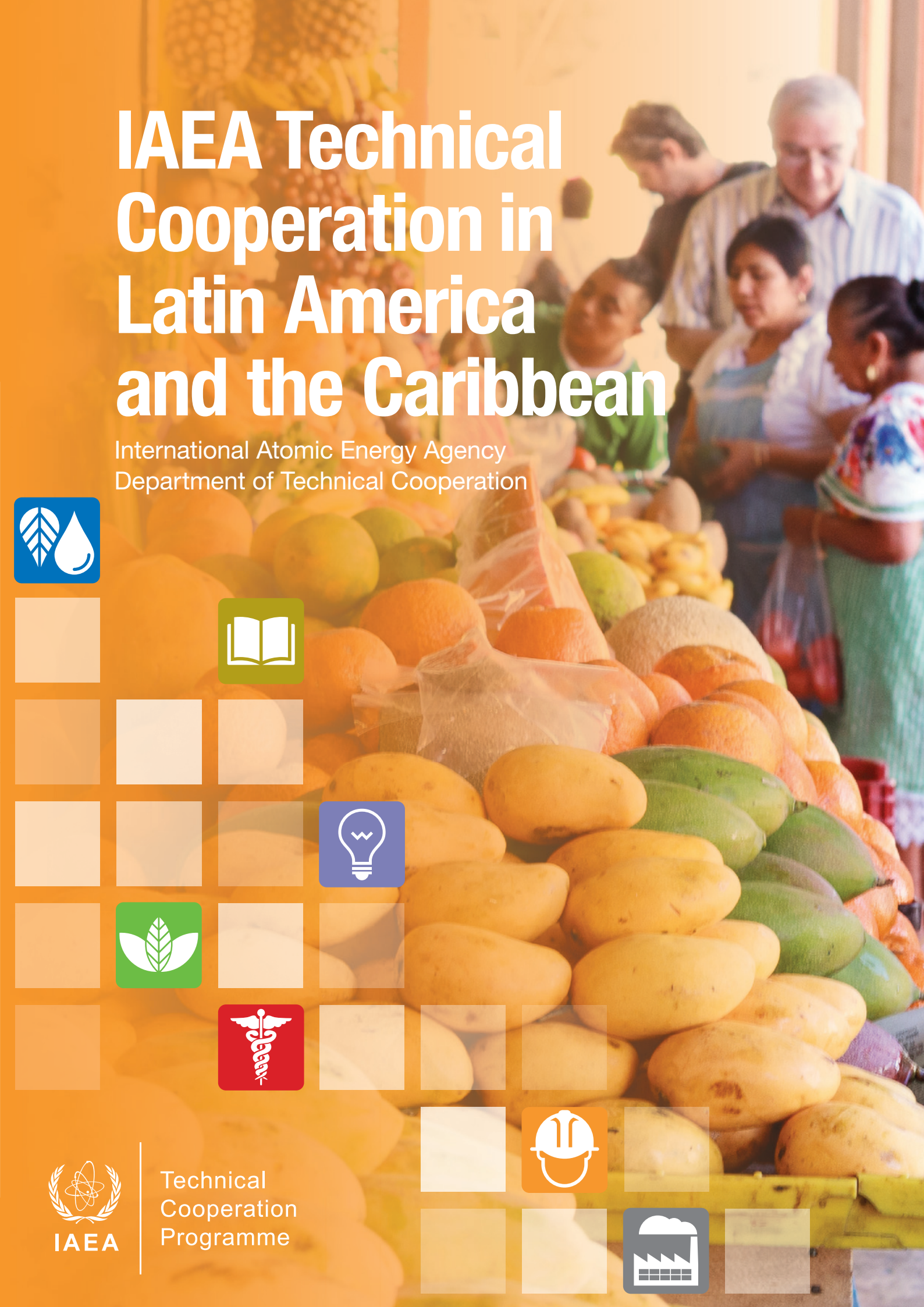
IAEA Technical Cooperation in Latin America and the Caribbean

International Atomic Energy Agency
Department of Technical Cooperation



IAEA

Technical Cooperation Programme

Foreword by Hua Liu, Deputy Director General and Head of the Department of Technical Cooperation

The IAEA's technical cooperation (TC) programme is the main mechanism for providing assistance to IAEA Member States in the peaceful, safe and secure application of nuclear science and technology for development. The programme aims to strengthen technical and human resource capacities, with the long term goal of contributing to sustainable socioeconomic development, and the attainment of the Sustainable Development Goals.

Nuclear science and technology offer a cost effective alternative or complementary solution to many development challenges. In addition, they can be used to generate credible, timely data that help countries make informed decisions on many national and regional policy issues. Nuclear technology offers a wide range of beneficial applications, including diagnosing and treating diseases such as cancer, developing new varieties of staple foods, generating low-carbon energy, and monitoring natural resource use and environmental pollution.

The IAEA works closely with Member States and partner organizations in Latin America and the Caribbean in key areas such as health and nutrition, food and agriculture, natural resource management and nuclear energy, while at the same time helping countries to establish and maintain a robust nuclear safety and security infrastructure.

IAEA technical cooperation projects in Latin America and the Caribbean have a visible positive impact on the lives of the people of the region, and I look forward to our continued effective collaboration.

What is the IAEA Technical Cooperation Programme?

The technical cooperation programme is the IAEA's primary mechanism for building capacities in the peaceful application of nuclear technology in its Member States. The programme supports their efforts to 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.

Foreword by Luis Longoria, Director Division for Latin America and the Caribbean

The TC programme's support to the Latin America and Caribbean region is well established, spanning six decades and accounting for significant progress in the peaceful application of nuclear science and technology. Today, the IAEA's technical cooperation programme is providing 31 countries in the region with essential skills and capacities, enabling them to apply nuclear science and technology to address key socioeconomic needs and ensure sustainable development.

Our assistance brings positive impact to a broad range of end users: from farmers and cancer patients to scientists, researchers and policymakers. IAEA assistance includes improving food quality and security, enhancing human, animal and environmental health, supporting water resource management, examining and assuring more sustainable energy supplies, introducing cleaner and more efficient industrial processes and strengthening radiation safety. In addition, we provide countries affected by natural or manmade disasters with emergency assistance. In 2020, we responded to the COVID-19 pandemic by providing Member States with real time RT-PCR, or reverse transcription polymerase chain reaction, machines, diagnostic kits and other items, as well as training for technicians and scientists in laboratories around the world.

The Regional Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL), established in 1984, is an agreement between most IAEA Member States in the Latin America and the Caribbean region for technical and economic cooperation to promote the use of nuclear techniques for peace and development. It provides a framework for Member State collaboration with the support of the IAEA and other international partners, and addresses key development priorities in the region, focusing on food security, human health, the environment, energy, industry and radiation safety.

This brochure provides an overview of the activities of the TC programme in Latin America and the Caribbean, and highlights a number of successful projects. It also describes important initiatives such as the IAEA's support for South-South cooperation and how it works to expand capacities in nuclear science and technology. I hope you will find this overview of our technical cooperation activities interesting and informative.

Technical cooperation in Latin America and the Caribbean: An overview

COVID-19 assistance to Latin America and the Caribbean

Real time RT-PCR is a nuclear-derived method for specific detection of the presence of genetic material from humans or animals and their respective pathogens, including the RNA coronavirus SARS-CoV-2 that causes COVID-19. It is one of the most sensitive techniques available today for detecting the virus.

The Technical Cooperation Division for Latin America and the Caribbean is responsible for the implementation of interregional project INT0098, which was designed to respond to the needs of Member States in the event of disease outbreaks, emergencies and disasters. The IAEA delivered support to Member States to address COVID-19 through INT0098, providing emergency support packages consisting of RT-PCR machines, diagnostic equipment and consumables, personal protective equipment (PPE) and biosafety cabinets for safe analysis of the samples, as well as orientation and educational materials such as videos, webinars and operational procedures and protocols.

As of June 2023, 130 countries and territories have received IAEA assistance, including 33 countries from the Latin America and the Caribbean region, with 306 laboratories and institutions receiving IAEA technical cooperation support. INT0098 is the largest project in the history of the TC programme with over 37 million euros in funding, including extrabudgetary contributions from several donors to support this operation.

Areas of activity

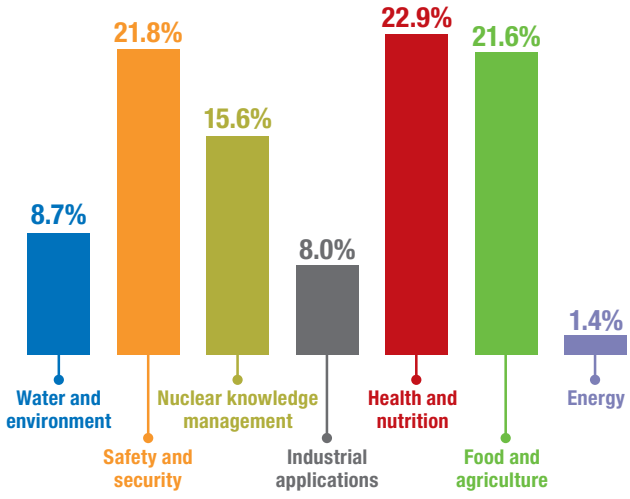


Figure 1: Actuals in the Latin America and the Caribbean region in 2022 by technical field.

The technical cooperation programme in Latin America and the Caribbean and the Sustainable Development Goals

Zero Hunger. The TC programme supports IAEA Member States in using nuclear techniques to fight hunger and malnutrition, and to improve food security and safety. In partnership with the Food and Agriculture Organization of the United Nations (FAO), countries improve their capacities to protect crops from insect pests and develop new crop varieties with better yields, drought tolerance and resistance to diseases.

Health and Well-Being. Nuclear technology plays a unique role in supporting the health and well-being of populations. The TC programme works with countries to develop comprehensive cancer control programmes, establish radiation medicine capacities and improve the availability and safe use of medical radioisotopes to diagnose and treat non-communicable diseases including cancer, and to detect and diagnose communicable diseases such as COVID-19. The IAEA also helps countries to use isotopes to combat malnutrition and its associated risks, particularly in children.

Clean Water and Sanitation. Isotopic techniques are used to help investigate the age, source, movement and interactions of bodies of water such as rivers and aquifers. The TC programme builds national capacity to monitor, identify and analyse data. These data can support evidence-based decision making for water resource management and policy, enabling more sustainable use of water resources, while protecting and preserving existing water ecosystems.

Affordable and Clean Energy. The TC programme fosters the efficient and safe use of nuclear power by supporting existing and new nuclear programmes around the world, building capacity in energy planning and analysis, and in nuclear information and knowledge management. The IAEA helps countries meet growing energy demand for development, while improving energy security, reducing environmental and health impacts, and mitigating climate change.

Industry, Innovation and Infrastructure. Nuclear technology can make an important contribution to economic growth and sustainable development. The TC programme helps countries to increase their industrial competitiveness through using nuclear techniques for non-destructive testing of industrial products and buildings, and in applying irradiation techniques to improve the durability of products. Nuclear techniques can also help countries improve their access to international markets, for example through food irradiation and improved pest management approaches.

Climate Action. Nuclear science and technology can play an important role in climate change monitoring, mitigation and adaptation. The TC programme supports countries in using nuclear techniques to understand, monitor, mitigate, and adapt to environmental changes, and in collecting data to support science-based policies and actions.

Life Below Water. Nuclear and isotopic techniques help countries to better understand and monitor ocean and marine health. This includes analysing ocean acidification, the presence of harmful algal blooms and the impact of microplastics. The TC programme supports collaboration between regional and interregional laboratory networks.

Life on Land. The TC programme supports national efforts to reverse the degradation of land and soil, and the loss of biodiversity by building capacities in the use of isotopic techniques to provide accurate assessments of areas at risk. The resulting data provide evidence to help inform conservation methods and policies that protect and restore natural resources and ecosystems.

Partnerships for the Goals. The IAEA collaborates closely with leading international organizations, such as the FAO and the World Health Organization, as well as with civil society, to help maximize the impact of its support towards attaining national and regional development priorities and the Sustainable Development Goals.

Strategic and regional cooperation

Country Programme Framework

The Country Programme Framework (CPF) is a medium-term strategic planning document, generally covering a period of four to six years. Prepared by a Member State in collaboration with the Secretariat, it defines mutually agreed priority development needs and interests to be supported through technical cooperation activities. The CPF reflects national development plans, country specific analyses and lessons learned from past cooperation. The CPF serves to ensure that projects are focused effectively and in line with the Sustainable Development Goals.

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countries with active CPFs in TC's Latin America and Caribbean region

South-South cooperation and the Regional Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean

South-South cooperation is the exchange of knowledge, resources and technology between developing countries in economic, social, cultural, environmental and technical domains. Such cooperation promotes self-reliance, strengthens local ownership and builds regional expertise through a wide-ranging and comprehensive approach. The IAEA is committed to expanding such collaboration to increase the peaceful uses of nuclear science and technology, and to contribute to greater sustainable development in Latin America and the Caribbean. Working with its Member States in the region, the IAEA established the Regional Cooperative Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL) in 1984. The Agreement promotes dialogue and cooperation among its members, ensures that activities align with national and regional development priorities and strengthens the use of nuclear techniques for peace and development.

In 2020, ARCAL endorsed the Third Regional Strategic Profile (RSP) for the region, named 'ARCAL Agenda 2030' to align its contributions to the United Nations 2030 Agenda for Sustainable Development, covering the period 2020–2030. It provides an assessment of the region's context in the areas of human health, food safety and agriculture, environment, energy, radiation technology and radiation protection, and identifies the most pressing needs that can be addressed through nuclear technology. In 2019, Caribbean Member States also came together to endorse a Regional Strategic Framework (RSF) which specifically identifies shared development challenges affecting Caribbean countries. The RSP and RSF share a common goal of working together more closely and leveraging available resources and capacities in the region.

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Member State countries participating in ARCAL

Gender mainstreaming

The TC programme is committed to addressing the gender gap faced by a number of nuclear institutions and to promoting greater female participation in the nuclear field. In 2019, the IAEA and ARCAL launched a series of workshops to support young professionals, especially women, and strengthen their role in the promotion and use of nuclear science and technology. The workshops focused on demonstrating nuclear techniques used by IAEA Member States, such as isotope hydrology, food irradiation and radiography, to address development challenges and to build the skills needed by young professionals to succeed in their technical fields.

The initiative encouraged participants to build a network which then became a catalyst for the creation of a new regional chapter of the non-profit organization Women in Nuclear for Latin America and the Caribbean: WiN ARCAL, which was officially inaugurated in September 2021 and is composed of women from 12 countries of the region that are committed to implementing gender mainstreaming initiatives at the national and regional levels. In addition, new national WiN chapters were created in Chile, Colombia, Peru, and Venezuela, complementing chapters already established in Argentina, Bolivia, Brazil, Cuba, Ecuador and Mexico.

Food and agriculture

The TC programme in Latin America and the Caribbean helps Member States to improve their food safety and security, and to reduce hunger and malnutrition. Nuclear techniques can be used to improve crop productivity and mitigate the effects of climate change through the development of new seed varieties, to assess and enhance crop nutritional levels, and to improve food safety through irradiation. With IAEA support for training, equipment and technical expertise, countries in the region have increasingly gained the specialist skills needed to support their national and regional food and agriculture programmes.

Food safety experts trained by the IAEA use nuclear technology to analyse food samples in Heredia, Costa Rica. (Photo: L. Gil/IAEA)

Costa Rica: Ensuring food safety

Since 2015, experts from Costa Rica's National Laboratory for Diagnosis and Research in Animal Health (LANASEVE) have received training in the latest nuclear and conventional analytical technologies to detect contaminants and residues in food, including fish and meat. With state of the art equipment and expert advice provided by the IAEA and FAO, the country no longer needs to rely on laboratories abroad to certify the safety of its food, and is now able to access international markets as a result of expanding its use of nuclear technology. Thanks to the IAEA's technical cooperation support, LANASEVE now tests 310 samples each month for pesticides, veterinary drug residues, heavy metals, marine biotoxins and other organic and inorganic pollutants which can contaminate food. By testing and analysing samples locally, Costa Rica's fish and meat producers are saving time and money and are in a better position to ensure their products meet international food safety standards.

Jamaica: Improving crop production, fertilizer and water use efficiencies with nuclear technologies

The IAEA has provided support to enhance agricultural productivity, food security and farmer incomes in Jamaica. In partnership with the Ministry of Agriculture and Fisheries, the National Irrigation Commission and the National Environmental Planning Agency, soil samples were collected and analysed to determine the right amounts of moisture and fertilizer needed to increase sweet potato crop yields and improve resource use. The project helped increase yields, and reduced fertilizer and water usage by 35 and 15 per cent respectively, saving the equivalent of US$1300 per hectare. In addition, these improvements enabled the National Irrigation Commission to reduce its annual energy costs by US$510 000.

The IAEA supported farmers in Jamaica to improve crop productivity by optimizing the use of water and fertilizer. (Photo: IAEA)

Peru: Improving crops

The IAEA and FAO assisted Peru in applying nuclear techniques to improve an Andean grain, kiwicha, which typically grows at altitudes of 3000 to 5000 metres. The cereal is high in dietary fibre and minerals (such as iron, magnesium and manganese) and has been shown to reduce hypertension and cholesterol.

Although a staple food for the ancient Incas, kiwicha was largely forgotten until scientists began looking at its potential for improving nutrition and for export to global markets. The IAEA/FAO Joint Programme worked with the Nuclear Breeding Department at the University of La Molina in Lima to develop a variety of kiwicha with larger and more consistent grains, and higher yields under marginal conditions, improving its marketability and export value. The newly developed variety increased exports to Japan tenfold from 20 metric tonnes in 2002 to 200 metric tonnes in 2009. Today, kiwicha is cultivated on more than 450 hectares of land by

SIT Fruit Fly eradication in Mexico. (Photo: SENASICA)

Farmers in Peru are benefitting from a new variety of the grain kiwicha, developed with IAEA assistance. (Photo: IAEA)

small farmers, NGOs, small and medium sized businesses and public and private institutions, with harvests producing 5000kg per hectare.

Regional: Protecting and expanding horticultural production

More than 195 million metric tonnes of fruit are produced each year in Latin America and the Caribbean. The region is a net exporter of agricultural commodities, accounting for around 16 per cent of the world's food and agricultural products. However, insects such as the Mediterranean fruit fly, one of the most invasive non-native pests, has been responsible for damaging agricultural productivity and the livelihoods of farmers. In Brazil alone, the fly causes approximately US$242 million worth of economic losses each year.

In response, the IAEA and FAO launched a regional project to strengthen existing capacities to manage these pests by using the sterile insect technique (SIT) – an environmentally friendly way to control insect pests that involves mass-rearing and sterilizing a target insect, followed by an area-wide release of the sterile males – and to prepare guidelines on the monitoring and control of invasive pest species.

Through this initiative, Member States can now identify potential fly infestations and systematically establish, declare and maintain areas of low prevalence to mitigate the risks to crops. During the project, five new areas were declared as fruit fly free or having a low prevalence. In the Dominican Republic, the eradication of the Mediterranean fruit fly enabled horticultural exports worth US$40 million to be restarted. In Mexico, the IAEA helped eradicate the Bactrocera scutellata (Hendel) fly within seven months. Today, the country protects 473 000 hectares of land, yielding over 11 million tonnes of fruit valued at US$3.3 billion annually.

International entomologists work with the MOSCAMED-RD trap reviewers in Punta Cana. (Photo: L. Gil/IAEA)

Health and nutrition

Improving human health and nutrition is a key priority for IAEA Member States in Latin America and the Caribbean. Nuclear techniques contributed to a wide range of benefits in these areas. The IAEA is supporting countries in the region to diagnose and treat both communicable and non-communicable diseases by introducing and upgrading clinical equipment, building specialist skills and technical capacities, and by helping countries to devise comprehensive cancer control programmes. In 2019 the IAEA's Technical Cooperation Division for Latin America and the Caribbean received an award from the United Nations Interagency Task Force on the Prevention and Control of Non-Communicable Diseases (UNIATF) for its contribution to the prevention and control of non-communicable diseases. Since 2020, emergency assistance has also been provided to help IAEA Member States detect and manage COVID-19. Through an interregional technical cooperation project, the IAEA is providing countries with a package of equipment essential for detecting, tracking and studying the coronavirus that causes the COVID-19 disease.

Aedes mosquitoes transmit diseases such as dengue, Zika and yellow fever. (Photo: D. Calma/IAEA)

Inauguration of the newly installed brachytherapy unit in Honduras. (Photo: SRECI)

Honduras: Establishing the country's first brachytherapy facility

Brachytherapy is a form of radiation therapy where a radioactive source is placed close to or inside a tumour. With IAEA assistance, Honduras' first publicly accessible brachytherapy unit began providing services for patients at the San Felipe national hospital in Tegucigalpa. Hospital personnel, including radiation oncologists, medical physicists, nurses and radiation therapists received comprehensive training in the use of the equipment to ensure the safe and effective treatment of patients. Today, the facility can treat 1000 patients a year, particularly those suffering from cervical, prostate, breast and skin cancers.

Peru: Enhancing capacities for tissue engineering

In 1996, with IAEA assistance, Peru established a tissue bank at the National Institute of Child Health in San Borja to help treat patients with wounded or damaged skin. The demand for tissue grafts was high and imported material increased the treatment price, making it difficult for patients on low incomes to afford them. In addition, the treatments available did not allow doctors to provide care for their patients who suffered burns on more than 55 per cent of their total body surface area. However, with the help of tissue engineering, or skin cultivation, Peruvian scientists and radiation specialists are now able to develop a greater amount of tissue from skin biopsies and use scaffolds — structures with uneven surfaces — for new cells to grow. The IAEA is providing training courses, expert missions, scientific visits and equipment to increase national capacity and knowledge in this area. In addition, the Peruvian Institute of Nuclear Energy and the National Institute of Child Health are collaborating with hospitals and universities around the country to teach these new techniques.

Specialists trained by the IAEA used radiation technology to grow new skin and cover a patient's wounds. (Photo: INSN-SB)

Uruguay: Improving nuclear medicine services

Uruguay has been assisted by the IAEA to strengthen its capacities in the production of radiopharmaceuticals used to diagnose and treat prostate cancer. This included the procurement of the radionuclide Lutetium-177 (177Lu) for the production of therapeutic radiopharmaceuticals at the Uruguayan Centre of Molecular Imaging (CUDIM).

Studies carried out by the National Cancer Institute (INCA), in cooperation with CUDIM, demonstrated the efficacy of the radioisotope for treating prostate cancer. Based on these findings, treatment plans for around 50 per cent of patients were modified to include 177Lu-PSMA, specifically for those in advanced stages of the disease.

Radiopharmaceuticals for the diagnosis of diseases such as cancer are being produced at the Uruguayan Centre for Molecular Imaging in Montevideo. (Photo: CUDIM)

The IAEA also assisted Uruguay to develop specialist skills in radiopharmacy, nuclear medicine, medical physics, oncology and urology at the Institute. This ensured that staff were trained to manage and deliver appropriate treatment for prostate cancer patients receiving targeted radionuclide therapy. Electronic personnel dosimeters were also provided to staff involved in the production, control and management of radiopharmaceuticals.

Regional: Enhancing the use of the sterile insect technique to fight mosquito-borne illnesses

The Aedes aegypti mosquito is the main vector (or carrier) of diseases such as chikungunya, dengue and Zika virus disease, and poses a large public health problem in Latin America and the Caribbean. In 2019 alone, more than 2 million people in the region contracted dengue. To help address this, the IAEA is supporting Member States to develop capacities in the use of the sterile insect technique (SIT) to control the mosquito. Activities will be geared at reducing the number of Aedes aegypti mosquitos and consequently reducing cases of chikungunya, dengue and Zika. This will relieve pressure on the region's public health systems. The IAEA will also support regional capacity to establish national mosquito surveillance programmes and to irradiate mosquitoes for release within the national vector control programme.

Nuclear and radiation safety

When using nuclear technology, it is of paramount importance to protect people, workers and the environment from the harmful effects of ionizing radiation.
In 2019, a quarter of the technical cooperation programme's resources for Latin America and the Caribbean were used to improve nuclear and radiation safety. Together with its Member States, the IAEA works to strengthen nuclear legislative and regulatory frameworks and enhance the knowledge and skills of industry leaders, legislators and regulators, medical professionals, scientists and emergency response personnel, among others.

Trainees participating in a capacity building event—organized through RLA9081—search for orphan sources, during a field exercise.
(Photo: J.C. Benitez Navarro/IAEA)

Workshop participants with officials from the IAEA Office of Legal Affairs Lourdes Vez Carmona, Section Head, Non-Proliferation and Policy-Making Section and Fanny Tonos Paniagua, Nuclear and Treaty Law Section. (Photo: IAEA)

Bolivia: Improving the nuclear legislative and regulatory

The IAEA provided support Bolivia to strengthen its nuclear legislative and regulatory framework, helping the country to comply with IAEA Safety Standards and to establish legal, governmental and regulatory infrastructures for nuclear, radiation, radioactive waste and transport safety. A nuclear law approved in 2019 was developed with IAEA assistance to provide a legal framework for conducting activities related to nuclear energy and ionizing radiation. This will ensure adequate protection for individuals, property and the environment. It also provides the framework for guidelines on radiation safety and protection, physical safety and radioactive waste management for institutions and companies involved in the radiological field, and provides clear rules and regulations regarding authorization and licensing. Under the framework of the nuclear law, Bolivia drafted regulations in preparation for licencing and establishing a research reactor, a multi-purpose irradiation facility and a cyclotron radiopharmacy positron emission tomography and computed tomography (PET/CT) unit.

With the new equipment, scientists in Paraguay can now measure radiation in the environment. (Photo: ARRN)

Paraguay: Inauguration of environmental monitoring stations

In 2019, three unmanned environmental monitoring stations were installed to detect and measure radiation from the soil and air in Alberdi, Asunción and Pilar. The stations enable the Radiological and Nuclear Regulatory Authority (ARRN) to develop national baseline data on naturally occurring radiation and to identify and respond to any changes in radiation levels. With IAEA support, national experts were trained to measure radiation levels and to identify the sources responsible for the radiation. Additional support included the provision of a liquid scintillation analyser and complimentary training to allow scientists to measure radioactivity levels in water, sediments and food samples. The new stations and laboratory equipment have significantly increased the country's ability to differentiate and measure radiation levels and respond to an accidental release or lost source.

Regional: Strengthening control of radioactive sources and regulatory frameworks in the Caribbean

The IAEA is assisting 12 Member States in the Caribbean to accelerate the development of their nuclear and radiation safety infrastructures. Since 2016, the IAEA technical cooperation programme has supported training for the drafting of regulations, radiation protection, and the operational functions of regulators, including notifications, authorizations and inspections. Support was also provided to establish national registers of radiation sources and to develop capacities for effective preparedness and response to radiological emergencies. These efforts are promoting greater radiation safety in the region, ensuring that participating countries can fully benefit from the research, medical and industrial applications of nuclear science and technology.

Energy

Nuclear science and technology play a major role in the development of sustainable energy. Using its Milestone approach, the IAEA helps countries in Latin America and the Caribbean to make progress through the various phases of nuclear power infrastructure development, including nuclear workforce planning.

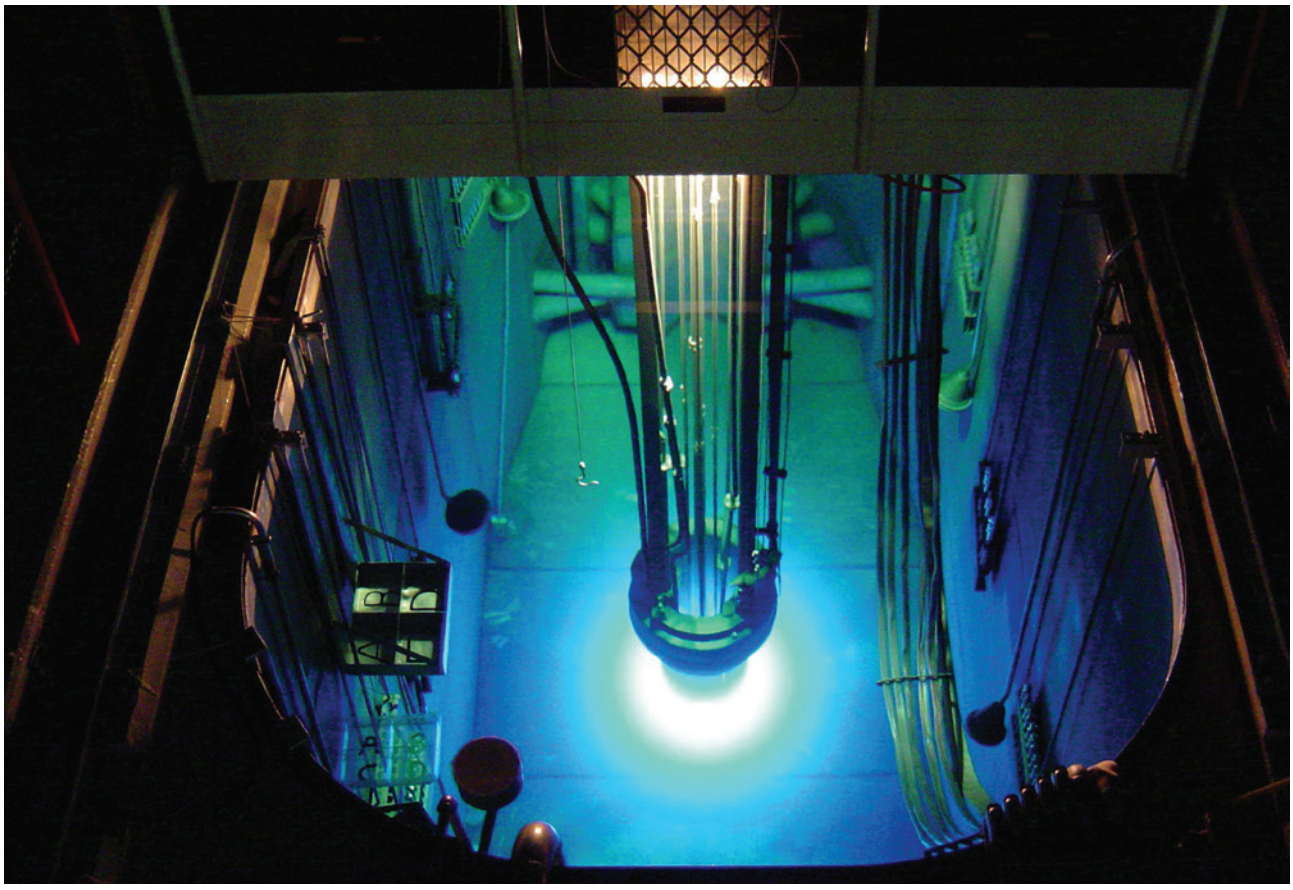
Inside the Atucha II reactor in Argentina.

Argentina: Nuclear power plant development

The IAEA provided expert advice to support the completion of Argentina's third nuclear power plant, Atucha II, which was scheduled to start operating in 1987. Due to financial issues, the project was delayed until 2005 with 81 per cent of the plant completed. Through more than 25 IAEA expert missions, including project management, document reviews and workshops, Argentina finalized construction in 2011, and by 2014 had successfully prepared Atchua II for its commissioning, start-up, and safe and reliable operation. The plant now produces 42 per cent of the country's electricity, contributing to national efforts to provide clean, reliable and affordable energy.

Mexico: Research reactor modernization

Mexico's TRIGA Mark-III reactor, located at the Centro Nuclear 'Dr Nabor Carrillo Flores', is essential for the production and supply of radiopharmaceuticals used in nuclear medicine, as well as for determining elemental composition through neutron activation analysis, and for educational uses. In 2012, Mexico finalized the conversion of



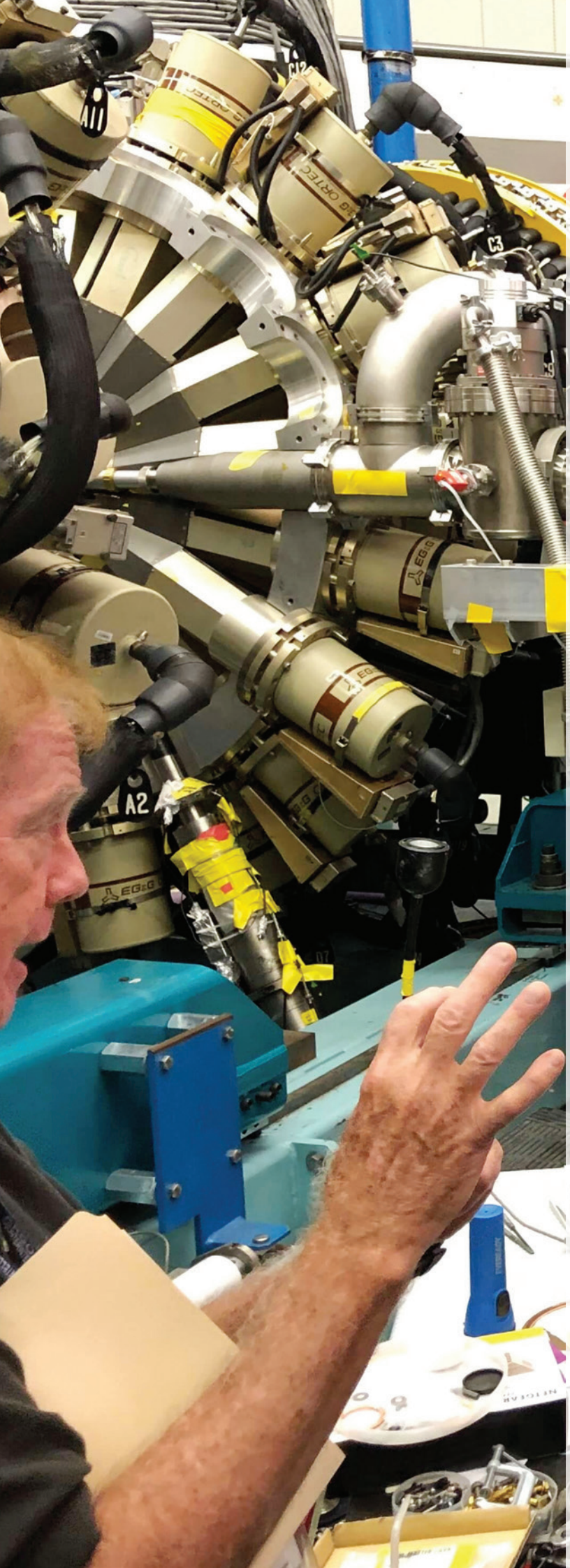
Inside the TRIGA Mark-III reactor. (Photo ININ)

the reactor's fuel from mixed low and highly enriched uranium to low enriched uranium only. The IAEA initiated a project to modernize the reactor, including support for a new instrumentation and control system and new graphite elements for the reactor core, as well as updating the continuous monitoring system for airborne particulates. Further support helped upgrade the ventilation, electrical and cooling systems. The installation of these new systems and components enabled Mexico to extend the life of the reactor in a safe and efficient manner and secured the continuation of national radiopharmaceutical production, neutron activation analysis and reactor related education.

Working towards sub-regional energy integration: 20 participants from 13 Member States in Latin America and the Caribbean attended a five-day project coordination meeting. (Photo: O. Yusuf/IAEA)

Regional: Strengthening energy planning

Based on Latin America and the Caribbean's desire to prioritize a comprehensive analysis of energy supply and demand scenarios, the IAEA supported the development of plans for sustainable energy at a sub-regional level. Since 2018, 210 experts from 15 countries have been trained in the use of the IAEA's energy planning tools and methodologies. Following their training, experts have developed three sub-regional studies on energy demand and two sub-regional studies on energy supply using the IAEA's Model for Analysis of Energy Demand (MAED) and its Model for Energy Supply Strategy Alternatives and their General Environmental Impacts (MESSAGE). With the benefit of new data on energy production, distribution and consumption throughout the region, project counterparts can identify opportunities to increase efficiencies and promote sustainable energy through greater cross-border energy transmission and integration. They can also examine how the energy, environmental and social policies outlined in each national energy plan are aligned with the achievement of broader sustainable development and climate change mitigation goals for the region.



Nuclear knowledge development and management

Building, sharing, maintaining and utilizing knowledge is essential to develop and maintain the technical expertise and competences required for nuclear power programmes and the application of other nuclear technologies. To preserve institutional memory, the IAEA collaborates with Member States and develops methodologies and guidance to plan, design and implement nuclear knowledge management programmes.

Regional: Developing a Master's programme in Advanced Radiotherapy Techniques

In 2017, the first IAEA-supported Master's course in Advanced Radiotherapy was launched at the Arturo López Pérez Foundation (FALP) and University of Los Andes in Santiago, Chile, to help address the region's shortage of qualified radiation oncologists. With annual numbers of new cancer cases in the region projected to exceed 2.5 million by 2040, the ARCAL-supported programme will accelerate the establishment of a body of trained radiation oncologists to help meet demand for services, and will offer students the opportunity to improve and update their knowledge of the industry for the safe and effective implementation of radiotherapy techniques.

Medical Director, Dr. Hugo Marsiglia, speaking at the inauguration ceremony of the second Master's programme on advanced radiotherapy, 27 September 2018, Arturo López Pérez Foundation (FALP). (Photo: FALP)

The IAEA's pioneering School of Nuclear Knowledge Management for the Central American and Caribbean region was held on 3–7 December 2018 in Costa Rica. (Photo: National University of Costa Rica)

Regional: Establishing the first nuclear knowledge management school in Latin America and the Caribbean

In 2018, Costa Rica established the first nuclear knowledge management school in the Latin American and Caribbean region with IAEA assistance. Twenty-two participants from eight countries participated in the pilot programme. Half of the participants and over 60 per cent of the experts were women, demonstrating a consistent drive towards addressing the gender imbalance in the region's nuclear sector. Through a combination of online and classroom courses, the programme teaches participants about nuclear knowledge management, strategies and tools in an engaging and interactive manner. The course also provides strategies and highlights the importance of retaining critical knowledge and safeguarding information for future generations concerning developments in the field.

Secondary school teachers were trained to use the NUCLEANDO platform at a national training course in Costa Rica, from 29 July to 2 August 2019. (Photo: E. Genini/IAEA)

Regional: Promoting professional development in nuclear science and technology

The IAEA, together with Argentina's National Atomic Energy Commission (CNEA) and the Latin American Network for Education in Nuclear Technology (LANENT), supported the development of NUCLEANDO, a multimedia educational programme which aims to encourage over 250 000 students to participate in the nuclear science and technology field. NUCLEANDO offers schools and students online educational kits with innovative and engaging tools and resources to introduce the subjects into their curriculum. First piloted in Costa Rica and subsequently in Uruguay, the programme highlights the advantages and uses of peaceful applications of nuclear technology while complementing conventional teaching in primary and secondary schools.

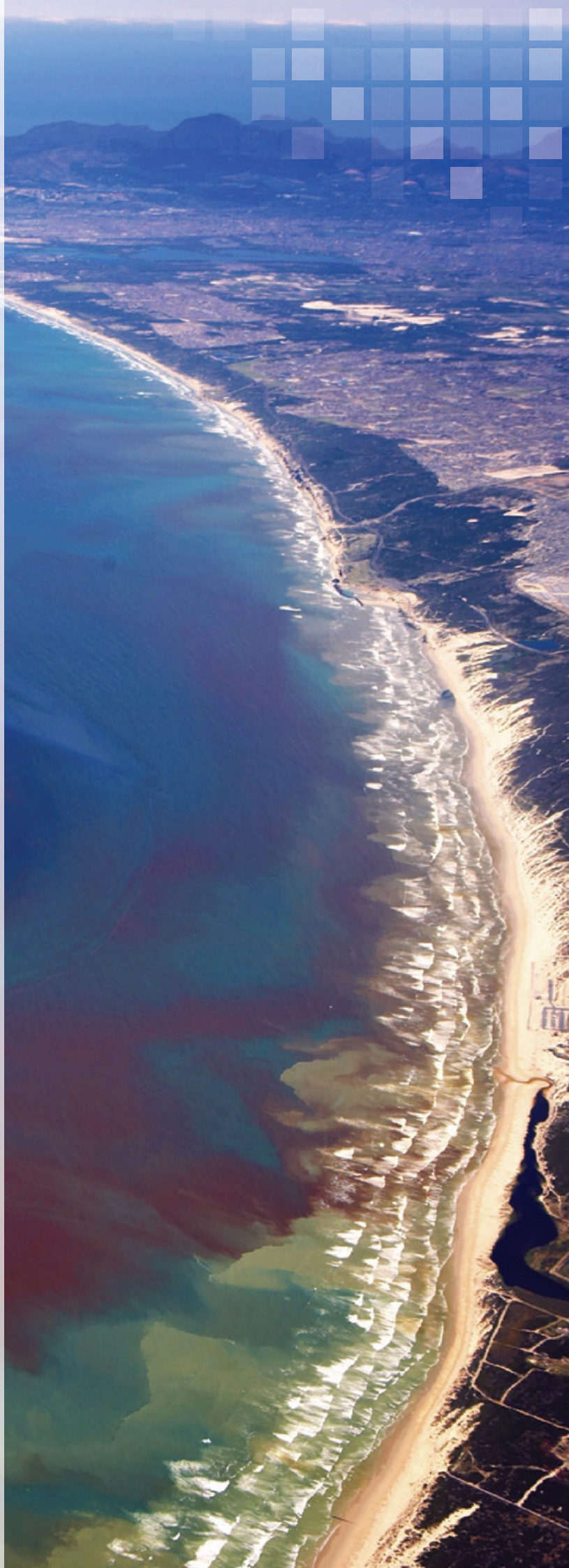
Regional: Promoting the sustainability of nuclear institutions

Under an IAEA-ARCAL project, the region's nuclear institutions have been working to promote the sustainability of nuclear science and technology and to create close collaborative networks. Through a series of workshops and meetings, common challenges and opportunities are being identified and strategies developed to contribute to the sustainability of nuclear institutions. The meetings provide a platform to exchange good management practices, strengthen the integration of regional development efforts, identify and establish new partnerships and promote the peaceful uses of nuclear technologies.

Participants visit the Quality Control Laboratory of Mexico's National Nuclear Research Institute (ININ). (Photo: Counterpart ININ)

Water and the environment

Nuclear science and technology can help countries to manage and make use of natural resources more sustainably, as well as improve understanding of natural processes and contribute to the protection of the environment. The IAEA's technical cooperation programme helps countries in Latin America and the Caribbean to measure and analyse pollutants and environmental radioactivity in air, land and ocean, to monitor and assess the effects of climate change on oceans and to better manage and protect marine resources and coastal zones, as well as to use isotope hydrology to improve understanding and quantification of groundwater resources.



Scientists at INVEMAR, Colombia's Marine and Coastal Research Institute. To the left, a sample of whale bones. (Photo: L. Gil/IAEA)

Colombia: Protecting the marine environment

Colombia has worked with the IAEA since 2007 on applying nuclear techniques to better understand the impact of harmful pollutants and contaminants on its waters. The Marine and Coastal Research Institute (INVEMAR) received equipment and training to study changes in the marine environment, such as increases in ocean acidification and the presence of microplastics. By studying how acidification and pollution affect their seas, policymakers in Colombia are better equipped to take appropriate measures to preserve the fragile marine ecosystem.

Ecuador: Using isotope hydrology to characterize the Zamora River Basin

Mining activities in south-eastern Ecuador have had adverse effects on the water quality of the nearby Zamora River. To improve the conservation of the river basin, the IAEA supported Ecuador's Water Secretariat (SENAGUA) with specialized training and equipment, including a water isotope spectrometer to support the analysis of isotopic data that provides information on water quality, quantity and historical movement. This hydrological data also reveals details of the basin's water cycle, recharge rate, and the interaction between surface and ground water – essential for measuring the sustainability of a water source. In addition, the IAEA in close cooperation with SENAGUA and the Pan-American Health Organization in Ecuador supported the training of more than 25 technical staff from the Water Secretariat and over 100 students and professors from the Amazon Regional University (IKIAM). This assistance enabled SENAGUA to collect, integrate and validate information obtained from the Zamora River, and will support decision makers in the development and implementation of new groundwater resource management policies.

The Bombuscaro River, an important tributary of the Zamora River, located in Ecuador's Zamora-Chinchipe Province. (Photo: A. Neild)

Marine scientists and communicators draft awareness-building products on threats to the ocean. Santa Marta, Colombia. (Photo: L. Gil/IAEA)

Regional: Bringing together scientists and communication experts to monitor marine and coastal environments

Marine scientists working with nuclear-derived techniques have joined communication experts from Latin America and the Caribbean to raise awareness about threats to the ocean's health. In an IAEA-led workshop in Santa Marta, Colombia, more than 20 experts worked together to produce plain-speaking advocacy materials to explain the role of nuclear science in monitoring marine environments. A new science and communication network, REMARCO, is connecting 18 countries in the region and is providing a platform to discuss ways to address common challenges in marine and coastal environments, such as marine pollution, ocean acidification, harmful algal blooms and microplastics. Since the establishment of REMARCO in 2016, numerous studies have been conducted, with advocacy materials published to highlight the role of nuclear technology, and appropriate remediation and mitigation proposals have been developed to support the work of policymakers in the region.

Regional: Protecting the Guarani aquifer, one of the world's largest groundwater reservoirs

Using isotope hydrology, new data on the Guarani aquifer has been brought to light. Hidden under lush green fertile lands, the aquifer spans over 1.2 million square kilometres — three times the size of the Caspian Sea. With stores of over 37 000 cubic kilometres of fresh water in its sandstone pores and fissures dating back to between 130 and 200 million years ago, it is a source of drinking water, and supplies the region's industry, agricultural irrigation and thermal spa tourism.

The Guarani Aquifer spans over 1.2 million square kilometres and supplies the region with fresh water for drinking, agriculture and tourism. (Photo: M. R. Caetano-Chang/UNESP)

Four Latin American countries (Argentina, Brazil, Paraguay and Uruguay) supported the analysis and assessment of the aquifer to study its age, origin and evolution, as well as its water quality and risks of contamination. The new analysis is enabling the four countries to better manage the transboundary aquifer and has led to the establishment of the Project for Environmental Protection and Sustainable Development of the Guarani Aquifer System, also known as the Guarani Project.

Industrial applications and radiation technology

Nuclear techniques and radiation technology have widespread industrial applications. They can be used to identify and assess material properties, measure pollution levels, sterilize and disinfect components, monitor and optimize industrial processes and change chemical, physical and biological properties to produce new kinds of materials. The IAEA supports Member States in the Latin American and Caribbean region to help optimize their processes and improve production efficiency.

With IAEA support, the Food Irradiation Plant in Havana, Cuba, reopened after 20 years. The facility enables the country to extend the shelf-life of fruit and vegetables, ensure food safety and increase the quality of food exports. (Photo: M Klingenboeck/IAEA)

Scientists use radiation techniques to treat cultural artefacts like this damaged book and help improve their durability. (Photo: Institute of Brazilian Studies/IEB/USP, São Paulo, Brazil).

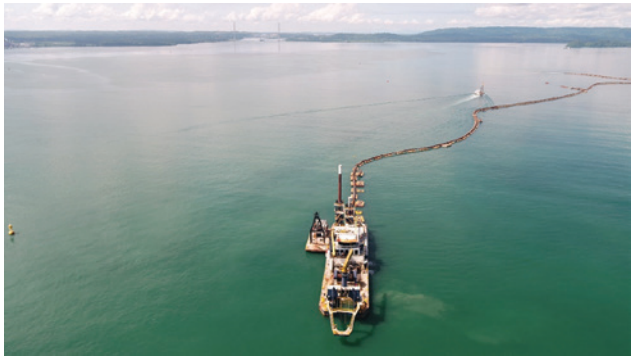
Brazil: Using gamma irradiation to preserve cultural heritage artefacts

Art conservationists and nuclear scientists are working together to preserve more than 20 000 cultural artefacts in Brazil. For more than 15 years, the IAEA and staff from the Nuclear and Energy Research Institute (IPEN) in São Paulo have worked to establish capacities in radiation techniques that are used to treat, analyse and preserve cultural artefacts ranging from art pieces and public document archives to rare military artifacts. With IAEA support, Brazil has established gamma irradiation capacities to disinfect items, fight mould and insect infestations and improve the durability of historical artefacts without the use of chemicals. By strengthening the knowledge and capacity to use nuclear techniques, IPEN has become a key resource for many experts in the region and around the world.

Cuba: Reinstating irradiation capacities

The IAEA has helped Cuba to reinstate irradiation capacities at two key institutions: the Centre of Applied Technologies and Nuclear Development (CEADEN) and the Food Industry Research Institute. With the benefit of expert missions, training courses and the delivery of critical equipment, CEADEN now has the capacity to conduct irradiation at laboratory scale. By restoring irradiation capacities, the IAEA is also assisting the country to improve food security and access to international

markets, while reducing food import costs. Food irradiation technology offers a safe and sterile way to better preserve food, and minimizes the risk of food-borne contaminates which can cause illnesses. The upgraded food irradiation plant at the Food Industry Research Institute will not only be available for the food and agriculture sector but is also expected to support industrial processing, radiation sterilization and decontamination, treatment of persistent pollutants and the production of medical 'smart materials,' such as hydrogel which can repair human tissue.



Study site, Panama Canal, province of Colón. (Photo: ACP)

Panama: Analysing sediment movements in the Panama Canal

Each year, more than 252 million tonnes of the world's goods move through the Panama Canal. To ensure that the commercial links between the Atlantic and Pacific oceans remain open, Panama must constantly dredge the canal. This is a costly exercise, further complicated by seasonal tropical storms. With IAEA support, experts in Panama have increased their ability to use radiation technology to model the movements of sediment in the waterway. IAEA support included training and the procurement of nucleonic gauges to measure sediment. In late 2019, Panama successfully deployed its first probe to measure the sediment profiles on the canal's Atlantic side. Once the oceanic measurement of the Pacific side is complete, the Panama Canal Authority will finalize a Sediment Profile Measurement Plan to conduct dredging operations more effectively while improving water management processes and ship navigation.

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International Atomic Energy Agency
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