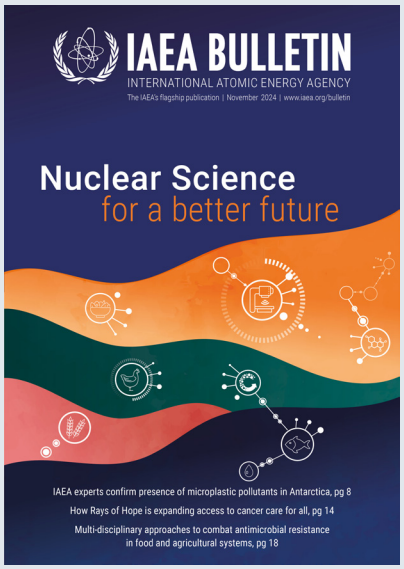
IAEA BULLETIN

INTERNATIONAL ATOMIC ENERGY AGENCY

The IAEA's flagship publication | November 2024 | www.iaea.org/bulletin

Nuclear Science for a better future



IAEA BULLETIN
is produced by the
Office of Public Information and Communication
International Atomic Energy Agency
Vienna International Centre
PO Box 100, 1400 Vienna, Austria
Telephone: (43-1) 2600-0
iaeabulletin@iaea.org

Editor: Kirstie Gregorich Hansen
Managing Editors: Patricia Puhm, Emma Midgley
Design & Production: Ritu Kenn

IAEA BULLETIN is available online at
www.iaea.org/bulletin

Cover:
IAEA

Follow us on

IAEA Atoms for Peace and Development

The mission of the **International Atomic Energy Agency** (IAEA) is to help prevent the spread of nuclear weapons and to help all countries — especially in the developing world — benefit from the peaceful, safe and secure use of nuclear science and technology.

Established as an autonomous organization under the United Nations in 1957, the IAEA is the only organization within the UN system with expertise in nuclear technologies. The IAEA's unique specialist laboratories help transfer knowledge and expertise to IAEA Member States in areas such as human health, food, water, industry and the environment.

The IAEA also serves as the global platform for strengthening nuclear security. The IAEA has established the Nuclear Security Series of international consensus guidance publications on nuclear security. The IAEA's work also focuses on helping to minimize the risk of nuclear and other radioactive material falling into the hands of terrorists and criminals, or of nuclear facilities being subjected to malicious acts.

The IAEA safety standards provide the fundamental principles, requirements and recommendations to ensure nuclear safety and reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from the harmful effects of ionizing radiation. The IAEA safety standards have been developed for all types of nuclear facilities and activities that serve peaceful purposes, as well as for protective actions to reduce existing radiation risks.

The IAEA also verifies through its inspection system that Member States comply with their commitments under the Nuclear Non-Proliferation Treaty and other non-proliferation agreements to use nuclear material and facilities only for peaceful purposes.

The IAEA's work is multi-faceted and engages a wide variety of partners at the national, regional and international levels. IAEA programmes and budgets are set through decisions of its policymaking bodies — the 35-member Board of Governors and the General Conference of all Member States.

The IAEA is headquartered at the Vienna International Centre, Vienna, Austria. Field and liaison offices are located in Geneva, New York, Tokyo and Toronto. The IAEA operates scientific laboratories in Monaco, Seibersdorf and Vienna. In addition, the IAEA supports and provides funding to the Abdus Salam International Centre for Theoretical Physics, in Trieste, Italy.

Tackling global challenges through nuclear science

By Rafael Mariano Grossi, IAEA Director General

The world faces challenges, some of them existential and others very serious. Food insecurity is on the rise and freshwater resources are shrinking. The natural environment is under threat. Climate change is an unwelcome accelerant. The burden of these challenges disproportionately affects people who live in developing economies, particularly low and middle income countries (LMICs). Life-saving cancer treatments are unevenly distributed, meaning that the disease is curable in some countries and a death sentence in others.

For nearly 60 years, the IAEA has been helping to address such challenges and to facilitate cross-border collaboration. It has helped to dramatically increase Member States' capacity to use nuclear science and technology towards the achievement of the Sustainable Development Goals (SDGs). The uses of nuclear are so wide-ranging that they directly support more than half the SDGs and indirectly support all of them.

The IAEA's 12 laboratories in Austria and Monaco are unique in the United Nations (UN) system. They translate nuclear research into practical applications in food and agriculture, water resource management, marine monitoring and cancer care, while also providing training and capacity building for Member States.

The IAEA's technical cooperation (TC) programme transfers nuclear technologies and applications to Member States. By sharing knowledge, building partnerships and facilitating regional cooperation, the TC programme helps countries sustainably address their most urgent priorities, from food and agriculture to energy.

This issue of the *IAEA Bulletin* showcases some of the ways in which nuclear applications are helping to increase food security, improve water resource management, protect our oceans, tackle the impacts of climate change and narrow the gap in cancer care in LMICs.

The IAEA launched **ZODIAC** in 2020 to help countries detect, identify and contain outbreaks of diseases originating in animals that can be transmitted to humans. It is our contribution to preventing the next pandemic. Staff at about 100 national laboratories are now trained and 50 laboratories are newly equipped to use nuclear techniques to track diseases, share information and collaborate.

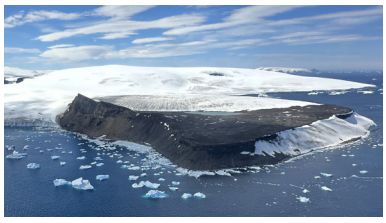
A recent IAEA study found that plastic pollution can be detected even in the remote biomes of Antarctica. Our **NUTEC Plastics** initiative helps countries fight plastic pollution and is now working with 63 of them to trace the movement of microplastics through ecosystems. Another 31 countries are developing new plastic upcycling and recycling processes using radiation technology.

The number of cancer sufferers around the world is expected to double by 2045. Despite advances in treatment, access to cancer care is uneven. Millions of Africans still have no access to radiotherapy, essential for about half of all cancer cases. **Rays of Hope** improves diagnosis and treatment for those in need. Since 2022, more than 80 countries have requested support, including more than 20 requesting specialized radiotherapy or medical imaging equipment. Ten cancer care and research institutions, spread across all regions, are now Rays of Hope Anchor Centres, serving as regional hubs for knowledge and training.

As part of the IAEA's long partnership with the Food and Agriculture Organization of the United Nations, the **Atoms4Food** initiative builds on decades of expertise in soil, crop and coastal management and nutrition, supporting countries in their efforts to improve food security and address hunger. The initiative offers customized strategies to increase agricultural productivity by developing new crop variants, minimizing food loss, ensuring food safety, enhancing nutrition and adapting to climate challenges.

The IAEA's Ministerial Conference on Nuclear Science, Technology and Applications and the Technical Cooperation Programme will focus on innovation and collaboration to tackle global challenges to human health and the health of our planet. Nuclear science and technology are part of the solution, and there is even more benefit they could bring.

CONTENTS



NUCLEAR EXPLAINED

IAEA UPDATES

Harnessing nuclear technology to the service of humankind — together

By Kai Mykkänen

Kai Mykkänen is the Minister of Climate and the Environment of Finland and the co-chair of the IAEA's 2024 Ministerial Conference on Nuclear Science, Technology and Applications and the Technical Cooperation Programme.

The end of November marks an important milestone for the IAEA, whose motto is 'Atoms for Peace and Development'.

The IAEA Ministerial Conference on Nuclear Science, Technology and Applications and the Technical Cooperation Programme will be held in Vienna from 26–28 November. Finland is extremely honoured to co-chair the conference together with Ghana. In my capacity as Minister of Climate and the Environment of Finland and co-chair of the upcoming conference, I want to highlight why this meeting is of instrumental importance. In my assessment, I build on the three main thematic areas of the conference: climate change, health and food safety and security.

Climate change is an existential threat to humankind and the environment. We must do our utmost to curb carbon dioxide emissions and the time for action is now — not later. Nuclear energy is a key energy policy tool in transforming our societies into low carbon economies. In Finland, our electricity sector is already nearly carbon dioxide-free, thanks to the long term policy of developing nuclear energy and renewable energy in tandem. This would not have been possible without the strong commitment of policymakers, industry, the regulatory authority and other stakeholders in nuclear safety. Public awareness and acceptance are the key enablers for nuclear. We must keep people informed of nuclear technology and pay close attention to nuclear safety, from the design and construction of nuclear power plants to their safe operation and decommissioning. This also includes the management of spent nuclear fuel and radioactive waste.

The second focus of the conference is health. Millions of people around the world lack access to radiotherapy. The humanitarian cost of this is unacceptable. The IAEA's Rays of Hope initiative aims to combat cancer by bringing cancer care within reach of those in need. Nuclear technology can help us to rise to the challenges of zoonotic diseases which, as the recent COVID-19 pandemic has shown, can have devastating impacts. In this context, I would like to underscore the importance of the IAEA's Zoonotic Disease Integrated Action (ZODIAC) initiative.

Nuclear technology plays a pivotal role in enhancing food safety and security, which is the third substantive theme of the conference. Hunger remains a grave concern for millions of people all over the world and the IAEA's Atoms4Food initiative strives to remedy the situation, for example by improving crops with nuclear technology. I have noted with pleasure that, in Vienna, the Group of Friends of Food Security is working actively. Together, we must put an end to hunger. Nuclear is a proven technology and more

versatile than it might first appear. In addition to the uses described above, nuclear techniques can be employed for a vast array of tasks, ranging from the detection of microplastics in the oceans to the preservation of cultural heritage. I would like to stress that a feature common to all these endeavors is nuclear science. It is the basis of everything in the nuclear field and can only be maintained by contributing to training, education and research. I want to pay tribute to the work conducted in the IAEA Seibersdorf laboratories just outside Vienna. The great work of improving people's lives is being done there every day — visit the site and you will be amazed.

People with nuclear expertise are the nuclear community's biggest asset. It is therefore necessary to ensure that we have enough trained workforce and experts in the future. This should not be taken for granted and we must pay particular attention to attracting young people to the nuclear sector. We must also pay attention to the proportion of women in the sector. We should do our best to bring more women into this important field, starting from the early stages of education. Nuclear should become a truly inclusive community of professionals.

We, the decision makers of the IAEA's Member States, have a lot of work ahead of us. We are simultaneously facing several daunting challenges that have a major impact on the everyday lives of our citizens, who need solutions. We must heed this call and seize the opportunity that nuclear technology provides. In fact, it can offer us tools beyond our imagination. We also need industry, financial institutions and other key stakeholders to embark on this journey with us. Let us walk this common path together and take the first step in Vienna in November.

"Nuclear science is the basis for everything in the nuclear field and can only be maintained by contributing to training, education and research."

Nuclear science, technology and applications, and the technical cooperation programme

By Kwaku Afriyie

Kwaku Afriyie is the Minister for Environment, Science, Technology and Innovation of Ghana and the co-chair of IAEA's 2024 Ministerial Conference on Nuclear Science, Technology and Applications and the Technical Cooperation Programme.

Nuclear science and technology have significantly impacted various aspects of human life, ranging from healthcare advancements to industrial processes. Global platforms such as the IAEA Ministerial Conference on Nuclear Science, Technology and Applications and the Technical Cooperation Programme unite experts, policymakers and stakeholders to discuss progress in these fields and shape global nuclear policies, safety standards, and the socioeconomic benefits of nuclear technology.

One major area of growth in nuclear science over the past decade is nuclear medicine, in particular in diagnostic imaging and cancer treatment. Radiation technologies are also increasingly applied in food irradiation and sterilization, and various industrial processes. The construction of new reactors, in particular in Asia, reflects a resurgence in nuclear energy, with advancements in research reactors further emphasizing its importance. Innovations such as small modular reactors and advanced pressurized water reactors are notable for their potential non-power applications, including water desalination and medical radioisotope production.

The renewed interest in nuclear energy arises from the need for clean, cost-effective and reliable energy sources to combat climate change. Safety concerns, high costs and waste management challenges — especially after accidents like those at Three Mile Island (1979), Chornobyl (1986) and Fukushima (2011) — have been mitigated through technological advancements, improved safety protocols and a shift in public perception. As a result, nuclear technology is increasingly seen as a solution to global energy challenges and a key contributor to the United Nations' Sustainable Development Goals (SDGs), in particular in health, food security and environmental sustainability.

In developing regions like Africa, nuclear science is playing a transformative role, with the IAEA providing technical cooperation to build local capacity. In Ghana, nuclear techniques including food irradiation and mutation breeding are applied in agriculture to develop disease resistant crops like cassava, a staple, thus improving food security and managing post-harvest losses. The Food and Agriculture Organization of the United Nations estimates that one third of global food production is lost to pests and spoilage, exacerbating hunger for over 700 million people. Technologies such as food irradiation, which extends the shelf life of food and reduces foodborne illnesses, and the sterile insect technique, which manages pests such as tsetse flies, fruit flies and mosquitoes, are instrumental in addressing these challenges, in alignment with the IAEA's Atoms4Food initiative.

Nuclear science is also having a substantial impact on cancer treatment. According to the World Health Organization, over 70 per cent of cancer deaths occur in developing countries, primarily due to limited access to treatment equipment and services. Expanding access to radiotherapy is essential in addressing this public health crisis. The IAEA's Rays of Hope initiative aims to provide radiotherapy equipment and training in regions where cancer treatment is limited, in particular in Africa.

Beyond healthcare and agriculture, nuclear technologies are used in water resource

management and geological resource exploration. In Ghana, isotope hydrology is used to trace underground water movements for better water management. Ghanaian scientists are participating in global efforts to combat plastic pollution through nuclear-based initiatives under the IAEA's Nuclear Technology for Controlling Plastic Pollution (NUTEC Plastics) initiative. The country is working with the IAEA Milestones Approach to guide its phased process of implementing nuclear power as part of its energy transition programme.

Human resource development has been crucial to the growth of nuclear science in Ghana and across Africa. The IAEA's technical cooperation (TC) programme has trained over 730 graduates in nuclear science through the School of Nuclear and Allied Sciences at the University of Ghana, which serves as a regional designated centre (RDC). Efforts to increase women's participation in science, technology, engineering and mathematics (STEM) disciplines, through initiatives like the IAEA's Marie Skłodowska-Curie Fellowship Programme, are essential, in particular in the Global South where gender disparity remains high.

Ghana's progress in nuclear science has positioned it as a leader and role model in Africa capable of contributing to knowledge sharing efforts. With IAEA support, the country has received accreditation to host RDCs for education and training in nuclear sciences, medical physics, radiation protection and safety. Its Biotechnology and Nuclear Agriculture Research Institute has become Africa's first IAEA Collaborating Centre in the field of plant breeding and genetics. This progress highlights the importance of international cooperation in advancing nuclear science for development.

Looking ahead, the role of nuclear science in achieving the SDGs by 2030 cannot be overstated. For sustained progress, international cooperation, stronger regulatory frameworks and investments in nuclear infrastructure — especially in radioactive waste management — are vital. Human resource development in the Global South must be scaled up to produce skilled workers capable of maintaining and advancing nuclear technologies. Public education on the benefits and risks of nuclear science is equally crucial to increase acceptance and ensure its safe, equitable and effective application worldwide.

The conference therefore offers a timely opportunity for stakeholders to explore these issues and plan for the future of nuclear science and technology. Through the IAEA's TC programme and sustained international collaboration, nuclear science can continue to address some of the world's most pressing challenges.

"In developing regions like Africa, nuclear science is playing a transformative role, with the IAEA providing technical cooperation to build local capacity."

IAEA experts confirm presence of microplastic pollutants in Antarctica

By Ellie McDonald, Omar Yusuf

> "We have started a scientific campaign aimed at identifying the real dimension of the problem of microplastic pollution, which is affecting the entire world and the pristine Antarctic environment."
>
> — Rafael Mariano Grossi, IAEA Director General

At least one million plastic bottles are bought each minute around the world, while a further nine million plastic bags are sold every sixty seconds, according to the United Nations Environment Programme. With more than 400 million tonnes of plastic waste produced each year, plastic pollution has become one of the most pressing global environmental challenges today and an enduring obstacle to sustainable development. This pollution is not always visible to the naked eye as plastic degrades with time and is absorbed by ecosystems and through the food chain.

A recent IAEA study has uncovered evidence that plastic pollution can be found even in the remote biomes of Antarctica. Using nuclear and nuclear-derived techniques, the IAEA was able to detect microplastics at smaller sizes than previously measurable using conventional methods.

"We have started a scientific campaign aimed at identifying the real dimension of the problem of microplastic pollution, which is affecting the entire world and the pristine Antarctic environment," said IAEA Director General Rafael Mariano Grossi at the launch of the project.

The IAEA brings together countries, partners and new technologies to address global plastic pollution under its Nuclear Technology for Controlling Plastic Pollution (NUTEC Plastics) initiative. Marine monitoring is a central pillar of the initiative and, in January 2024, the IAEA launched a scientific research mission to Antarctica under the initiative to investigate and measure the magnitude of plastic pollution in the remote Antarctic region.

"There is a growing concern to understand the impact of plastics and microplastics on the Antarctic ecosystem," said Argentine Foreign Minister Diana Mondino at a side event at the IAEA's General Conference in 2024. "We believe that the NUTEC Portal will be a valuable and effective tool to support the IAEA's efforts to address shared challenges through the peaceful applications of nuclear energy".

Joined by a team of Argentinian scientists, IAEA experts visited three of the six permanent environmental research stations operated by Argentina — namely the Marambio, Esperanza and Carlini bases — as well as the Argentine icebreaker Irizar with the aim of using this existing infrastructure to support the collection of environmental samples and subsequently prepare them for analysis at the IAEA Marine Environment Laboratories in Monaco.

The preliminary results from the IAEA's analysis of the Antarctic seawater, beach sand, molluscs and penguin faeces indicate the presence of microplastics in all samples. The microplastics detected included a variety of polymers, including plastic fibres and fragments, most commonly polytetrafluoroethylene (PTFE), polyvinyl chloride (PVC), polypropylene and polyethylene terephthalate (PET).

This study is an important contribution to the growing body of scientific analysis indicating the presence of plastic and microplastic waste in soil, produce, water and air samples in all corners of the globe. Once finalized, the IAEA's research results will be shared with the Scientific Committee on Antarctic Research, a specialized body of the International Science Council that provides independent advice to the Antarctic Treaty system, the Intergovernmental Panel on Climate Change and the United Nations Framework Convention on Climate Change.

In addition, technical and scientific collaboration with the Chilean Antarctic Institute will utilize Chilean Antarctic bases to collect samples for analysis at the IAEA Marine Environment Laboratories in Monaco. This will strengthen Chile's capacities in sample collection and analysis and will establish a baseline of microplastic levels in the Chilean Antarctic Territory. Through its NUTEC Plastics initiative, the IAEA is helping to equip laboratories in 86 countries with the capacities and resources to sample, characterize and analyse microplastics in marine and coastal environments through technical cooperation projects and coordinated research projects.

As only 10 per cent of plastic is recycled globally, the IAEA is also making additional efforts to focus on upcycling activities designed to enable countries to utilize renewable resources as alternatives to petroleum-based materials and repurpose plastic waste before it contributes to broader pollution. Currently, 39 countries are involved in upcycling activities through NUTEC Plastics. Irradiation can be used to treat existing plastics and to render them fit for reuse – extending current recycling potential and enabling a wider and higher-value reuse. Significant progress has been made in the Asia-Pacific and Latin America regions, with innovative radiation technology successfully applied in Argentina, Indonesia, Malaysia and the Philippines. These four pilot countries have also established strategic partnerships with the private sector, to validate the technology and initiate scale-up strategies.

NUTEC Plastics is paving the way for a cleaner, more sustainable global future. The continued collaboration between the IAEA, its Member States, industrial partners and subject experts will be crucial in advancing technology and building capacity to continue to assess and address plastic pollution. Through its forward-looking approach and collaborative efforts, NUTEC Plastics aims to make available the power of nuclear technology to address one of the most pressing environmental challenges of our time.

IAEA NUTEC PLASTICS

This IAEA flagship initiative brings together public and private partners across the globe to address the challenge of plastic pollution and improve plastic recycling as well as monitoring pollution in the ocean, where the bulk of plastic waste ultimately ends up.

Global Collaboration for a Cleaner Future

The initiative represents a global effort under the IAEA to combat plastic pollution, involving 86 countries in marine microplastics monitoring and 39 countries developing innovative recycling technology.

Innovative Use of Nuclear Science

Leveraging the power of nuclear science and technology, NUTEC Plastics uses irradiation to treat existing plastics for higher-value reuse and employs nuclear science for the trace and monitor microplastics in the ocean.

Marine Microplastics Monitoring

Over 50 labs worldwide are being equipped for marine microplastics analysis, turning them into an interconnected network supporting standardized sampling, analysis protocols and data sharing.

climate change

How nuclear science and technology enables sustainable development in a climate-stressed world

food

Nuclear and related techniques support the development of sustainable agrifood systems that are more climate resilient.

GHG

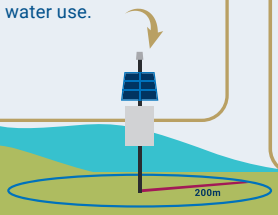
Agriculture and land use contribute about 25% of GHG emissions.

Nuclear techniques provide reliable methods for **tracing, quantifying and understanding emissions.**

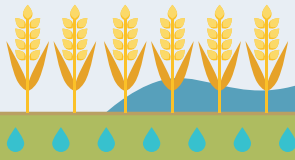
The **sterile insect technique** (SIT) helps manage invasive insect species caused by climate change and reduces the need for chemical pesticides.

Pakistan has developed climate-resilient varieties of pulses through plant breeding, which has doubled its yield by hectare, boosting food security and economic stability.

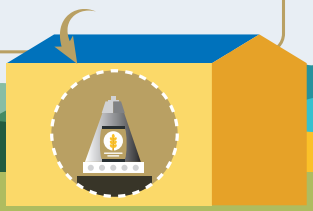
By using nuclear technologies, like the **Cosmic Ray Neutron Sensor**, and isotopic techniques for water-saving irrigation, specific water quantities can be given to crops, greatly reducing water use.



Plant mutation breeding accelerates the natural mutation process in plants, producing new varieties with improved quality, higher yields and resistance to climate change.



Food irradiation extends the shelf life of food, helps prevent the spread of pests and diseases and facilitates international trade.



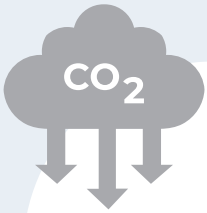
Nuclear techniques enable the **accurate tracking of nutrients from fertilizers to plants,** providing farmers with critical data.

Nuclear techniques provide solutions to **diagnose, monitor, prevent and tackle transboundary animal and zoonotic diseases.**

In **Benin**, farmers' use of integrated soil fertility management practices have increased yields while saving fertilizer, hence reducing GHG emissions.

Climate change is profoundly reshaping ecosystems and threatening food and water security. Globally, agrifood systems are under strain, while freshwater resources are shrinking. The natural environment, including the oceans, is under threat.

Nuclear science and technology can help countries continue their progress towards sustainable development by addressing many of the unprecedented challenges the world faces today.



Nuclear power produces around a quarter of the world's low carbon electricity.

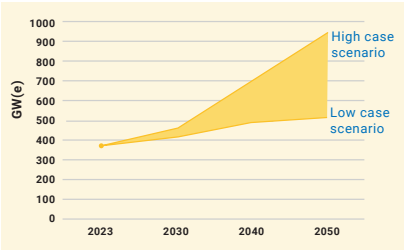
It enhances development as part of a just energy transition by providing jobs and other economic benefits to local communities, expanding access to electricity for sustainable development.

energy Nuclear energy plays a key role in reducing greenhouse gas emissions and strengthening energy security.

The net zero transition requires all clean energy sources to work together to meet energy demand. Nuclear adds the needed stability to clean energy systems for renewables, such as solar and wind, to fully flourish.

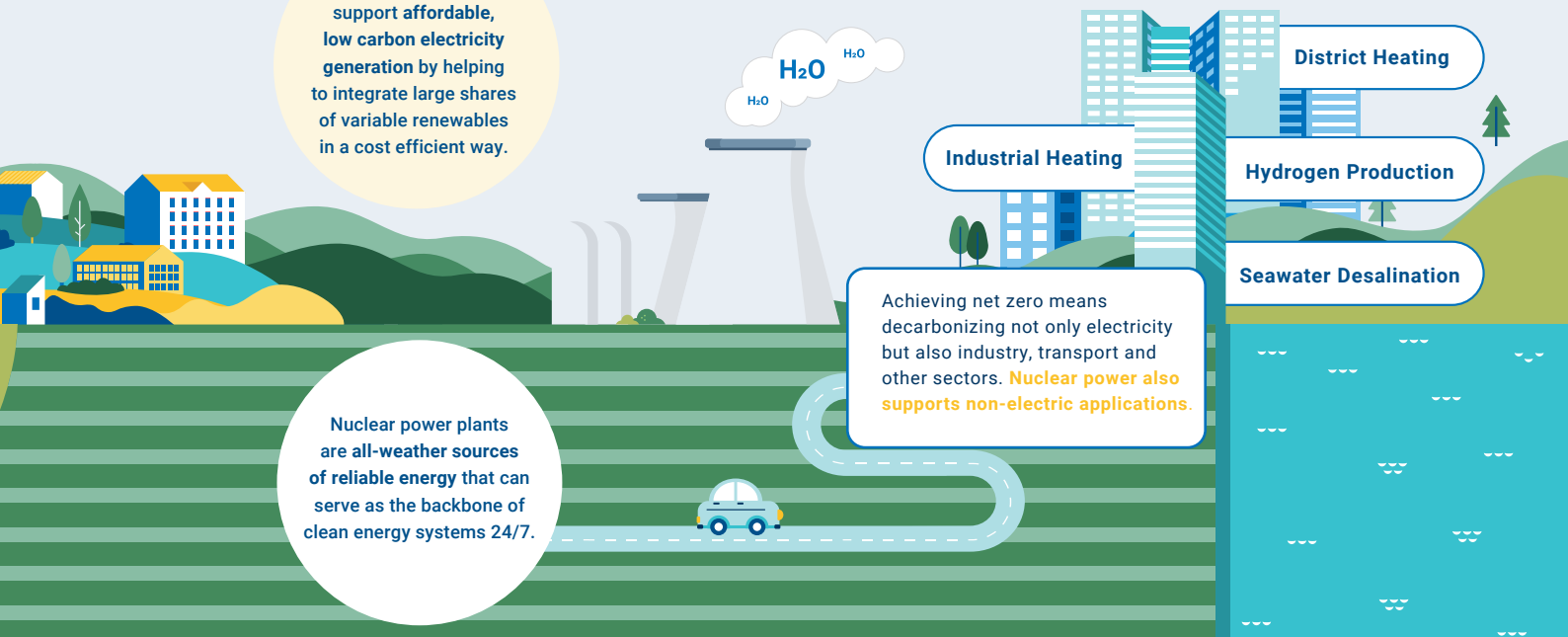
Following the momentum from the historic inclusion of nuclear energy in the Global Stocktake at COP28, world leaders gathered in Brussels in March 2024 at the first ever Nuclear Energy Summit, co-organized by the IAEA in Belgium.

IAEA nuclear capacity projections to 2050



Global nuclear capacity could more than double by 2050. To achieve net zero goals, financial investments in expanding nuclear capacity will need to increase from US $50 billion — the annual average from the last 5 years — to US $125 billion, annually.

Nuclear power can support **affordable, low carbon electricity generation** by helping to integrate large shares of variable renewables in a cost efficient way.



Achieving net zero means decarbonizing not only electricity but also industry, transport and other sectors. **Nuclear power also supports non-electric applications.**

Nuclear power plants are **all-weather sources of reliable energy** that can serve as the backbone of clean energy systems 24/7.

Countries are using nuclear science and techniques to enhance food and water security, protect the environment, produce clean energy and develop strategies to minimize harm to fragile coastal and marine ecosystems.

The IAEA is helping countries realize the vast potential of nuclear science and technology, from supporting the introduction of clean nuclear energy to researching climate resilient agrifood systems in partnership with the United Nations Food and Agriculture Organization.

water

Nuclear technology provides key insights on the water cycle, empowering communities to achieve sustainable water management.

Scientists around the world track raindrops and **use big data to improve water supply.**

Scientists in Europe and Central Asia have worked together to determine **the status of freshwater resources in rivers, aquifers and glaciers.**

Climate change is shrinking glaciers globally, reducing future meltwater availability for downstream communities. Isotope hydrology helps track freshwater contributions to downstream ecosystems.

From the Andes to the Himalayas, **scientists are tracking the consequences of glacier retreat.**

Climate change is affecting the source, distribution and intensity of precipitation worldwide and the occurrence of snow. These changes can lead to increased incidences of floods and droughts.

Climate change is altering river flow patterns. Isotope hydrology can identify the origin of river water and assess its quality to better manage river health.

Groundwater recharge and availability is increasingly affected by changes in precipitation.

Scientists in the Sahel region are using isotopic techniques to study groundwater quality and recharge rates, helping to guide sustainable water management.

Samples of water that can be analysed with nuclear techniques

Isotopes are like the fingerprints of water. Isotopic hydrology offers a unique and powerful tool to determine the age, source, quality and movement of water resources – key information that is not available through any other means.

Nuclear techniques can help countries monitor and assess environmental changes, meaning they can understand ecosystem processes, enabling science-based policies that can provide resilient solutions in adapting to climate change.

ocean

Nuclear technology makes a difference in better understanding the impacts of climate change in coastal and marine ecosystems and countering the loss of biodiversity.

The IAEA supports countries to track shared ocean issues and to standardize the collection of data.

Learn more about how countries in Latin America and the Caribbean are working together through the REMARCO network.

Scientists at the IAEA prepare samples as part of blue carbon research.

Researchers at the IAEA are studying the effects of ocean acidification and other environmental stressors on marine organisms.

Blue carbon ecosystems capture CO_2 emissions, acting as a nature-based solution to mitigate climate change.

Nuclear and related techniques help to assess the absorption capacities of these ecosystems.

The ocean absorbs CO_2, causing **ocean acidification**, affecting marine life and the livelihoods of up to 3 billion people who depend on the ocean.

Increasing global temperatures and human activities have led to an increase in **harmful algal blooms**, which are poisonous to human and marine lives.

The IAEA builds national capacity to use radioligand receptor binding assays, a nuclear technique, to detect them.

The IAEA uses **nuclear and isotopic techniques** to gain a better understanding of the impact that microplastics have on marine ecosystems, and to evaluate any additional contamination risks from associated pollutants.

Infographic: A. Vargas, R.Kenn/IAEA

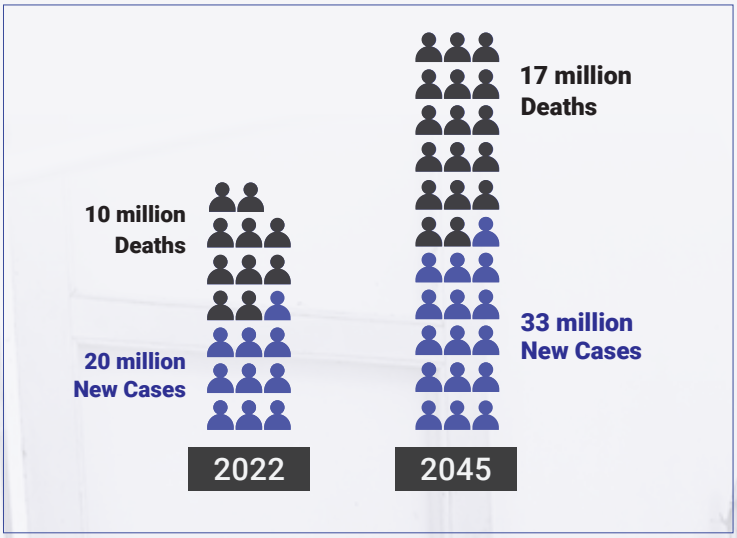
How Rays of Hope is expanding access to cancer care for all

By Ellen Swabey-Van de Borne, Peter Lee

In 2022, 10 million people died from cancer

This number is expected to grow over the next two decades.

Low and middle income countries are expected to carry the highest burden.

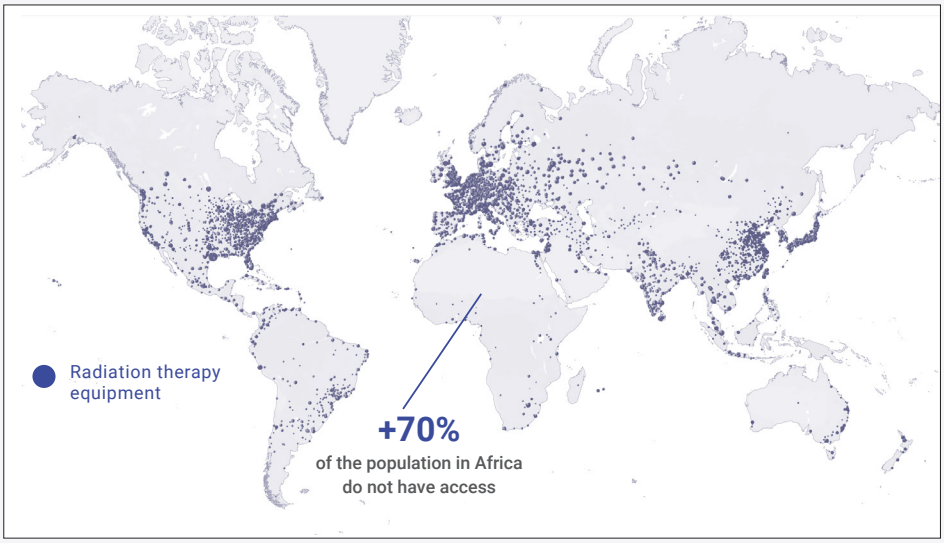


Source: Globocan 2022

Radiotherapy helps in about half of all cancer cases

However, this life-saving treatment cannot reach all of those in need.

The situation is most acute in countries that lack radiotherapy facilities and trained personnel.



Source: IAEA, 2024

Cancer care is a global challenge, especially in those parts of the world where the number of cancer patients requiring radiotherapy is outpacing access to this technology. In 2022, only 21 per cent of countries met the minimum radiotherapy resource requirements. That year, 20 million new cases were diagnosed and 10 million people died from this non-communicable disease.

The burden is heaviest in low and middle income countries (LMICs), where over 70 per cent of cancer deaths occur. Yet, LMICs receive only 5 per cent of global spending in this area.

To expand access to lifesaving cancer treatment, particularly in LMICs where the need is greatest, IAEA Director General Rafael Mariano Grossi launched the Rays of Hope initiative in February 2022.

"Each individual death is a tragedy. The fact that cancers that are routinely diagnosed and successfully treated in high income countries are killing increasing numbers of people in developing countries is an injustice," says IAEA Director General Rafael Mariano Grossi.

Under the **Rays of Hope: Cancer Care for All** initiative, the IAEA works with international organizations and partners including the World Health Organization (WHO) to provide expertise, training and resources around the world, enabling cancer patients to access safe and secure radiotherapy and diagnostic imaging services.

For many years already, the IAEA has been conducting imPACT Reviews – comprehensive assessments of a country's cancer control capacities and needs – with the WHO and the International Agency for Research on Cancer (IARC), using an evidence-based approach to expanding access to cancer care. To date, around 130 such reviews have been carried out in support of countries around the world. ImPACT Review recommendations have helped inform technical cooperation projects, national cancer control plans and strategic funding documents.

The IAEA has also designated ten cancer institutes around the world as Rays of Hope regional anchor centres to serve as regional knowledge, capacity-building, research and innovation hubs providing targeted support in training, research and quality assurance.

These centres have a demonstrated record of working with the IAEA, deep technical expertise and robust governance and medical infrastructures. By strengthening and expanding the capacity of a selected centre to conduct its critical work, the IAEA aims to maximize the delivery of high impact interventions to cancer patients.

Since data are pivotal for advancing cancer treatment, research and education, the IAEA is also developing a global radiation medicine database (SUNRISE) under the Rays of Hope initiative. The insights generated by this database on the impact of radiation medicine initiatives will help policymakers and practitioners alike to undertake more targeted action.

Here are just a few examples of how the IAEA has been supporting different regions, including through Rays of Hope:

In **Latin America and the Caribbean**, the procurement of 32 mammography units was initiated in 2024 to support breast cancer screening services and diagnosis. When complete, this will allow up to 250 000 women in 19 countries to be screened every year. The IAEA also offered technical guidance to help centres to plan, design and operate high quality and safe screening services.

Since 2023, **Ukraine** has received expert advice, equipment and training to address its urgent and increasing needs to diagnose and treat cancer patients. Efforts are also under way to train more professionals in radiology, nuclear medicine and radiotherapy through a comprehensive, multidisciplinary virtual training programme and the establishment of an in-country training facility.

Under the framework of Rays of Hope, **Indonesia** has been receiving support, including on the development of a national roadmap for scaling up radiotherapy and nuclear medicine services. The 2024 imPACT Review helped inform the development of Indonesia's National Cancer Control Plan 2024–2034 which was announced in October 2024.

With its current cancer population of nearly 20 000 expected to double by 2045, **Malawi** was one of the seven 'first wave' countries to join Rays of Hope when it launched in February 2022. Since joining the initiative, long term training and refresher courses for radiotherapy and medical imaging

IAEA RAYS OF HOPE
CANCER CARE FOR ALL

Rays of Hope aims to help widen access to cancer care in low- and middle-income countries by improving the availability of radiotherapy services, medical imaging, and nuclear medicine in underprivileged nations.

Comprehensive Approach

By integrating various elements such as radiation safety legislation, quality control, guidance, training, and equipment into a cohesive set of interventions, Rays of Hope seeks to maximize impact through sustainable projects tailored to the specific needs of each country.

Promoting Global Health

Rays of Hope directly contributes to the 2030 Agenda for Sustainable Development, particularly aiming to fulfil Sustainable Development Goal 3 (Good Health and Well-Being), by striving to reduce illness from non-communicable diseases by one-third.

Demand-driven Support

Nations in need of assistance through Rays of Hope engage by submitting formal requests to the IAEA, ensuring that the support provided is directly aligned with each country's specific needs and priorities.

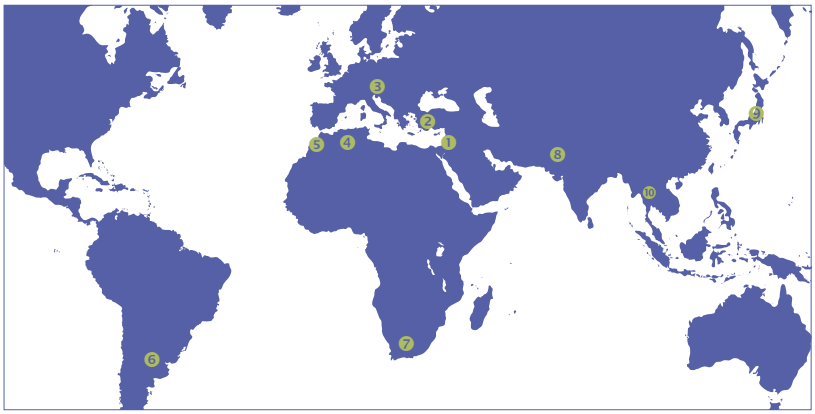
professionals have been held. A linear accelerator, high dose rate brachytherapy machine, computed tomography (CT) simulator and dosimetry equipment have been delivered, with additional equipment in the process of being procured. Now that radiotherapy and brachytherapy bunkers have also been constructed, Malawi is ready for the launch of its first public radiotherapy facility.

In April, an anchor centre in **Türkiye** held a week-long workshop which brought together nearly 100 professionals from Europe and Central Asia to successfully develop a roadmap to strengthen paediatric radiotherapy services. In August, an anchor centre in Japan organized a course which trained nuclear medicine physicians from 15 different countries on streamlined and emerging theranostics techniques to diagnose and treat cancer patients.

"Our resources and commitment will all be mobilized to ensure the success of the Rays of Hope initiative, as we collectively strive to bring Rays of Hope to communities in need," said Artit Ungkanont, Dean of Mahidol University's Faculty of Medicine as its Ramathibodi Hospital in Thailand became an anchor centre.

ANCHOR CENTRES

Anchor centres are institutions working in cancer care and research that have shown themselves to be resilient through the decades and capable of becoming knowledge hubs for their respective regions. They will work with the IAEA to improve educational and research infrastructure and quality assurance.



❶ King Hussein Cancer Centre (Jordan)

❷ Ege University Faculty of Medicine (Türkiye)

❸ Institute of Oncology Ljubljana (Slovenia)

❹ University Hospital Centre of Bab El-Oued and Pierre and Marie Curie Cancer Centre (Algeria)

❺ Institut National d'Oncologie (Morocco)

❻ Comisión Nacional de Energía Atómica (Argentina)

❼ Steve Biko Academic Hospital – NuMeRI (South Africa)

❽ Atomic Energy Cancer Hospital, Nuclear Medicine, Oncology and Radiotherapy Institute, Islamabad (Pakistan)

❾ The Japanese Network of Cooperation in Radiation Medicine for Rays of Hope (Japan)

❿ Faculty of Medicine in Ramathibodi Hospital, Mahidol University (Thailand)

€70m+ received from donors and partners, including Member States and the private sector.

80+ requests received for support.

13 partnership agreements with world-renowned professional societies in cancer care.

20+ countries initiated the procurement of specialized radiotherapy or medical imaging equipment.

10 Anchor centres established (see box above).

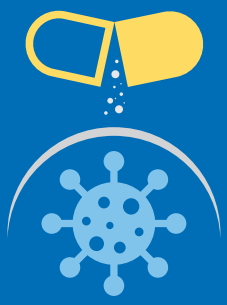
Data since February 2022

SCAN HERE

To join the Rays of Hope initiative and increase access to cancer care for all

Multi-disciplinary approaches to combat antimicrobial resistance in food and agricultural systems

By Monika Shifotoka



Antimicrobial resistance occurs when bacteria, viruses, fungi or parasites no longer respond to antimicrobial treatments, turning once-manageable infections into deadly, untreatable conditions.

Antimicrobial resistance (AMR) is a growing global threat, often referred to as the 'silent pandemic'. AMR jeopardizes global health, food security and economic stability by rendering common treatments ineffective against previously treatable infections. The World Health Organization estimates that, in 2019 alone, AMR was directly responsible for 1.27 million deaths worldwide. Projections indicate that this figure could rise to 40 million by 2050, underscoring the urgent need for action. AMR occurs when bacteria, viruses, fungi or parasites no longer respond to antimicrobial treatments. The IAEA has taken a multi-disciplinary approach to address AMR, focusing on its impacts on food and agricultural systems.

Tracking AMR in food and agriculture

Food production is a key area where AMR can develop and spread. Misuse of antimicrobials, particularly the overuse of antibiotics in livestock, contributes to the development of resistant bacteria. The Joint FAO/IAEA Centre helps address this issue by testing drugs and residues in food, monitoring antimicrobial use and enforcing stricter control measures. Nuclear and related techniques involving carbon-14, tritium-labelled tracers and stable isotopes are used to identify drug residues in food and the environment, while also assessing drug quality to ensure effective levels of active ingredients. Resistance develops when pathogens are exposed to inadequate doses of drugs, allowing them to 'adapt' to these treatments.

The persistence and spread of antimicrobial residues in agricultural environments can be traced using advanced isotopic techniques. A carbon-13 labelled antimicrobial, developed by the Technical University of Munich in Germany in research partnership with the IAEA, helps researchers trace antimicrobial compounds through soil and water. Effective soil and water management is crucial, as agricultural run-off can carry resistant bacteria and antimicrobials into surrounding ecosystems, potentially affecting both animals and humans.

Strengthening preparedness for AMR and zoonotic threats

The IAEA's Zoonotic Disease Integrated Action (ZODIAC) initiative, which was launched in June 2020 during the COVID-19 pandemic, is helping countries to enhance pandemic preparedness by providing countries with tools to identify zoonotic pathogens — organisms that can jump from animals to humans — before they spread. ZODIAC provides access to data on the impact of zoonotic diseases on human health and develops novel technologies for the detection of zoonotic diseases. The initiative also assists countries in detecting potential AMR in farm animal environments.

"Over the years, research has shown that a lot of people are becoming anti-microbial resistant, where even if they are taking antibiotics, they are not being cured, and that is not only in humans but in animals also," says Shariffa Joubert from the Animal Health Laboratory in the Seychelles. She took part in a regional AMR workshop in October 2024, organized under the IAEA's technical cooperation programme in collaboration with the Seychelles Government.

"Because we need to be mindful of what we eat, it is then important to diagnose animals that are resistant, to ensure that our livestock remain healthy and safe for consumption," says Joubert.

The ZODIAC initiative focuses on building global capacity, offering training for veterinary professionals and providing necessary equipment to laboratories worldwide. Regional ZODIAC training courses have been conducted at national laboratories in Argentina, Bulgaria, Ethiopia, Republic of Korea and Senegal.

Nuclear and nuclear-derived techniques such as isotopic and molecular methods can help assess how resistance genes are transferred between bacterial populations in animals, humans and the environment. This knowledge is invaluable for understanding how AMR spreads and for developing targeted interventions to contain it.

Joining forces through One Health

Given the complexity of AMR, a coordinated, multi-sectoral approach is essential. The One Health initiative brings together stakeholders from human health, animal health, food production and environmental sectors to collaborate on strategies to combat AMR. This integrated approach acknowledges that the health of people, animals and the environment are all interconnected. By working together, these sectors can design policies, implement monitoring programs and drive research to mitigate the risks of AMR while improving health outcomes and economic sustainability.

IAEA ZODIAC

The ZODIAC initiative was launched in June 2020. It supports laboratories with technology, equipment and training to enable Member States in timely detection of zoonotic pathogens of emerging or re-emerging zoonotic diseases.

Innovation and novel technologies

The initiative emphases research, development, and innovation, making the latest advancements in immunological, molecular, nuclear, and isotopic techniques immediately available to institutions participating in ZODIAC.

ZODIAC Laboratories and Coordination

Currently, 128 Member States have ZODIAC National laboratories, and ZODIAC National Coordinators.

Empowering Decisions with Data

ZODIAC provides access to data on the impact of zoonotic diseases on human health and enables science and results-based decisions.

WATCH HERE

"The lessons we have learned from our global response to the COVID-19 pandemic have underscored the critical importance of early detection, robust surveillance, and international cooperation in managing the threats to global health", says Najat Mokhtar, Deputy Director General and Head of the IAEA's Department of Nuclear Sciences and Applications. "These same principles are also vital for confronting the challenge of AMR."

The IAEA, together with the FAO, has worked to better understand and tackle transboundary animal diseases, including zoonotic diseases, for over 60 years. It is now drawing on this experience to combat the growing threat of AMR.

Small islands, big impact

Improving agriculture and nutrition in Pacific Island States

By Melissa Evans, Omar Yusuf

The Pacific Islands have made progress in improving agriculture and enhancing nutrition under a new localized IAEA approach to using nuclear science to address development challenges.

The IAEA, through its technical cooperation programme, supports seven Pacific Small Island Developing States (Pacific SIDS) in a broad range of areas including food, agriculture and health and nutrition. In that context, it has been implementing the Sub-Regional Approach to the Pacific Islands over the last two years, focusing on areas where nuclear science and technology can have the biggest impact.

The IAEA, through its technical cooperation programme, supports seven Pacific Small Island Developing States in a broad range of areas including food, agriculture and health and nutrition.

SIDS are recognized by the United Nations as a distinct group of developing countries with shared challenges. Pacific SIDS face several common obstacles to development, including vulnerability to climate change. Risks such as extreme weather and seawater intrusion, together with long transportation times for goods, present significant challenges in terms of the production, availability and safety of food. South-South cooperation allows countries to work together to tackle these challenges more effectively.

“By jointly utilizing national facilities such as research institutions or universities, the Pacific Islands are building their resilience as a subregion,” explained Javier Romero, IAEA Project Management Officer.

Through a coordinated research project organized by the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture (Joint FAO/IAEA Centre), scientists at the National Agricultural Research Institute of Papua New Guinea enhanced their capabilities to analyse chemical hazards in everyday foods such as milk, helping to improve food safety in the country.

Nuclear technology can be used to develop new crop varieties better suited to changing climate conditions, for example by exposing seeds to radiation so as to induce spontaneous genetic variation in plants. This technique, known as mutation breeding, helps boost countries’ biodiversity by producing new plant varieties with improved traits. Vanuatuan researchers attended a regional training course organized by the Joint FAO/IAEA Centre and gained hands-on experience in all aspects of mutation breeding, from screening and validation of the characteristics of a new crop variety to quality control.

“The contribution of new technologies such as mutagenesis using gamma rays holds large potential for SIDS,” said Juliane Kaoh, Head of Horticultural Perennial Crops at Biosecurity Vanuatu. “Thanks to the IAEA’s support we managed to do it for sweet potato, and the irradiated plants are under investigation in the Vanuatu Agricultural Research and Technical Centre.”

A further plant breeding training course for SIDS was held in 2022 at the Pacific Community’s Centre for Pacific Crops and Trees in Fiji. Participants from Fiji, the Marshall Islands, Papua New Guinea, Samoa

and Vanuatu were trained in techniques for mutation breeding. They also learned how to screen for biotic stresses involving living organisms such as fungi, bacteria, viruses and insects, and for abiotic stresses such as drought, salt and extreme temperatures in crops.

Obesity is a risk factor for the development of non-communicable diseases, which are now the leading cause of death in most Pacific countries. Nuclear techniques help assess the effect of lifestyle changes on body composition (lean mass and fat mass). The IAEA is now supporting Fiji National University to become a subregional hub for nutrition programmes through capacity building and the provision of equipment. In April 2024, participants from Fiji, Papua New Guinea, Samoa and Tonga received training in nuclear techniques for nutrition at an IAEA sponsored course hosted by the university. The participants completed hands-on training in the isotopic technique of deuterium dilution to accurately assess and monitor human body composition and total energy expenditure in order to inform the design and improvement of activities aimed at the prevention and control of obesity and related health risks.

The flagship initiative Atoms4Food, launched in 2023 by the IAEA and the Food and Agriculture Organization of the United Nations, provides practical assistance to countries, including SIDS, to enhance resilience and address priority challenges in the area of food security and safety.

FAO & IAEA

ATOMS4FOOD
GROWING FOOD SECURITY

Atoms4Food builds on nearly 60 years of experience developed jointly by the IAEA and the Food and Agriculture Organization of the United Nations (FAO) in supporting countries to use nuclear and isotope technology solutions. The Joint FAO/IAEA Centre advances and supports the safe and appropriate use of nuclear and related technologies in food and agriculture and provides the following services:

1. An Assessment Mission to map food security needs and develop a tailored plan to address food security challenges.
2. A Crop Variety Improvement Service to build crop improvement programmes using the nuclear method of plant mutation breeding to create more robust and nutritious crops.
3. A Soil and Water Management and Crop Nutrition Service to use the precision of nuclear and isotopic science to gather information on soil fertility; major crops and their average yield; and the availability of fertilizer and water irrigation systems.
4. An Animal Production and Health Service to provide a scientific assessment of the epidemiological situation of animal diseases; interventions for prevention, diagnosis and control; and laboratory and other veterinary service capacities.
5. An Insect Pest Control Service to tackle insect pests that affect agricultural production by using the nuclear-based sterile insect technique (SIT).
6. A Food Safety and Control Service to assess laboratory capabilities; the capacity to conduct surveillance of food hazards; and authenticity and irradiation applications.
7. A Public Health Nutrition Service to inform impactful nutrition programming using evidence on the nutritional value of foods and diet quality derived from the use of stable isotope techniques.

How the IAEA delivers impact on the ground

Some of the most pressing challenges facing the world today are in the areas of health, food security, water resource management and climate change. For decades, the IAEA has been delivering support to countries through its technical cooperation programme, helping them to benefit from nuclear science and technology solutions to these problems.

climate change

Problems associated with climate change and rising sea levels are already impacting the people of Fiji and directly affecting their future. The IAEA is helping communities adapt to climate change by assisting them in the use of nuclear techniques to breed more resilient crops, preserve soil and freshwater resources, and gain key insights into the health of the ocean.

In Paraguay, limited radiotherapy services prevent cancer patients from getting the treatment they need to survive. The IAEA helps countries like Paraguay to procure radiotherapy equipment and trains local professionals to help bridge the cancer care gap around the world by widening access to safe and secure radiotherapy services for cancer patients.

health

Malta is one of the ten most water stressed countries in the world. For thousands of years, the country has battled with the issue of drought. Now, the IAEA and partners are helping water experts in Malta use isotope hydrology to enable water authorities to understand and protect their limited resources, in particular in the context of climate change.

The IAEA helps countries to collect and analyse water data so that they can establish a full picture of local water systems. Data and insight can drive policy on water use, agriculture, the location of industrial facilities and housing developments, and more.

water resource management

Nuclear science is making a significant difference in helping Kenya adapt to climate change. Scientists and farmers use irradiation to induce mutations in plants, speeding up the natural evolutionary process to develop new crop varieties. The IAEA helps countries to apply climate smart practices that increase soil fertility and water use efficiency, and to build capacities in the use of isotope hydrology to track and monitor water resources.

food security

The technical cooperation programme explained

The technical cooperation (TC) programme is the IAEA's primary mechanism for transferring nuclear technology to countries, helping them address key development priorities in areas such as health and nutrition, food and agriculture, water and the environment, industrial applications, and nuclear knowledge development and management.

The TC programme also helps countries identify and meet their future energy needs and assists in improving radiation safety and nuclear security worldwide, including through the provision of legislative assistance.

It provides support through capacity building, knowledge sharing, partnership building, support for networking, and procurement.

The TC programme operates in four geographic regions: Africa; Asia and the Pacific; Europe; and Latin America and the Caribbean.

Within each region, it helps countries address their specific needs, taking into consideration existing capacities and different operational conditions. The TC programme aims to leverage capacities in each region by facilitating cooperation between countries within a region and beyond. South-South and triangular cooperation play an important role in supporting the exchange of nuclear knowledge and technology and enhancing the impact and sustainability of the IAEA's contribution to development.

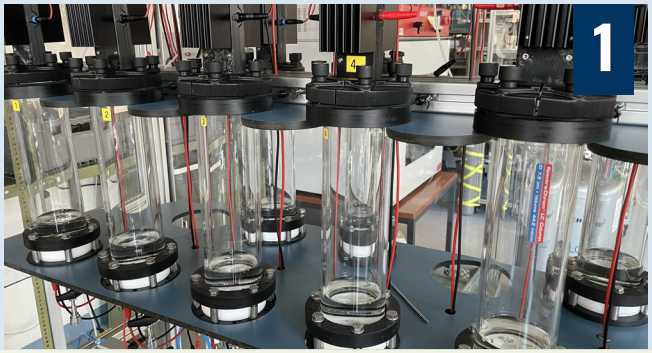
WATCH HERE

technical cooperation

The IAEA's unique laboratories

Nuclear science plays a pivotal role in addressing some of the world's most urgent challenges — enhancing healthcare, contributing to food safety and security, and monitoring the environment. At the heart of these efforts are the 12 IAEA nuclear science and applications laboratories, located in Austria and Monaco. These laboratories are advancing research and technology that directly impact millions of lives, for a healthier, more secure future for all.

PROTECTING **WATER RESOURCES**



Access to clean, sustainable water is a challenge facing many countries. The IAEA **Isotope Hydrology Laboratory** helps countries manage precious water resources through isotope hydrology techniques, which use naturally occurring isotopes to track water movement and quality. From mapping groundwater supplies to identifying sources of contamination, these techniques are crucial for addressing global water shortages and managing transboundary water resources to ensure sustainable access for future generations.

SECURING THE WORLD'S **FOOD SUPPLY**

The threat of food insecurity is exacerbated by climate change, pests and dwindling resources. The **Plant Breeding and Genetics Laboratory** is addressing these challenges by using radiation technology to accelerate the natural evolution of plants. Since 1964, more than 3400 new plant varieties have been created with desired traits, including drought resistant wheat, salt tolerant rice, and varieties with higher yields and shorter maturation periods. These advancements help farmers cultivate crops in changing environments, boosting yields and enhancing nutrition.

At the same time, the **Soil and Water Management and Crop Nutrition Laboratory** focuses on optimizing the sustainable use of natural resources in agriculture. Using nuclear and isotopic techniques, the laboratory helps countries improve soil fertility and water conservation, ensuring that crops are produced efficiently while minimizing environmental impacts. From studying soil erosion to enhancing the uptake of nutrients like nitrogen, the laboratory's research provides critical support to farmers, helping them increase productivity without depleting natural resources.

A GLOBAL EFFORT FOR A HEALTHIER, SAFER FUTURE

12 LABS

in 3 LOCATIONS supporting over 160 COUNTRIES

From healthcare to food security and water management to environmental protection, the IAEA's laboratories are interconnected in their mission to harness nuclear technology for the greater good.

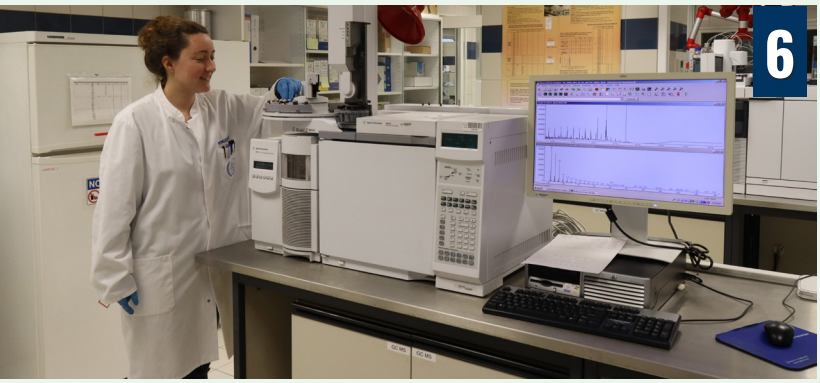
Each laboratory's work contributes to solving the world's most pressing challenges, and together they form a global effort that empowers nations to build a healthier and more sustainable and secure future for all.

Food safety remains paramount in ensuring public health and maintaining international trade. The **Food Safety and Control Laboratory** uses stable isotope analysis to trace food origins, helping countries meet international standards for their products. These advanced tracing techniques protect consumers and foster trust in global food supply chains. Complementarily, food irradiation — a gentle and non-invasive technology — preserves the nutritional content, flavour and overall quality of food products. This method ensures that food can be exported in compliance with international food safety requirements, reaching consumers around the globe. By replacing the use of chemicals or heat, food irradiation reduces costs and losses, thus contributing to more sustainable consumption patterns.

The work of the IAEA also extends to enhancing food safety by applying nuclear techniques to detect possible contaminants. Scientists at the **Marine Environment Laboratories**, for example, are helping researchers find dangerous biotoxins in marine algae that can lead to outbreaks of contaminated seafood.

Pest control is another critical component in protecting crops. For over six decades, the **Insect Pest Control Laboratory** has pioneered the sterile insect technique (SIT), which uses radiation to sterilize insects and curb pest populations. From preventing fruit fly outbreaks in Latin America to controlling mosquitoes that spread disease, the SIT has revolutionized sustainable pest management, benefiting both agriculture and public health while reducing the use of pesticides.

PROTECTING **THE PLANET**



The health of our oceans is a key concern in the face of pollution, climate change and overexploitation. The **Marine Environmental Studies Laboratory** monitors contaminants such as heavy metals and petroleum hydrocarbons, providing vital data to protect marine ecosystems.

Additionally, the **Radioecology Laboratory** tackles plastic pollution through the Nuclear Technology for Controlling Plastic Pollution (NUTEC Plastics) initiative, using nuclear techniques to trace microplastics in marine organisms and assess their long term impact on ecosystems.

The IAEA Environment Laboratories, including the **Radiometrics Laboratory**, further extend this effort by tracking environmental radioactivity across 90 countries. The data they collect inform policies aimed at preserving ocean health. The Ocean Acidification International Coordination Centre plays a key role in addressing ocean acidification, providing countries with tools such as data on pH levels, standardized monitoring methods and modelling techniques, and enabling them to adapt to changing marine conditions.

On land, the **Terrestrial Environmental Radiochemistry Laboratory** supports countries in monitoring pollutants, helping communities respond to environmental emergencies. Providing reference materials and proficiency tests, this laboratory ensures that laboratories around the world can accurately measure radioactivity and industrial pollution, protecting both human health and the environment.

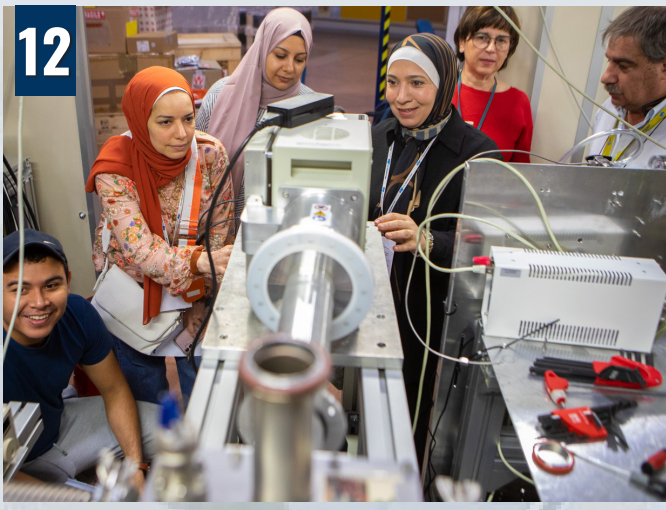
TRANSFORMING **GLOBAL HEALTHCARE**

The challenge of providing safe, effective healthcare is universal. The IAEA's **Dosimetry Laboratory** strives to ensure that patients undergoing radiation therapy worldwide receive the correct doses, safeguarding their health. It also plays a crucial role in the calibration of diagnostic imaging equipment, such as X ray machines and CT scanners, ensuring that procedures deliver accurate doses of radiation to patients. With over 5500 dosimetry audits and 3000 calibrated instruments, the laboratory supports the accurate use of radiation in hospitals, helping millions of patients receive life-saving treatments while minimizing risks.

Global health threats like antimicrobial resistance and zoonotic diseases are on the rise. The **Animal Production and Health Laboratory** is tackling these threats by supporting the Zoonotic Diseases Integrated Action (ZODIAC) initiative and using nuclear and related techniques to diagnose, monitor, prevent and control zoonotic and animal diseases. Additionally, the laboratory assists countries in optimizing livestock reproduction and breeding practices, enhancing animal nutrition, and promoting sustainable animal production. During the COVID-19 pandemic, the laboratory supported over 286 laboratories in 128 countries with essential diagnostic kits and personal protective equipment, highlighting its vital role in global health preparedness.

ADVANCING **SCIENCE AND TECHNOLOGY**

Innovation in science and technology is key to solving the world's biggest challenges. The **Nuclear Science and Instrumentation Laboratory** supports cutting-edge nuclear instrumentation and techniques, providing countries with the tools and expertise needed to monitor radiation and develop new nuclear applications. Whether through X ray spectrometry, neutron generators, or accelerator technology, this laboratory develops technology supporting global capacity in radiation monitoring, nuclear security, environmental protection, and industrial development.



17 GOALS TO TRANSFORM OUR WORLD

The IAEA advances SDG 1 (No Poverty) by implementing technical cooperation projects that enhance food safety and export competitiveness in rural areas. By applying nuclear techniques, the IAEA helps improve agricultural practices, boost economic opportunities and support sustainable livelihoods, reducing poverty in marginalized communities.

The IAEA supports SDG 2 (Zero Hunger) by using nuclear techniques to boost food security. Through the flagship initiative Atoms4Food, a partnership with the Food and Agriculture Organization of the United Nations (FAO), it helps countries increase production and yields, control insect pests, improve water and soil management and livestock health. These innovations address hunger and malnutrition by strengthening agricultural practices globally.

SDG 2 INDICATORS 2.1, 2.2, 2.4, 2.5

The IAEA furthers SDG 3 (Good Health and Well-being) by improving access to cancer and cardiovascular treatment using nuclear medicine and radiation therapy. Through initiatives like Rays of Hope, the IAEA strengthens radiation safety and regulatory systems in low and middle income countries and offers expert guidance, training, equipment and quality control for better health care.

SDG 3 INDICATORS 3.3, 3.4, 3.8, 3.9, 3.B.2, 3.C

The IAEA promotes SDG 4 (Quality Education) by offering training in diverse areas of nuclear technology and its applications. This includes face-to-face and online courses, fellowship programmes, and specialized schools aimed at building capacity. By enhancing expertise in fields like nuclear medicine, agriculture and energy, the IAEA fosters knowledge-sharing and sustainable development.

SDG 4 INDICATORS 4.3, 4.B

The IAEA and the SUSTAINABLE DEVELOPMENT GOALS

The IAEA enhances SDG 5 (Gender Equality) by empowering women in nuclear through targeted education and training. Initiatives like the Marie Skłodowska-Curie Fellowship Programme and Lise Meitner Programme provide women with opportunities to advance their careers in nuclear science in order to drive global scientific and technological innovation.

SDG 5 INDICATORS 5.5, 5.5.2, 5.B

The IAEA contributes to SDG 6 (Clean Water and Sanitation) by helping countries enhance their access to water. The IAEA works with isotopic techniques to shed light on the age and quality of groundwater and shares this knowledge with experts around the world. Some countries use this to implement integrated water resource management policies to sustainably use resources and to protect water and water-related ecosystems, while others use them to address scarcity and improve freshwater supplies.

SDG 6 INDICATORS 6.3, 6.3.1, 6.4, 6.5.1, 6.A

The IAEA advances SDG 7 (Affordable and Clean Energy) by fostering the safe use of nuclear power to deliver clean, reliable and affordable energy, improve energy security, reduce environmental and health impacts and mitigate climate change.

SDG 7 INDICATORS 7.A, 7.3.1, 7.A.1

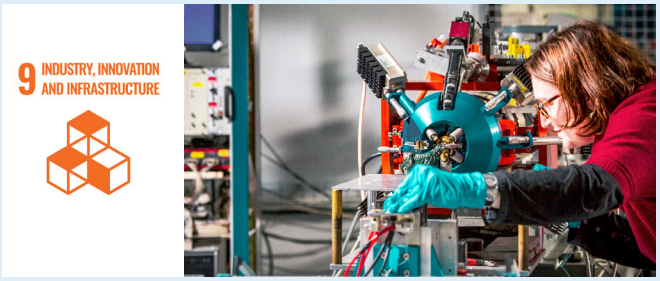
To further SDG 8 (Decent Work and Economic Growth), the IAEA supports livelihoods by promoting nuclear techniques that support job creation and economic growth, and by setting standards on radiation protection of occupationally exposed workers.

SDG 8 INDICATORS 8.2, 8.8.1

"The promotion of peaceful nuclear technologies is at the heart of the IAEA's mandate.

We transfer technology and knowledge to some 145 countries and territories every year, which supports them in the achievement of the Sustainable Development Goals."

— Rafael Mariano Grossi, IAEA Director General



The IAEA furthers SDG 9 (Industry, Innovation and Infrastructure) by supporting innovation in nuclear energy technologies, helping countries to increase the competence of their industries by using irradiation technology and other nuclear techniques

SDG 9 INDICATORS 9.1, 9.4, 9.5, 9.A, 9.B

The IAEA promotes SDG 10 (Reduced Inequalities) by enhancing countries' capacity to use nuclear technology effectively, safely and securely, including where countries lack the adequate know-how and resources.

SDG 10 INDICATORS 10.A, 10.B

By increasing the safety, resilience and sustainability of cities through the use of isotopic techniques to measure pollution and its sources, particularly in urban areas, the IAEA aims to advance SDG 11 (Sustainable Cities and Communities).

SDG 11 INDICATORS 11.4, 11.6

The IAEA contributes to SDG 12 (Responsible Consumption and Production) by supporting waste management, including the safe and secure management of radioactive waste, environmental remediation and the management of plastic waste and sustainable production. NUTEC Plastics is the IAEA's flagship initiative to address the global challenge of plastic pollution.

SDG 12 INDICATORS 12.4, 12.5, 12.A

The IAEA supports SDG 13 (Climate Action) by promoting nuclear techniques that play a key role in climate change mitigation, monitoring and adaptation. Nuclear power plants generate more than one quarter of the world's low carbon electricity and can support a climate resilient energy system and economy.

SDG 13 INDICATORS 13.2, 13.2.2, 13.3, 13.B

13 CLIMATE ACTION

14 LIFE BELOW WATER

By helping countries understand and monitor ocean health and marine phenomena like ocean acidification, harmful algal blooms and the impact of plastic pollution through nuclear techniques, the IAEA helps to advance SDG 14 (Life Below Water).

SDG 14 INDICATORS 14.3, 14.A

The IAEA furthers SDG 15 (Life on Land) by supporting the sustainable use of land through isotopic techniques to promote agricultural best practices, improve conservation methods and protect resources, ecosystems and biodiversity.

SDG 15 INDICATORS 15.1, 15.3, 15.4, 15.8, 15.8.1

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

The IAEA advances SDG 16 (Peace, Justice and Strong Institutions) by helping to deter the spread of nuclear weapons by providing credible assurance that nuclear material remains in peaceful use through the implementation of nuclear safeguards.

SDG 16 INDICATORS 16.3, 16.4.2, 16.6, 16.10

By maximizing the nuclear technology contribution to development objectives through partnerships with Member States, UN agencies, research organizations, civil society and the private sector, the IAEA supports SDG 17 (Partnerships for the Goals).

SDG 17 INDICATORS 17.3, 17.3.1, 17.5, 17.6, 17.7, 17.9, 17.11, 17.13, 17.15, 17.17

17 PARTNERSHIPS FOR THE GOALS

LEARN MORE ABOUT SDG INDICATORS

IAEA empowers African scientists to manage mapping of regional groundwater resources

By Monika Shifotoka

Water resources in Africa are under pressure due to growing water demand, water quality degradation and climate change. On the continent, more than 41 groundwater aquifers are shared by two or more countries, making a joint approach to protection beneficial.

African scientists in the Sahel have found quality groundwater sources through South–South cooperation, thanks to a nuclear technique and a decade of IAEA support in building capacities in isotopic hydrology to determine the age, vulnerability and sustainability of water.

The IAEA is equipped with a state-of-the-art Isotope Hydrology Laboratory that maps water and provides scientific insights for the sustainable management of water resources such as rivers, lakes and underground aquifers.

IAEA-trained experts from 13 Sahel countries* are now leading studies into shared groundwater resources in 5 basins, bolstering transboundary water management.

"Today, it is thanks to the support of the IAEA in my training that our laboratory produces high quality analytical results and can conduct research projects and provide good quality analytical services even outside Togo," said Togolese scientist Goumpoukini Boguido.

Boguido completed his doctoral degree with IAEA support; he now manages the Applied Hydrology and Environmental Geology Laboratory of the University of Lomé in Togo, and conducts analyses of water samples for the region with a laser isotope analyser provided by the IAEA. He also supervises university students to help train the next generation of African isotope hydrologists.

Through an IAEA postgraduate programme, 60 students are learning to map groundwater resources, thereby improving regional self-reliance. Abdallah Mahamat Nour, head of the HydroGeosciences and Reservoirs Laboratory at the University of N'Djamena in Chad, said that the IAEA has helped his work as a postdoctoral fellow.

"My postdoctoral project has made it possible to make significant progress in understanding the water resources of the Lake Chad basin," said Mahamat Nour. "The support has enabled me to set up a range of tools and equipment that are now very useful for laboratory activities." Mahamat Nour also supervises the research work of several Chadian IAEA fellows, guiding them in their research projects.

** Algeria, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal and Togo.*

Togolese scientist Goumpoukini Boguido and Masamaéya Gnazou with a laser isotope analyser at the University of Lomé, Togo provided by the IAEA.

(Photo: University of Lomé, Togo)

The Global Water Analysis Laboratory Network

Strengthening water resource management with nuclear science

By Monika Shifotoka

Climate change and land-use change are combining to alter global hydrological cycles, driving the need to improve water resource management. The IAEA's Global Water Analysis Laboratory Network (GloWAL Network), launched during the United Nations 2023 Water Conference, makes a direct contribution towards improving water resource management using nuclear techniques.

"GLOWAL aims to assist countries in generating essential information to improve the resilience of water systems to the combined effects of climate and land use change," says Jodie Miller, Section Head of the Isotope Hydrology Section at the IAEA.

The First Coordination Meeting of the GloWAL Network was held in June 2024 with the goal of identifying areas where the network can accelerate the achievement of Sustainable Development Goal (SDG) 6 (on clean water and sanitation), as global efforts to meet its 2030 targets are off track.

Laboratory services capable of providing reliable data in a timely manner are the cornerstone of any country's capacity to better understand and manage its water resources and to plan, implement and interrogate actions that support national water governance and resilience of supply.

The GloWAL Network enables collaboration and communication between laboratories across the world to share knowledge, foster capacity building and support training so that every laboratory can reach its full potential.

By enabling independent data generation on water resources in developing countries, the network will help to narrow the technical gaps between developed and developing countries, bringing together financial investment and scientific innovation in water analysis and improving the sustainability of countries' water resource management.

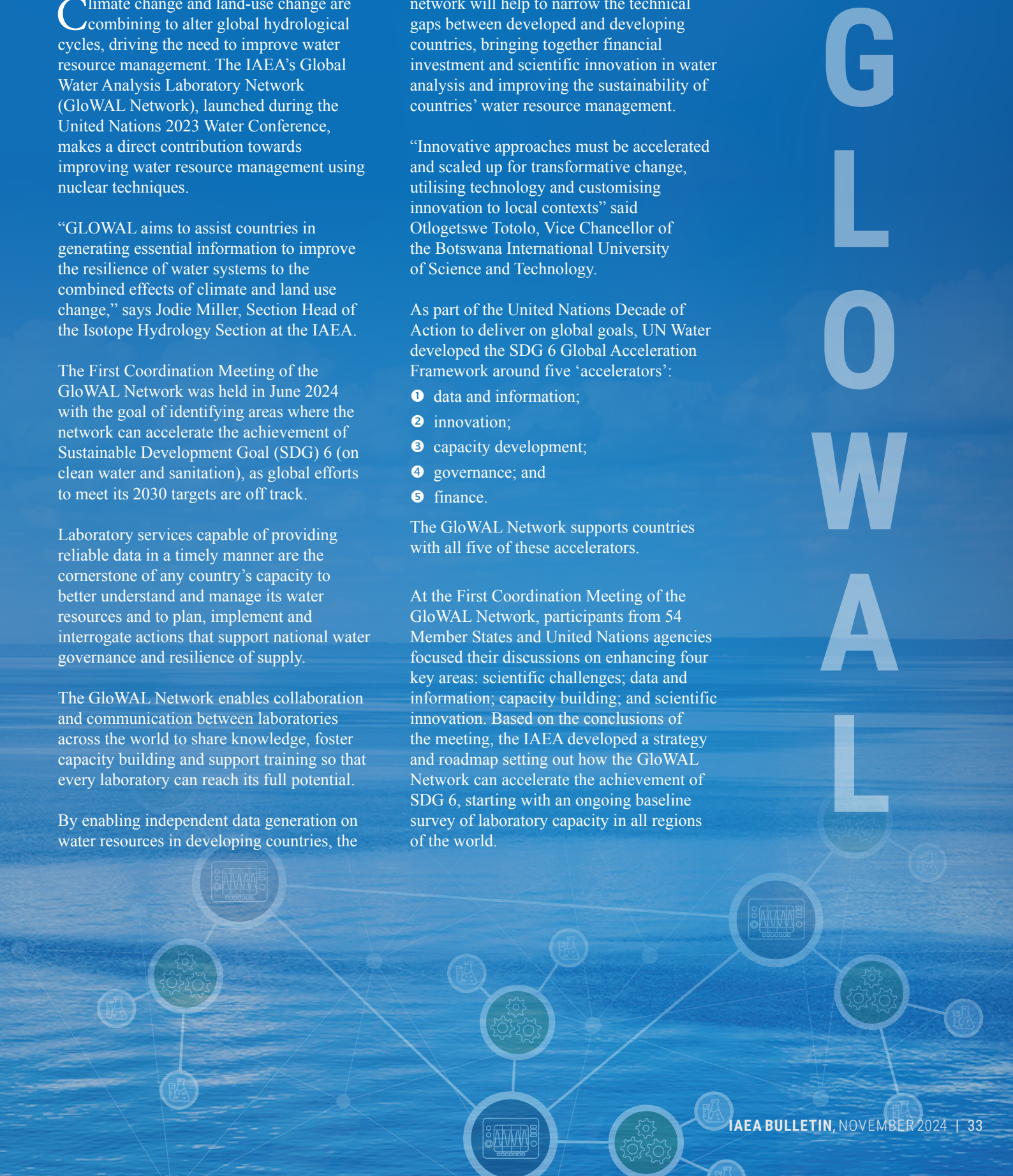
"Innovative approaches must be accelerated and scaled up for transformative change, utilising technology and customising innovation to local contexts" said Otlogetswe Totolo, Vice Chancellor of the Botswana International University of Science and Technology.

As part of the United Nations Decade of Action to deliver on global goals, UN Water developed the SDG 6 Global Acceleration Framework around five 'accelerators':

1. data and information;
2. innovation;
3. capacity development;
4. governance; and
5. finance.

The GloWAL Network supports countries with all five of these accelerators.

At the First Coordination Meeting of the GloWAL Network, participants from 54 Member States and United Nations agencies focused their discussions on enhancing four key areas: scientific challenges; data and information; capacity building; and scientific innovation. Based on the conclusions of the meeting, the IAEA developed a strategy and roadmap setting out how the GloWAL Network can accelerate the achievement of SDG 6, starting with an ongoing baseline survey of laboratory capacity in all regions of the world.



What Is Blue Carbon?

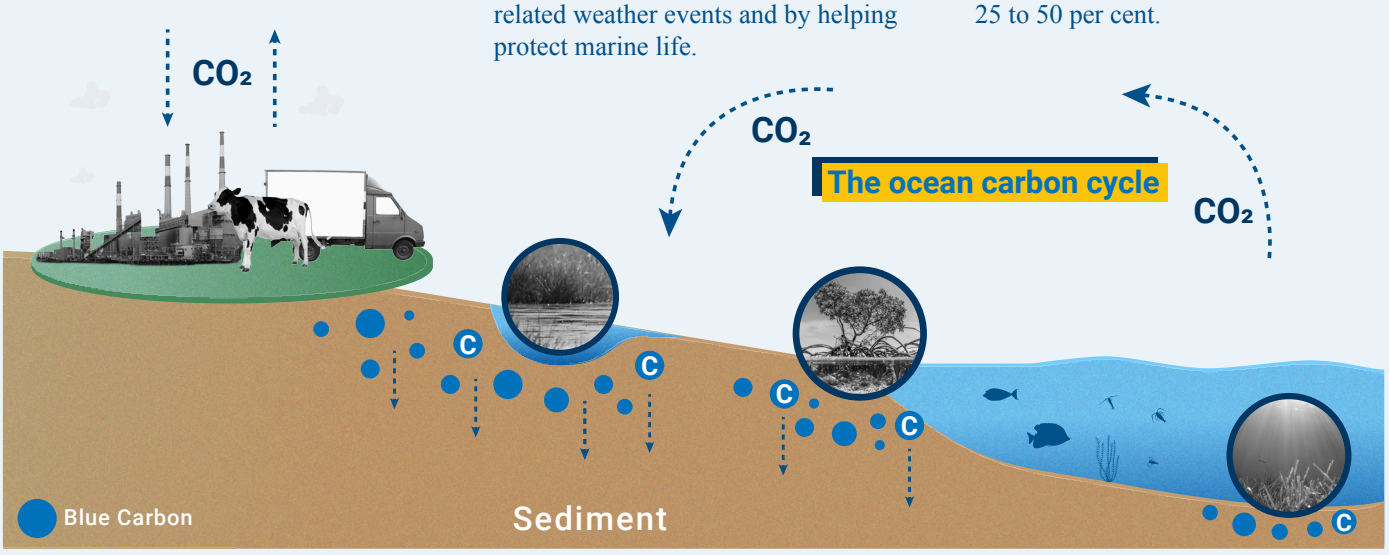
Blue carbon refers to organic carbon captured and stored by the ocean in vegetated coastal ecosystems such as mangrove forests, saltmarshes or seagrass meadows. In these blue carbon ecosystems, organic carbon accumulates in sediment where it is stored. These ocean habitats are spread along our coasts, can be found on every continent except Antarctica and cover approximately 50 million hectares — a territory almost double the size of the United Kingdom.

Blue carbon ecosystems have the potential to help people and coastal environments mitigate and adapt to climate change.

This is not only because coastal ecosystems can sequester large amounts of carbon, they also play an important role in protecting coastlines from erosion and reducing the impacts of storm surges and rising sea levels. Vegetation growing in coastal areas can help improve water quality by filtering pollutants; support biodiversity by providing habitat for a variety of species; and serve as nurseries for fish and shellfish. These factors show how vegetated coastal ecosystems help make people and communities more resilient in the face of climate change and related severe weather events, both by protecting coastal areas from climate change-related weather events and by helping protect marine life.

Blue carbon ecosystems help sustain the environment by mitigating climate change. Conversely, destroying and eroding coastal areas storing blue carbon could lead to the release of large quantities of sequestered carbon back to the atmosphere over a short period of time.

Scientists agree that the capacity of blue carbon ecosystems to sequester carbon has been drastically reduced over the past 70 years as a result of unsustainable coastal development, deforestation, environmental pollution and other destructive activities. In the past 50 years, the area covered by vegetated coastal habitat has shrunk by 25 to 50 per cent.



How do coastal ecosystems act as a carbon sink?

Billions of tonnes of carbon are constantly moving through the atmosphere, land and oceans. The ocean carbon cycle is a set of vital processes that helps regulate the Earth's climate and support sustainable marine life.

Carbon sequestration occurs when carbon is removed from the carbon cycle and stored in marine sediment for long periods of time.

What can nuclear science do?

Sediment that accumulates in the seagrasses, mangroves and marshes can be analysed to help indicate changes in the environment over periods of time, ranging from a few years to millions of years. The capacity of vegetated coastal ecosystems to sequester and store carbon in their sediments can be measured by nuclear and isotopic techniques.

The IAEA Marine Environment Laboratories in Monaco use these elements to determine the rates at which organic carbon accumulates in marine sediments using sediment core samples from vegetated coastal ecosystems. Sediment cores are collected by using long plastic tubes that during sampling are able to preserve the layers of sediment accumulated over time.

The naturally occurring radioactive isotope lead-210 (210Pb), in combination with some artificial radionuclides such as caesium-137 (137Cs) are used to determine the sedimentation rates in the sediments at timescales of decades – up to around 100 years, a period during which human induced impacts on the environment have dramatically increased.

These techniques encompass radiochemical separation and measurements by alpha and gamma spectrometry adapted to each isotope. This is then combined with the measurement of organic carbon contents and its isotopes along the sedimentary record by mass spectrometry methods to assess the organic carbon stocks and burial rates.

How can Blue Carbon be used as a nature-based climate solution?

Blue carbon can help to fight climate change by removing excess carbon from the atmosphere and storing it for hundreds or thousands of years. However, this very capacity to sequester carbon makes it imperative that these ecosystems are protected and preserved. When we damage these coastal habitats, the carbon previously stored is released, leading to further negative impacts.

Investing in blue carbon is investing in a future where nature helps to slow the impacts of climate change and policymakers use evidence-based data to support the sustainable management of the ocean and coastal vegetated ecosystems. Protecting these areas means healthier coasts, healthier ecosystems and a healthier planet.

What is the role of the IAEA?

1. The IAEA's Marine Environment Laboratories apply nuclear and isotopic techniques to better understand the carbon cycle and evaluate the potential capacity of vegetated coastal ecosystems to store carbon.

2. The Laboratories focus on researching marine and coastal ecosystems, biodiversity loss, ocean acidification and accumulation of trace elements and other pollutants in marine ecosystems.

3. The IAEA is involved in projects to assess the rates of carbon sequestration in vegetated coastal areas and to aid in data collection in more than 40 countries.

4. Through its technical cooperation programme, the IAEA supports European, Asia-Pacific, Latin American and Caribbean, and African countries by training scientists and building capacity to accurately measure carbon sequestration rates in blue carbon ecosystems.

5. The IAEA helps its Member States to evaluate potential environmental and socio-economic impacts of changes in ecosystems and implications for sustainable food security.

6. The IAEA also works to raise awareness of other ocean-based climate changes, including ocean acidification, which occurs as a result of excess CO_2 concentrations in ocean water, through its Ocean Acidification International Coordination Centre (OA-ICC).

— By Emma Midgley and Mariia Platonova. Infographics by A. Huescar Barber/IAEA

Celebrating 60 years of

This October, the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture (Joint FAO/IAEA Centre) celebrates a remarkable milestone — its 60th anniversary. Established in 1964, this partnership between the Food and Agriculture Organization of the United Nations (FAO) and the IAEA has advanced the use of nuclear science to boost food security, agricultural productivity and environmental sustainability.

Over the past six decades, the Joint FAO/IAEA Centre has harnessed nuclear technologies to support countries in tackling critical global challenges, from increasing crop yields and protecting livestock to controlling pests, advancing soil and water management and safeguarding food safety and authenticity.

The FAO/IAEA Agriculture and Biotechnology Laboratories have been a central part of the Joint FAO/IAEA Centre's work since its establishment. These state-of-the-art laboratories are the backbone of the Joint FAO/IAEA Centre's operations, focusing on the development of technologies to help address agricultural and environmental challenges. Today, the laboratories remain at the forefront of science, technology and innovation, and continue to provide essential research, capacity development and technology transfer to countries.

Six decades of advancing nuclear science for food and nutrition security

Since its establishment, the Joint FAO/IAEA Centre has made significant contributions towards the improvement of agrifood systems through the application of nuclear science and nuclear-related techniques, in five key working areas:

Insect pest control

The Joint FAO/IAEA Centre actively advances the development and application of the sterile insect technique (SIT) and other radiation based pest management technologies.

A scientist rearing tsetse flies in the Insect Pest Control Laboratory at the Joint FAO/IAEA Centre.
(Photo: M. Casling/FAO/IAEA)

The SIT has been one of the core functions of the Joint FAO/IAEA Centre since its inception, allowing it to effectively control insect pests while reducing or eliminating reliance on chemical pesticides. Using the SIT, male insects of targeted species can be sterilized with ionizing radiation. In Fort Myers in Florida, United States of America, the SIT is being used to suppress mosquitoes that have developed resistance to insecticides.

In 2024, the SIT played a key role in eradicating the medfly from the Dominican Republic after a resurgence following its initial eradication in 2017. The SIT has been instrumental in helping the country to regain access to important export markets.

Plant breeding and genetics

A key aspect of the Joint FAO/IAEA Centre's work is the advancement of mutation breeding to produce plants that demonstrate improved traits. This technique involves the irradiation of plant seeds and other plant materials to accelerate the natural mutation process, leading to the development of desirable genetic variations that enhance agricultural productivity.

To support collaboration and knowledge sharing between countries, the Joint FAO/IAEA Centre maintains the FAO/IAEA Mutant Variety Database (MVD), a comprehensive repository for information on officially released mutant crop varieties. As of 2024, the database holds records of 3433 improved mutant varieties released globally, covering over 200 plant species.

FAO and IAEA partnership

In 2022, the Joint FAO/IAEA Centre sent seeds to the International Space Station to explore the effects of cosmic radiation and microgravity on plant genetics. Scientists are now analysing space-induced mutations to identify traits that could make crops more resilient to climate change.

Soil and water management and crop nutrition

Nuclear and isotopic techniques provide valuable tools for quantifying and improving soil fertility and crop nutrition. The FAO/IAEA Joint Centre develops and transfers solutions for monitoring and managing the interactions between water, soil and nutrients, enhancing the productivity and sustainability of cropping systems. In addition, it leads efforts to tackle soil contamination and remediation, addressing challenges such as heavy metals, antimicrobial resistance, microplastics and radioactive contaminants.

Using nitrogen-15 isotopic techniques, the Joint FAO/IAEA Centre trained local researchers and farmers in Lao People's Democratic Republic to optimize fertilizer use while effectively incorporating rice straw and manure as nutrient sources. Field trials conducted on local farms demonstrated substantial increases in rice yields, bolstering food security in a nation that relies heavily on rainfall-dependent rice cultivation. This initiative not only improved agricultural productivity but also promoted sustainable practices crucial for the resilience of the country's agricultural sector.

Tools such as the cosmic ray neutron sensor (CRNS) are changing how water resources are managed by providing precise data on soil moisture levels. By measuring naturally occurring neutrons in soil, the CRNS offers precise, real time and large scale monitoring of moisture content.

The cosmic ray neutron sensor seen in the background sends real time soil moisture content data to the phone in the foreground. (Photo: IAEA)

Animal production and health

The Joint FAO/IAEA Centre plays a vital role in improving animal production and health by applying nuclear and related techniques. Its work has driven improvements in livestock productivity, feed efficiency, and the diagnosis and control of animal diseases, leading to safer and more efficient livestock systems.

In August 2020, with support from the Joint FAO/IAEA Centre, laboratories in Bosnia and Herzegovina and Serbia successfully utilized genome sequencing to characterize the COVID-19 virus. This capability, which is based on real time reverse transcription–polymerase chain

Scientists supported by the Joint FAO/IAEA Centre prepare irradiated vaccines for animals. (Photo: IAEA)

reaction (real time RT–PCR) techniques, enabled researchers to trace the origins of the virus and analyse transmission patterns. Veterinary laboratories were particularly well prepared thanks to their experience of zoonotic diseases, allowing for effective intervention planning and the sharing of crucial data on virus mutations.

To tackle transboundary animal and zoonotic diseases, the Joint FAO/IAEA Centre's Veterinary Diagnostic Laboratory Network (VETLAB Network) strengthens veterinary laboratory diagnostic capacities across countries, in particular in Africa and Asia. The VETLAB Network facilitates the sharing of expertise, training and information among national diagnostic laboratories for animal diseases. It enhances preparedness and response for animal and zoonotic disease outbreaks by harmonizing regional approaches to early detection and disease alerts.

Food safety and control

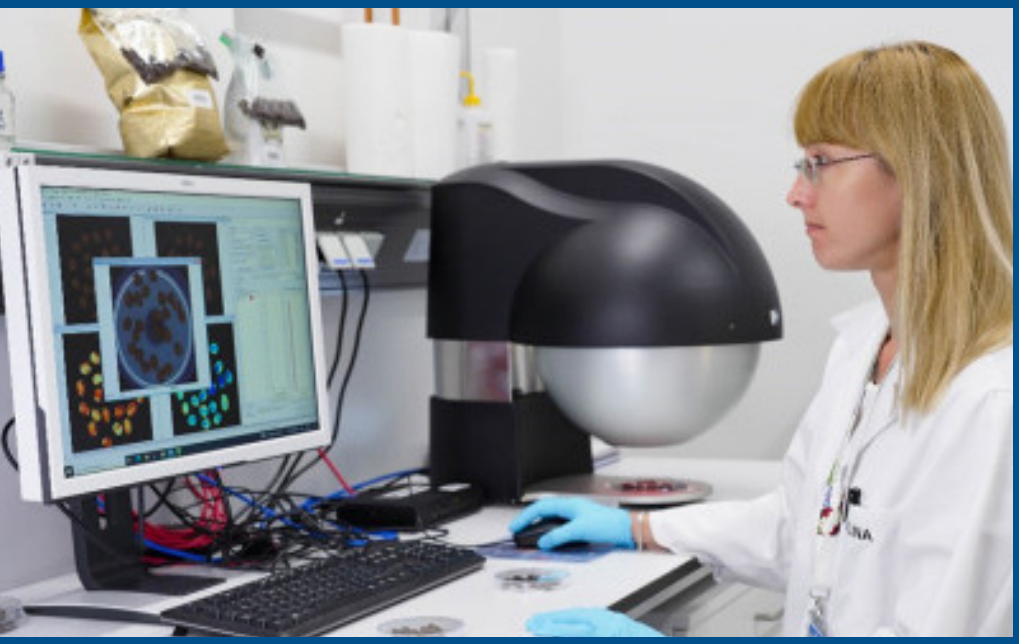
The IAEA and FAO assist countries in combating food fraud, detecting harmful contaminants and ensuring the authenticity and quality of food products.

For example, Viet Nam has significantly increased its food exports by applying food irradiation techniques, which effectively prevent the spread of transboundary pests and eliminate microorganisms that can spoil food, ensuring that consumers receive safe products.

A further example of the Joint FAO/IAEA Centre's efforts to enhance food safety is the assistance it has provided to Sri Lanka's Food Safety and Quality Assurance Laboratory since 2001 to develop advanced testing capabilities for the detection of aflatoxins, a dangerous contaminant produced by fungi on crops like corn and peanuts. Nuclear techniques are used to monitor food products for aflatoxin contamination and play a key role in shaping national food safety regulations, ensuring that contaminated food does not reach the market, and protecting local and international consumers from potential health risks such as cancer.

In Bangladesh, the Joint FAO/IAEA Centre provided training for scientists at the Veterinary Drug Residue Analysis Laboratory (VDRAL) in how to test for a range of food hazards and screen and verify residues and contaminants in food. VDRAL now uses various isotopic and nuclear based analytical tools and techniques to determine antimicrobial residues and mycotoxins in foods of animal and plant origin, and efforts are under way to build capacity for microbiological testing of food, including testing for food-borne zoonoses. With the support of the Joint FAO/IAEA Centre, more than 3000 food samples — including eggs, milk, chicken and shrimp — are analysed annually to generate residue data.

In an effort to curb food fraud, the Joint FAO/IAEA Centre develops and transfers nuclear techniques to detect fraudulent food. For example, scientists from the Jožef Stefan Institute in Slovenia, supported by the Joint FAO/IAEA Centre, employed isotopic analysis to identify fraudulent white truffles. This method helps to determine the origins of the truffles and prevent food fraud effectively.



A scientist in the Food Safety and Control Laboratory at the Joint FAO/IAEA Centre performing tests that use multispectral imaging to detect the economically motivated adulteration of Arabica coffee beans. This analytical technique can help prevent food fraud in coffee.
(Photo: M. Casling/IAEA)

IAEA Director General Rafael Mariano Grossi speaking on World Food Day at the opening session of the Food and Agriculture Organization (FAO) of the United Nations in Rome.

(Photo: Diego Candano Laris/IAEA)

Celebrating 60 years of innovation and collaboration

As the Joint FAO/IAEA Centre marks its 60th anniversary, it reflects on a legacy of innovation and collaboration that underscores the critical role of science and international cooperation in tackling global challenges in agrifood systems transformation. The Joint FAO/IAEA Centre is dedicated to developing solutions to promote access to nutritious and safe food for a growing population while minimizing agriculture's environmental impacts and addressing climate change threats.

To help boost global food production and nutrition, the IAEA and FAO launched the Atoms4Food initiative at the World Food Forum in 2023. The initiative offers countries tailor-made approaches to various aspects of food and agriculture, and supports countries in the use of innovative nuclear techniques to enhance agricultural productivity, increase the resilience of agrifood systems, enhance food production, improve food safety and tackle the challenges of climate change.

The Joint FAO/IAEA Centre will continue to drive innovation and deliver tangible solutions to the ever changing agricultural challenges facing the world by fostering research for development, enhancing capacity development and knowledge sharing, and strengthening partnerships.

Historic achievements

While there have been many notable achievements in recent years, the Joint FAO/IAEA Centre has been developing and applying valuable nuclear techniques throughout its six decades, with significant impacts in the field. These include: a project launched in 1979 to control the tsetse fly in Nigeria, resulting in the eradication of the pest from the entire project area by 1987; the transformation of saline soils into productive farmlands following the introduction of salt-tolerant varieties of barley and wheat in Pakistan in 1978; and a contribution to the eradication of rinderpest in the early 1980s.

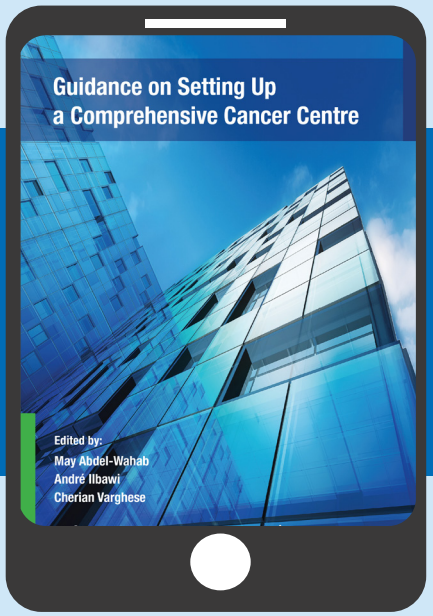
Plant breeders from the Joint FAO/IAEA Centre and India analysing a sorghum field in India, circa 1978. (Photo: A. Meike/IAEA)

AO & IAEA

Did you know

This IAEA-WHO framework serves as an invaluable resource for countries in their ongoing efforts to strengthen their capacity for cancer control?

Scan to learn more



Browse all IAEA Publications

free online

www.iaea.org/publications

To order a book, write to
sales.publications@iaea.org

IAEA Publications

3rd International Conference on

Applications of Radiation Science and Technology

#ICARST2025

7–11 April 2025

Vienna, Austria

Organized by the

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

CN-332

Partner With Us

for a better future

The IAEA welcomes
Member States, industry, financial institutions and other stakeholders
to partner with us on our flagship initiatives and contribute
their expertise, modelling tools, industrial knowledge, advocacy and financial resources.

HUMAN HEALTH

IAEA DIAC

IAEA RAYS OF HOPE
CANCER CARE FOR ALL

WOMEN IN NUCLEAR

IAEA Lise Meitner PROGRAMME

IAEA Marie Skłodowska-Curie FELLOWSHIP PROGRAMME

ENERGY

IAEA ATOMS 4 NET ZERO

IAEA NUCLEAR HARMONIZATION & STANDARDIZATION INITIATIVE

ENVIRONMENT

IAEA NUTEC PLASTICS

FOOD & AGRICULTURE

FAO & IAEA ATOMS4FOOD
GROWING FOOD SECURITY

Learn more about the IAEA's **flagship initiatives**

IAEA
Atoms for Peace and Development

ISSN 0020-6067
24-04225