2022

IAEA Technical Cooperation Programme

The IAEA Technical Cooperation Programme

Selected Highlights

2022

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SUSTAINABLE DEVELOPMENT GOALS

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SUSTAINABLE DEVELOPMENT GOALS

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Foreword

The IAEA technical cooperation (TC) programme is the IAEA's major vehicle for delivering support to Member States for the peaceful application of nuclear science and technology. The programme is designed together with Member States to meet national, regional and interregional development priorities, and contributes to the attainment of the Sustainable Development Goals.

The technical cooperation programme is active in 149 countries and territories, including 35 least developed countries, and provides support in a wide range of areas that address crucial development issues, including: energy; health and nutrition, especially radiation medicine against cancer; food and agriculture; water and the environment; industrial applications; nuclear knowledge development and management; and safety and security. The programme contributes to the delivery of important IAEA initiatives such as ZODIAC, designed to help countries build capacity to detect and control zoonotic outbreaks, Rays of Hope, focused on assisting countries to improve their cancer care capacities, and NUTEC Plastics, which supports efforts to address plastic pollution through recycling, using radiation technology, and marine monitoring, using isotopic tracing techniques. Support is also offered to countries interested in small modular reactors — a potential flexible and low-carbon energy source. Regional and interregional projects are used to address common challenges across national boundaries, including the needs of least developed countries and small island developing States.

The TC programme supports countries through targeted capacity building that includes short and long term training as well as the provision of expert advice, procurement of equipment, and the establishment and strengthening of nuclear and radiation safety and security.

This brochure showcases a selection of 2022 technical cooperation success stories across Africa, Asia and the Pacific, Europe and Central Asia, and Latin America and Caribbean. I hope this will help readers better understand the technical cooperation programme and the ways in which the programme supports the sustainable development of Member States.

HUA LIU

IAEA Deputy Director General and
Head of the Department of Technical Cooperation

The contents of this brochure were originally prepared for and published on the official IAEA website:
www.iaea.org/technicalcooperation

Held for the first time in the Asia-Pacific region, the United Nations Global South-South Development Expo attracted more than 4 0000 participants, representing national governments, private sector foundations, development organizations and over 20 United Nations agencies. (Photo: IAEA)

IAEA showcases South-South cooperation successes at Bangkok conference

Melissa Evans, IAEA Department of Technical Cooperation
Laura Vai, IAEA Department of Technical Cooperation

From 12 to 14 September, at the United Nations Global South-South Development Expo (GSSD Expo) in Bangkok, Thailand, the IAEA showcased the contributions of nuclear technology to global development and shared best practices in South-South and Triangular Cooperation, organizing a side event in collaboration with the United Nations Office for South-South Cooperation (UNOSSC), UN Economic and Social Commission for Asia and the Pacific (ESCAP) and the Government of Thailand, and an exhibition booth, complementing the IAEA Virtual Booth launched in July.

The Expo was held in person for the first time since 2018 and held in the Asia-Pacific region for

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- At the United Nations' Global South-South Development Expo in September 2022, the IAEA organized a side event highlighting the key role that South-South and triangular cooperation play in the activities of the technical cooperation programme.
- The United Nations Office for South-South Cooperation launched the fourth volume of the publication 'Good Practices in South-South and Triangular Cooperation for Sustainable Development' that features five IAEA case studies.

the first time ever. The event brought together more than 4 000 representatives of national governments, development agencies and over 20 United Nations agencies, in addition to private sector and youth delegates.

South-South cooperation plays a key role in the implementation of the IAEA's technical cooperation programme. "It's quite simple: we couldn't fulfil our mandate of Atoms for Peace and Development without it," said IAEA Director General Rafael Grossi on the Expo's opening day, stressing that South-South cooperation is key to the work of the IAEA.

"Many developing countries in Asia and the Pacific are now actively supporting neighbouring countries by providing training on nuclear techniques to support better healthcare outcomes, cleaner environments and safer food," said Ambassador Morakot Sriswasdi of the Kingdom of Thailand, underscoring the strong support extended by her government to the IAEA in support of its efforts to promote South-South cooperation. "The Government of Thailand is committed to supporting this dynamic and co-organized this side event to help share the experiences, good practices and wisdom of South-South policymakers and practitioners. We believe that nuclear science and technology is a valuable contribution to achieving the Sustainable Development Goals."

Held on 13 and 14 September, respectively, the regional Asia-Pacific Directors Forum and in the Global Directors Forum benefitted from IAEA interventions, underscoring the crucial role that partnerships plays in South-South cooperation at the IAEA. (Photo: IAEA)

Held on 12 September, UN South-South Day, the IAEA side event, 'Harnessing the Power of the Atom to Support COVID-19 Recovery and Address Global Challenges,' benefitted from high level participation, with interventions by Xiaojun Grace Wang, the Deputy Director for Programme and Operations at UNOSSC, and Adnan Aliani, Director of Strategy and Programme Management at ESCAP, as well as representatives from Thailand's Ministry of Foreign Affairs and expert interlocutors from Viet Nam, Thailand and Fiji.

Shaukat Abdulrazak, Jane Gerardo-Abaya and Luis Longoria Gandara, Directors of the IAEA Technical Cooperation Divisions for Africa, Asia and the Pacific, and Latin America and the Caribbean, respectively, also participated to share examples of effective South-South cooperation in each region.

"Development and the peaceful application of nuclear technology to benefit the livelihoods of people has been one of the most valuable achievements of humankind. Yet, the awareness, understanding, knowledge and capacity to actually leverage this benefit — leaving no countries, no people behind — is still very level among developing countries: that's where South-South and triangular cooperation can really be leveraged to help expand this benefit," explained Deputy Director Wang during the side event.

Vichai Puripunyavanich, a nuclear scientist at the Thailand Institute of Nuclear Technology (TINT), shared his perspective as a panellist at the IAEA side event, showcasing the benefits of nuclear science and technology for food security in Thailand. "There are three main radiation applications for agriculture at the Institute — plant breeding, fruit fly control through the Sterile Insect Technique and food irradiation," said Puripunyavanich. "We collaborate with the IAEA and other countries through training courses and fellowships or symposiums and regional training courses, such as the latest one in Indonesia on mutation breeding."

During the side event, Adnan Aliani of ESCAP stressed the importance of South-South cooperation for energy planning: "It is critical that support must be extended to countries in nuclear

Xiaojun Grace Wang, the Deputy Director for Programme and Operations at the UNOSSC, and Adnan Aliani, Director of Strategy and Programme Management at ESCAP, participated in the IAEA side event, alongside representatives from Thailand's Ministry of Foreign Affairs, expert interlocutors from Viet Nam, Thailand and Fiji, and IAEA Directors.

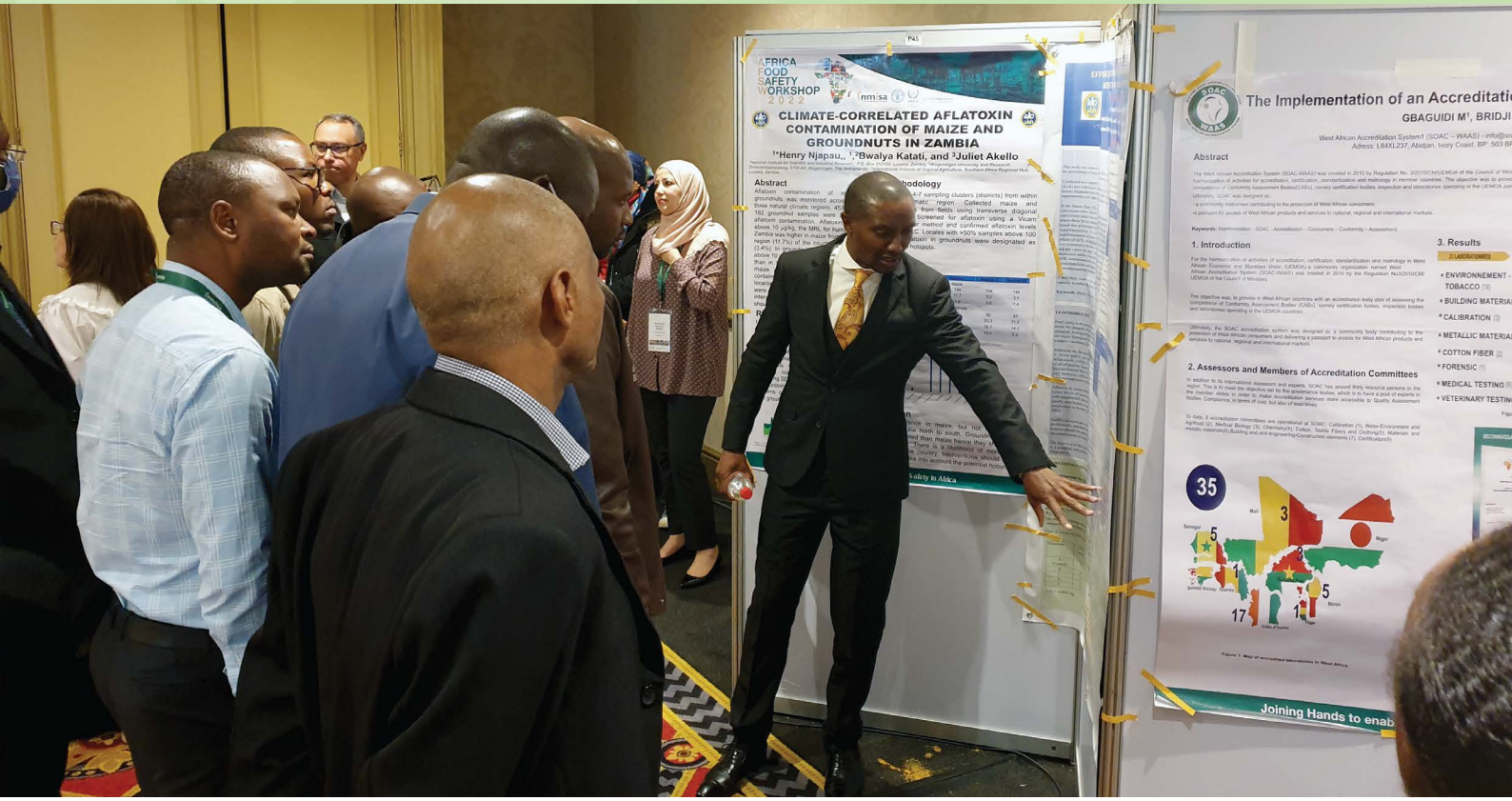
science and technology through South-South cooperation. As countries increasingly look to low-carbon options, increased South-South and triangular cooperation is needed to advance technology and applications, while also ensuring the highest level of operational safety standards in the deployment of nuclear technologies."

The UN South-South Day also provided the occasion for the launch of the UNOSSC Good Practices in South-South and Triangular Cooperation for Sustainable Development Vol. 4, which includes five examples of IAEA good practices in the areas of food safety, cancer care, capacity building, industry and water management in Africa, Asia and the Pacific, and in Latin America and the Caribbean.

Open for three days, the IAEA's exhibition booth at the GSSD Expo — staffed by experts from the Agency's Department of Technical Cooperation and stocked with publications presenting the IAEA's work in South-South cooperation — attracted the attention of many conference-goers, including the 300 young representatives participating in the YOUTH4SOUTH special event.

The IAEA actively participated in the regional Asia-Pacific Directors-General Forum and in the Global Directors Forum, which took place on 13 and 14 September, respectively. At the latter, IAEA Deputy Director General and Head of the Department of Technical Cooperation Hua Liu stressed the crucial role that teamwork plays in South-South cooperation at the IAEA: "The IAEA works in close partnership with Member States, United Nations agencies, research organizations and civil society to maximize the contribution of nuclear science and technology to the achievement of development priorities, and thus, achieving development goals."

As Director General Grossi remarked at the opening of the Expo, "some challenges simply can't be solved alone." In keeping with this ethos, IAEA staff participating in the GSSD Expo identified and leveraged opportunities presented by the event to engage with the private sector, foundations and national development agencies, with the aim of continuing to enhance the support provided by the IAEA to its Member States via well anchored South-South mechanisms.



A participant presenting his poster on the impact of climate change on mycotoxins and laboratory accreditation at the African Food Safety Workshop, jointly held by the IAEA and the FAO in Johannesburg, South Africa, 27 June–1 July 2022. (Photo: J. Sasanya/IAEA)

IAEA, FAO workshop strengthens food safety network across Africa

James Sasanya, IAEA Department of Nuclear Sciences and Applications

Supporting initiatives to enhance food safety across the continent was the focus of an African Food Safety Workshop jointly held by the IAEA, the Food and Agriculture Organization of the United Nations (FAO) and the National Metrology Institute of South Africa (NMISA).

Over 280 experts and researchers from 43 countries' food safety regulators, food testing laboratories, food manufacturers, and governmental and non-governmental organizations, shared experiences on vital topics, such as preventing food fraud, monitoring radionuclides, using radio receptor assays and stable isotopic techniques for veterinary drug and pesticides residues, as well as mycotoxins, toxic metals and biotoxins. Participants also addressed responding to food borne illnesses and disease outbreaks, setting maximum residue limits, and implementing effective food monitoring and surveillance programmes.

AT A GLANCE

- An African Food Safety Workshop was hosted by the IAEA, together with FAO and NMISA.
- The Food Safety Strategy for Africa (2022–2036) was launched by the African Union Development Agency.

“This workshop showed the commitment of the African continent not just to increase food safety and trade nationally and in the region, but to support achieving several Sustainable Development Goals, including good health and well-being, industry, innovation and infrastructure as well as ending poverty and hunger,” said Shaukat Abdulrazak, Director of the IAEA’s Technical Cooperation Division for Africa. “African Union leadership and various stakeholders across the continent discussed cross-cutting food safety issues and had a common voice on strategies for supporting the Africa Continental Free Trade Area, addressing food trade rejections, and ensuring consumer protection and food security.”

During the five-day event held in Johannesburg, South Africa, from 27 June to 1 July 2022, participants discussed the benefits of ISO accreditation for food safety and international trade; ways of collecting scientifically reliable data on levels of food hazards, such as mycotoxins, drug and pesticide residues, persistent pollutants, toxic metals and microplastics; and how to develop regionally-tailored laboratory testing and reference materials, which could enable countries to provide better analytical services.

“We need to build institutional excellence, which would lead to more ISO accreditation for laboratory services,” said Ndwakhulu Mukhufhi, Chief Executive Officer at NMISA. “This can be achieved by sharing relevant reference material and conducting training programmes. Institutions such as NMISA are here to support.”

Participants agreed that there was a need throughout the region to increase food safety awareness among the general public. They also agreed that capabilities and mechanisms for setting food safety standards should be strengthened, including maximum residue limits, and that it was important to embrace a One Health approach to food safety in Africa.

Workshop participants presenting their laboratory and research findings at the African Food Safety Workshop, jointly held by the IAEA and the FAO in Johannesburg, South Africa, 27 June–1 July 2022. (Photo: J. Sasanya/IAEA)

“Establishing and promoting networks is a top priority,” said Qu Liang, Director of the Joint FAO/IAEA Centre for Nuclear Techniques in Food and Agriculture. “Networks and such events offer Member States a platform to share knowledge and experiences on food safety. Leveraging the advantages of nuclear science, the Joint Centre will continue to serve as a mechanism to transfer relevant technology, addressing current and emerging food safety and trade issues.”

The workshop coincided with the launch of the Food Safety Strategy for Africa (2022–2036) by the African Union Development Agency, aimed at improving public health, food and nutrition security, sustainable livelihoods and economic growth. The African Union had already laid out a roadmap to strengthen its member countries’ capabilities in the area of food safety in its Sanitary and Phytosanitary Policy Framework for Africa — launched in 2019.

“Incorporating the policy framework and the strategy into regional economic communities’ and Member States’ long term strategies and frameworks is crucial for sustainable financing and implementation,” added Godfrey Bahiigwa, Director of the African Union’s Department of Agriculture and Rural Development.

IAEA Fellows at the 'Regional Training Course on Mutation Breeding and Efficiency Enhancing Techniques for Resistance to Banana Fusarium Wilt Race TR4' in IAEA Laboratories in Seibersdorf, Austria. (Photo: D. Calma/IAEA)

IAEA trains Latin American scientists in fighting banana disease

Press release

The International Atomic Energy Agency (IAEA) has trained scientists from six Latin American countries in using nuclear and related techniques to detect and contain a banana disease threatening a quarter of the global production of a crop that is providing jobs and nutrition for hundreds of millions of people around the world. The training included the development of genetic disease resistance in bananas.

One of the most devastating banana diseases in the world, the banana Fusarium wilt, is spreading rapidly in the region. It hurts global supplies of the world's most popular export banana variety — the Cavendish.

AT A GLANCE

- The IAEA conducted an expert mission to the Andes in October 2021 to coordinate the response to the Fusarium wilt Tropical Race 4 (TR4) outbreak.
- Twelve scientists from Brazil, Colombia, Costa Rica, Ecuador and Peru attended an IAEA training to learn irradiation techniques to increase bananas' resistance to banana Fusarium wilt.

In response to an urgent request from affected countries, last year Director General Rafael Mariano Grossi pledged that the IAEA would provide immediate assistance in combatting the disease and preventing it from causing further damage, working together with the Food and Agriculture Organization of the United Nations (FAO).

“Immediately after receiving the request for assistance, we dispatched a technical mission to assess the situation and provide emergency assistance. Training scientists from the region is a vital part of this assistance as it builds skills and other capacity in managing and controlling a disease that is hurting livelihoods across the region,” said Director General Grossi, who met the researchers during their training at the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture in Seibersdorf, Austria.

As part of the assistance, twelve scientists from Brazil, Colombia, Costa Rica, Ecuador, Peru and Venezuela received training in February in Seibersdorf. The topics covered mutation breeding, tissue culture, development of mutant populations, and screening protocols for disease resistance.

“Thanks to the training, I understand the high potential of irradiation approaches to increase banana’s resistance to Fusarium wilt. I was glad to learn how the IAEA can contribute to the resolution of this important problem in our countries,” said Mauricio Soto-Suárez, a PhD researcher in plant pathology from Colombia. He is one of the banana breeders, pathologists, and tissue culture specialists, who participated in the two week training course, which took place at the Plant Breeding and Genetics Laboratory at the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture in Seibersdorf and at IAEA Headquarters in Vienna.

The IAEA will support the affected countries over the next five years in disease detection, surveillance, and containment. They will also receive scientific advice on how to boost the genetic resistance of banana plants using mutation breeding and associated biotechnologies.

In August 2021, experts and authorities from the Andean community — Bolivia, Colombia, Ecuador and Peru — reached out to the IAEA when they discovered the continuing spread of the latest variant of the Fusarium wilt disease, Tropical Race 4 (TR4), in the region. It has now spread to more than 20 countries around the world.

The course follows an IAEA expert mission to the region in October 2021 during which the existing situation for TR4 was discussed, a draft five-year plan was agreed, and urgent procurement needs were addressed.

The banana is one of the world’s top staple foods, with over 400 million people relying on this fruit for food security and income. The annual production of bananas across the globe amounts to some 155 million metric tons, with about 25 million tons exported from tropical countries in Latin America, the Caribbean and other parts of the world.

TR4 is a soil-borne disease, which can survive for decades in the soil, making it difficult to control. The only long-term response is to develop and deploy new banana varieties with effective disease resistance. This can be done thanks to mutation breeding — a process using irradiation techniques that help develop new disease resistant crop varieties for farmers. Confined to Southeast Asia for decades, TR4 was discovered in Latin America for the first time in 2019, causing a national emergency in Colombia, the fifth largest exporter of bananas in the world.

The IAEA, in partnership with the FAO, has a long and established track record in applying nuclear and related techniques to improve crop plants, and develop variants resistant to diseases. Banana research in the IAEA/FAO laboratories and relevant capacity building in Member States goes back at least two decades. It addresses key techniques that include cell and tissue culture, mutation induction, screening for disease and pest resistance, and related molecular and cytogenetics techniques.

The IAEA, IARC and WHO conducted an imPACT Review in Uzbekistan to assess the national capacities and health system readiness to respond to the cancer burden. (Photo: C. Henrich/IAEA)

IAEA, WHO and IARC conduct assessment to inform further investments in cancer care in Uzbekistan

Lisa Berthelot, IAEA Department of Technical Cooperation
Igor Veljkovikj, IAEA Department of Technical Cooperation
Christoph Henrich, IAEA Department of Technical Cooperation

Uzbekistan has made substantive progress in the expansion of access to, and quality of, cancer care services, a team led by the IAEA, World Health Organization (WHO) and International Agency for Research on Cancer (IARC) concluded this month, following an imPACT Review.

In the years since the conclusion of a 2014 review mission, the number of functioning external beam radiotherapy machines in Uzbekistan has grown from five machines in four cancer care institutions to 19 in 15 institutions in 2022.

In 2020, more than 20 000 new cancer cases were registered in Uzbekistan, an annual figure that is expected to nearly double by 2040,

AT A GLANCE

- An IAEA-WHO-IARC imPACT review mission was conducted in Uzbekistan to analyse infrastructure and equipment. Uzbekistan now has 19 external beam radiotherapy machines available in 15 facilities.
- Uzbekistan is developing a new National Cancer Control Programme (NCCP) to expand and enhance cancer care.

according to the IARC. In its efforts to address the growing cancer burden, the Government of Uzbekistan invited experts from the IAEA, WHO and the IARC to assess its national capacities in cancer control and to provide corresponding recommendations to strengthen their national cancer infrastructure and workforce.

Comprising international and national cancer specialists, the team provided actionable guidance to expand and enhance cancer care in Uzbekistan — particularly in the areas of breast, cervical and childhood cancers — by scaling up prevention and early diagnosis services, improving quality and access to treatment, and by guiding the development of a new national cancer control programme (NCCP) and further investments in cancer control.

Following in-country visits to key facilities and discussions with the main stakeholders and service providers, the imPACT Review equips national decision makers with baseline data and analysis on cancer control capacities in their country.

"This imPACT review also included an in-depth analysis of infrastructure, equipment and workforce needs in the main cancer care hospitals in the country," said Christoph Henrich, the Programme Management Officer of the IAEA's technical cooperation programme in Uzbekistan. "This information is now being used to define corresponding equipment and human resource capacity building activities for upcoming oncology projects for the country."

National cancer control planning

One of the main priorities of Uzbekistan is to formulate a comprehensive cancer control strategy in the context of available resources. Responding to this need, the IAEA, WHO and IARC can support national, evidence-based planning for the introduction of the most effective cancer control interventions, across the entire cancer control spectrum, from cancer prevention and early diagnosis to treatment and palliation.

"Without careful planning and evidence-based strategies, there is a risk that resources available for cancer control will be used inefficiently or inequitably," said Lisa Stevens, Director of the IAEA Programme of Action for Cancer Therapy (PACT). "By supporting the development of comprehensive, data-driven NCCPs, we can help countries achieve a substantial degree of cancer control even where resources are severely limited."

As part of the imPACT Review, Uzbekistan received technical advice from the IAEA, WHO and IARC to align the development of their new NCCP with key national health policies and

Uzbekistan is a focus country of the WHO Global Initiative for Childhood Cancer (GICC). According to the WHO, 80% of children with cancer will survive in high-income countries, but only 20% will survive in low- and middle-income countries. (Photo: C. Henrich/IAEA)

“The Ministry of Health appreciates the long-term partnership with the IAEA, WHO and IARC, working together to improve the capacity of the health system in responding to cancer burden,” said Deputy Minister of Health Basithanova. (Photo: C. Henrich/IAEA)

country-specific cancer burden, existing health infrastructure, available resources as well as the socioeconomic context of Uzbekistan.

“The Ministry of Health appreciates the long-term partnership with the IAEA, WHO and IARC, working together to improve the capacity of the health system in responding to the cancer burden. We very much value the recommendations from the imPACT Review as they will guide us in ensuring health care in Uzbekistan is provided according to internationally recognized standards,” said Uzbekistan’s Deputy Minister of Health, Elmira Basithanova. “Our objective is to strengthen early detection and treatment services for the most prevalent cancers in the country, such as cervical, breast, colorectal and childhood cancers. Using the expertise from the three agencies, we will continue our collaboration in the future and work together towards formulating the new national cancer plan of Uzbekistan based on the recent mission findings.”

The road ahead

For Uzbekistan, and other countries working on strengthening comprehensive cancer care capabilities, there are options for international support, funding and partnerships. The IAEA is committed to being part of this support. On World Cancer Day 2022, the IAEA launched the Rays of Hope initiative to assist low- and middle-income countries to increase access to radiotherapy.

To address the growing need for funds and to maximize the impact of the Rays of Hope initiative, the IAEA is working closely with the Islamic Development Bank (IsDB) to coordinate funding for equipment, training and education through a partnership agreement signed in 2019.

Within the framework of this partnership, a project with Uzbekistan was launched. Through this, the IAEA provides technical advice to the Government of Uzbekistan in the implementation of the initiative to increase access to cancer care. The latest imPACT Review will further guide the planning and implementation of this Uzbekistan-IsDB project.

Experts from the IAEA, WHO and IARC reviewed Uruguay's cancer services to provide advice to the government on how to tackle the country's growing cancer burden. (Photo: G. Saporiti/IAEA)

Uruguay takes decisive action to reverse high cancer incidence and mortality rates

Lisa Berthelot, IAEA Department of Technical Cooperation
Giovanni Saporiti, IAEA Department of Technical Cooperation

Experts rolled up their sleeves in Uruguay in the final weeks of 2021 as they assessed the country's cancer control system and worked towards finding solutions to strengthen cancer control capacities and lower mortality rates. Together with the Ministry of Public Health and 20 national experts, the IAEA, the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC) brought in an international team of specialists to focus on how to tackle these rates, which remain high despite the medical expertise available in the country and the technological investments made in recent years.

Over five days at the end of December, an imPACT Review team of international experts met with almost 100 national stakeholders, including oncology physicians, nursing staff, hospital and laboratory technicians and public administration officials. They visited seven public and nine private cancer facilities in both urban and rural parts of the country, as part of the review.

AT A GLANCE

- An IAEA-WHO-IARC imPACT mission to Uruguay analysed cancer control services through site visits and meetings with approximately 100 national stakeholders.
- Findings suggest a renewed focus on public cancer centres, quality control and standardization of services, a review of equipment and training of specialized staff.

The imPACT team also travelled to the department of Florida (90 kilometres north of Montevideo) to visit three of the main cancer facilities in rural Uruguay. The visit allowed experts to consolidate an analysis of the urban and rural realities, and to develop a series of recommendations to strengthen access to cancer control services for the entire population.

Building on virtual meetings and workshops that started in September, the experts held extensive discussions on Uruguay's capabilities and needs in human resources, cancer detection, diagnostic and treatment technologies as well as infrastructure.

"Receiving this imPACT mission is a great opportunity for Uruguay, as much for the medical staff as for the patients and us in the Ministry," said Daniel Salinas, Minister of Public Health. "This joint mission provides us with an unbiased and transparent analysis of the current situation of our cancer control system, allowing us to develop solutions that aim to reach the highest international standards while respecting the specificities of our country."

The four most frequent types of cancer in Uruguay are breast, prostate, colorectal and lung cancer, similarly to other high-income countries. These four cancers are responsible for half of the 8 000 annual cancer deaths in the country of 3.5 million every year. According to the National Cancer Registry, more than 16 000 new cases are registered each year.

Over five days in December 2021, an imPACT Review team of international experts visited 16 cancer facilities in both urban and rural parts of Uruguay, as part of the review of its cancer services. (Photo: G. Saporiti/IAEA)

Uruguay's cancer control and prevention system is made up of public and private providers, a national registry, civil society, administrations and public institutions. To tackle the cancer burden, the experts noted that an important effort of coordination between these parties is necessary to ensure a coherent and aligned strategy in line with national health priorities and goals.

The imPACT team also recommended a focus on areas such as the promotion of comprehensive public cancer centres, the regulation of medical practices for the quality control and standardization of services, the technological renewal of equipment and training of staff with specific reference to the medical specialities needed in the centres. Such needs include: radiotherapists, medical physicists, technicians and anatomy-pathologists.

"The pandemic has taught us that imPACT missions, usually carried out in person, can benefit from a hybrid approach, including a series of preliminary virtual meetings with the different counterparts. This allows us to allocate much more time during the country visit to discuss the quality of the services provided and the most realistic and consistent recommendations to overcome the limitation in the country," said Andres Cordova, a senior radiation oncologist from Chile and a member of the imPACT team. "The experience with Uruguay taught us that this new formula works and can be capitalized on for future reviews."

The National Program for Cancer Control (PRONACCAN) team and the national experts appointed by the Ministry of Public Health accompanied the entire evaluation process, organizing and facilitating visits to cancer facilities and providing a local prospective to the analysis.

A workshop was organized on the last day of the mission to discuss the main findings and the preliminary recommendations with the Minister of Health and senior officials from WHO and the IAEA to ensure the imPACT findings will contribute to and support national efforts.

IAEA Director General Rafael Grossi officially launched the Rays of Hope initiative during a side event at the Summit of Heads of States of the African Union in February 2022. (Photo: IAEA)

Chad and Senegal reach key milestones in Rays of Hope initiative and cancer control planning

Thuloane Tsehlo, IAEA Department of Technical Cooperation
Giovanni Saporiti, IAEA Department of Technical Cooperation

Chad and Senegal are two of the eight pioneer countries of Rays of Hope, the IAEA initiative to increase access to radiotherapy for cancer patients in low- and middle-income countries. Nine months into the initiative, Chad is making preparations for its first cancer therapy centre in N'Djamena and plans to launch its National Cancer Control Plan (NCCP) in early 2023, while Senegal has recently completed its NCCP, detailing an ambitious national objective to scale up cancer care outside Dakar, in particular increasing access in Diamniadio.

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- Chad is preparing for its first cancer therapy centre in N'Djamena and intends to launch its NCCP in 2023.
- In May 2022, more than 50 national healthcare professionals gathered to validate Senegal's NCCP together with IAEA staff and international experts. The NCCP focuses on scaling up cancer care, with a particular focus on improved access in Diamniadio.

Improving access to cancer care in Senegal

Today, there are four operational linear accelerators — the machine most commonly used to deliver radiotherapy to cancer patients — in Senegal, each of which has a capacity to treat approximately 30 patients a day, under normal conditions. The country is also expanding its nuclear medicine services with a plan to serve other countries in the West African region. The IAEA has supported Senegal in the evolution of its programme on cancer care, including upgrading from 2D to 3D radiotherapy and brachytherapy in 2019, which has the benefit of producing more individualized patient treatment, better clinical outcomes and reduced side effects.

In May 2022, at an event marking a pivotal milestone for Senegal, more than 50 national professionals from hospitals, public administration and civil society participated in the official validation of the national NCCP for 2022–2025, alongside IAEA officials and international experts in cancer control.

"The development and adoption of this new NCCP allows the government of Senegal to identify the priorities for cancer prevention and control," said Dr Babacar Gueye, Director of the Senegalese Ministry of Health's Directorate for Disease Control. "In particular, this plan will guide us in allocating the necessary resources to reactivate the cancer registry and to advance the decentralization of radiotherapy services.

"Furthermore, by defining the baseline and the targets for the next five years, we will be able to monitor and evaluate the progress of our capacity to scale up the access to cancer diagnosis and treatment to the whole country."

Macky Sall, President of Senegal and Chairperson of the African Union for 2022, promoted the potential of Rays of Hope to scale up access to cancer care in the region. (Photo: UN Video)

On World Cancer Day 2022, Rays of Hope was launched by IAEA Director General Rafael Mariano Grossi, joined by, among others, Senegal's President and Chairperson of the African Union, Macky Sall, who has since made statements championing the initiative in his country, across the African region and most recently at the 77th Session of the United Nations General Assembly.

Through the Rays of Hope initiative, the IAEA has provided technical advice to reinforce the cancer control programmes in these participating countries, where the two most common cancers are breast and cervical cancer, with the support of the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC).

Decentralizing cancer care in Chad

In 2020, following the development of a bankable document with IAEA assistance to describe their planned activities to potential donors, over €20 million was mobilized by the Kuwait Fund for Arab Economic Development in support of Chad's cancer control activities. In particular, the funds will be used to construct the first public centre for the treatment and control of cancer in N'Djamena, the national capital.

"The Rays of Hope initiative provides a concrete step for our country towards a long-term investment strategy," said Dr Fatima Haggar, National Coordinator of the Chadian Ministry of Public Health's Programme on Cancer. "This perspective will allow the government to develop a set of milestones to be achieved during the next ten to fifteen years to ensure the whole population of Chad has equal access to diagnosis and treatment services."

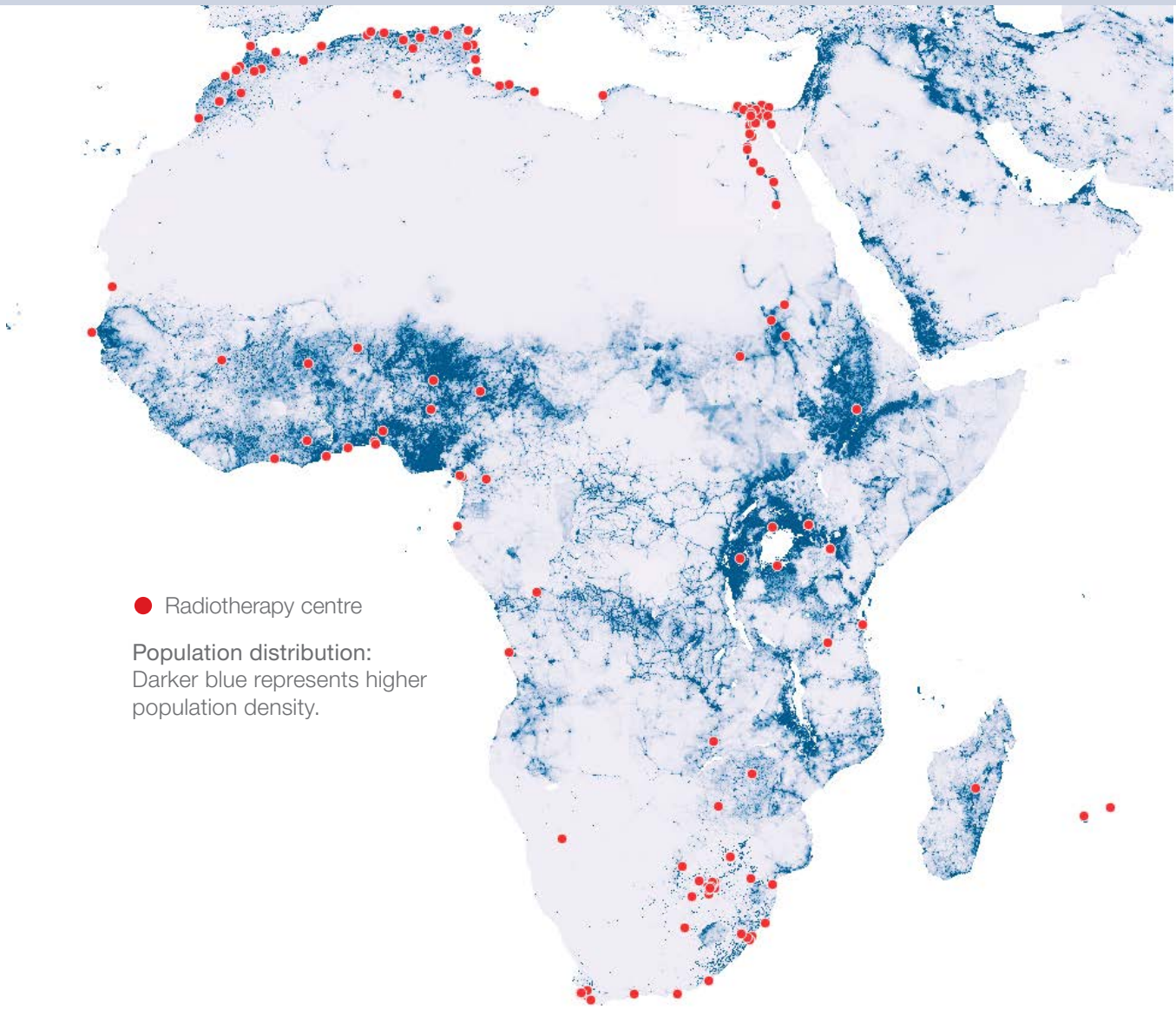
Chad's NCCP for the 2022–2026 period includes the development of capacity building programmes in medical oncology, radiation oncology and surgical oncology for all categories of staff — including physicians, technologists, medical physicists and nurses — and the construction of the first cancer centre in Ndjamena region. The completion of the NCCP, along with the anticipated completion of the cancer centre in 2025, brings important progress and hope for cancer patients in Chad.

"As we all know, a stand-alone initiative cannot tackle the cancer burden," Dr Haggar said. "We must ensure a comprehensive strategy to address the whole continuum of cancer, from prevention to palliative care. By establishing the first cancer centre in N'djamena and strengthening our information system, we want to promote the comprehensive care of cancer patients, ensure an effective referral system to the centre and the timely diagnosis and appropriate treatment of patients."

Following the recommendations of an assessment of cancer control (imPACT Review) in Chad in 2012, the country has focused efforts on training in oncology for doctors, setting up a unit of paediatric care, while strengthening anatomical units and imaging equipment. Because there is no radiotherapy programme yet in Chad, a radiotherapy referral system facilitates the travel and treatment of patients to receive radiotherapy abroad, mainly in Cameroon, Egypt, France, Jordan, Sudan, Turkey and Tunisia. Instituting national radiotherapy capability is precisely the area that Rays of Hope can help improve.

For Chad and Senegal, as well as other countries in need of increased access to radiotherapy for cancer patients, Rays of Hope is already starting to build on the IAEA's strong history of support in healthcare where it most needed.

OVER 70% OF THE POPULATION OF AFRICA DOES NOT HAVE ACCESS TO RADIOTHERAPY.



Practical training sessions on the use of radiopharmaceuticals with African experts took place in Indonesia. (Photo: Indonesia's National Nuclear Energy Agency (BATAN))

Building radiopharmaceutical sustainability for cancer care in Africa

Puja Daya, IAEA Office of Public Information

Cancer is a leading cause of death globally, but it is one that hits lower income countries particularly hard. Without the use of radiopharmaceuticals — medical drugs containing radioisotopes — the abilities of doctors in such countries to detect and treat cancer are limited.

This problem is especially acute in Africa. In order to address it, the IAEA is helping African countries to build expertise through educational and training programmes, and to develop their own facilities to locally produce radiopharmaceuticals, which in many cases have a short shelf life and need to be used quickly after production.

Local and independent radiopharmaceutical production will lessen African countries' reliance

AT A GLANCE

- Together with the Government of Morocco, the IAEA launched a French-language radiopharmacy master's programme in Africa. In 2021, the first cohort graduated, giving Burkina Faso, Côte d'Ivoire, the Democratic Republic of the Congo and Mauritius their own certified radiopharmacists for the first time. In South Africa, radiopharmacists from Ethiopia, Kenya, Uganda and Zambia completed similar master's programmes.
- With IAEA support, Tunisia has begun using positron emission tomography (PET), and Algeria installed a medical cyclotron to produce radiopharmaceuticals and PET imaging.

on imported shipments and expertise and help to reduce costs. Trained and qualified radiopharmacists are key to this strategy.

"Without qualified radiopharmacists, the sustainable use of radiopharmaceuticals for cancer care is nearly impossible," said Aruna Korde, a radiopharmaceutical scientist at the IAEA. She has been working with health and education authorities in Africa to develop training for local radiopharmacists. "Countries require their own radiopharmacists to contribute to the diagnosis of cancer patients as soon as possible, and we are helping make that happen by expanding radiopharmacist training into different languages," Korde said.

Through an IAEA technical cooperation project, in collaboration with the Government of Morocco, a French-language master's programme on radiopharmacy was introduced to address Africa's shortage of qualified radiopharmacists. In 2021, the first cohort from the programme graduated, giving Burkina Faso, Côte d'Ivoire, the Democratic Republic of the Congo and Mauritius their own certified radiopharmacists for the first time. A similar collaboration with South Africa led to radiopharmacists from Ethiopia, Kenya, Uganda and Zambia completing their master's programmes. Furthermore, radiopharmacists continue to be trained in Africa through hands-on training courses.

To enhance the knowledge of radiopharmaceuticals in the region, the IAEA is helping to establish the African Association of Radiopharmacy, to be launched in February 2022. The Association will bring together a network of radiopharmacy professionals to collaborate and share experiences. As part of this initiative, the IAEA is supporting both the development of a regional education centre to train radiopharmacists and the upgrading of facilities to strengthen the self-sufficient production of radiopharmaceuticals.

Expanding and upgrading radiopharmacy facilities

As the field of radiopharmaceuticals rapidly evolves and more advanced diagnostic techniques, such as positron emission tomography (PET) and radiotherapeutics, become increasingly common, countries new to radiopharmaceuticals need to catch up quickly, explained Korde.

"Countries require their own radiopharmacists to contribute to the diagnosis of cancer patients as soon as possible, and we are helping make that happen by expanding radiopharmacist training into different languages."

Aruna Korde
IAEA Radiopharmaceutical Scientist

Several African countries are working on expanding and upgrading their radiopharmaceutical facilities for the production of radiopharmaceuticals, with the help of the IAEA's technical cooperation programme and through IAEA coordinated research projects.

Through support from the IAEA, Tunisia has been able to start using PET, while Algeria recently installed and started a medical cyclotron — a machine that enables the country to produce its own radiopharmaceuticals and allows for routine PET imaging for many types of cancers, such as lymphomas and lung and colon cancers. This has also enabled the implementation of labelling with the radioisotope gallium-68, which is used for the diagnosis and staging of prostate cancer and neuroendocrine tumours. PET imaging will also allow for the introduction of effective and targeted cancer treatment therapy.

Nuclear medicine and PET imaging techniques are essential for cancer management but are increasingly expensive and inaccessible in many countries. With the new cyclotron facility in Algeria, it is now possible to easily produce large quantities of radiopharmaceuticals to help diagnose and treat more patients each day.

"The development and use of radiopharmaceuticals and their applications in recent years has allowed us to increase our knowledge in detecting, assessing and better treating various types of cancers we previously could not."

Salah Bouyoucef
Professor of Nuclear Medicine at the Bab El Oued Teaching Hospital in Algeria

Through IAEA initiatives, African countries that previously had no capacity to produce and use radiopharmaceuticals now do, or soon will. Ethiopia, for example, is in the midst of building its first medical cyclotron at St. Paul's Hospital Millennium Medical College in Addis Ababa.

The science: How radiopharmaceuticals work and fight cancer

Radiopharmacy involves the preparation and handling of radiopharmaceuticals for diagnosis, treatment and palliation, and is increasingly used for the management of cancer. It enables the screening of tumours, the selection of appropriate therapies, and the monitoring and evaluation of a tumour's behaviour. Radiopharmaceuticals are produced in hospitals or at industrial radiopharmacies by radiopharmacists, who are responsible for ensuring product quality and radiation safety.

Radiopharmaceuticals contain small amounts of radioactive substances called radioisotopes — atoms that emit radiation. The radioisotopes used can be produced by irradiating a specific target inside a nuclear research reactor or in particle accelerators, such as cyclotrons. Once produced, the radioisotopes are tagged on to certain molecules based on biological characteristics, which result in radiopharmaceuticals.

Once inside a patient's body, the different physical characteristics and biological properties of radiopharmaceuticals cause them to interact with or bind to different proteins or receptors. The drugs tend to concentrate more in specific body parts depending on the physiological processes and biological characteristics of the radiopharmaceutical. Using special cameras, doctors are able to precisely examine cancerous cells by selecting specific types of radiopharmaceuticals that bind with tumours and make them distinctive. If the radioisotope emits particulate radiation, the radiopharmaceutical may also be used in therapeutical applications.

Radiopharmaceuticals are medicines that contain small amounts of radioactive isotopes. They are used to diagnose and treat diseases, and need to be produced under carefully controlled conditions and tested for quality before being given to patients. (Photo: S. Slavchev/IAEA)

Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation, met with Andrew Holness, Prime Minister of Jamaica, at the University Hospital of the West Indies. (Photo: IAEA)

Jamaica opens its first public nuclear medicine centre with IAEA support

Press release

A new nuclear medicine centre that will provide the life-saving diagnosis and treatment of non-communicable diseases has opened in Jamaica, with the support of the International Atomic Energy Agency (IAEA) under its Rays of Hope initiative launched earlier this year to help countries fight cancer. The country's first such public centre is located in the University Hospital of the West Indies in the capital Kingston, and will help with the management of cancer and other diseases — including cardiovascular diseases, diabetes and chronic respiratory diseases — that are responsible for of seven out of ten deaths in Jamaica.

AT A GLANCE

- With IAEA support through the Rays of Hope initiative, a new nuclear medicine centre was inaugurated at the University Hospital of the West Indies in Jamaica. The IAEA provided equipment, including a SPECT/CT diagnostic machine, a dose calibrator and radiopharmacy equipment.

Although it has more than 7 000 new cancer cases per year, until now Jamaica has only operated four teletherapy machines in its public medical facilities and had no nuclear medicine facilities. Patients, including those with prostate, lung and colorectal cancer — the most common types in the country — can now also be diagnosed in the new centre, which will extend the overall capabilities of the country.

"Nuclear medicine and its support for early diagnosis and treatment can mean the difference between life and death. This facility will benefit citizens of Jamaica and the wider Caribbean — patients can now get cutting edge care at a fraction of the cost," said Prime Minister Andrew Holness at the inauguration ceremony on 30 June. "This will be the only public nuclear medicine in the country — and it is a result of the teamwork with the International Atomic Energy Agency," he continued.

Prime Minister Holness, who attended the inauguration ceremony at University Hospital, also spoke about the importance of continuing cooperation with the IAEA to provide solutions to sustain operation of the centre and to maintain the skills of its staff. In the future, the facility might also serve as a regional centre providing support to neighbouring countries.

"Today, we celebrate a significant milestone in the fight against non-communicable diseases," said Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation. He also talked about the future cooperation under the IAEA's Rays of Hope. "Through Rays of Hope, we will continue to support the expansion of radiation medicine capacities in Jamaica, in diagnosis as well as treatment, including through support for the development and training of the national cancer care workforce," he added.

Under the umbrella of the IAEA's technical cooperation programme, the IAEA provided the new centre with essential equipment, such as a SPECT/CT diagnostic machine, a dose calibrator, equipment for radiopharmacy facilities and phantoms, together with a supply of the material and reagents necessary for nuclear medicine. As a part of the assistance, the IAEA has trained staff, including nuclear medicine technologists, radiopharmacists, radiologists, and medical physicists, in clinical applications of nuclear medicine. IAEA experts have also advised the country on how to establish an accredited training programme for nuclear medicine professionals.

The IAEA's targeted assistance to Jamaica in this area started in 2014, 12 years after the last existing public nuclear medicine facility closed due to the lack of personnel and resources. Since then, Jamaica has operated two private facilities, which many people cannot afford. The facilities also did not have sufficient capacity for the country's population of almost three million people.

The safe and secure use of the radioactive material necessary for the treatment and diagnosis of patients in the new centre will be overseen by the Hazardous Substances Regulatory Authority (HSRA), the country's independent regulatory body. The HSRA was launched in 2020, the first fully independent and operational body in the Caribbean Community (CARICOM). Through the technical cooperation programme, the IAEA provided the HSRA with training and equipment to conduct regulatory functions and guidance to establish a new database for the inventory of radiation sources.

To ensure sustainability and to contribute to the expansion of services, the IAEA will continue to provide Jamaica with assistance including PET/CT technology, radionuclide therapy, and the further training of medical professionals. Such assistance is aligned with Jamaica's National Development Plan, Vision 2030. The Plan is built on four strategic goals for the country's development — one of which is "A Healthy and Stable Population."

The IAEA has six decades of experience in helping countries fight non-communicable diseases, including cancer. The assistance provided by the IAEA has enabled many countries, including those in Latin America and the Caribbean, to establish and strengthen safe, secure and effective radiation medicine including radiotherapy, radiology and nuclear medicine capabilities.

Attendees at the event, 'Revealing Secrets Using Nuclear Techniques,' held during IAEA's 66th General Conference, were given an overview of the ways in which nuclear techniques can be used to investigate the composition and origin of historical objects. (Photo: A. Vlasov/IAEA)

From ancient artefacts to Slovenian truffles: revealing secrets using nuclear techniques

Annie Engstroem, IAEA Office of Public Information and Communication

During an analysis of Vincent van Gogh's artwork 'Head of a Peasant Woman,' art conservators at the National Galleries of Scotland made a surprising discovery: a self-portrait of the painter was hidden underneath layers of glue and cardboard. The discovery was possible thanks to nuclear non-destructive testing (NDT), a method involving X-rays used to detect the presence and measure the concentration of elements in virtually all types of material.

X-ray fluorescence (XRF) was one of several nuclear analytical techniques discussed on 26 September by participants of the event, 'Revealing Secrets Using Nuclear Techniques,' held during IAEA's 66th General Conference, to showcase the potential of nuclear techniques in uncovering secrets of both the past and the present.

AT A GLANCE

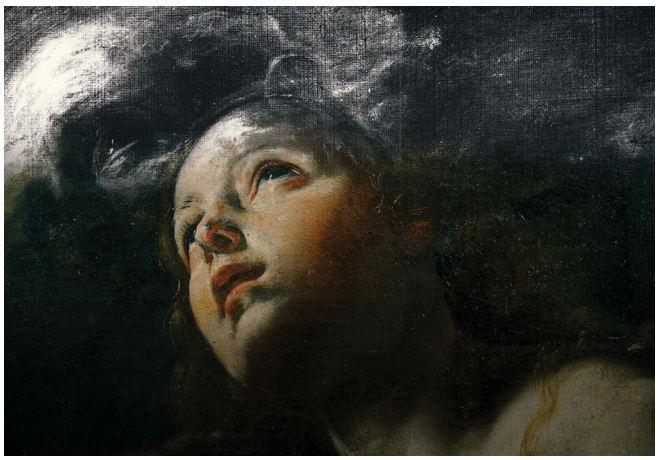
- At the 66th IAEA General Conference, participants learned about the varied applications of nuclear non-destructive testing techniques, including dating cultural artefacts and preventing food fraud.
- Through NDT, it was discovered that Vincent van Gogh's painting, 'Head of a Peasant Woman,' contains a self-portrait beneath the surface.

Attendees also heard about the applicability of NDT in various domains, from investigating the composition and origin of historical objects to revealing fraud and verifying the authenticity of paintings, food and timber.

In the field of cultural heritage, non-destructive testing techniques allow researchers to assess the integrity and physical properties of objects without damaging them, in contrast to traditional chemical analytical methods, which have proved valuable to restorers when dealing with historical artefacts and other valuable or fragile pieces.

"Cultural heritage objects contain within their building blocks information that can only be unravelled by scientific analysis and examination," said Matthew Grima, forensic scientist and manager at Heritage Malta's Diagnostic Science Laboratories. "It is thus fantastic to be able to apply them also in a non-destructive way, sourcing the information without damaging the object."

At the event, attendees learned that accelerator-based techniques, like ion beam analysis (IBA) can be applied to determine the composition of cultural artefacts, such as paintings. For instance, it is possible to get analytical information from the sub-surface of a painting, in addition to the X-ray fluorescence spectroscopy data that provides analytical information from the surface. The combination of these techniques revealed that the sfumato technique, a fine shading artistic technique perfected by Leonardo da Vinci, was used to produce a soft transition between colours and tones to achieve a realistic impression in several renaissance paintings, including the Mona Lisa.



Using x-radiography to uncover hidden paintings. (Photo: Heritage Malta)

"This example shows that accelerator and portable systems are complementary nuclear based-techniques for the NDT of paintings and more generally for cultural heritage materials," said Lucile Beck, researcher in cultural heritage at the French Alternative Energies and Atomic Energy Commission (CEA).

Radiocarbon dating, an additional accelerator-based nuclear analytical technique, has been used to determine the age of cultural heritage items by examining the decay of the radioactive isotope carbon-14 to reveal how old artefacts are or the order in which certain events happened.

An additional outstanding capability of accelerator-based analytical techniques is their use to determine the composition, structure and age of cultural artefacts, which in turn can be used to identify their origin and trading routes and reveal forgeries.

Attendees also gained insight into the application of nuclear analytical techniques in other areas, such as the traceability and authenticity of food. In this field, the use of stable isotope analysis can provide evidence of food adulteration or substitution, and verify the geographical origin of food products.

Pointing out the important role of nuclear techniques in assessing the authenticity of food, particularly those with high-value labelling claims, Lidija Strojnik, researcher at the Josef Stefan Institute in Slovenia, said, "food fraud is a big global issue since it affects 10 per cent of the global food supply and costs the global industry between $30 to 40 billion every year. The use of stable isotopes opens up new possibilities to detect food fraud in the supply chain, such as the mislabelling of the country of origin of food crops and the adulteration of natural flavours with cheaper synthetic counterparts." In Slovenia, fraudulent truffles, the world's most expensive food, were identified through isotopic analysis.

The versatile applications of nuclear analytical techniques were emphasized by all participating experts, who discussed the breadth of their utility, which even extends to countering and monitoring environmental issues. Participants also learned that isotopic techniques can be used to counter deforestation by tracing the origin of timber and revealing illegal logging, and to uncover and predict the source of greenhouse gases in the atmosphere.

The student winners of the 2021 competition were selected based on a video contest in which they demonstrated how nuclear science and technology can help meet the United Nations Sustainable Development Goals. The winning teachers were chosen from video submissions discussing innovative science teaching methods. (Photo: IAEA)

International Youth Day: new IAEA nuclear science and technology student competition for Asia

Omar Yusuf, IAEA Department of Technical Cooperation

Sustainable development needs the energy, skills and drive of young people, and the focus of this year's International Youth Day, observed annually on 12 August, is building and promoting greater intergenerational solidarity. The IAEA supports this effort and is working to foster greater interest in nuclear science and technology in young people through a new series of student and teacher competitions in Asia and the Pacific — winners will participate in a 2023 study tour of the IAEA's laboratories and facilities in Austria.

"The world envisioned by the Global Sustainable Development Agenda is one which today's youth will inherit, so their engagement with global development challenges, and their familiarity with science-backed solutions, will be the key to success," said Jane Gerardo-Abaya, Director of the IAEA's Technical Cooperation Division for Asia and the Pacific. "The IAEA's nuclear science

AT A GLANCE

- On International Youth Day, a competition on the benefits of nuclear technology was launched for students and teachers in the Asia-Pacific region. The winners are invited to the IAEA for a week-long study programme.

and technology (NST) student competitions help us to pass the baton on to the next generation, by sparking interest early and highlighting the potential of science to change the world."

Launched on 2 August, the 2022–2023 student competition was open to three categories of participants. Secondary school students were asked to develop 3-minute-long video presentations describing the potential of nuclear technology to address the challenge of global plastic pollution, while their older peers in universities or other tertiary academic institutions were invited to share proposals to enhance the reach, impact and sustainability of IAEA activities through partnerships and through the IAEA's key programmes, including NUclear TEChnology for Controlling Plastic Pollution (NUTEC Plastics), Rays of Hope and the Zoonotic Disease Integrated Action (ZODIAC) initiative. Finally, the video submissions of participating teachers focus on new and creative methods they have devised to introduce students without scientific backgrounds to nuclear science and technology and related topics.

Interested students and teachers had until 21 October 2022 to submit their proposals via the official website and, following review by IAEA experts, the selected finalists presented their projects at the 2023 Virtual NST Education Exhibition during a live question and answer session. The session kicked off on the International Day of Education, 24 January 2023, and concluded on the International Day of Women and Girls in Science, 10 February. The competition winners will be invited to visit the IAEA's headquarters in Vienna to participate in a week-long study tour.

"The IAEA's nuclear science and technology (NST) student competitions help us to pass the baton onto the next generation, by sparking interest early and highlighting the potential of science to change the world."

Jane Gerardo-Abaya, Director of the IAEA's Technical Cooperation Division for Asia and the Pacific

Increasing youth engagement

Over the years, the IAEA has been looking to strengthen its engagement with Asian youth. In 2018, the IAEA launched a regional technical cooperation project that aimed to supply secondary school teachers in 26 Asian and Pacific countries with the curricula and tools needed to introduce nuclear and isotopic science to at least 1 000 000 young pupils between the ages of 12 and 18.[1]

In 2021, the IAEA organized student competitions to encourage high school students to think creatively about the role played by nuclear science and technology in meeting the Sustainable Development Goals. After receiving more than 200 video submissions from students at 37 schools and institutions, the IAEA organized a virtual nuclear science and technology education exhibition — attended by over 20 000 visitors from 100 countries — to showcase the contributions of the winning student teams, as well as participating teachers. As the project reached more students, its objective grew more ambitious: the target audience was expanded beyond secondary school students to include students in tertiary education.

1 RAS0079, 'Educating Secondary Students and Science Teachers on Nuclear Science and Technology'

Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation, delivers remarks at the meeting of RCA national representatives (Photo: J. O'Brien/IAEA)

RCA recognizes key achievements with awards on 50th anniversary

Melissa Evans, IAEA Department of Technical Cooperation
Zoe Dahse, IAEA Department of Technical Cooperation

Attendees at an event to mark the 50th anniversary of the Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA) heard IAEA Director General Rafael Grossi describe the Agreement as a "beautiful example of cooperation that is based on the desire to improve the lives of people in this region."

With IAEA support, the RCA has successfully promoted human resource development in the region for the past five decades. More than 170 RCA projects have enabled training for 10 000 counterparts through over 650 regional training courses. In addition, more than 4 500 experts and lecturers have been recruited to provide expertise, experience and skills for the safe, effective and efficient use of nuclear technology in support of sustainable development.

AT A GLANCE

- 2022 marked the 50th anniversary of the Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA).
- IAEA General Conference participants celebrated the successes of the RCA, including more than 170 RCA projects completed with IAEA support.

Held on the margins of the IAEA's 66th General Conference to mark the 50th Anniversary of the RCA's founding, the first-ever RCA Ministerial-Level Meeting provided a unique opportunity to reflect on these and other accomplishments. To recognize particularly outstanding achievements, an awards ceremony convened by the RCA Chair, Tran Chi Thanh from Viet Nam, honoured the contributions of individuals and institutions. Twenty-eight awards were presented to recipients from 12 countries, each recipient nominated by RCA State Parties based upon their long-term commitment and support to the RCA programme.

"These major achievements and success stories can serve as strong examples of regional cohesion and cooperation, and we must take lessons learned from the past fifty years to strive to build on our successes," said Hua Liu, Deputy Director General and Head of the Department of Technical Cooperation, speaking at the awards ceremony.

At the Ministerial-Level Meeting, RCA State Parties reinforced their commitment to the IAEA's technical cooperation programme, through the adoption of a Joint Declaration. The declaration reaffirms the vital role of the RCA in facilitating the peaceful application of nuclear science and technology, contributing to addressing regional challenges and enhancing the socio-economic well-being of the region. In addition to underscoring the continued importance of the 50-year-old agreement, the Joint Declaration sets out future priorities, including expanding membership in the region and strengthening partnerships to ensure far-reaching success.

Also during the week of the IAEA General Conference, a meeting of RCA national representatives provided a platform to determine future regional priorities for the agreement. State Parties heard how the RCA Medium Term Strategy for 2024–2029 is being drafted by a working group based on lessons learned from the previous iteration.

Representatives also discussed the outcomes of a feasibility study focused on a potential RCA scholarship programme in nuclear-related fields that could build regional capacity of highly qualified human resources through master's degree programmes. On behalf of Viet Nam, which holds the current RCA Chairpersonship, Minister of Science and Technology Huynh Thanh Dat underscored the key role of human resources in the success of any scientific or nuclear programme. "We are living in a time where we have many critical problems that pose an issue to future development, so we need more human resources," he said.

The scholarship programme under discussion would expand on existing IAEA support, with the aim of reaching around 1000 RCA awardees by 2032. In Asia and the Pacific, many countries have already established postgraduate education scholarship programmes in a broad range of nuclear-related disciplines, in addition to the IAEA's Marie Sklodowska-Curie Fellowship Programme, which sponsors around 100 women students per year.

As the first of the IAEA's regional agreements, the RCA has grown from a ground-breaking initiative to a catalyst for development in the region. "The RCA has 50 years of experience, let us commit for another 50 years and for generations to come," IAEA Director General Rafael Grossi said.

History of the RCA

The RCA was founded in 1972 under the auspices of the IAEA to promote regional cooperation in the peaceful uses of nuclear science and technology to address regional challenges through research and development.

There are now 22 State Parties to the RCA Agreement: Australia, Bangladesh, Cambodia, China, Fiji, India, Indonesia, Japan, Republic of Korea, Laos, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Palau, Philippines, Singapore, Sri Lanka, Thailand and Viet Nam.

State Parties to the Regional Cooperative Agreement meet on the margins of the General Conference (Photo: J. O'Brien/IAEA)

In January 2022, experts from Cuba's CPHR successfully extracted more than 50 disused sealed sources, conducting the operation unaided by international experts. (Photo: CPHR)

Experts safely manage disused radioactive sources after revival of Cuba's food irradiation services

Omar Yusuf, IAEA Department of Technical Cooperation

Technologists from Cuba's Centre for Radiation Protection and Hygiene (CPHR) successfully removed 52 disused sealed radioactive sources from the country's only food irradiation plant on 11 and 12 January, transferring them to the waste management facility for safe and secure storage. Organized for the first time under the supervision of Cuba's nuclear regulatory authority, this operation demonstrated the experience and skills acquired by CPHR staff following IAEA capacity building support in this area over many years.

"This achievement represents the latest milestone in the country's efforts to re-establish its discontinued food irradiation services," said Raquel Scamilla Andreo Aledo, IAEA Programme Management Officer for Cuba. "These efforts further demonstrate Cuban efforts to promote the safe and secure implementation of radiation applications for the benefit of the economy."

AT A GLANCE

- In line with the IAEA Safety Standards, 52 disused radioactive sources were removed from Cuba's food irradiation plant and transferred to Cuba's Centre for Radiation Protection and Hygiene's waste management facilities for storage.

Regaining capacities, resuming operations

In 1987, with IAEA support, Cuba's Food Irradiation Plant (PIA), the first and only facility of its kind in the country, was put into operation at the Food Industry Research Institute (IIIA) in Havana with the aim of improving food quality, reducing spoilage and destroying bacteria through food irradiation.

A decade later, however, the PIA discontinued its irradiation services due in part to the decreasing radioactivity of their sealed sources and the need for technological improvements at the facility. In 2005, Cuba's Nuclear Energy and Advanced Technologies Agency (AENTA) developed a strategy to redevelop the country's irradiation capacities. The strategy was supported by an IAEA technical cooperation (TC) project[2] designed to promote and encourage radiation services in important sectors of the country's economy.

Following expert missions, training courses and the provision of equipment through the TC programme, in February 2019 IAEA experts and Cuban specialists installed new cobalt-60 radioactive sources at PIA, enabling the facility to reopen its doors and make its services available after a near 25-year hiatus.

To finalize the installation of the new sources, their low-activity predecessors had to be removed. However, without a suitable container available for the safe and secure transport and storage of the disused radioactive sources, they could not be transferred to Cuba's radioactive waste storage facility and consequently were deposited into a reserve pit, located in the same facility of the irradiator. These activities were carried out with the assistance of IAEA experts.

"The reserve pit has the same design as the main irradiator pit," explained IAEA Nuclear Engineer Juan Carlos Benitez Navarro. "Its function is to temporarily store sealed radioactive sources in special circumstances, for example for resourcing, maintenance, or repair works in the irradiator."

In mid-2021, the transport and storage container was procured through a regional TC project[3]. The container provided adequate shielding for the 52 disused radioactive sources. Subsequently, in early 2022, operations to extract the sources from the reserve pit began.

Organizing a safe source removal operation

Before launching the sealed radioactive source removal operation, CPHR experts received guidance and training in the handling of the container, its auxiliary components and their corresponding tools. Special devices had to be designed and manufactured to facilitate the alignment of the container with the channels of the reserve pit.

A comprehensive safety assessment was also conducted, based on the IAEA Safety Standards, identifying safety barriers and any potential for accidents and their consequences. Operational doses under normal and accident conditions were estimated and a radiological emergency response plan was prepared to ensure the safety of the experts and the success of the operation.

All related documents were submitted to the Nuclear Safety Directorate (DSN), the national regulatory authority of Cuba in radiological and nuclear safety matters, which carried out its evaluation and approved the CPHR plans.

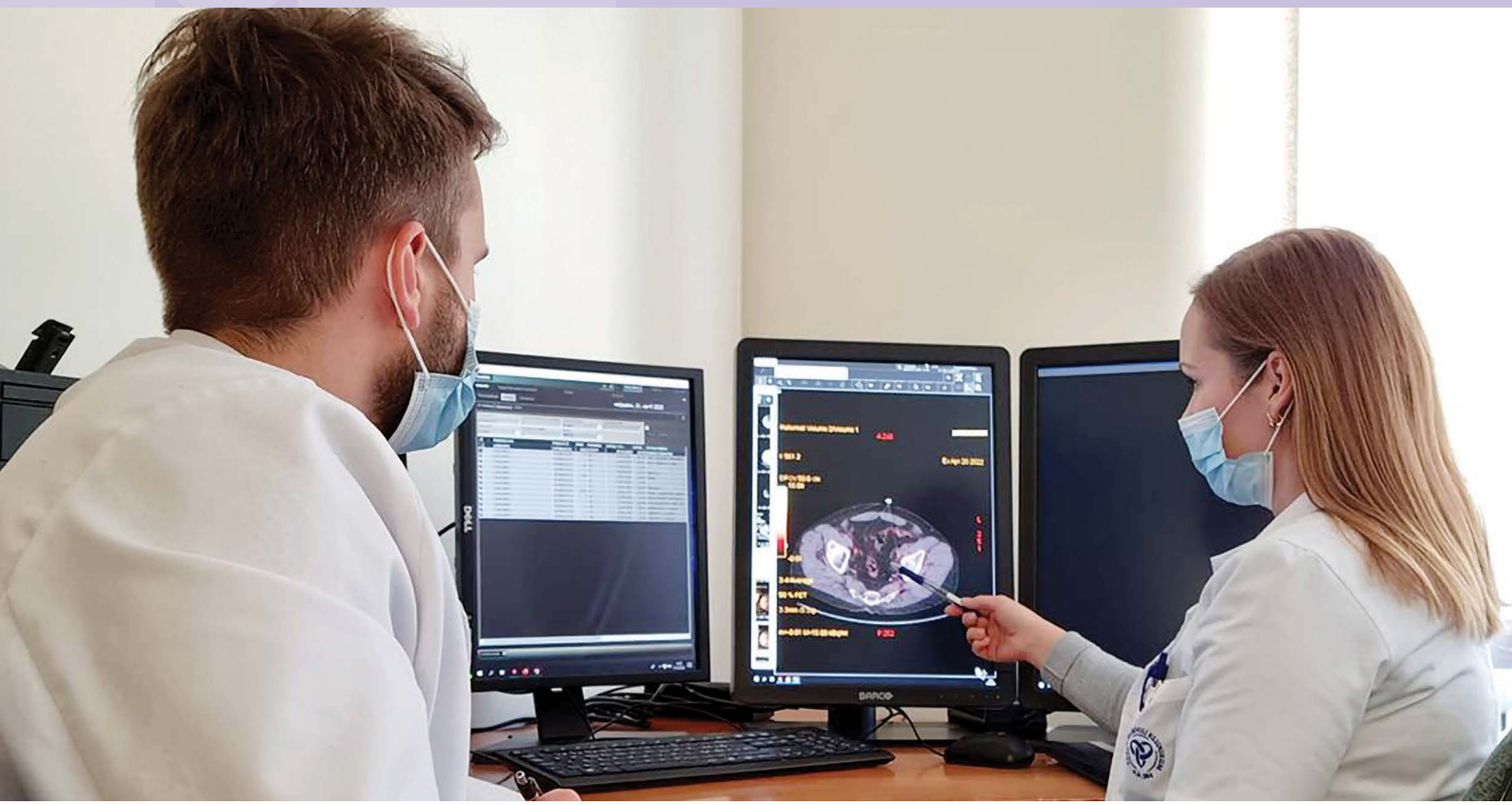
Finally, tests were carried out at the reserve pit to evaluate and verify the correct operation of the container and the custom source handling tool.

On 12 January, the 52 disused radioactive sources were removed from the reserve pit and loaded to the container as planned and transported to the CPHR's waste management facilities where they are now safely stored.

The IAEA Safety Standards help to ensure appropriate safety measures are implemented during the management of disused sealed radioactive sources.

2 CUB1012, "Improvement of Radiation Services in Cuba"

3 RLA9078, "Enhancing the National Regulatory Framework and Technological Capabilities for Radioactive Waste Management



Radiologists consulting patient data in the national Picture Archiving Communication System. (Photo: Tartu University Hospital, Estonia)

IAEA steps up efforts to ensure patient safety during medical procedures using radiation

Lenka Dojcanova, IAEA Office of Public Information and Communication

Medical procedures using radiation are saving lives around the globe every day. A strong national framework for radiation protection and safety ensures that patients are protected during these procedures. In March 2022, the IAEA piloted a model for a new type of advisory mission to assess such a framework in Estonia, which ensures that benefits outweigh the risks.

Every year, four billion diagnostic and therapeutic procedures using ionizing radiation are conducted around the world including radiotherapy, nuclear X-ray imaging, such as X-rays and computed tomography.

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- International experts completed a pilot mission to Estonia to review national regulations and documents, conduct interviews and visit sites to evaluate them against the radiation protection and safety framework.
- The pilot mission to Estonia served to help experts improve the methodology and guidelines for future safety standards country visits.

Medical professionals need to select the most appropriate medical procedures and perform them safely using the right dose to diagnose and treat diseases such as cancer.

"There are frequently observed gaps in the implementation of safety standards related to medical exposure around the world, which could have an impact on patients' safety. To improve the situation, the IAEA is stepping up its efforts in assisting countries not only on how to improve the regulatory framework but also on how to implement different aspects."

Jenia Vassileva
IAEA Radiation Protection Specialist

While the IAEA is providing various peer reviews and advisory services related to radiation safety, there has not been a service focusing on the specific and comprehensive review of the national framework for radiation protection and safety in medicine.

Member States from Europe and Central Asia, a region with rapidly growing applications of advanced techniques in medicine, were the first to propose such missions under the technical cooperation programme.

Following the draft guidelines, a pilot mission was organized and an IAEA-led team of experts in regulatory and practical aspects of radiation protection in medicine compared the country's actual practices with the International Basic Safety Standards (BSS), which set a number of requirements and responsibilities to achieve radiation protection in medical exposures. The team also assessed arrangements against the Specific Safety Guide on Radiation Protection and Safety in Medical Uses of Ionizing Radiation, which provides recommendations and guidance on fulfilling the BSS.

Pilot in Estonia

Estonia, which expressed interest in being the first pilot country, has been selected based on prerequisites such as an effective governmental, legal and regulatory framework for radiation safety that covers medical uses of ionizing radiation.

During the nine-day mission, experts from Croatia, Finland, Lithuania, Italy, Ireland and Slovenia reviewed national regulations and other written material and conducted interviews and site visits in close cooperation with the Estonian regulatory body, health authority, professional bodies and end users such as hospital staff. The experts visited Estonia's two radiotherapy and three nuclear medicine departments, and diagnostic and interventional departments in Tallinn, Tartu, Parnu and East Viru.

"The team recognized the willingness of Estonia to further strengthen the regulatory and practical arrangements for radiation protection and safety in medical exposures, and the openness and cooperation of all stakeholders involved in the mission activities," said Ritva Bly, the mission Team leader, and Principal Advisor of the Regulatory body of Finland (STUK).

As a good practice, the team recognized that authorized health professionals can consult the information about patient medical history in the national Picture Archiving Communication System (PACS), which saves patient exposure data along with images

"This mission helped us identify issues in the implementation of the safety standards related to medical exposure and receive advice on how to improve related regulations and mechanisms for its implementation in practice."

Ilmar Puskar
Head of the Climate and Radiation Safety Department at the Environmental Board of Estonia

and other patient information, when referring patients to a radiological procedure, or when deciding which procedure to perform. This helps avoiding unnecessary exposure of patients via, for instance, repeating exams without medical justification.

The team recommended improvements to national arrangements for communication with relevant professional bodies: for example, referral guidelines for strengthening justification of procedures are needed, as a practical tool for health professionals to select the most appropriate imaging method. In addition, the methodology for establishing and utilizing diagnostic reference levels, which indicate wherever doses to the patients or the amount of radiopharmaceuticals used for the same examination in different departments may be unusually high or low, should be updated.

Way forward

The pilot mission in Estonia offered an opportunity to test the methodology and guidelines of this upcoming advisory service that is yet to be formalized. Based on the results, the team identified areas for amendments such as better balancing of site visits and interviews, and improvements in the preparatory work.

The updated methodology will be used to design the next pilot under a new regional technical cooperation project aiming to continue strengthening patient safety and implementation of the justified and optimized use of ionizing radiation in medicine. Experiences from the pilots and improved guidelines will be used to design a new advisory service.

“Following these efforts, countries will be able to learn from each other thanks to exchange of experts and good practices,” said Eve-Kulli Kala, IAEA Director of Technical Cooperation Division for Europe. “Having good regulation and a framework for its implementation in medicine is a prerequisite for sustainable and efficient technical cooperation projects in this area.”

The IAEA’s first radiation safety pilot mission to Estonia was conducted in a hybrid format. (Photo: J. Vassileva, IAEA)

Regional Research Observatory on the Environment and Climate (RROEC) has been inaugurated by President of the Republic of Djibouti and Head of the Government Ismaïl Omar Guelleh. (Photo: IAEA)

Djibouti, with IAEA support, opens observatory to monitor climate change impacts

Press release

Djibouti inaugurated a research observatory in October 2022 to study the impact of climate change. The observatory, established with the assistance of the International Atomic Energy Agency (IAEA), will help the country prone to drought and famine to better manage water and food resources that are increasingly under threat from global warming. The new facility, the Regional Research Observatory on the Environment and Climate (RROEC), will use nuclear and related techniques to produce data and climate models that can inform political decisions on climate adaptation and resilience for the country, and potentially for the whole East African region.

"Thanks to the IAEA and other partners, this observatory became a reality — we are able to put in place reliable and operational models for climate change adaptation and lasting

AT A GLANCE

- A new Regional Research Observatory on the Environment and Climate was inaugurated in Djibouti in October 2022 with IAEA support.
- The observatory will use nuclear science and technology to produce climate models and other tools to inform governments' environment management plans.

resilience," said the President of the Republic of Djibouti and Head of the Government Ismaïl Omar Guelleh during the opening ceremony on 23 October, which was attended also by President of Somalia Hassan Sheikh Mohamud and other high-level representatives from the region including from Comoros, Ethiopia, Rwanda, Somalia, Sudan and Uganda.

Facing water scarcity due to low levels of precipitation, Djibouti's population of one million is highly vulnerable to climate change and the country imports nearly all of its food. Higher temperatures, increased aridity, water scarcity and rising sea levels are expected to continue to affect the country.

The observatory was inaugurated at the Climate Change and Research Conference held from 23 to 25 October, where scientists, students, researchers and decision makers from the East African region discussed regional environmental and climate issues. Over three days, they shared best practices and identified opportunities to initiate collaboration under the newly opened RROEC. In the future, the observatory will build and extend capacity to the whole East African region, where food scarcity caused by changes in climate has become a widespread challenge.

Some of the factors causing this situation are chronic droughts, floods, tropical cyclones and pest invasions. According to available research, if poor seasonal rainfall continues throughout this year, an unprecedented drought in the Horn of Africa, combined with famine, could be imminent. Also, if the temperature rises by 2°C compared with pre-industrial levels, over 90 per cent of East African coral reefs are projected to be severely degraded by bleaching, and African marine and freshwater fisheries will be significantly threatened.

"The burden of climate change falls disproportionately on the most vulnerable among us. Here in Djibouti, and across Africa, higher temperatures, droughts, and rising sea levels threaten lives and livelihoods," said IAEA Director General Rafael Mariano Grossi during his opening speech. Referring to RROEC, he said: "I am delighted that the IAEA was able to make it happen. But we will not stop here, we will continue to assist Djibouti to achieve its priorities including its climate change adaptation goals."

The RROEC will use information from isotopes — elements with specific physical and chemical properties — to produce climate models and mapping tools. It will track, among others, the origin of air masses that bring rain, groundwater replenishment rates, and the movement of water through the hydrological cycle. Such information can be used by governments and aid agencies to assist with the management and prevention of water crises or other environmental crises.

For example, isotopic data can be used to produce groundwater vulnerability maps that can inform decision makers about water availability in the aquifers. This information can support management of aquifers, increase awareness about water quality and scarcity, and improve warning systems on droughts and floods in Djibouti and the Horn of Africa.

RROEC has been built with the help of the IAEA's technical cooperation programme, which supported training programmes, expert activities and the supply of state-of-the-art laboratory equipment. The Observatory is operated by local staff, who have been trained by the IAEA on various nuclear applications related to climate change and adaptation matters.

Environmental protection and climate change is one of the areas identified in the Country Programme Framework signed between Djibouti and the IAEA for the years 2022–2027. This framework is the reference for the medium-term planning of technical cooperation between a Member State and the IAEA, and identifies priority areas where the transfer of nuclear technology through the technical cooperation programme will be directed to support national development priorities.

Between 2012 and 2020, the IAEA supported 120 countries in climate adaptation projects, many of them in Africa. The Agency attends the annual United Nations Climate Change Conferences, more commonly referred to as the Conference of the Parties, or COP, and organizes several events to highlight how nuclear technology and applications contribute to tackling climate change. COP27 started on 6 November in Egypt.

Students during the IAEA's first PhD conference on 11 March in Vienna, Austria. (Photo: J. O'Brien)

In search of groundwater: PhD students from the Sahel meet to characterize and understand water

Lenka Dojcanova, IAEA Office of Public Information and Communication

Making sure there is enough fresh water to support the 135 million people in one of the driest regions on earth was the subject of the first ever IAEA conference for PhD students held in March 2022. Sixteen attendees from Africa's Sahel region presented their work and results on how to improve the management of water resources using isotope hydrology techniques.

During the one-day meeting, the young researchers discussed solutions that can be used in the Sahel, where water demand is projected to increase fourfold in households, and ninefold in industry by 2050. Groundwater resources will continue to be used to meet this growing demand.

The PhD conference was part of a technical cooperation project to support thirteen African countries to better understand and manage

AT A GLANCE

- With IAEA support, young researchers from thirteen African countries are gaining expertise in groundwater resource management.
- As part of a regional technical cooperation project, African PhD students from the Sahel region convened in Vienna in March 2022 to discuss their research on improving water management using isotope hydrology techniques.

shared water resources across the Sahel. With support from this project, students from Benin, Burkina Faso, Cameroon, the Central African Republic, Chad, Ghana, Nigeria, Senegal and Togo are working towards their PhD or post-doctoral programmes and will become experts trained to identify the origin, flow patterns, quality, and renewal rate of groundwater using isotopic techniques (see 'The Science').

"Using isotopes to date and characterise the qualitative potential of water has taught me that groundwater is a strategic resource, and its protection is indispensable," said Fricelle Song from Cameroon, who is studying at the university in her home country and also at a university in France. "This PhD programme is helping me acquire many skills including analytical laboratory techniques essential for the proper functioning of the laboratory at my university."

During their studies at the partner universities abroad – in Canada, Ghana, France, Italy, Morocco and Tunisia – the students from the Sahel are gaining additional expertise as well as skills in the collecting samples in the field and analysing them in isotope laboratories.

"Investment in people is the most important investment we can make. This unique conference served as a platform to connect these students, connect their research, and connect their countries," said Neil Jarvis, the IAEA Section Head responsible for the project.

The current technical cooperation project addresses characterization, management and monitoring of groundwater through data collection and interpretation, and training. It builds on an earlier project, in which scientists from Algeria, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal and Togo were trained in water sampling for isotopic analysis in order to carry out a detailed survey of groundwater supplies.

Building on the first phase of the project which ended in 2017, they have analysed a further 2 000 water samples from different aquifers from five major transboundary aquifer systems: the Iullemeden Aquifer System, the Liptako-Gourma-Upper Volta System, the Senegalo-Mauritanian Basin, the Lake Chad Basin and the Taoudeni Basin. The results from this water analysis provided critical information for the management of water systems in these basins. "You cannot manage what you don't measure. The new data confirmed the presence of large amounts of good quality groundwater," said Jodie Miller, Head of the Isotope Hydrology Section at the IAEA and the chair of the PhD conference. "Now it is up to the national and regional experts, including these PhD students, to work together to understand and interpret these data."

The project also contributes to the goals of Africa's Agenda 2063 and to the UN's 2030 Sustainable Development Goals (SDGs), specifically to SDG 6, which is calling to ensure the availability and sustainable management of water and sanitation for all by 2030. According to the UN Global Acceleration Framework, one of the accelerators on how to solve water crisis is to improve data and information accessibility for decision makers.

The science

Water is naturally tagged with isotopic 'fingerprints.' These enable scientists to determine the source, age, movement and interactions of water above and below ground. Stable isotopes of water, oxygen-16, oxygen-18, hydrogen-1 and hydrogen-2, along with the radioactive isotope hydrogen-3 (tritium) help us better understand how and where to find water resources by measuring their amounts and proportions in samples to track the path of water molecules in the water cycle. They are commonly used to trace the source of water and its flow pathways during different hydrological processes, from precipitation to surface and groundwater, and further, into the drinking water supply. Such information provides a scientific basis needed for their sustainable management into the future.

The coordination meeting provided opportunities for project participants to visit aquifer springs, river catchment areas and other sites where groundwater may be sampled for analysis. (Photo: C. Henrich/IAEA)

Revealing hidden links between groundwater aquifers, climate change and human activities in Europe and Central Asia

Omar Yusuf, IAEA Department of Technical Cooperation

Close to 30 hydrology experts from 27 countries shared initial groundwater monitoring results in May 2022 at a regional coordination meeting in Krakow, Poland, as part of an IAEA technical cooperation project[4] to study the effects of climate change on groundwater aquifers in countries in Eastern Europe and Central Asia. The project brings together 28 countries and focuses on building capacity in the use of isotope hydrology to answer fundamental questions about the future availability of groundwater resources.

According to UN Water, an estimated 2.5 billion people worldwide depend entirely on groundwater for their livelihoods, which have come under threat due to the growing volatility of rainfall patterns and the growing frequency of extreme weather events.

AT A GLANCE

- Through a regional IAEA technical cooperation project, hydrology experts from 28 countries in Europe and Central Asia were trained to identify and monitor vulnerabilities impacting groundwater using isotopic techniques.
- Experts from 27 countries came together in May 2022 to discuss the effects of climate change on regional groundwater aquifers.

4 RER7013, 'Evaluating Groundwater Resources and Groundwater-Surface-Water Interactions in the Context of Adapting to Climate Change'

The direct and indirect effects of climate change on groundwater resources are not yet fully understood. “To develop sustainable water-use policies and adaptation strategies, national authorities first need a foundation of accurate data to understand potential threats to water security,” said Christoph Henrich, IAEA Programme Management Officer.

“Groundwater sustainability in Cyprus is threatened by a number of factors, many of which are projected to worsen or intensify in coming years,” added Christos Christophi, Senior Geological Officer at the Cyprus Geological Survey Department, one of the meeting participants. “In addition to the naturally semi-arid environment of Cyprus, challenges such as overexploitation, seawater intrusion and groundwater quality deterioration linked to human activities are major sources of pressure.”

Using skills developed through a series of IAEA training events conducted in 2020 and 2021, hydrology professionals participating in the project are now applying isotopic techniques to identify vulnerabilities affecting important local and transboundary groundwater resources, to calculate recharge rates and to model regional water cycles.

Eight case studies, each focusing on a particular geographic area or specific hydrology aspect, are being conducted through the ongoing project, including an assessment of the threat of nitrate contamination in European river basins, an exploration of the effects of climate change on irrigation waters across the European plain, and an analysis of factors affecting the sustainability of the Oko transboundary aquifer, which is shared by Bosnia & Herzegovina.

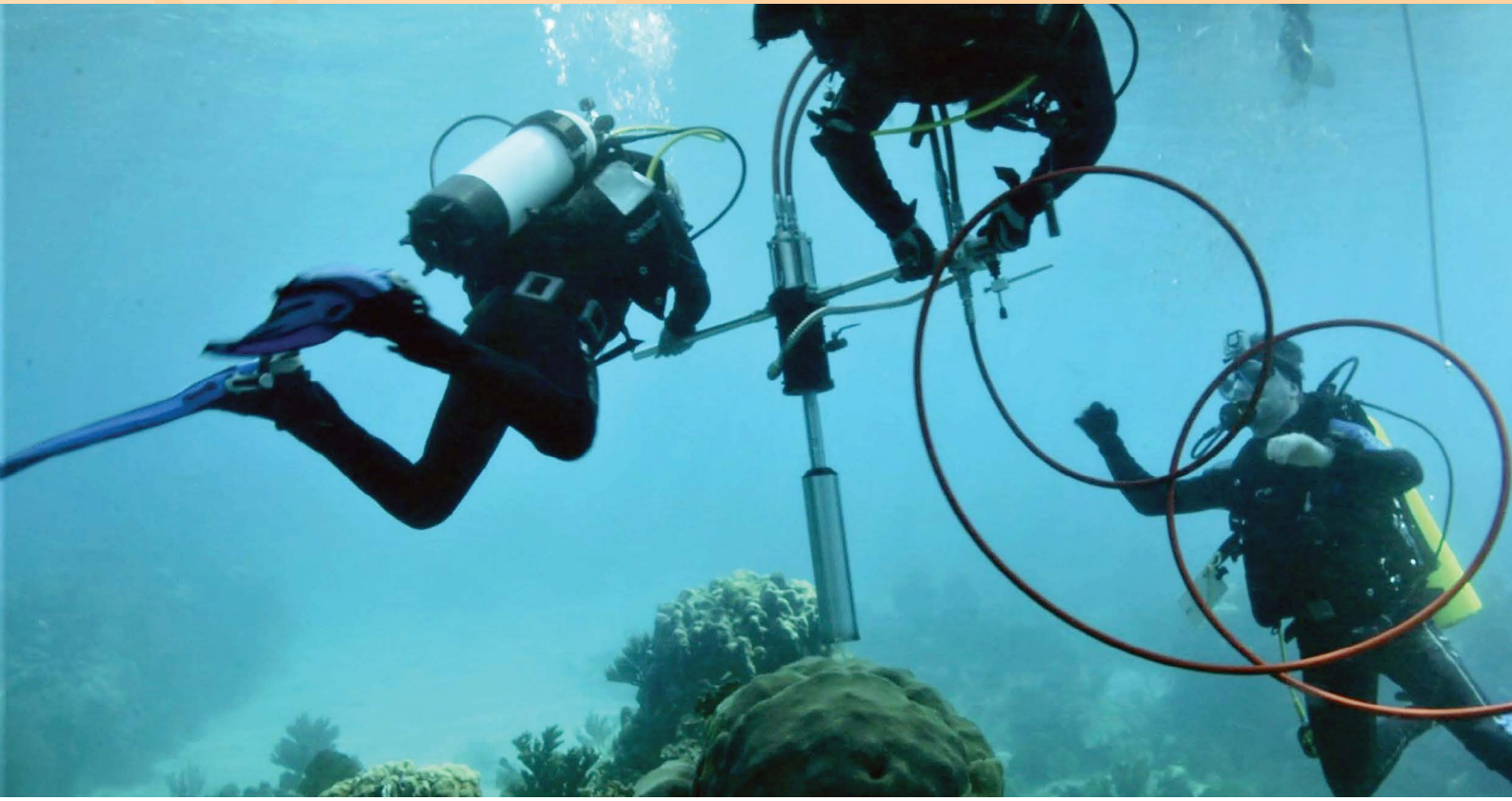
“Water resources in Poland, measured per capita, are naturally quite low. If we are to mitigate the nitrate pollution affecting our limited groundwater sources — which often finds its source in agricultural pesticides — we must first understand its origins and pathways,” explained Przemyslaw Wachniew of the Krakow University of Science and Technology, which hosted the meeting. “Environmental tracers are an indispensable tool in our study and allow us to quantify groundwater inflows to streams and to identify the sources of these nitrate contaminants.”

Held from 16 to 20 May, the meeting’s participants visited the Kocinka River catchment area, a groundwater monitoring site in Kocin, the Olczyskie karstic spring in the Tatra Mountains and thermal waters in Bukowina Tatrzanska.

Finally, under the supervision of IAEA and international experts, participants sampled groundwater from a treatment plant in Wierzchowisko, which will be analysed at national laboratories in the participating countries.

“The experts have now returned home and will soon analyse the groundwater jointly sampled in Wierzchowisko,” explained IAEA Isotope Hydrologist Oliver Kracht. “By transmitting their outcomes to the IAEA, we can compare all the resulting data to ensure their laboratory equipment is appropriately calibrated, their testing methods follow the correct procedure, and their measurements are accurate.”

The Kocinka catchment is located in southern Poland, discharges into the Liswarta and Vistula rivers, and sits atop none of the largest groundwater basins in Poland. (Photo: C. Henrich/IAEA)



Experts collect samples from a 230-year-old coral core to enable a historical reconstruction of pH and temperature trends. (Photo: L. Aragon Lopez/CEAC-CUBA)

First three countries in Latin America and the Caribbean submit marine sampling data to the SDG 14 monitoring portal

Omar Yusuf, IAEA Department of Technical Cooperation
Magali Zapata Cazier, IAEA Department of Technical Cooperation

Marine environment experts in Colombia, Cuba and Mexico have begun submitting marine sampling data to the United Nations' Sustainable Development Goal (SDG) 14.3.1 Data Portal, a monitoring tool developed by the United Nations Educational, Scientific and Cultural Organization's Intergovernmental Oceanographic Commission (IOC) for the sharing of ocean acidification data. The Data Portal, created in 2020, acts as a focal point for experts to submit, validate, store and share data related to ocean acidity, both for the purposes of SDG reporting and to establish a historic baseline and persisting trends in marine pH levels.

"Cuba, Colombia and Mexico are the three first countries in the region to have submitted

AT A GLANCE

- Marine sampling data collected at the Regional Observatory on Ocean Acidification was submitted to the United Nations' SDG 14.3.1 Data Portal by experts from Colombia, Cuba and Mexico.
- The Regional Observatory was established with the support of the IAEA's technical cooperation programme in 2020 by 18 Latin America and Caribbean countries, as part of the Marine Coastal Stressors Research Network for Latin America and the Caribbean (REMARCO).

reporting on this particular indicator, SDG 14.3.1," said Carlos Alonso Hernandez, Acting Section Head at the IAEA Environment Laboratories. "Given the importance of overcoming the challenges posed by ocean acidification, their data represents an encouraging milestone towards increasing understanding of the historical trend in pH in the region through the use of nuclear and isotopic techniques, and the impact of climate change on the oceans acidification."

The data was gathered from the Regional Observatory on Ocean Acidification, established with the support of the IAEA's technical cooperation programme in 2020 by 18 Latin America and Caribbean countries. The observatory is part of REMARCO, the Marine Coastal Stressors Research Network for Latin America and the Caribbean, and consists of 55 permanent coastal stations that measure marine acidity and study carbon absorption in regional waters.

Supporting ocean studies

REMARCO was set up in 2018 under the auspices of a regional IAEA technical cooperation project. The network provides a unique space for Latin American and Caribbean marine scientists to share data and research for peer review, and is supporting the harmonization of monitoring standards and practices in the region. Network members are also engaged in analysing marine and coastal environmental vulnerabilities. These are then shared with decision makers in the region.

REMARCO's network of experts are currently highlighting ocean acidification, harmful algal blooms (HABs) and pollution derived from the increasingly ubiquitous presence of marine plastics as among the most pressing marine environmental concerns facing the region.

"For the region to face these challenges in an effective way, the IAEA and REMARCO experts agree that coordinating action, harmonizing methodologies and sharing data, and comprehensive training and guidance on the use of nuclear and isotopic techniques to address common marine and coastal environment challenges are needed," explained Magali Zapata Cazier, Programme Management Officer of the regional project.

Building on the long-standing collaboration between the IOC and the IAEA's Marine Environment Laboratories in Monaco, an e-learning course on ocean acidification sampling and analysis was launched under the project and hosted on the IOC's Ocean Teacher Global Academy Platform (OTGA) in October 2021. Supported by Colombia's Marine and Coastal Research Institute, INVEMAR, and using a standardized method developed by REMARCO experts, the training course will introduce participants to the tools, procedures and analytical best practices necessary for the development of robust, empirical data on the pH, total alkalinity and dissolved carbon of coastal waters.

"Bringing scientific expertise and national decision makers together is at the heart of this project," explained Luis Longoria, Director of the Division of Latin America and the Caribbean of the Department of Technical Cooperation. "The ocean acidification e-learning course on the OTGA platform is only the first step in further training opportunities that will benefit not only Latin America and the Caribbean, but will also be expanded to share experiences with other regions."

Understanding the science

As oceans absorb carbon dioxide (CO_2) released into the atmosphere by human activities, the acidity of seawater begins to increase — this process is known as ocean acidification, and it has emerged as a key global issue in the last decade due to its negative effect on marine life.

Experts use nuclear technology and isotopic techniques to study the calcification of coral reefs, to develop a historical record of past acidity, and to model possible future trends.

"The Intergovernmental Oceanographic Commission of UNESCO and the IAEA work hand-in-hand to leverage the science of ocean acidification to support the needs of peoples and governments to mitigate and adapt to this potentially daunting problem," said the Head of the IOC's Ocean Science Section, Salvatore Arico. "At the core of such efforts is the need to develop the adequate scientific capacity to study and measure ocean acidification, through an inclusive and open access to training opportunities and data sharing. This is indeed a highly synergistic collaboration, for the benefit of science, knowledge and society."

When fully operational, Barakah Nuclear Power Plant in the United Arab Emirates will meet almost 25 per cent of the country's electricity demand, making a significant impact on efforts to fight climate change. (Photo: ENEC)

IAEA joins Indonesia for G-20 event highlighting nuclear power for clean energy transition

Jeffrey Donovan, IAEA Department of Nuclear Energy
Nicholas Watson, IAEA Department of Nuclear Energy

The importance of nuclear power in the clean energy transition was showcased by the Group of Twenty (G-20) in June 2022 as IAEA Director General Rafael Mariano Grossi and experts joined representatives from Indonesia, holder of the G-20 Presidency, as well as South Korea and the United Arab Emirates to discuss the role of nuclear technology in achieving net zero and Sustainable Development Goals.

The virtual event, 'Nuclear Potentials in the Energy Transitions,' co-organized by the IAEA and Indonesia as part of the G-20 webinar series, will help inform the work of the G-20

AT A GLANCE

- IAEA Director General Rafael Mariano Grossi presented the environmental benefits of nuclear power at the G-20 meeting in June 2022.
- The IAEA and Indonesia co-organized the event, 'Nuclear Potentials in the Energy Transitions,' to inform the work of the G-20 Energy Transition Working Group.

Energy Transition Working Group (ETWG) aimed at achieving a global agreement on the switch to sustainable energy during the G-20 summit set for Bali, Indonesia, on 15 to 16 November. It featured IAEA and other experts on topics including emerging technologies, such as small modular reactors (SMRs), as well as Agency support to newcomer countries looking to add nuclear to their energy mix.

"Nuclear power is a proven resource," Director General Grossi said in his keynote address, highlighting that over the past five decades it "has avoided about 70 giga tonnes of CO_2 and reduced the enormous number of deaths caused by air pollution." But nuclear can do more than keep the lights on, he added. "It can also reduce CO_2 emissions generated by industry in non-electrical applications, such as hydrogen production, industrial steam, and water desalination."

The G-20 is a multilateral platform connecting the world's major developed and emerging economies. It plays a key role in charting the direction of the global economy, representing more than 80 per cent of global gross domestic product and 60 per cent of the world's population. G-20 working groups including the ETWG provide in-depth analysis of key issues to help inform the G-20 decision making process.

Nuclear power is currently operated in 32 countries, providing about 10 per cent of the world's electricity and about 25 per cent of its low carbon electricity. Some 441 reactors are in operation for a total capacity of almost 400 gigawatts. Fifty-three reactors are under construction in 17 countries, with China building the most reactors (15). Studies by the International Energy Agency (IEA) indicate that global nuclear power capacity will need to double by 2050 if the world is to achieve the climate change goals of the Paris Agreement. Much of that expansion will need to come in newcomer countries, many of them in the developing world where the need for low carbon energy to power economic growth and development is acute, according to the IEA.

"I am certain that nuclear will be a significant technology for clean energy systems, not only for developed countries but also emerging economies and developing countries."

Indonesia's Prahoro Nurtjahyo, Co-Chair of the G20 Energy Transition Working Group

"Ninety per cent of the growth in nuclear capacity between 2020 to 2050 will happen in developing countries, led by China," Peter Fraser, an IEA expert, said during the event. "Nuclear energy will provide about ten per cent of the energy needed by China by 2060, which is up from four per cent today. But nuclear makes a huge contribution in providing stability to a carbon neutral power system in China in 2060. It's that kind of central system service that nuclear can play a big role in, even in a system dominated by wind and solar."

The IAEA plays a key role in supporting newcomer countries through its Milestones Approach in the development of infrastructure for a safe and sustainable nuclear power programme, including through regional technical cooperation projects, said Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation. "In the first stage of a nuclear power implementation programme, it is very important to have very strong support from the government," said Liliya Dulinets, Head of the IAEA's Nuclear Infrastructure Section. "Of course, that's important during all the stages, but in the first stage it's really very important."

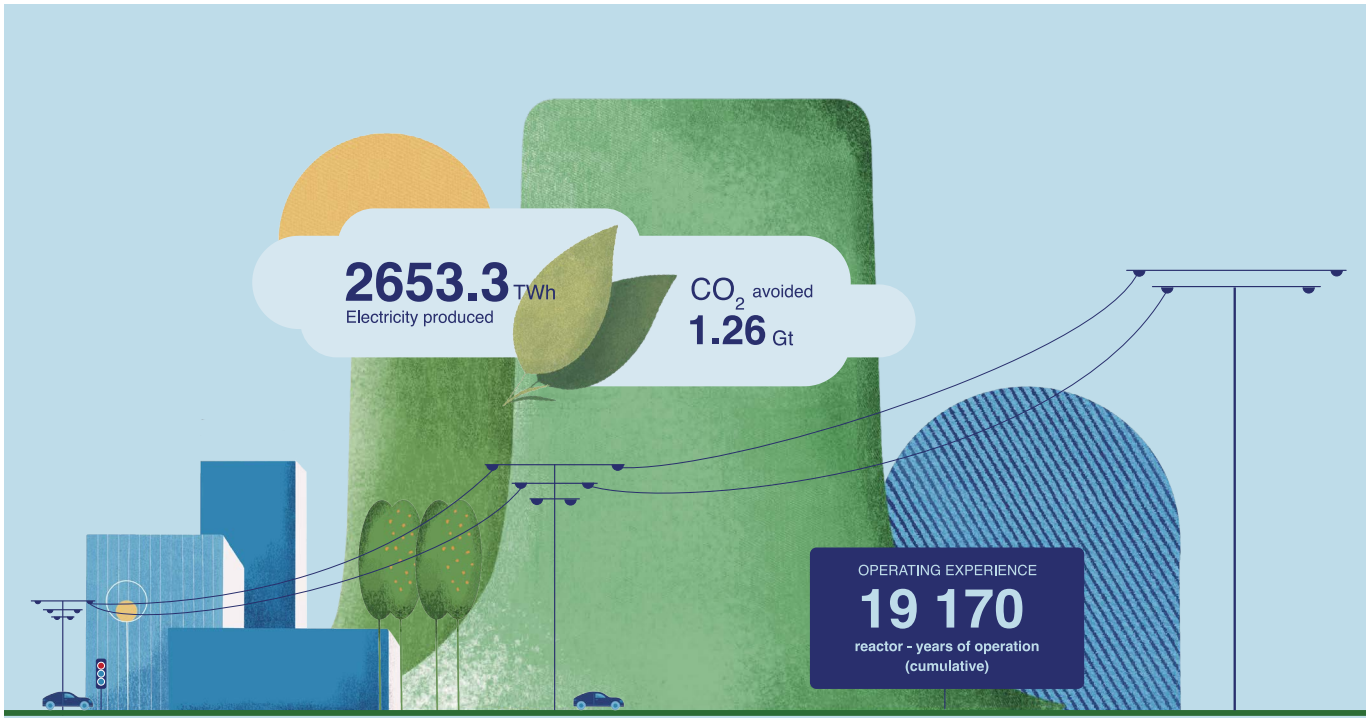
Almost 30 newcomers, including Indonesia, are either exploring or embarking on nuclear power and working with the IAEA, whose Integrated Nuclear Infrastructure Review (INIR) service helps to assess national efforts on developing nuclear infrastructure. Indonesia, which hosted an INIR in 2009, has ambitions to develop nuclear power by 2060 to help "maintain system reliability", said Andriah Feby Misna of the Indonesian Ministry of Energy and Mineral Resources.

The UAE worked extensively with the IAEA as it developed infrastructure to support the construction of four large nuclear power reactors, two of which have come online in recent years. When the plant is fully operational, it will meet almost 25 per cent of electricity demand, making a significant impact on the country's efforts to fight climate change, said Ambassador Hamad Alkaabi, Permanent Representative of the UAE to the IAEA.

Other IAEA experts highlighted benefits of nuclear power, including having the smallest land requirement of all low carbon technologies and studies showing that the transition to net zero will be less costly when nuclear is part of the energy mix. They also noted the potential role for nuclear in producing low carbon hydrogen to help decarbonize hard-to-abate sectors such as industry, transport and heat for buildings.

There is also strong evidence of a link between the development of a nuclear power programme and economic growth and prosperity, and South Korea is a good example of this, according to Manki Lee of the Korea Atomic Energy Research Institute. Last year, a working paper by the International Monetary Fund said that investments in nuclear power produced the biggest economic multiplier effect of any clean energy source, producing about 25 per cent more employment per unit of electricity than wind power, with workers in nuclear earning one-third more than those in the renewable energy industry.

"I am certain that nuclear will be a significant technology for clean energy systems, not only for developed countries but also emerging economies and developing countries," concluded Indonesia's Prahoro Nurtjahyo, Co-Chair of the ETWG.



Nuclear Power Electricity Generation and CO_2 Avoidance

Participants at the regional meeting in Cyprus (Photo: Cyprus Institute)

Planning for clean, reliable energy in Europe

Melissa Evans, IAEA Department of Technical Cooperation
Manuel Welsch, IAEA Department of Nuclear Energy

A new compilation of case studies covering six countries in Europe and Central Asia highlights different potential pathways to achieving low-carbon energy targets in line with the Paris Agreement — an international treaty aiming to reduce global warming. The six case studies in the publication, 'Energy Planning Support to Europe and Central Asia', were developed in the framework of a broader regional technical cooperation project. Based on countries' anticipated energy demands, the case studies evaluate multiple possible energy sources in different development scenarios. The findings revealed that the paths to net zero emissions will be varied.

AT A GLANCE

- As part of an IAEA regional technical cooperation project, a new compilation of case studies was published that highlights different potential energy planning options in six European and Central Asian countries.
- The IAEA organized a regional meeting in October 2022 that brought together representatives to share good practices in energy and climate planning.

For instance, for those countries with existing nuclear power programmes, the refurbishment and lifetime extensions of power plants are key considerations, as outlined in the case study of the Republic of Armenia. In the case of Georgia, improving the energy efficiency of buildings is a priority, as homes and businesses are the primary energy consumers. While phasing out fossil fuels is a key priority in some decarbonization strategies, the resulting social impact requires consideration, such as the impact on those employed in the coal sector, as noted in the study of North Macedonia.

Together with international partners, the IAEA supports countries in the energy modelling required to develop comprehensive decarbonization plans. As part of a regional technical cooperation project, the IAEA organized a 'Regional Meeting on Integrated Energy and Climate Planning' that was hosted from 10–12 October 2022 by the Cyprus Institute and brought together representatives from 14 countries in Europe and Central Asia to exchange good practices and discuss their experiences in the development of integrated energy and climate plans. The meeting also served as an opportunity to discuss how to best align the IAEA's energy planning support with existing planning processes, such as the European Union-led effort to develop integrated national energy and climate plans.

Upon request, the IAEA also supports countries in their efforts to establish nuclear power programmes through the IAEA Milestones Approach. "In Latvia, we are currently preparing our new energy and climate plan that will include nuclear power for the first time as one of the possible options to decarbonize Latvia's energy sector by 2050," said Agnese Lickrastina from the Ministry of Economics in Latvia. Nuclear power is just one potential component among the complex constellation of considerations in the process of integrating energy and climate planning.

"Reliable, affordable and sustainable energy is an interconnected mega-topic that countries have to solve," said Mr Farukh Kasimov from the Academy of Sciences of Tajikistan. "In Tajikistan, 98 per cent of our electricity is generated by hydropower using precipitation and meltwater from the glaciers covering our mountains. The warming of our climate means that our glaciers are melting rapidly, which is already having an impact on our electricity supply. In addition, the water is also used for other sectors and in our neighbouring countries downstream of our rivers. Our example shows that energy is interconnected with the climate, land-use and water systems, affecting industry, agriculture and economic well-being. This lends itself to integrated decision making and energy planning."

The regional meeting also served as an opportunity to discuss international collaboration with representatives from the European Union, the International Energy Agency, the Energy Community, the International Renewable Energy Agency and the German Agency for International Cooperation (GIZ). At the 2022 UN Climate Change Conference (COP27) in Sharm El-Sheik, an IAEA pavilion hosted a variety of events on its work on energy planning and the role of nuclear power as a low carbon energy source, including events on financing, promotion and partnering with renewable energy.

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Programme

Department of Technical Cooperation
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