



### Monitoring and Sustaining Food Safety and Quality with Nuclear Techniques

What is food safety and quality, why is it important?

Food safety and quality relates to the whole food supply chain, from production to processing and consumption, widely known as ‘farm-to-table’. Food safety is of paramount importance to protect the health of the consumer and to help ensure food security.

Globally in many countries, people’s health and livelihoods depend on food production, and food exports are often a major contributor to the economy. Ensuring that food is safe and of good quality is therefore vital both domestically and for international trade.

Climate change is an additional factor that is also having an impact on **food safety**, for example influencing the prevalence of natural food toxins that may accumulate in food when conditions support the growth of toxin-producing fungi, moulds or algae.

The IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO), supports Member States in the development and application of nuclear techniques to improve their food safety and control systems. These efforts contribute directly to the achievement of the United Nations’ Sustainable Development Goals (SDGs) 1, 2 and 12 — no poverty, zero hunger and responsible production — as food safety and quality form an integral part of these SDGs.



The FAO/IAEA Joint Division helps provide technical assistance to Member States that want to implement irradiation technology in making their food safer.

(Photo: IAEA)

#### Protection against food fraud

Trade is globalized, and a food safety crisis or incident in one country may eventually affect consumers in many other countries and regions. To address these transboundary challenges, joint efforts worldwide are needed more than ever to enhance food safety and quality.



Food-related fraud can harm people or damage trade. Recent examples include:

1. beef adulterated with horse meat
2. milk adulterated with melamine
3. sub-standard food products containing pathogens
4. parasites, antibiotics or dioxin contaminants.

Such situations have gripped global attention, ruined reputations and highlighted the critical necessity to both protect the consumer and demonstrate that food contamination or fraudulence will not go unnoticed.

Food fraud costs the food industry between US \$10 billion and US \$15 billion a year, affecting approximately 10% of all commercially sold food products. This is in addition to the common challenge of food contamination that affects public health and trade in foodstuffs, despite stringent standards and guidelines. Establishing and strengthening capabilities that ensure a secure and credible food supply chain is the key to ensuring food safety and quality, protecting consumers and promoting domestic and international trade.

## How can isotopic techniques help?

Isotopic and related techniques play an often unique role in the development of science-based food safety, quality and control systems. They can help in **food fraud**, to identify and combat fraudulent, adulterant and illegal additives in food and feed, to determine food origin or to verify product authenticity, and to test and quantify various harmful residues or contaminants such as pesticides, veterinary drugs, mycotoxins or heavy metals.

Stable isotope measurements of hydrogen, carbon, nitrogen, oxygen, sulphur, boron and strontium content provide valuable information on the geographical origin of food. These isotopic techniques also provide an advantage in the development of analytical methodologies for quality assurance.

Alongside conventional techniques, they represent valuable tools for enabling authorities to implement control and monitoring policies effectively and take

remedial action whenever necessary to ensure the integrity of the food supply.

About 1200 laboratory personnel are trained annually at the FAO/IAEA Agriculture & Biotechnology Laboratories in Austria and in training programmes conducted in Member States.

## Why and how is food irradiated?

**Food irradiation** has the same benefits as heat processing, refrigeration, freezing or processing with chemicals but, unlike these processes, irradiation does not change the temperature or leave residues. The technique controls spoilage and food-borne pathogens or insect pests without significantly affecting the taste, look or smell of the foods. Irradiation is also a viable pest control method, providing phytosanitary security for traded fresh produce by preventing insects and other pests from developing or reproducing in the food.

Food irradiation is a regulated technology that employs energy in the form of gamma radiation, X-rays or high energy electron beams to suppress spoilage and eliminate food-borne pathogens or post-harvest pests, reducing the risk of food-borne illnesses as well as food waste and spoilage.

## Food safety: a prerequisite to access global food trade

Global standards, guidelines and recommendations for the production of safe and high-quality foods are preconditions for global trade. This in turn requires that the necessary analytical capacities exist to detect and monitor food contaminants, such as pesticide and veterinary drug residues, radionuclides, toxic metals and mycotoxins. These may result from production processes or from unintended contamination along the food chain.

The IAEA and FAO assist Member States with establishing and using the analytical technologies needed to measure residues and contaminants in food and also facilitate the establishment of national and/or international standards, guidelines and protocols.





**The Food and Environmental Protection Laboratory run by the Joint FAO/IAEA Division in Seibersdorf (Austria) helps to establish effective systems to support food authenticity, food traceability and contaminant control, to enhance food safety and international agriculture trade.** (Photo: D. Calma/IAEA)

To strengthen Member States' national capacities, the IAEA and FAO work closely with the **International Plant Protection Convention (IPPC)** and the **Codex Alimentarius Commission (CODEX)**, for example to harmonize worldwide analytical protocols and irradiation standards and develop criteria on radionuclide levels in food and water.

## How does the IAEA and FAO help?

The FAO is one of the Agency's closest partners. Since 1964, the two organizations together govern the **Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (Joint Division)**. This cooperation is marked by complementary mandates, common targets, joint programming, co-funding and coordinated management.

They continue to work towards strengthening collaboration in a number of areas of common interest, including global food safety and quality. This alliance assists Member States in developing, adopting and applying nuclear and related techniques that provide science-based solutions to regulating food safety.

As many countries strive to meet local consumer demands and stringent import requirements amid stiff competition on the international food market, the demand for support to set up or improve national food safety and quality control systems has equally grown each year. In response to these demands, the Joint Division's research and development work on nuclear and isotopic techniques and capacity-building activities, often through the IAEA's technical cooperation programme, have helped initiate or strengthen effective national residue and contaminant monitoring programmes in over 50 countries.

These services are geared towards the wider application of standards that meet food quality and safety requirements, improve public health and facilitate international trade.

## Capacity building: training and sharing expertise

The IAEA and FAO support Member States through applied research, training and technical guidance on the application of nuclear, isotopic and irradiation technologies to strengthen national



practices and capabilities in this field. This facilitates reliable, routine control programmes that, besides safeguarding consumers, enhance food export opportunities.

Technology is developed at the Agriculture & Biotechnology Laboratories run by the Joint FAO/IAEA Division in Seibersdorf (Austria). It is then transferred to testing laboratories and regulatory bodies in Member States, or developed in-country with technical support. Assistance, expertise and technical developments are also provided

in food irradiation for food quality, sanitary and phytosanitary applications.

## More information

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

[www.iaea.org/topics/food-and-agriculture](http://www.iaea.org/topics/food-and-agriculture)

[www.iaea.org/about/organizational-structure/departments-of-nuclear-sciences-and-applications/joint-fao/iaea-division-of-nuclear-techniques-in-food-and-agriculture](http://www.iaea.org/about/organizational-structure/departments-of-nuclear-sciences-and-applications/joint-fao/iaea-division-of-nuclear-techniques-in-food-and-agriculture)

**Over 1500 samples are checked using nuclear and isotopic techniques to detect minute quantities of contaminants in food rapidly at the national food quality control laboratory in Chile.** (Photo: IAEA)



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IAEA, Vienna International Centre, PO Box 100, 1400 Vienna, Austria

Email: [info@iaea.org](mailto:info@iaea.org) • Telephone: +43 (1) 2600-0 • Facsimile +43 (1) 2600-7