1. In celebrating half a century of fruitful collaboration between the Food and Agriculture Organization (FAO) of the United Nations and the International Atomic Energy Agency (IAEA), the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (the Joint Division) continues to champion the goals of both the IAEA, to accelerate and expand the contributions of nuclear technologies to promote global health and prosperity, and the FAO in its efforts to eliminate world hunger and reduce poverty through sustainable agricultural and rural development, improved nutrition and food safety and security.

2. The mission of the Joint Division is to strengthen capacities in the use of nuclear and complimentary techniques to help ensure sustainable food security/safety and to disseminate these techniques through international activities in research, training and outreach to its Member States. The Joint Division consists of five sections; working in the areas of food and environmental protection, soil and water management, plant breeding and genetics, animal production and health, and insect pest control.

3. The Joint Division continues to strengthen its collaboration with sister Divisions in FAO Headquarters to improve food safety, protect consumer health and facilitate international agricultural trade by providing assistance, coordinating and supporting research, providing technical and advisory services, providing laboratory support and training, and collecting, analyzing and disseminating information. The activities most closely related to the work of Codex are nuclear and isotopic analytical methods to monitor food contaminants and trace and authenticate food products, the use of irradiation for the control of food contaminants, and the management of nuclear and radiological emergencies affecting food and agriculture.

A WEB APPLICATION ON FOOD CONTAMINANTS

4. Accessing analytical methods remains a problem to many developing country Member States, especially in the form of validated method protocols. To help address this problem, the Joint Division supports the Codex Committee on Pesticide Residues in foods by publishing analytical methods online, freely available over the internet. These methods are provided mainly by National Authorities and are published on the Food Contaminant and Residue Information System (FCRIS), accessible through http://nucleus.iaea.org/fcris/. The FCRIS resource contains information on analytical techniques for the detection of food contaminants such as pesticide and veterinary drug residues. As regards crop matrix analyses and pesticides, the Pesticide Residue Methods (PRM) database thus far contains several commonly used multi-residue methods, pesticide class specific methods and single pesticide residue methods otherwise referred to as enforcement methods. Since the methods contain detailed protocols, they can be adapted in most laboratories to address specific needs of the Member States.

5. An example of the general PRM database is displayed in Figure 1 with a more detailed PRM record in Figure 2. The first page of an actual method displayed on clicking the “SOP” link is shown in Figure 3. FCRIS also includes the Pesticide Attributes Database (PAD), a resource for physicochemical/toxicological data that contains information of relevance to food safety/environmental laboratories. Links to other international pesticide databases are included which provide significant details about the physical and chemical properties, toxicity and environmental fate and effects, etc. Snap shots of the information accessible through the data base are shown in Figures 4 and 5.

1 Document prepared by and under responsibility of the Joint FAO/IAEA Division on Nuclear Techniques in Food and Agriculture, IAEA Headquarters, Vienna, Austria.

2 This section is presented in relation to discussions held at the 36th Session of the Joint FAO/WHO Codex Alimentarius Commission (REP13/CAC, paragraphs 138-141) concerning the Recommended Methods of Analysis for Pesticide Residues (CODEX STAN 229-1993).
User demand for the methods is high, especially from developing Member States. We therefore welcome the submission of additional analytical protocols from Codex members and observers through the FCRIS database. Relevant information on related topics, such as accessing certified reference materials, is also welcome. Pesticide registrants are also encouraged to share their enforcement methods with Member States through the same database.

With regard to the CCPR Discussion Paper on Performance Criteria for Suitability Assessment of Methods of Analysis for Pesticide Residues (Agenda Item 9, REP13/CAC, paragraphs 138-141), the Joint Division is willing to continue supporting CCPR and related Codex Committees by obtaining, hosting and making available analytical methods to Member State laboratories to support their efforts to monitor pesticide residues in foods. The Joint Division is also available to offer assistance in the preparation of a document on performance criteria specific to methods for determination of pesticide residues in food products, including participation in respective working groups.

**FAO and IAEA Coordinated Research and Technical Cooperation Projects – Pesticide Residues in Foods**

The IAEA encourages and assists research and development on the uses of nuclear and related techniques and fosters the exchange of scientific and technical information. Certain activities are designed to stimulate and coordinate research by scientists in IAEA Member States in selected fields related to nuclear techniques. These research activities are normally implemented through Coordinated Research Projects (CRPs) which unite research institutes in both developing and developed Member States to collaborate on a theme of interest. The objective of the research is to produce outputs that can be applied downstream through capacity building Technical Cooperation Projects in Member States. For example, a recent CRP “Integrated Analytical Approaches to Assess Indicators of the Effectiveness of Pesticide Management Practices at the Catchment Scale” has produced guidelines for sampling and analysis of pesticide residues in foods that can be applied through TCPs aimed at supporting food safety/security and sustainable development through Good Agricultural Practices in Member States such as in Latin America and the Caribbean. Such generic guidelines enhance harmonized laboratory techniques and approaches as well as laboratory networking. The outcomes of this CRP are being compiled into a book to be published in 2015 with the aim of strengthening stakeholder roles in ensuring the prudent use of pesticides in agriculture.

The Joint Division will host an International Symposium on Food Safety and Quality: Applications of Nuclear and Related Techniques at the IAEA Headquarters in Vienna, Austria, from 10 - 13 November 2014. The symposium will cover a wide range of topics involving nuclear and complementary techniques in food and agriculture including food irradiation, residue analysis, food authentication, traceability and contaminant control and will include related issues such as climate change, emerging opportunities and threats to the integrity of the food supply, chemometrics and guidelines for consumer protection and international trade. The event will provide a forum for interdisciplinary networking and the Joint Division extends its warm invitation to scientists, laboratory analysts, policymakers, regulators, food producers and others concerned with food safety and quality to participate in the symposium. More information on the symposium is available online at [http://www-pub.iaea.org/iaeameetings/46092/Food-Safety-and-Quality](http://www-pub.iaea.org/iaeameetings/46092/Food-Safety-and-Quality).

The Food and Environmental Protection Sub-programme continues to provide scientific and technical support for over 40 national and regional FAO and IAEA TCPs, a number of which are associated with pesticides and related food chemical contaminants (see Table 1). Relevant training/stakeholder workshops are also conducted as components of these projects.
<table>
<thead>
<tr>
<th>Country</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belize</td>
<td>Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority; Providing Technical Assistance and Training for Upgrading National Laboratory Capacity</td>
</tr>
<tr>
<td>Benin</td>
<td>Monitoring Safe Food Supply through Total Diet Studies and the Application of Nuclear and Complementary Analytical Techniques</td>
</tr>
<tr>
<td>Central African Republic</td>
<td>Enhancing Laboratory Capacity to Control Chemical and Bacteriological Hazards in Foodstuffs of Animal Origin</td>
</tr>
<tr>
<td>China</td>
<td>Building Technological Capacity for Food Traceability and Testing of Pesticide Residues in Food</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>Strengthening of Good Agricultural Practices for Food Safety/Security and Environmental Protection; Enhancing the Capacity to Control Contaminants and Residues of Veterinary Medicines and Pesticides in Foodstuffs of Animal Origin Using Nuclear and Conventional Analytical Techniques</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Improving Food Security and Environmental Sustainability by Monitoring Wetlands as Indicators of Good Agricultural Practice in Palm Oil Production</td>
</tr>
<tr>
<td>Mongolia</td>
<td>Enhancing Analytical Equipment for Animal Disease Prevention, Diagnosis and Surveillance (MON5019)</td>
</tr>
<tr>
<td>Morocco</td>
<td>Improving Veterinary Drug Residue Detection and Animal Disease Diagnosis with Nuclear and Molecular Techniques (MOR5034)</td>
</tr>
<tr>
<td>Namibia</td>
<td>Assessing the Spatial Distribution of Lead, Cadmium and Selected Pesticide Residues in Livestock Farming</td>
</tr>
<tr>
<td>Oman</td>
<td>Strengthening National Capabilities in Food Safety and Food Traceability</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs</td>
</tr>
<tr>
<td>Panama</td>
<td>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</td>
</tr>
<tr>
<td>Paraguay</td>
<td>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</td>
</tr>
<tr>
<td>African (regional)</td>
<td>Establishing a Food Safety Network through the Application of Nuclear and Related Technologies</td>
</tr>
<tr>
<td>Asia (regional)</td>
<td>Building Technological Capacity for Food Traceability and Food Safety Control Systems through the Use of Nuclear Analytical Techniques; Implementing Best Practices of Food Irradiation for Sanitary and Phytosanitary Purposes; Strengthening Adaptive Climate Change Strategies for Food Security through the use of Food Irradiation (RCA)</td>
</tr>
<tr>
<td>Latin America (regional)</td>
<td>Harmonizing and Validating Analytical Methods to Monitor the Risk of Chemical Residues and Contaminants in Foods to Human Health (ARCAL CXXVIII); Supporting Quality Management for the Assessment and Mitigation of Impacts of Contaminants on Agricultural Products and in the Environment (ARCAL CXXIV); Improving Agricultural Production Systems Through Resource Use Efficiency (ARCAL CXXXVI); Developing Indicators to Determine the Effect of Pesticides, Heavy Metals and Emerging Contaminants on Continental Aquatic Ecosystems Important to Agriculture and Agroindustry (ARCAL CXXXIX)</td>
</tr>
</tbody>
</table>

**Figure 1 - General view of the Pesticide Residue Methods database**

<table>
<thead>
<tr>
<th>Substance Group</th>
<th>Class</th>
<th>Method Title</th>
<th>Method Source</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>Specific</td>
<td>Determination of Cyfluthrin and Beta-Cyfluthrin Residues in Various Crops</td>
<td>U.S. EPA</td>
<td>1998/01/15</td>
</tr>
<tr>
<td>Others</td>
<td>Specific</td>
<td>An Analytical Method for the Determination of Residues of Atrazine at Extreme Tolerance Levels on Alfalfa, Potatoes, Orange (Jame), and Grapes by Gas Chromatography using Methylphosphonate Detection</td>
<td>AI-1</td>
<td>1997/01/31</td>
</tr>
<tr>
<td>Others</td>
<td>Indolylated</td>
<td>Analysis and Confirmation for Ethylene Dinitriles in Animal Tissues by Gas Chromatography</td>
<td>USDA-FSHE</td>
<td>1997/01/31</td>
</tr>
<tr>
<td>Others</td>
<td>Multi-Residue</td>
<td>Analysis of Multiple Pesticides from Food Using the QuECHERS Sample Preparation Approach, LC-MS and GC-MS Analysis by HPLC-KD, A. Carl, Gro chilly, Art Dieta, Salki, Sarno and Deri, Inc., Pesticides Inc., Tenance, California, USA,</td>
<td><a href="http://www.epsciences.com">www.epsciences.com</a></td>
<td>2014/01/01</td>
</tr>
<tr>
<td>Others</td>
<td>Specific</td>
<td>Analytical Method for Detection of Residues in Stored Potatoes and Onions in Potato Treatments of Chrysophanol</td>
<td>BRA</td>
<td>1994/06/18</td>
</tr>
</tbody>
</table>

**Figure 2 – Summary page for a Pesticide Residue Method in the database**

<table>
<thead>
<tr>
<th>Category</th>
<th>Method Type</th>
<th>Method Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>Screening</td>
<td>Analysis of Multiresidue Pesticides from Food Using the QuEChERS Sample Preparation Approach, LC-MS and GC-MS Analysis by HPLC-KD, A. Carl, Gro chilly, Art Dieta, Salki, Sarno and Deri, Inc., Pesticides Inc., Tenance, California, USA,</td>
</tr>
<tr>
<td>Method Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scope and Application</td>
<td></td>
<td>Adaptation of QuEChERS method for crop and vegetable matrices, should be easily applicable to all vegetables and cereals, including LC-MS and GC-MS MS.</td>
</tr>
<tr>
<td>Method Summary</td>
<td></td>
<td>Analysis of food products is challenging due to the variety and complexity of both the pesticides and the compounds of interest. Sample preparation and downstream analysis require careful consideration to ensure method robustness as well as accurate and precise results. In this method, we explore the analysis of multiple pesticide residues in food samples. This article will walk through the step-by-step process of developing the analytical method, from sample preparation to analysis, best suited to the data requirements.</td>
</tr>
<tr>
<td>Applicable Concentration Range</td>
<td></td>
<td>See method</td>
</tr>
<tr>
<td>QC Requirements</td>
<td></td>
<td>See method</td>
</tr>
<tr>
<td>Method</td>
<td></td>
<td>See method</td>
</tr>
<tr>
<td>Method</td>
<td></td>
<td>See method</td>
</tr>
<tr>
<td>Method</td>
<td></td>
<td><a href="http://www.epsciences.com">www.epsciences.com</a></td>
</tr>
<tr>
<td>Method</td>
<td></td>
<td>A-100</td>
</tr>
<tr>
<td>Citation</td>
<td></td>
<td>Analysis of Multiresidue Pesticides from Food Using the QuEChERS Sample Preparation Approach, LC-MS and GC-MS Analysis by HPLC-KD, A. Carl, Gro chilly, Art Dieta, Salki, Sarno and Deri, Inc., Pesticides Inc., Tenance, California, USA,</td>
</tr>
</tbody>
</table>
Analysis of Multiresidue Pesticides from Food Using the QuEChERS Sample Preparation Approach, LC–MS–MS and GC–MS Analysis

by Monika Kansal, A. Carl Sanchez, Art Dixon, Sueki Leung and Erica Pike, Phenomenex Inc., Torrance, California, USA.

Analysis of food products is challenging due to the variety and complexity of both the matrices and the compounds of interest. Sample preparation and downstream analysis require careful consideration to ensure method robustness as well as accurate and precise quantification. In this study we explore the analysis of multiple pesticide residues in spinach samples. This article will walk through the step-by-step process of developing the analytical method, from sample preparation to analysis, best suited to the date requirements.

Figure 1: Flow chart summary for AOAC 2007.01 QuEChERS method.

Figure 3 – First page for an actual Pesticide Residue Method available on the database

Pesticide Database

Search by Substance Name or CAS RN

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS Number</th>
<th>PPDB Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>001 Compendium of Pesticides, Alan Wood</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>002 Pesticide Action Network Pesticide Database</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>003 Pesticide Properties Database, The University of Herfordshire</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>004 Purdue University National Pesticide Information Retrieval System (NPIRS) Searchable Databases</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>005 Oregon State University National Pesticide Information Center</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>006 Case Western Reserve University National Pesticide Information Center</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>007 USDA FAO NNL Database</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>008 DBMS Pesticide Material Safety Data Sheet (MSDS) in the US</td>
<td>PPDB</td>
<td></td>
</tr>
<tr>
<td>1,3-dichloropropene</td>
<td>542-75-6</td>
<td>PPDB</td>
</tr>
<tr>
<td>2,3,5-TRI</td>
<td>50-33-7</td>
<td>PPDB</td>
</tr>
<tr>
<td>2,4,5-T</td>
<td>93-79-5</td>
<td>PPDB</td>
</tr>
<tr>
<td>2,4-D</td>
<td>94-75-7</td>
<td>PPDB</td>
</tr>
<tr>
<td>2,4-DB</td>
<td>94-82-5</td>
<td>PPDB</td>
</tr>
<tr>
<td>2-phenylphenol</td>
<td>90-43-7</td>
<td>PPDB</td>
</tr>
</tbody>
</table>

Figure 4 – Pesticide Attributes Database view
Chemical ID

- Identifying information, including synonyms, ID numbers, use type, chemical classification, a link to a list of all products containing this chemical and a list of the top crops this pesticide is used on in California.

- Signs and symptoms of poisoning, first aid, and links to treatment information for this chemical.

- Link to information on toxicity to humans, including carcinogenicity, reproductive and developmental toxicity, neurotoxicity, and acute toxicity.

- Links to world-wide registration status as well as regulatory information for the U.S. and California.

- Water quality standards and physical properties affecting water contamination potential.

- Toxicity to aquatic organisms.

- List of chemicals in the same family, including breakdown products, salts, esters, isomers, and other derivatives.

Figure 5 – Pesticide Attributes Database link to information on one of the outside databases. Clicking on each of the links will provide more detailed information on each topic.