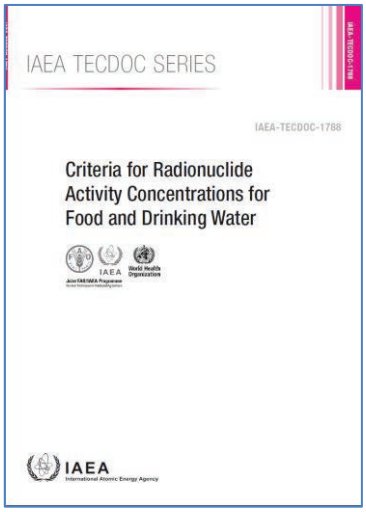
Participants are invited to provide high quality contributions related to remediation in the technical sessions concerning:

1. Agricultural Land and Water
2. Plant and Crop Products
3. Animals and Animal Feeds
4. Food and Commodities (Post-Harvest)

New IAEA TECDOC Publication: Criteria for Radionuclide Activity Concentrations for Food and Drinking Water

Technical Officer: Carl Blackburn

A new IAEA TECDOC publication was recently published by the IAEA entitled Criteria for Radionuclide Activity Concentrations for Food and Drinking Water. Developed in collaboration with member countries and international bodies, including the Joint FAO/IAEA Division, the TECDOC was finalized by the FAO, IAEA and WHO.



This TECDOC highlights the current international standards in this area including IAEA standards that exist for the management of food and drinking water in the immediate aftermath of a nuclear or radiological emergency and also the Guideline Levels for radionuclides contained in the Codex General Standard for Contaminants and Toxins in Food and Feed [CODEX STAN 193-1995]. However, this TECDOC also provides technical details and guidance on establishing national criteria for radionuclide activity concentrations (Bq/kg) for food and drinking water

in “normal situations” (i.e. not emergency exposure situations). An equivalent approach to that used to calculate the Codex Guideline Levels is used as an appropriate framework for calculating criteria (Bq/kg) for radioactivity in food in such “normal” circumstances or well after an emergency has been declared ended. The TECDOC complements, and does not supersede nor replace, activity concentrations already established for food, milk and water in IAEA standards and guidelines intended for use in nuclear or radiological emergency situations.

16th Phytosanitary Irradiation Treatment Schedule Published by the International Plant Protection Convention

Technical Officers: Carl Blackburn and Guy Hallman

A new international phytosanitary treatment was adopted at the 11th Session of the Commission on Phytosanitary Measures (CPM) of the International Plant Protection Convention held in Rome in April 2016. It has now been published as Annex 20 [3] of ISPM 28: Phytosanitary Treatments for Regulated Pests. This new treatment is for *Ostrinia nubilalis* (European corn borer) and concerns the irradiation of fruits and vegetables to a minimum absorbed dose of 289 Gy to prevent the first-generation offspring (F1) development past fifth instar, or a minimum adsorbed dose of 343 Gy to prevent F1 egg hatching from irradiated parent pupae (the most tolerant life stage). It is based on research undertaken by Mr Guy Hallman and Mr Richard Hellmich, at the Agricultural Research Service of the United States Department of Agriculture. Mr Guy Hallman is now with the Insect Pest Control Section of the Joint FAO/IAEA Division.

Ostrinia nubilalis (European corn borer) Image source: ©entomart

The European corn borer is a quarantine pest that affects several fresh products that are traded internationally, including corn-on-the-cob, bell peppers, and green beans. Although methyl bromide fumigation is the usual phytosanitary treatment, the use of this gas is under increasing regulation because it ultimately concentrates in the stratosphere and depletes ozone (atmospheric ozone filters out most of the sun's potentially harmful ultraviolet rays). Irradiation is being used as an alternative commercial treatment, not only does its application leave the ozone layer unaffected, it leaves no residues. Also, it does not significantly alter commodity temperature and therefore has least effect on fruit or vegetable quality.

There are now 16 phytosanitary irradiation treatments annexed to ISPM 28 as international standards and all are based on work carried out by participants of IAEA Coordinated Research Projects (CRPs) in this area. Using the results of our most recent CRP on the Development of Generic Irradiation Doses for Quarantine Treatments we aim to submit more treatments to the CPM for consideration as standards, when it next calls for proposals.

[3] Appendix 20 of ISPM28 can be uploaded from: https://www.ippc.int/en/publications/82518/

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