

Technical Cooperation Report for 2020

Report by the Director General



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

Technical Cooperation Report for 2020

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Preface

The Board of Governors has requested the transmission to the General Conference of the attached Technical Cooperation Report for 2020, the draft of which was considered by the Board at its June 2021 session.

The Director General is also hereby reporting in fulfilment of the request contained in resolution GC(64)/RES/11 on "Strengthening of the Agency's technical cooperation activities".

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Summary

The Technical Cooperation Report for 2020 provides an overview of the Agency's Technical Cooperation (TC) activities during the year, covering actions to strengthen the technical cooperation programme, programme resources and delivery, and programme activities and achievements. It also includes a special opening section on the delivery of COVID-19 support to Member States through the TC programme. Examples of project activities and achievements are listed in Annex 1 according to thematic area, and Annex 2 lists the TC programme Fields of Activity, grouped for reporting purposes. The report responds to General Conference resolution GC(64)/RES/11.

Part A.1 covers the context for the technical cooperation programme in 2020, opening with a special section on Agency efforts to support Member States in addressing COVID-19, and describing how the regular technical cooperation programme continued implementation despite pandemic constraints. Part A.2 provides an overview of the Agency's participation in global development dialogue through attendance at key United Nations meetings and conferences such as the United Nations (UN) Inter Agency Task Team (IATT) Workshop on Science, Technology and Innovation (STI), a special preparatory session for the High Level Political Forum that examined the role of science, technology and innovation in the response to the pandemic, the Interdepartmental Task Force on African Affairs, and the Committee on Environment and Development of the Economic and Social Commission for Asia and the Pacific, inter alia. Other important events with Agency participation included United Nations Industrial Development Organization (UNIDO) regional consultations on the circular economy, the Global Mountain Sustainability Forum 2020, the International Water Resource Association conference, and the Caribbean Community (CARICOM) Caucus Meeting of Permanent Representatives to the United Nations. The Agency's contribution to the fight against cancer was presented at global health events such as the World Health Summit and the World Health Assembly.

The TC programme delivers support in the form of capacity building and procurement of essential equipment. Part A.2 also provides examples of capacity building, with subsections focusing on third level and post-graduate education, legislative and drafting assistance, and on how the programme addresses the needs of least developed countries (LDCs) and supports responses to emergencies. The section closes with an overview of efforts to build awareness of the TC programme, through outreach, events, and participation in targeted conferences and symposia.

Part A.3 focuses on continuing efforts to enhance the efficiency and effectiveness of the TC programme. It describes activities to ensure that projects are linked with Member States' national development plans and other relevant development policies and goals, including SDGs, where applicable. To maximize programme impact, the Agency works in close partnership with Member States, United Nations agencies, national institutes and civil society. Agreements and Practical Arrangements signed in 2020 to support such partnerships are described in Part A.3. The report then provides an overview of the Agency's activities to improve programme quality in 2020 through workshops, training events and quality reviews and assessments, and the section closes with coverage of the participation of women in the TC programme.

Part B presents a summary of financial and non-financial programme delivery indicators. It reviews the resources received for the TC programme through the Technical Cooperation Fund (TCF), and mobilized through extrabudgetary and in-kind contributions. Payments to the TCF in 2020 totalled €80.2 million¹, or 91.1% of the TCF target set for the year.² New extrabudgetary resources for 2020 came to €44.1 million and in-kind contributions

¹ This figure does not include National Participation Costs, assessed programme cost arrears and miscellaneous income.

² Total payments received in 2020 include €105 994 either of deferred or of additional payments by eleven Member States. Excluding these payments, the 2020 rate of attainment on payments would have been 91.0%.

were €0.1 million. Overall, implementation for the TCF reached 80.4% in 2020. Nuclear knowledge development and management³, health and nutrition, and food and agriculture were the top areas of disbursement for the programme.

Part C highlights programme activities and achievements, and covers assistance to Member States in the peaceful, safe, and secure application of nuclear science and technology. It highlights regional and interregional activities and achievements in technical cooperation in 2020, and presents an overview of the activities of the Programme of Action for Cancer Therapy (PACT).

A brief selection of project examples is presented in Annex 1 according to thematic area, covering health and nutrition, food and agriculture, water and the environment, industrial applications, energy planning and nuclear power, radiation protection and nuclear safety, and nuclear knowledge development and management. Annex 2 lists the technical cooperation programme Fields of Activity.

³ The interregional project INT0098, 'Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters', through which the IAEA's support to Member States in addressing COVID-19 was delivered, is classified under the Field of Activity 'Nuclear knowledge development and management'.

The Agency's Technical Cooperation Programme in Figures

(as at 31 December 2020)



⁴ Includes donor contributions and government cost-sharing. Please refer to Table A.5 of the Supplement to this report for details.

⁵ Year-end budget is the total value of all technical cooperation activities approved and funded for a given calendar year plus all approved assistance brought forward from previous years but not yet implemented.

⁶ Due to the travel restrictions as a result of the COVID-19 pandemic, figures marked * are considerably lower than normal. Wherever possible training was conducted in a virtual format. Virtual events are given in the subsequent row.

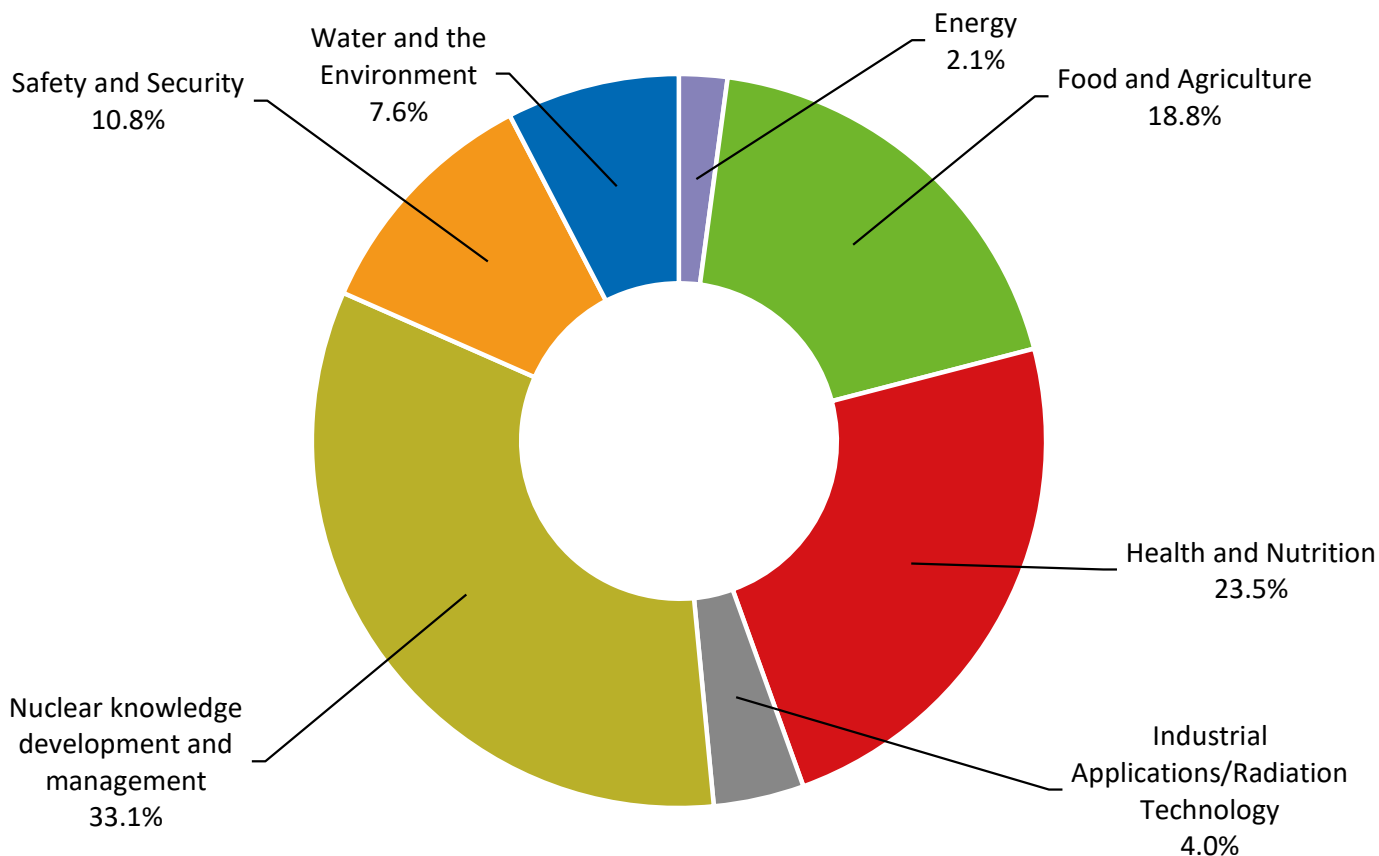


Figure 1: Actuals by technical field for 2020.^{7,8}

⁷ Throughout this report, percentages in charts may not add up to 100% exactly due to rounding. Unless otherwise stated, all figures are denominated in Euros.

⁸ The interregional project INT0098, 'Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters', through which the IAEA's support to Member States in addressing COVID-19 was delivered, is classified under the Field of Activity 'Nuclear knowledge development and management'.

Technical Cooperation Report for 2020

Report by the Director General

This document responds to the request by the General Conference to the Director General to report on the implementation of resolution GC(64)/RES/11.

Part A of the report provides an overview of the progress achieved in delivering the technical cooperation programme in 2020.

Part B reports on the management of financial resources and programme delivery at an aggregate level in the calendar year 2020.

Part C reports on regional activities and programme achievements during 2020.

Annex 1 provides examples of project activities and achievements in specific thematic areas.

Annex 2 lists the technical cooperation programme Fields of Activity



A.

STRENGTHENING THE AGENCY'S TECHNICAL COOPERATION ACTIVITIES



A. Strengthening the Agency's Technical Cooperation Activities⁹

A.1. RESPONDING TO THE COVID-19 PANDEMIC

Since December 2019, the world has been dealing with a new type of coronavirus, SARS-CoV-2, which causes COVID-19 disease. Declared a pandemic by the World Health Organization (WHO) on 11 March 2020, COVID-19 has affected almost every part of the world, with impacts going far beyond the health sector. The IAEA technical cooperation programme has delivered important support to Member States as they address the pandemic.¹⁰

Ensuring continued delivery of the TC programme

The delivery of IAEA support to Member States to address the COVID-19 pandemic required an unprecedented effort on the part of the Secretariat, especially as the delivery of regular technical cooperation activities continued uninterrupted, albeit in extraordinary circumstances and during a period of unforeseeable challenges and travel restrictions. The Secretariat engaged closely with Member States and programme partners to ensure the safety of fellows and scientific visitors, and to ensure business continuity. In each region, intensive consultations with all project stakeholders were held to agree on necessary adjustments to the programme, and TC activities and events were postponed or reprioritized, while other elements of programme delivery were stepped up. The procurement component continued as normal to the extent possible, including advancing procurement planned under TC projects for the year 2021. Project coordination meetings and capacity building activities were held virtually where possible.

"The IAEA technical cooperation programme has delivered important support to Member States as they address the pandemic."

⁹ Section A responds to section 1, operative paragraph 3, of resolution GC(64)/RES/11 on assisting Member States in the peaceful, safe and secure application of nuclear science and technologies; section 2, operative paragraph 1 on development of nuclear technology and know-how and its transfer to and among Member States for peaceful uses; section 2, operative paragraph 2 on strengthening TC activities through development of effective, efficient and outcomes oriented programmes; section 2, operative paragraph 3 on efforts to further advance gender mainstreaming and gender balance, including among experts and lecturers; section 2, operative paragraph 4 on contributing to the implementation of the principles expressed in the Istanbul Declaration and the Programme of Action for the Least Developed Countries for the Decade 2011 – 2020, and to the attainment of internationally agreed development goals including the SDGs; section 3, operative paragraph 1 on strengthening TC activities, including the provision of sufficient resources, in accordance with Member States' requests based on their needs and national priorities; section 3, operative paragraph 5 on providing Member States adequate information and training on project development, including through e-learning; section 3, operative paragraph 6 on regular reporting on the implementation and outcomes of TC projects and encouraging submission of Project Progress Assessment Reports (PPARs); section 3, operative paragraph 8 on applying the two-step mechanism in monitoring the quality of TC projects; section 3, operative paragraph 9 on adherence to the central criterion and all the TC requirements; section 5, operative paragraph 1 on assisting Member States in implementing the 2030 Agenda and on reporting on the implementation of partnerships; section 5, operative paragraph 2 on coordination and optimization of complementary activities, including by participating in relevant UN processes; section 5, operative paragraph 3 on the Agency's participation and contribution to South-South and triangular cooperation; section 5, operative paragraph 7 on strengthening public communication in all official languages of the Agency, on the impact of the TC activities, with a view to showcasing the contribution of atomic energy, including to the SDGs, and to reaching out to new partners, and to regularly provide information to Member States; and to section 6, operative paragraph 1, on reporting to the General Conference at its sixty-fifth regular session on the implementation of the content of the resolution.

¹⁰ For detailed information on technical cooperation provided to Member States to address the pandemic, please refer to documents GOV/INF/2020/6, GC(64)/INF/4 and GOV/INF/2021/4.

The Agency continued its practice of holding bilateral meetings with Member States on the margins of the IAEA General Conference, mostly via virtual platforms, which enabled more participation. Meetings of National Liaison Officers (NLOs) and regional cooperative agreement groups were also mostly held virtually.

To enable the continuation of Programme of Action for Cancer Therapy (PACT) support, the Agency, the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC) adapted the conduct of imPACT Review Missions, using a hybrid modality to add a virtual component prior to a subsequent in-country mission. imPACT Review experts used a combination of virtual meetings, photos, recorded video and virtual live walk-throughs of health facilities to review countries' cancer control capacities and needs. This allowed the Agency and its partners to continue to support their Member States by providing a baseline situation analysis and a set of recommendations to guide cancer control planning and investments. In addition, virtual consultations were held with 13 Member States to take stock of progress in the implementation of cancer control efforts and imPACT Review recommendations, and over 30 virtual briefing sessions were held with donor Member States and others to present opportunities for contributions to IAEA's cancer-related efforts.

Supporting Member State efforts to address COVID-19

The Agency provided support to Member States' efforts to address COVID-19 mainly through the interregional technical cooperation project INT0098, 'Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters', which was approved off-cycle by the Board of Governors at its meeting in November 2019 as part of the 2020–2021 technical cooperation programme.

By the end of 2020, 285 national laboratories in 127 countries and territories had received support through the project, with 1 950 purchase orders issued for RT-PCR and diagnostic kits and related items, delivered through over 2 500 shipments.



In July, Seychelles received equipment from the IAEA to enable the country to use a nuclear-derived technique to rapidly detect the coronavirus that causes COVID-19. (Photo: Seychelles counterpart)

Agency assistance also included the provision of technical advice and guidance to individual laboratories, the issuance of guidelines and standard operating procedures, and, in collaboration with WHO regional offices, the delivery of targeted webinar series in Arabic, English, French, Russian and Spanish. Twenty-one educational videos on the use of RT-PCR and serology were developed by the Agency, also in five languages. The recordings are available online on the IAEA Human Health Campus.

Agency assistance was made possible through generous extrabudgetary contributions from Member States and the private sector totalling € 26.3 million. The biopharmaceutical company Takeda Pharmaceutical Company Limited contributed € 4.1 million for the provision of testing and biosafety equipment to requesting countries.

In June 2020, IAEA Director General Rafael Mariano Grossi launched an initiative to strengthen global preparedness for future pandemics like COVID-19. The initiative, called ZODIAC, builds on the IAEA's experience in assisting countries in the use of nuclear and nuclear-derived techniques for the rapid detection of pathogens that cause transboundary animal diseases, including ones that spread to humans.

A.2. TECHNICAL COOPERATION IN 2020: AN OVERVIEW

Global developments in 2020: The context for the TC programme

Global development dialogue

Much work in 2020 was done in response to the COVID-19 pandemic, programmatically and in terms of advocacy and outreach with external partners. Building on past achievements, the Agency continued to position nuclear science and technology as an important driver in the implementation of the 2030 Agenda for Sustainable Development.

At the beginning of the year, a special session on Nuclear Technology Applications for the SDGs was included in the programme of the UN Interagency Task Team (IATT) Workshop on Science, Technology and Innovation (STI), providing an overview of how nuclear science and technology can support countries towards achieving the SDGs, and offering concrete examples of solutions where nuclear techniques can improve human and animal health, accelerate prosperity and protect the planet.

Following on from this, in June the Agency made a presentation at a special preparatory session for the High Level Political Forum, specifically looking at STI in the response to the pandemic. The IAEA signalled its work in relation to SDG 17 and the Technology Facilitation Mechanism — a main focus under the goal — by becoming one of the key partners in the new *2030 Connect* platform which was launched in July 2020. The IAEA's emergency response support is showcased on this platform among *Solutions to Address the COVID-19 Pandemic*.

“The IAEA signalled its work in relation to SDG 17 and the Technology Facilitation Mechanism — a main focus under the goal — by becoming one of the key partners in the new 2030 Connect platform which was launched in July 2020.”



In October, IAEA Director General Rafael Mariano Grossi joined a panel discussion on ‘Partnership for the Goals’ at the 2020 World Health Summit, which addressed ongoing human health challenges and the toll that the COVID-19 pandemic has taken on sustainable development efforts. DG Grossi said there is a clear need for United Nations agencies, research organizations and civil society groups to organize more closely around common issues to take collective action toward achieving the 17 United Nations Sustainable Development Goals. (Photo E. Perez-Alvan/IAEA)

The Agency also participated in several meetings of the Interdepartmental Task Force on African Affairs, joining discussions on the Africa UN Knowledge Hub for COVID-19 and deliberating on advocacy and communication strategy, and on UN system support for Africa's response to COVID-19. Within the framework of the Practical Arrangements between the IAEA and African Commission on Nuclear Energy (AFCONE), signed in 2019, the Agency participated in several virtual meetings in 2020, including a webinar on uranium co-organized by AFCONE and the International Science and Technology Center in September, the AFCONE-Women in Nuclear Africa webinar in November, and the AFCONE-African

Union Commission -IAEA webinar on Nuclear Power in Africa in December. The Agency also contributed to the review of AFCONE's five-year strategic plan.

In the Asia and the Pacific region, the Agency took part in the virtual sixth session of the Committee on Environment and Development of the Economic and Social Commission for Asia and the Pacific to highlight IAEA initiatives on COVID-19, and the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) programme related to air and the marine environment. At the Sea of Solutions event hosted by the Government of Viet Nam with the United Nations Environment Programme (UNEP), the Agency explored partnerships to address plastic pollution. At the United Nations Industrial Development Organization regional consultations on the circular economy, the Agency shared information on the efforts of Member State in Asia and the Pacific to promote a circular economy and the sustainable use of natural resources. Finally, the Agency reiterated its readiness to continue supporting the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States in the consultative process for a renewed partnership when attending preparations for the Fifth UN Conference on LDCs.

In October, the Agency participated virtually in the Global Mountain Sustainability Forum 2020 organized by the United Nations University and Eurac Research, and presented Agency work on climate change adaptation in high mountain areas within the context of an interregional technical cooperation project. Also in October, the Agency attended a conference organised by the International Water Resource Association, focused on addressing groundwater resilience in the face of climate change. On behalf of 38 counterparts from 27 countries in the Europe region, the Agency presented a regional TC project which aims to enhance regional capacities for isotope-based assessment of water resources in the context of adapting to climate change. The aim was to raise awareness among national and international stakeholders and decision makers, and to explore potential collaboration with other development partners in this area.

As part of a concerted effort to heighten awareness of the TC programme among key stakeholders in the Latin America and the Caribbean region, particularly in newer IAEA Member States and within the leadership of CARICOM, the Agency participated in the CARICOM Caucus Meeting of Permanent Representatives to the United Nations in December 2020. The Agency highlighted the work of the TC programme in CARICOM Member States and shared specific examples of regional cooperation across all thematic areas.

The Agency's important contributions to the fight against cancer continued to be highlighted at key global health events, such as the World Health Summit, the World Health Assembly, WHO Regional Committee Meetings, London Global Cancer Week and the Joint United Nations Programme on HIV/AIDS Programme Coordinating Board, among others.

Building human capacity

The technical cooperation programme is the major vehicle through which the Agency transfers nuclear technology to Member States and builds their capacities in the peaceful use of nuclear science and technology. It is a One House programme that brings together skills and expertise from across the Agency to meet Member State needs.

The Agency embarked on an ambitious project in the Asia and the Pacific region in 2018, aiming to build capacity and develop tools and resources for nuclear education that would reach at least one million secondary school students throughout the region by 2021. In partnership with the University of Tokyo, the Australian Nuclear Science and Technology Organisation (ANSTO) and Argonne National Laboratory, the Agency trained a core group of secondary school educators in various countries who replicated these efforts to hundreds of teachers and experts in the region, teaching and encouraging students to recognize the potential of nuclear technologies in various applications in their daily lives. By early 2020,

“The Agency embarked on an ambitious project in the Asia and the Pacific region in 2018, aiming to build capacity and develop tools and resources for nuclear education that would reach at least one million secondary school students throughout the region by 2021... By early 2020, the project had already reached more than one million students throughout 20 Member States in the region.”

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In Latin America and the Caribbean, the Agency is helping national nuclear institutions (NNIs) to develop and implement service sustainability strategies through regional project RLA0069, 'Promoting Strategic Management and Innovation at National Nuclear Institutions through Cooperation and Partnership Building - Phase II (ARCAL CLXXII)'. Strengthening capacities for strategic planning and management is essential for business continuity and sustainability in these institutions. In November, a three-month training course was launched in collaboration with Argonne National Laboratory to provide young future leaders and managers of NNIs in the region with strategic planning and management capacities.

Third level and post-graduate education

Two Postgraduate Educational Courses (PGEC) in Radiation Protection and Safety of Radiation Sources were held in Ghana and Morocco (for English and French-speaking countries respectively), through which 51 young professionals were trained as radiation protection officers. In June 2020, the Hashemite Kingdom of Jordan expressed interest in hosting a PGEC in Arabic in 2021. The Agency subsequently completed a first virtual Education and Training Appraisal review mission to Jordan in December.

Throughout 2020, the Agency continued to support several initiatives in postgraduate education in nuclear science and technology in Africa. Supported through a regional project for PhD sandwich programmes. Thirteen candidates from 13 Member States (including ten Least Developed Countries) carried out PhD research work in foreign universities, complementing the PhD coursework in the candidates' home country universities. A further ten candidates pursued Master's degrees in nuclear science and technology at the University of Alexandria, Egypt, and the University of Ghana through the two-year African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) Master's Programme in nuclear science and technology.

In the health sector, support for post-graduate education continued to be a key focus of attention. For example, six candidates were awarded long-term fellowship training, hosted by African institutions under a regional AFRA project, in radiation oncology and medical physics. The project complements several national projects focused on long-term training in radiation medicine. A group fellowship programme on clinical training in medical physics for imaging has been initiated, which will support 14 candidates, hosted by Egypt and Ghana. In Rabat, Morocco, five candidates from French-speaking countries started a Master's programme in radiopharmacy – several of the students will be the first qualified radiopharmacists in their countries. Three candidates from English-speaking countries passed a pre-qualification exam to start their Master's programme in radiopharmacy in South Africa. They are expected to complete the programme in 2022.

Despite the challenges posed by the COVID-19 pandemic, most of the 15 PhD sandwich fellowship students participating in a regional water resource management project for the Sahel region were able to complete their first period at foreign universities. The project aims to enhance self-reliance in isotope hydrology expertise.

In 2020, Viet Nam successfully established a Bachelor's degree programme in medical physics in Nguyen Tat Thanh University, in Ho Chi Minh City with the support of TC project VIE6030, 'Development of Education and Training in Medical Physics', which aims to create a new generation of medical physicists. The national education programme framework for medical physics was also completed and a pilot programme started – the first official programme of its kind in the country. Decree 142/2020/ND-CP on regulations setting the conditions for conducting radiation works and atomic energy application support services was issued by the Government of Viet Nam in December 2020, making

it a prerequisite that personnel conducting radiation practices, such as radiotherapy and nuclear medicine, hold a degree in medical physics.

Legislative and drafting assistance

In 2020, the Legislative Assistance Programme, implemented primarily through the TC programme, conducted several workshops, missions and meetings to raise awareness, advise and train on developing and revising national legislation and adhering to and implementing the relevant international legal instruments. Twelve Member States from different regions received bilateral legislative assistance through written comments and advice on drafting national nuclear legislation. Virtual national workshops and seminars were conducted to support Bahrain, Costa Rica, and Viet Nam. In addition, senior officials and decision makers from the newest IAEA Member State, Turkmenistan, participated in July in their first national IAEA seminar on a legal framework for the safe, secure and peaceful use of nuclear technology. Further, 16 Member States from Europe and Central Asia participated in the Regional Workshop on Harmonising National Nuclear Law with International and European Law held in January. The event enabled the States to identify legislative assistance needs over the next two years.

Further to bilateral legislative drafting assistance, Belize, Djibouti, Nepal and Togo enacted nuclear legislation in 2020. In Latin America and the Caribbean, comprehensive nuclear legislation still needs to be developed in several Member States. Support is being provided through regional TC project RLA0067, 'Enhancing National Legal Frameworks'. In October, Belize's House of Representatives enacted the Radiation Safety and Security Act, which represents an important milestone establishing the legal basis for the system of regulatory control for the safe, secure and peaceful uses of nuclear science and technology.

Over the past decade, all regions made progress in developing and establishing adequate legal frameworks with the support of the Legislative Assistance Programme. More particularly, some 44 Member States adopted new nuclear legislation, more often than not following a comprehensive approach to national nuclear law. Many more drafted such legislation which is pending enactment. In particular, more than 20 States in Africa adopted new nuclear legislation, 10 in Asia and the Pacific, 10 in Europe and Central Asia and four in Latin America and the Caribbean.

Due to the COVID-19 pandemic, the 2020 session of Agency's annual interregional training programme, the Nuclear Law Institute (NLI), was postponed. A video celebrating the tenth anniversary of the NLI was launched during the margins of the 64th regular session of the General Conference. Since its establishment, some 600 officials participated in the NLI, with about two third of the students coming from Africa. To mitigate the impact of the pandemic, a new series of interactive webinars on nuclear law, implemented under the Legislative Assistance Programme, amassed over 2500 streams with participation from officials from over 100 countries. Given the success of this series and in response to expressed interest from industry, law firms, non-governmental organizations, civil society and academia, a webinar was held for the general public entitled 'Nuclear Law in Practice: The IAEA Perspective'.

Addressing the needs of Least Developed Countries (LDCs)

Human resource development and nuclear knowledge management are key factors in the successful application of nuclear science and technology for socioeconomic development. The Agency continues to address the specific needs of its LDC Member States. The TC programme in these countries focuses on the peaceful uses of nuclear science and technology in food and agriculture, health and nutrition, water and environment, energy, industry, and safety. Capacity building in these areas is provided through short- and long-term academic programmes to build a critical mass of scientists.

“Over the past decade, all regions made progress in developing and establishing adequate legal frameworks with the support of the Legislative Assistance Programme.”

The Agency participated in the twentieth meeting of the Inter-Agency Consultative Group (IACG) of the United Nations system and international organizations on the Implementation of the Istanbul Programme of Action (IPoA) for Least Developed Countries. United Nations (UN) organizations provided an update on the status of preparations for the upcoming Fifth UN Conference on the Least Developed Countries (LDC5) including the rescheduling of meetings due to the COVID-19 pandemic. The IAEA provided inputs to the annual report on UN System Support to the Least Developed Countries: Overview and Analysis of Contributions from the Inter-agency Consultative Group on LDCs.

Small Island Developing States (SIDS) have particular needs due to their geographic size and location. The needs of SIDS in the Asia and the Pacific region, including Fiji, Marshall Islands, Palau, Papua New Guinea and Vanuatu, are being addressed through a new Sub-regional Approach for the Pacific Islands (SAPI). Discussions and consultations on SAPI between relevant stakeholders continued in virtual format throughout 2020.

Agency support to LDCs in 2020: Assistance to Haiti and Yemen

In Haiti, four new national projects were initiated as part of the 2020–2021 TC cycle. Laboratory equipment was provided for soil sampling and analysis, together with materials for the determination of trace metals in food samples. An assessment of erosion and sedimentation processes in Haiti was conducted as a basis for planned capacity building activities. Water sampling equipment was acquired in 2020 to support a sampling campaign planned for 2021. In collaboration with the Ministry of Health, the Agency is assisting three public hospitals in the capital with a view to enhancing the safety and reliability of quality diagnostic imaging services.

In 2020, the Agency provided training for three nuclear medicine physicians from Yemen on nuclear medicine diagnostic and therapy at the King Hussein Cancer Centre in Jordan. Laboratory equipment and chemicals were provided to strengthen the operational capabilities of the Bio-Technology Laboratories of the Agricultural Research and Extension Authority. The IAEA also successfully delivered equipment for COVID-19 diagnosis, using a door-to-door delivery option.

Responding to emergencies

Following the MV Wakashio oil spill in August 2020, on the request of the Permanent Mission of Mauritius, the Agency provided emergency assistance for protection of the marine and coastal environment. Analytical equipment and training were provided for short-, medium- and longer-term monitoring of post-spill contamination and the associated impact.

The Republic of the Congo received IAEA support from the TC programme and the Nuclear Security Fund to finalize an urgent transport security plan, conduct a pre-shipment assessment and simulation, and carry out a site assessment of the location in which two disused radioactive sources – previously used in cancer treatment – will be temporarily stored until their final export. Training was provided to 45 participants and stakeholders from five government Ministries involved in the transport of the disused sources by road.

The Agency provided assistance to Lebanon in the aftermath of the explosion in the Port of Beirut in August 2020, including providing replacement parts for medical diagnostic equipment damaged in the explosion. Lebanon also requested and received additional COVID-19 RT-PCR kits following the explosion. The Agency is collaborating with the Office of the Commissioner for Atomic Energy and Alternative Energy and other academic scientists in France to consider complementarities to help Lebanon to assess the structural integrity of buildings damaged by the blast. The Agency is continuing to engage with

the Lebanese Atomic Energy Commission to provide assistance for the conduct of non-destructive testing of buildings affected or potentially affected by the blast.

Technical assistance to seven countries affected by the outbreak of African swine fever (Cambodia, China, Lao People's Democratic Republic, Mongolia, Myanmar, Thailand and Viet Nam) continued throughout 2020 under regional TC project RAS0081, 'Supporting Human Resource Development and Nuclear Technology Including Emerging Needs'. Immediate emergency support included the provision of nuclear-derived sampling and extraction kits (ELISA) and polymerase chain reaction (PCR) kits for rapid testing. Technical guidance, standard operating procedures and laboratory protocols for laboratory and veterinary staff were also provided.

Hurricanes Eta and Iota hit Central America in November 2020, causing significant damage to essential infrastructure, including health facilities. The Agency provided 12 mobile X-ray units to Colombia, Guatemala, Honduras and Nicaragua, which were the countries hardest hit by the hurricanes, helping to rapidly restore healthcare capabilities in the affected areas in these Member States, particularly in remote areas without nearby hospitals.

Building awareness of the technical cooperation programme

A new suite of information products – the country overview series – was initiated. Overviews of technical cooperation activities in most countries and territories in Africa and Asia and the Pacific are now available. Over 140 web stories on technical cooperation were published, and social media engagement continued to offer an important channel for communication. The IAEA's COVID-19 assistance was covered extensively online, and photographs of equipment delivery were made available on the Agency's Flickr account.

Outreach on technical cooperation in 2020

145+ IAEA web articles on technical cooperation

6441 @IAEATC Twitter followers (17% increase),
over 322 @IAEATC tweets

1882 @iaeapact Twitter followers (36% increase),
286 tweets (since June)

1686 LinkedIn TC Alumni Group members

In December 2020, the IAEA was featured as 'Partner of the Month' by the United Nations Office of South-South Cooperation on their South-South Galaxy website as part of an initiative to spotlight the work of organizations in South-South and triangular cooperation. IAEA information material made available on the South-South Galaxy website included several good practices in South-South and Triangular Cooperation (SSTC) for Sustainable Development, outlining support provided by the Agency to its Member States through the technical cooperation programme. The published good practices highlighted cooperation in the areas of groundwater resource management, non-destructive testing, and sustainability of regional networks.

The annual Seminar on Technical Cooperation for the Vienna diplomatic corps was conducted as a hybrid virtual/in-person event, attracting some 100 participants. The IAEA technical cooperation programme was also presented at an event on the margins of the IAEA's 'International Conference on Nuclear Security: Sustaining and Strengthening Efforts', raising awareness of the TC programme and its contribution to Member State development priorities, including the Sustainable Development Goals (SDGs).

One hundred and two bilateral meetings with Member States were held online on the occasion of the 64th IAEA General Conference, and the annual meetings of the regional and cooperative agreements also took place mostly online, notwithstanding significant differences in time zones. Two virtual side events related to technical cooperation were organized in September on the margins of the General Conference: 'Saving Women's Lives from Cancer', which took stock of the IAEA-Islamic Development Bank Partnership Initiative; and 'From Regulation to Clinical Practices: Ensuring Safety and Quality of Medical Radiological Procedures in Europe and Central Asia', which presented the implementation of the Basic Safety Standards in Europe and Central Asia. The virtual nature of side events at the General Conference resulted in greater than usual attendance.

A.3. BUILDING A MORE EFFICIENT, MORE EFFECTIVE TECHNICAL COOPERATION PROGRAMME¹¹

Revised Supplementary Agreements and Country Programme Frameworks

By the close of 2020, twelve countries had signed Country Programme Frameworks (CPFs), and the total number of valid CPFs was 113. All newly signed CPFs contain a concise and focused medium-term programme plan and are linked with relevant objectives of national and/or sectoral development plans and strategies, the SDGs and relevant outcomes of the countries' United Nations Sustainable Development Cooperation Frameworks (UNSDFs). The CPF preparation process applies a results-based approach to programme planning, implementation, monitoring, assessment and reporting, guided by the TC criterion and the consideration of gender.

The total number of Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the International Atomic Energy Agency (RSAs) was 141.

CPFs signed in 2020	
Chad	Mauritania
Chile	Mauritius
Croatia	Moldova
Georgia	Panama
Indonesia	Sudan
Lao PDR	Togo

Maximising programme impact through strategic partnerships

The Agency concluded or extended several new and existing partnerships related to technical cooperation in 2020. The focus was on expanding collaboration with various partners for the achievement of the SDGs and on tackling the most pressing and urgent challenge of 2020 – the COVID-19 pandemic.

In the area of cancer, the Agency joined forces with the Joint United Nations Programme on HIV/AIDS (UNAIDS) to scale-up efforts to tackle cervical cancer. Through the signing of a Memorandum of Understanding, the two organizations pledged to increase collaboration, focusing on low- and middle- income countries where 85 per cent of annual cervical cancer deaths occur. The Agency continued to strengthen its relationship with the Islamic Development Bank (IsDB) through the implementation of the Women's Cancers Partnership Initiative, which aims to increase cancer services for women in low- and middle- income countries.

Practical Arrangements were also concluded with the Union for International Cancer Control in 2020, with a focus on enhancing the role, capacity and quality of access to radiation medicine services as essential components of a comprehensive cancer control approach, and a new partnership was established with the Global Access to Cancer Care Foundation (GACCF). In addition, the Agency and the Sovereign Military Hospitaller Order of Saint John of Jerusalem of Rhodes and of Malta agreed to collaborate on outreach and resource mobilization for IAEA activities in nuclear medicine, radiation medicine, radiation oncology, radiotherapy and palliative care.

The decade long collaboration between the Agency and the French Society of Nuclear Medicine and Molecular Imaging (SFMN) was formalized through Practical Arrangements for enhanced cooperation in the area of nuclear medicine. The Arrangements, covering 2020 to 2023, provide a framework for capacity building in the areas of nuclear medicine, molecular imaging and allied disciplines, particularly for professionals from French-speaking countries. The Agency also extended its partnership with the International Federation of Pharmaceutical Manufactures and Associations.

“The Agency joined forces with the Joint United Nations Programme on HIV/AIDS (UNAIDS) to scale-up efforts to tackle cervical cancer.”

¹¹ Section A.3 responds to section 3, operative paragraph 4 of resolution GC(64)/RES/11 on optimizing the quality, the number and impact of TC projects and to create synergies among them; section 3, operative paragraph 8 on applying the two-step mechanism in monitoring the quality of TC projects; and to section 3, operative paragraph 11 on OIOS evaluation of TC projects on the basis of specific outcomes achieved in relation to objectives outlines in the relevant Country Programme Framework (CPF) or national development plan.

Technical cooperation partnerships signed by the Agency in 2020	
Partner (Memorandum of Understanding)	Area of cooperation
Joint United Nations Programme on HIV/ AIDS	Cancer partnership initiative for cervical cancer control
Partner (Practical Arrangements)	
Union for International Cancer Control	Enhancing the role, capacity and quality of and access to radiation medicine services as essential components of a comprehensive cancer control approach
Sovereign Military Hospitaller Order of Saint John of Jerusalem of Rhodes and of Malta	Outreach and resource mobilization in nuclear medicine, radiation medicine, radiation oncology, radiotherapy and palliative care
Global Access to Cancer Care Foundation	Training radiation oncologists, medical physicists, and radiation therapists, and enhancing training and clinical education capacities in LMICs
United Nations Industrial Development Organization	Peaceful uses of nuclear technology for inclusive and sustainable industrial development
RCA Regional Office (amended and extended in 2020 for another three years)	Performing secretariat duties for meetings under the 2017 RCA for research, development and training related to nuclear science and technology for Asia and the Pacific
French Society of Nuclear Medicine and Molecular Imaging	Nuclear medicine and molecular imaging
Caribbean Public Health Agency (extended in 2020 for another three years)	Peaceful uses of nuclear science and technology to prevent disease, promote and protect health, for sustainable socioeconomic development
International Federation of Pharmaceutical Manufacturers (extended in 2020 for another three years)	Cancer partnership initiative for comprehensive cancer control in low- and middle-income countries

Collaboration with the United Nations Industrial Development Organization was strengthened with the signature of Practical Arrangements enabling increased access to nuclear science and technology for common Member States to support sustainable industrial development efforts. Comprehensive technical support in agricultural value-chains for increased food security, better management of environmental stressors such as plastics, as well as energy planning tools and services for optimizing a country's sustainable energy mix, are some of the areas where countries are expected to benefit from this new initiative.

The Agency presented the uses of nuclear science and technology in Africa at the African Union Commission virtual meeting for Ministers in charge of Science, Technology and Innovation, and also made presentations to the Resident Representatives of African Members States to the African Union Commission in New York. The Agency continues to support the African Union's Pan-African Tsetse and Trypanosomiasis Eradication Campaign. Virtual platforms are being used to maintain the Campaign's momentum. Recognizing that partnerships between AFRA and regional entities are crucial, the Agency attended the signing of the Memorandum of Understanding between AFRA and AFCONE, which supports regional efforts in the area of using nuclear science and technology for peaceful purposes in Africa.

The Practical Arrangements signed with the Association of Southeast Asian Nations (ASEAN) Secretariat were operationalized with the development of an action plan, and cooperative activities are progressing under RAS9077, 'Supporting Regional Nuclear Emergency Preparedness and Response in the Member States of ASEAN Region'. Future TC projects are under preparation in the areas of agricultural value chain improvement, and on cultural heritage protection.

Continued close collaboration with Caribbean Community technical institutions, some of which have Practical Arrangements with the Agency, fostered ongoing engagement in regional priority development areas in the Caribbean. Practical Arrangements with the Caribbean Public Health Agency, first signed in June 2017 to address technical cooperation for the prevention of disease, promotion and protection of health for sustainable socio-economic development, were extended in January 2020 for a further three years. The Caribbean Disaster Emergency Management Agency collaborated with the Agency in the development of a model National Radiological Emergency Response Plan for the CARICOM region.

The Practical Arrangements with the University of West Indies Mona focus on training professionals in medical radiation physics and radiation safety. In 2020, the University, together with Jamaica's Hazardous Substances Regulatory Authority and other stakeholders, collaborated on an action plan for the formulation of a national education and training strategy in radiation safety. Supported by the Agency, the national institutions will continue collaborating to provide necessary education and training to professionals working with ionizing radiation in Jamaica and in the Caribbean region. In addition, the University of West Indies Mona Campus cooperated with Agency experts to review the theoretical Master's programme currently offered at the University. The review results will provide a basis for the expansion of the current theoretical programme to a full clinical Master's programme in cooperation with national hospitals.

The longstanding collaboration between the IAEA and the European Union continued in 2020. In July, the ninth EU-IAEA project review meeting under the 2016 Delegation Agreement took place virtually to review the implementation of the six ongoing EU-funded projects, three of which are TC projects. Implementation of the 2019 Delegation Agreement also began.

Resource mobilization

Effective resource mobilization is essential for the implementation of the unfunded (footnote-a/) component of the TC programme, particularly due to the increasing demand from Member States for IAEA support to tackle global challenges and to meet their development goals. In line with the Strategic Guidelines on Partnerships and Resource Mobilization, the Agency is moving actively, using a harmonized corporate approach, to seek new forms of collaboration and sources of funding to enable the expansion of the services offered to Member States. The Agency recognizes the generosity of the support provided to the TC programme by Member States, development banks, philanthropic organizations and the private sector, and strongly emphasizes the key role of countries participating in the TC programme in resource mobilization and government cost sharing, and in reaching out to non-traditional donors.

In 2020, extrabudgetary resources and in-kind contributions totalling €44.1 million were mobilized for the TC programme. €13.1 million was received through the Peaceful Uses Initiative mechanism. €26.3 million of the total figure was directed to the implementation of the interregional project INT0098, 'Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters', through which the IAEA's support to Member States in addressing COVID-19 was delivered.



Dr Joy St John, Executive Director of the Caribbean Public Health Agency signs the extension of Practical Arrangements with Luis Longoria, Director of TCLAC Division. (Photo: IAEA)

Ensuring the continual improvement of the TC programme

Improvements to increase the efficiency, effectiveness and impact of the 2020–2021 TC programme and the 2022–2023 TC programme currently under preparation continued throughout 2020, guided by the results-based approach and the TC programme quality criteria, which were also reviewed and revised.

The Guidelines for the Planning and Design of the IAEA 2022–2023 TC programme were issued in January. Guidance on the two-step quality assurance process, and on the information that should be included in TC project documents and the logical framework matrix (LFM), was further developed for project teams and reviewers.

The TC project report processing system (TC-Reports) was updated to facilitate evidence-based tracking of progress and to allow for aggregated portfolio reporting on progress and achievements. Relevant templates and user guides were updated accordingly. The analysis of Project Progress Assessment Reports (PPARs) for the 2019 reporting period showed a good overall submission rate of 71 per cent, albeit slightly lower than the previous year. This was possibly affected by COVID-19 related issues faced by Member States, which slowed down final PPAR submission towards the end of the reporting process in March 2020.

In response to COVID-19 travel restrictions, training material on managing the TC programme in line with results-based management principles was made available on the Programme Cycle Management Framework IT platform. It includes three online tutorials for Member States related to the TC project document template, the logical framework approach and the TC project workplan and budget. As at the end of 2020, the online tutorial on using the Logical Framework Approach had more than 2 300 views. An internal series of seminars on results-based management covered topics such as improving programme monitoring and project designs.

Multiple virtual training activities were carried out for Member States on project design and the Logical Framework Approach. These included interactive training for NLOs and counterparts in Bahrain, Cambodia, China, Lao PDR, Nepal, Saudi Arabia and Thailand in order to assist sound project design. A joint virtual webinar with the Division of Radiation, Transport and Waste Safety on the importance of radiation safety and the Radiation Safety Information Management System (RASIMS) as a tool for self-assessment and its relation to the TC programme was attended by more than 100 participants in August 2020. For the Europe region, a series of five interactive webinars were organized in October 2020 (in English and Russian), and for Latin America and the Caribbean, a two-month long webinar series (delivered in Spanish) provided a complete description of the TC programme's procedures and operating components, focusing on the most essential timelines and milestones for programme planning, design and implementation.

As in previous years, the Department of Technical Cooperation worked closely with the Office of Internal Oversight Services (OIOS) on addressing TC-related findings and recommendations of audits and evaluations. In 2020, 25 recommendations from OIOS were implemented and closed.

Female participation in the TC programme

The Agency strongly encourages the expansion of female participation in the TC programme, and Member States are encouraged to nominate female NLOs, meeting and workshop participants, fellows and scientific visitors, and counterparts.

In 2020, the Agency supported the establishment of regional chapters of Women in Nuclear (WiN) in Africa and Latin America and the Caribbean. The regional chapter for Latin America and the Caribbean was supported by a project launched in early 2020 through the ARCAL regional agreement that aims to support equal female participation in nuclear science and technology by empowering women and promoting their contribution to technical, scientific and leadership roles in the field. The project builds upon the

“The Agency strongly encourages the expansion of female participation in the TC programme, and Member States are encouraged to nominate female NLOs, meeting and workshop participants, fellows and scientific visitors, and counterparts.”

achievements of previous IAEA efforts in the region to prepare young female professionals for leadership responsibilities in their respective national institutions.

Support was also provided for the establishment or revival of national WiN chapters in Africa and in Latin America and the Caribbean, and WiN chapters were launched in Ghana, Lesotho, Nigeria, and Tunisia, as well as Chile, Ecuador and Peru.



In collaboration with Stand Up for Nuclear (an independent nuclear advocacy group), the counterparts of the Women in Nuclear (WiN) ARCAL project held a virtual event in September, 'Women in Nuclear: Conquering Spaces in Latin America and the Caribbean'. The event included a panel discussion which focused on tackling gender issues, and a series of talks, workshops and various activities on nuclear energy communications and gender equality.

In Africa, the Agency participated in a webinar organized by AFCONE in collaboration with WiN Africa, on 'African Women Contribution to Socio-Economic Development through Peaceful Uses of Nuclear Energy'.

A two-week regional training course on 'Women for Nuclear Science Education and Communication' was launched in late 2020 in cooperation with the Australian Nuclear Science and Technology Organisation (ANSTO). The course, a continuing education programme for female university science teachers and science communication professionals supported through the regional project RAS0081, 'Supporting Human Resource Development and Nuclear Technology Including Emerging Needs', aimed to train women educators to teach how nuclear science and technology is contributing to the achievement of the SDGs. It was attended by 59 educators and communicators from 36 IAEA Member States in Africa, Asia and the Pacific, Europe and Latin America and the Caribbean, with experts from ANSTO, Argonne National Laboratory and IAEA participating.



Cassandra Casey, General Manager of Communications and Community Relations at ANSTO, describes the importance of effective nuclear communication to regional training course participants. (Photo: ANSTO)

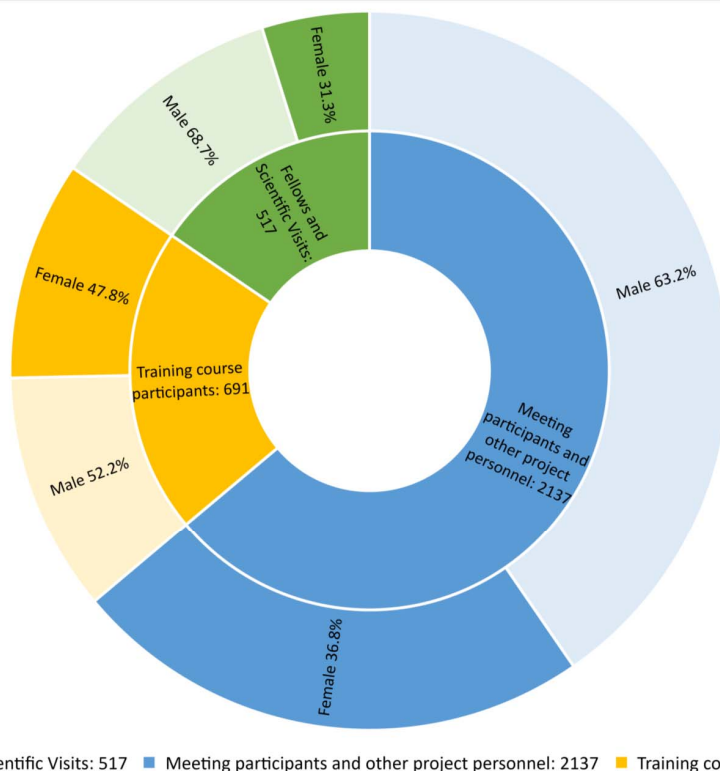


Figure 2: Male/female participation in the TC programme.



Figure 3: Percentage of male and female NLOs by region.

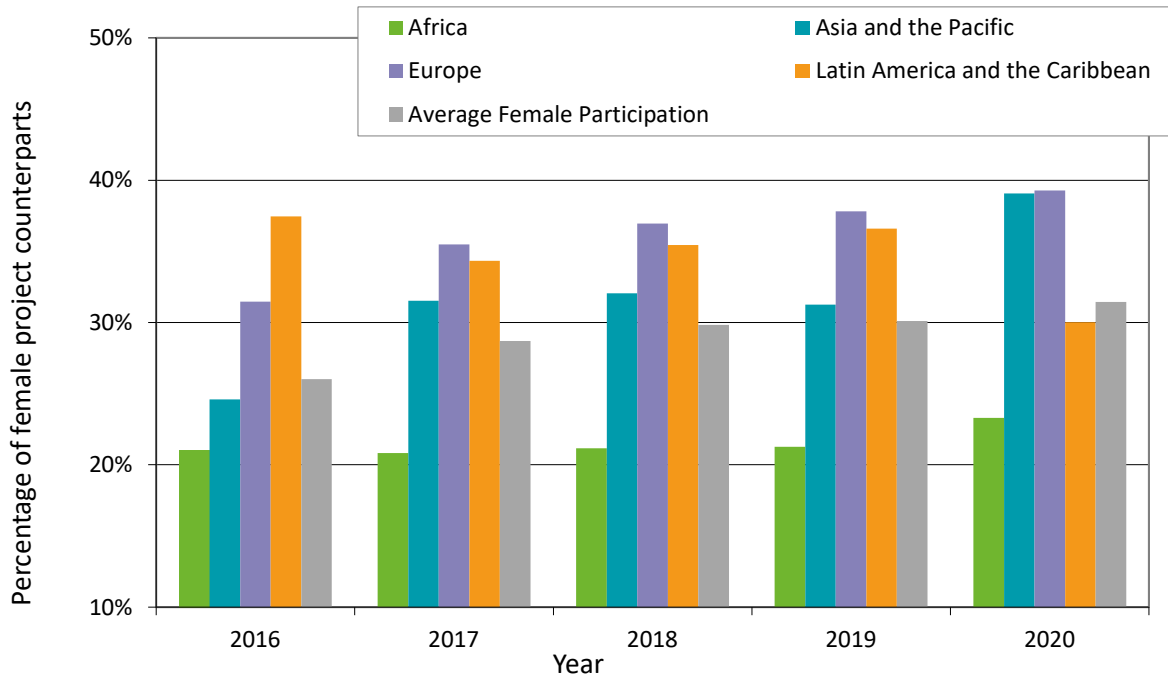


Figure 4: Female project counterparts by region, 2016–2020.

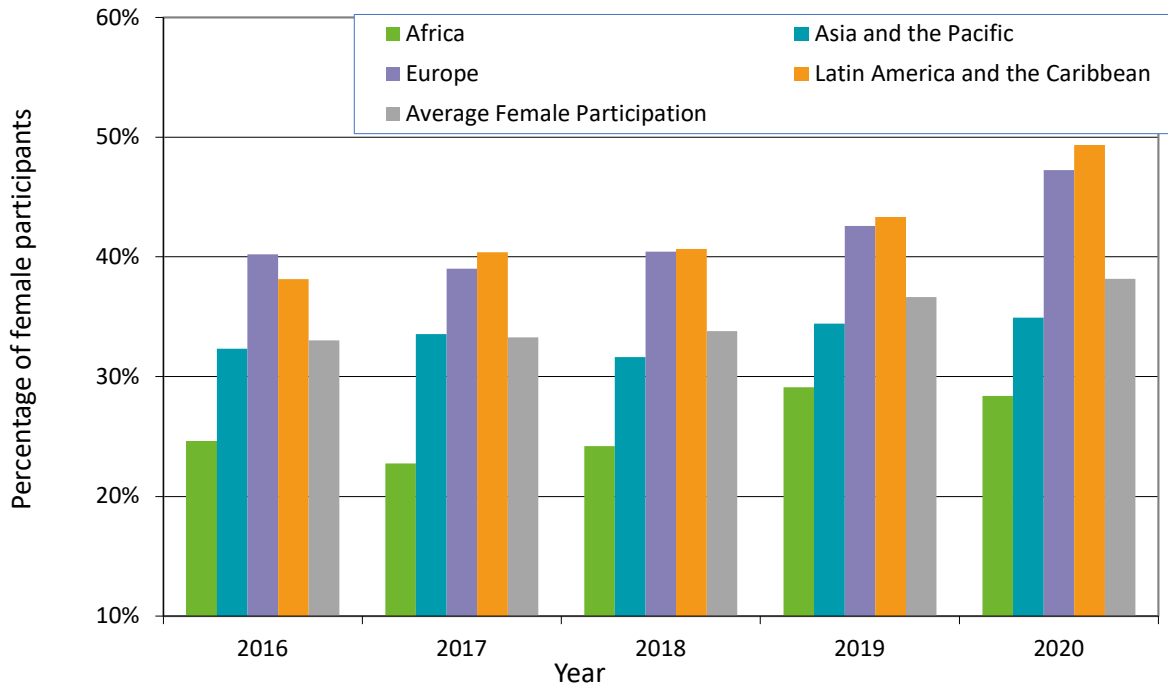


Figure 5: Female participation in training as fellows, scientific visitors, training course participants, meeting participants and other project personnel, 2016–2020.



B.

TC PROGRAMME RESOURCES AND DELIVERY

B. TC Programme Resources and Delivery¹²

B.1. FINANCIAL OVERVIEW

Resources for the technical cooperation programme

At the end of 2020, €81.6 million of the €88.1 million target for the 2020 Technical Cooperation Fund (TCF) had been pledged and €80.2 million in payments had been received. Total TCF resources including National Participation Costs (NPCs), assessed programme cost (APCs) arrears, and miscellaneous income amounted to €84.5 million (€80.2 million TCF, €3.7 million NPCs, and €0.5 million miscellaneous income). New extrabudgetary resources for 2020 came to €44.1 million and in-kind contributions amounted to €0.1 million.

The rate of attainment on pledges as at 31 December 2020 was 92.6% and the rate of attainment on payments on the same date was 91.1% (Fig.6). One hundred and twenty Member States, including 22 LDCs, paid their TCF target in full or partially. Total payments received in 2020 include €105 994 either of deferred or of additional payments by eleven Member States. Excluding these payments, the 2020 rate of attainment on payments would have still been 91.0%.

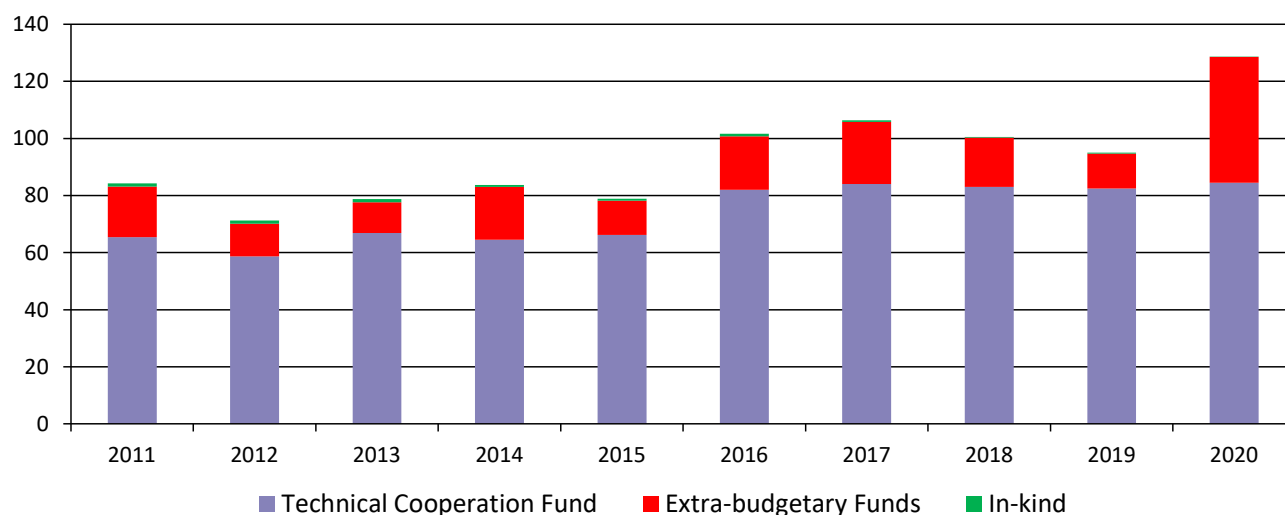


Figure 6: Trends in TC programme resources, 2011–2020.

¹² Section B responds to section 4, operative paragraph 5 of resolution GC(64)/RES/11 on the payment of TCF contributions and NPCs, and payment of APC arrears, taking into account the views of the General Conference when requesting Member States to pledge and pay their respective shares of the TCF targets and to make timely payments to the TCF; section 4, operative paragraph 8 on seeking resources to implement footnote-1/projects; section 4, operative paragraph 9 on making voluntary contributions to show flexibility as regards their use in order to enable the implementation of more footnote-a/projects; section 4, operative paragraph 10 on extra budgetary contributions including the PUI; and to section 5, operative paragraph 5 on cost-sharing, outsourcing and other forms of partnership in development by reviewing and amending or simplifying, as appropriate, relevant financial and legal procedures.

Table 1: TC programme resources in 2020

2020 target for voluntary contributions to the TCF	88.1 million
Technical Cooperation Fund, NPC, APC, miscellaneous income	84.5 million
Extrabudgetary resources ¹³	44.1 million
In-kind contributions	0.1 million
Total new resources for the TC programme	128.6 million

Table 2: Payment of National Participation Costs (NPCs) and assessed programme cost (APC) arrears

	Received in 2020	Outstanding payments at end 2020
NPCs	3.7 million	0.9 million
APCs	0 million	0.7 million

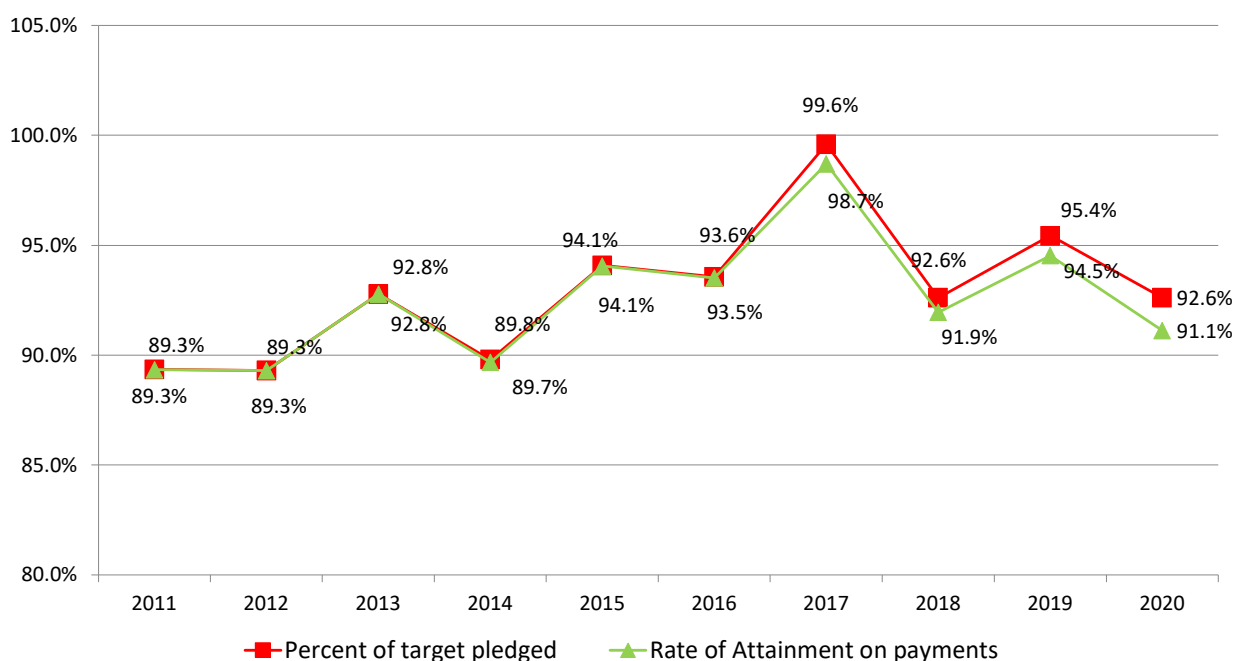


Figure 7: Trends in the Rate of Attainment, 2011-2020.

Extrabudgetary and in-kind contributions

Extrabudgetary contributions from all sources in 2020 (donor countries, international and other organizations, government cost sharing) accounted for €44.1 million. The breakdown of the €44.1 million is as follows: €3.6 million funding for activities where the donor is the recipient (commonly referred to as government cost sharing); €40.5 million from donors, of which €13.1 million was received through the Peaceful Uses Initiative mechanism. Eighteen African Member States provided extrabudgetary contributions amounting to €0.9 million for regional technical cooperation projects through the AFRA Fund. More detail is contained in Table 3 (extrabudgetary contributions by donor), Table 4 (government cost sharing) and Table 5 (contributions to PACT). In-kind contributions accounted for €0.1 million in 2020.

¹³ Please refer to Table A.5 of the Supplement to this report for details.

Table 3: Extrabudgetary contributions (where the donor is not the recipient) allotted to TC projects in 2020, by donor

Belgium	50 000	Netherlands	1 500 000
Bulgaria	10 000	Norway	2 065 433
Brazil	75 000	Pakistan	29 790
Canada	3 268 401	Philippines	4 550
Chile	9 060	Portugal	20 000
China	71 272	Russian Federation	905 000
Czech Republic	91 408	San Marino	32 866
European Commission	754 566	Spain	190 000
Estonia	20 000	Sweden	485 535
Finland	200 000	United Kingdom	561 798
France	100 000	United States of America	18 499 356
Germany	500 000	AFRA Fund	876 383
Japan	5 489 218	Korea Nuclear Association for International Cooperation (KNA)	136 850
Korea, Republic of	313 771	OPEC Fund for International Development (OFID)	46 050
Malaysia	10 000	Sovereign Military Order of Malta	10 000
Monaco	40 000	Takeda Pharmaceutical Company Limited, Japan	4 102 732
Total			40 469 039

Table 4: Funding where the donor is the recipient (Government cost sharing) allotted to TC projects in 2020

Albania	65 000	Malta	429 500
Benin	253 726	Mexico	974 000
Bosnia and Herzegovina	50 000	Morocco	450 000
Cameroon	172 725	Nigeria	454 200
Georgia	80 000	Pakistan	44 923
Hungary	20 000	Serbia	197 500
Jordan	380 250	Tunisia	15 250
Total			3 587 073

Table 5¹⁴: Extrabudgetary contributions to PACT, 2020¹⁵

Belgium	50 000
France	50 000
Monaco	40 000
Russian Federation	105 000
Sovereign Order of Malta	10 000
Sweden	294 695
Total	549 695

¹⁴ Funds presented under Table 5 are already reported under Table 3 above. Table 5 marks those contributions that were made to PACT only.

¹⁵ In addition to €549 695, €417 300 (reported under Table 3) has been received as a result of PACT resource mobilization efforts.

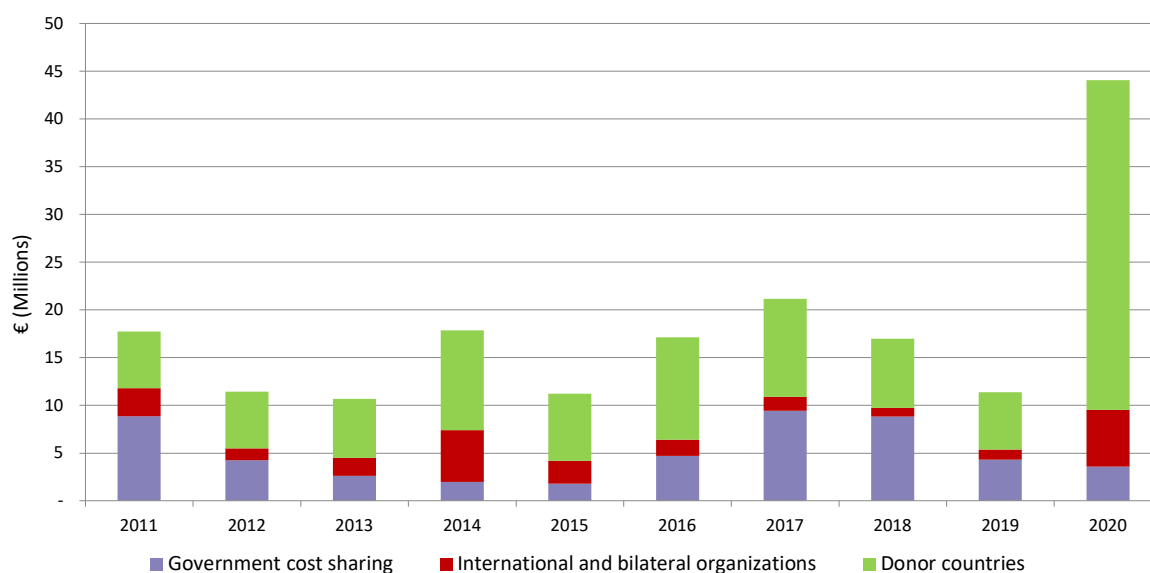


Figure 8: Trends in extrabudgetary contributions by donor type, excluding contributions to PACT, 2011–2020.

B.2. DELIVERING THE TECHNICAL COOPERATION PROGRAMME

Financial implementation

TC programme delivery is expressed in both financial and non-financial terms. Financial delivery is articulated in terms of actuals¹⁶ and encumbrances. Non-financial delivery (i.e. outputs) can be expressed numerically in terms of, for example, experts deployed, training courses conducted, and purchase orders obligated.

Financial implementation for the TCF, measured against the budget for 2020 as at 31 December 2020, reached 80.4% (Table 6).

Table 6: TCF financial indicators for 2018, 2019 and 2020

Indicator	2018	2019	2020
Budget allotment at year end ¹⁷	106 612 040	123 376 365	116 306 630
Encumbrances + actuals	91 377 251	109 937 361	93 473 177
Implementation rate	85.7%	89.1%	80.4%

Unallocated balance

At the end of 2020, the unallocated balance¹⁸ amounted to €0.0 million. €12.9 million were received as advance payments for the 2021 TCF in 2020. Some €1.5 million of cash is held in non-convertible currencies which cannot be used in the implementation of the TC programme.

¹⁶ Actuals are the equivalent of disbursements in line with the terminology in use since the implementation of the Agency-wide Information System for Programme Support (AIPS/Oracle).

¹⁷ 2020 budget allotment at year end includes carry-over from previous years of €8.7 million, already allotted to projects.

¹⁸ Total funds not allocated to TC projects.

Table 7: Comparison of the unallocated balance of the TCF

Description	2019	2020
Unallocated balance	1 737 654	-
Advance payment in 2019 and 2020 for TCF for following year	10 899 855	12 897 556
Non-convertible currencies that cannot be utilized	1 625 139	1 514 657
Currencies that are difficult to convert and can only be used slowly	15 747	223 167
Adjusted unallocated balance	14 278 395	14 635 380

Human resources and procurement

Human resource and procurement indicators show the non-financial delivery of the TC programme. Regarding procurement, a total of 4 118 purchase orders were issued in 2020, to a value of €81.1 million. This includes the procurement made in relation to the Agency's support to Member States on COVID-19.

Table 8: Delivery of outputs: non-financial indicators for 2020

Indicator		virtual
Expert and lecturer assignments	979	275
Meeting participants and other project personnel	2 137	1342
Fellowships and scientific visitors in the field	517	10
Training course participants	691	521
Regional and interregional training courses	32	22

Table 9: TC procurement in 2020

Division	Requisitions	Purchase orders issued	Value of Purchase Orders issued
TCAF	688	793	19 162 487
TCAP	623	533	12 511 130
TCEU	315	303	12 483 458
TCLAC ¹⁹	1 046	2 488	36 906 415
PACT	5	1	2 232
Total	2 677	4 118	81 065 722

At the end of 2020, 1 139 projects were active, and an additional 423 projects were in the process of being closed. During 2020, 355 projects were closed. Four projects were cancelled in consultation with the relevant Member State.

Programme Reserve projects

No Programme Reserve projects were requested in 2020.

¹⁹ The larger number of requisitions and purchase orders in this row (in comparison to previous years) are due to the interregional technical cooperation project INT0098, 'Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters', which is managed by TCLAC.



C.

PROGRAMME ACTIVITIES AND ACHIEVEMENTS IN 2020



Africa 2020

Photo: H Najapau/Zambia

C. Programme Activities and Achievements in 2020²⁰

C.1. AFRICA

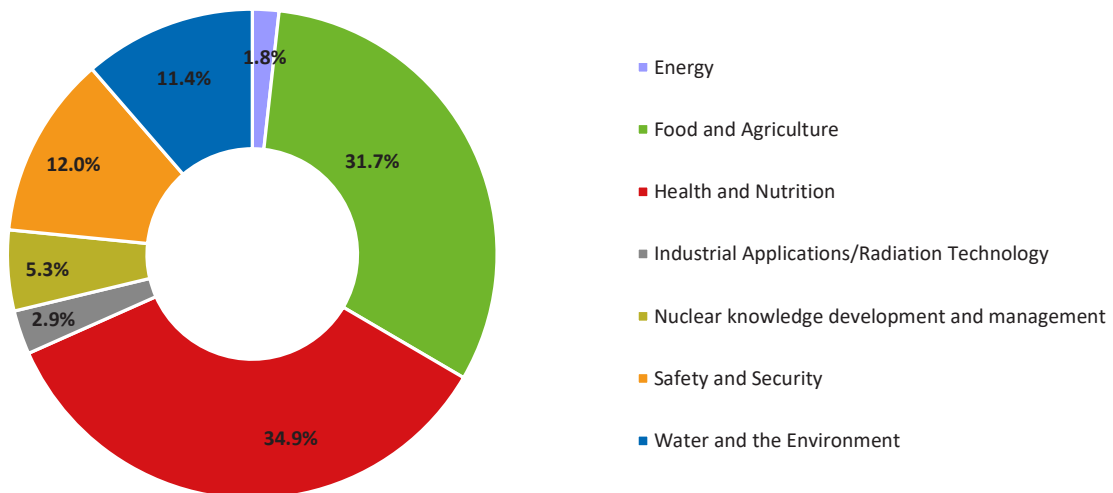
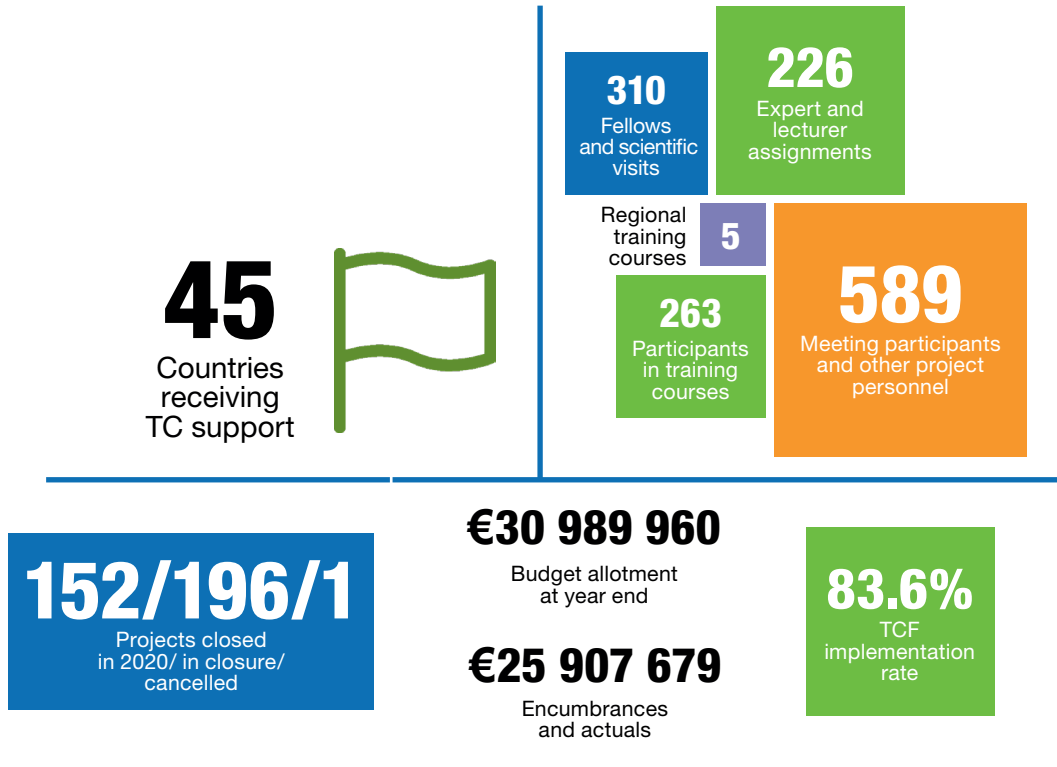


Figure 9: Actuals in the Africa region in 2020 by technical field.

²⁰ Section C responds to section 1 operative paragraph 3, of resolution GC (64)/RES/11 on assisting Member States in the peaceful, safe and secure application of nuclear science and technologies; section 2, operative paragraph 1 on development of nuclear technology and know-how and its transfer to and among Member States for peaceful uses; section 2, operative paragraph 5 on climate change adaptation and mitigation through the use of nuclear techniques; section 2, operative paragraph 9 on implementing new unified approach to cancer control and enable Member States to continue receiving robust support in maintaining, expanding and improving their cancer control capacity; section 2, operative paragraph 10 on efforts to reform PACT as well as on the status of all recommendations; and section 5, operative paragraph 4 on TC activities supporting the self-reliance, sustainability and further relevance of national nuclear and other entities in Member States.

Regional highlights in Africa

In 2020, 45 Member States in the Africa region, of which 26 were least developed countries, participated in the TC programme through 316 national projects and 34 regional projects. The programme achieved an implementation rate of 83.6% in the region.

Five Member States signed Country Programme Frameworks (CPFs). CPFs for Benin, Djibouti, Madagascar, Mali, the Republic of the Congo and Tunisia are at an advanced stage of preparation, and are planned for signature in 2021. In 2020, Comoros became the 46th IAEA African Member State. Djibouti and Togo approved their nuclear legislation, and Benin and Lesotho established national regulatory bodies.

The human resources component of the technical cooperation programme in Africa was profoundly affected by the travel restrictions resulting from the COVID-19 pandemic. Training courses with a strong hands-on nature could not be implemented. However, fellowships, particularly long term ones, continued to be implemented as far as possible. Some procurement planned under TC projects for the year 2021 was advanced. Virtual meetings and training courses were used to continue capacity building as far as possible.

The technical cooperation programme in Africa focuses on the priority areas highlighted in the AFRA Regional Strategic Cooperative Framework (RCF) 2019–2023 and the Regional Programme Framework for Africa 2019–2023. A mid-term review of the 2019–2023 RCF was conducted in 2020, and the three initial priority areas (food and agriculture, human health, and radiation and nuclear safety) were expanded to take into account emerging priority areas including climate change adaptation, sustainable energy development and human nutrition.

In 2020, 245 national and regional concepts were received in preparation of the 2022–2023 TC cycle, from which national and regional project designs are being formulated in line with the relevant CPFs, national sectoral plans and the 2019–2023 RCF.

The annual meeting of NLOs was held in Vienna, Austria in February 2020, with a second virtual meeting in October. Participants discussed and agreed on strategies and implementable decisions to further enhance the delivery of the technical cooperation programme in Africa. Lessons learned from measures adopted to mitigate the impact of the COVID-19 pandemic to ensure the continuity of the delivery of the TC programme were also discussed.

Several webinars were held with the African Commission on Nuclear Energy (AFCONE) to highlight the status of activities already implemented in Africa and to strengthen specific cooperation between the Agency and AFCONE.

The Agency participated in the 20th meeting of the Inter-Agency Consultative Group of the United Nations system and international organizations on the Implementation of the Istanbul Programme of Action (IPoA) for LDCs. The meeting focused on the UN's response to COVID-19 to assist LDCs.

On the invitation of the United Nations Office of the Special Adviser on Africa, the Agency also participated in the Interdepartmental Taskforce on African Affairs to discuss ways to ensure further coherence and an integrated approach for UN support for Africa.

Project highlights

The first harmonized quality control protocol in nuclear medicine and diagnostic radiology in the African region was established in 2020 under the regional project RAF6053, 'Enhancing Capacity Building of Medical Physicists to Improve Safety and Effectiveness of Medical Imaging'. This quality control protocol is expected to enhance the quality and safety of imaging services and will facilitate comparison of results as well as knowledge- and experience-sharing across the region. In addition, a large-scale survey was conducted for the first time to establish the baseline for the number of available imaging medical

CPFs signed in Africa in 2020

Chad Sudan

Mauritania Togo

Mauritius

“The first harmonized quality control protocol in nuclear medicine and diagnostic radiology in the African region was established in 2020.”



A disused radioactive source in the Republic of the Congo is securely guarded prior to its transport. (Photo: M. Warnau; D Ladsous/IAEA)

physicists and to quantify the shortage of personnel in this field. A total of 82 health facilities from 21 countries participated. One of the main findings was that in some countries even a twenty-fold increase in the number of imaging medical physicists will still not adequately cover the current shortfall.

The regional project RAF5073, ‘Strengthening Africa’s Regional Capacity for Diagnosis of Emerging or Re-emerging Zoonotic Diseases, including Ebola Virus Disease, and Establishing Early Warning Systems’, continued strengthening regional capacities to identify zoonotic diseases early and in safe and secure conditions. In 2020, focus was placed on building capacities to identify deadly viruses by sequencing their genetic material using whole genome sequencing techniques.

The network of 13 countries participating in project RAF7019, ‘Adding the Groundwater Dimension to the Understanding and Management of Shared Water Resources in the Sahel Region’, has undertaken sampling campaigns to address important gaps in existing knowledge of five basins in the Sahel region. By late 2020, 920 new samples had been taken and analysed. Preliminary assessment of the new data indicates that the aquifer systems of the Sahel region contain groundwater of good quality with regard to drinking water standards with, however, relatively significant mineralization and slight anthropogenic contamination observed locally. The results for stable and radioactive isotopes generally show two origins of recharge, reflecting the presence of significant current recharge as well as the existence of fossil waters in many countries.

Also under RAF7019, the IAEA Water Availability Enhancement (IWAVE) approach was carried out in a number of countries who were ready to implement this methodology (Benin, Cameroon, Ghana, Niger and Nigeria), and has now been expanded to include Mali, Senegal and Togo. Furthermore, in order to enhance regional self-reliance in isotope hydrology expertise, 15 PhD sandwich fellowships were awarded in 2019, with most students able to complete their first period at foreign universities in 2020, despite COVID-19 restrictions.

In the Central African Republic, with the support of CAF5011, ‘Building National Capacities for Improving the Efficiency of Biological Nitrogen Fixation for Food Security, Fertility Restoration and Rehabilitation of Degraded Soils’, nuclear techniques have been used to improve best practices in soil and water management. It has been shown in a field experiment that cassava yields could be tripled by applying the best practices. Efforts in 2020 focused on scaling up experimental results to farmers, with the aim of creating a bigger impact. Brochures were produced with the support of the project and translated into

“The network of 13 countries participating in project RAF7019 has undertaken sampling campaigns to address important gaps in existing knowledge of five basins in the Sahel region.”

“In Sierra Leone, the Agency concentrated on enhancing laboratory capacity at the Milton Margai College of Education and Technology in Freetown, specifically capacity for monitoring livestock diseases.”

the local language (Sango). More than 300 farmers from three localities (Mbaiki, Ndara and Pissa) benefited from training and field visits.

In Sierra Leone, the Agency concentrated on enhancing laboratory capacity at the Milton Margai College of Education and Technology in Freetown, specifically capacity for monitoring livestock diseases. Through TC project SIL5019, ‘Strengthening Capacities for the Diagnosis and Control of Zoonoses to Improve Public Health Services and Livestock Production’, laboratory technicians received extensive training on bacteriology, using virtual platforms, and a Laboratory Manual in Microbiology for Students was developed. This is now being used for teaching and practical courses on microbiology in Sierra Leone.

Under TC project PRC9001, ‘Establishing the National Regulatory Framework for Radiation Safety’, and with additional support from the Nuclear Security Fund, the Agency assisted the Republic of the Congo in increasing the security of disused radiotherapy cobalt-60 sealed sources. The two sources belong to the University Hospital of Brazzaville. One source, disused since 2010, had been stored at the Autonomous Port of Pointe Noire. The second source, not operational since 2015, was stored in the capital, Brazzaville. Following a comprehensive preparation phase, the Republic of the Congo finalized a transport security plan in November 2020 with the support of the Agency. A security system was designed for the package and a pre-shipment verification and simulation was conducted. In addition, 45 participants from the five government Ministries involved in the transport of the sources by road (Defence, Transportation, Health, Mines and Energy, Scientific Research and Technological Innovation) received training. A site assessment of the locations where the sources would be temporarily stored until their final export was conducted, and changes were made in line with IAEA recommendations to increase the security of these locations. The transport by road was carried out successfully and the two sources are now secured in accordance with international recommendations and awaiting final removal from the country to an authorized recipient for final management.

Regional cooperation

The 31st AFRA Technical Working Group Meeting (TWGM) took place in a virtual format in July 2020. Participants reviewed the performance of the AFRA programme and determined key recommendations to improve future programme delivery and performance. The meeting discussed the AFRA Working Document, the mid-term review of the AFRA



Shaukat Abdulrazak, Director of TCAF Division, speaks alongside HE Mrs Yayi Ladekan Eleonore, Minister of Higher Education and Scientific Research, from Benin, HE Mr Rapulane Molekane, Ambassador of South Africa to the IAEA and Chairman of the Vienna-based African Group, and current and incoming AFRA Chairs. (Photo: F. Omony/IAEA)

RCF 2019–2023, the regional programme for the 2022–2023 TC cycle, the AFRA Fund, human resource development strategy, Regional Designated Centres, the AFRA-AFCONE Memorandum of Understanding and annual reports of AFRA National Coordinators, Regional Designated Centres and project scientific consultants. A number of concrete programme and policy-related recommendations and resolutions to improve and enhance the performance of the AFRA programme were endorsed.

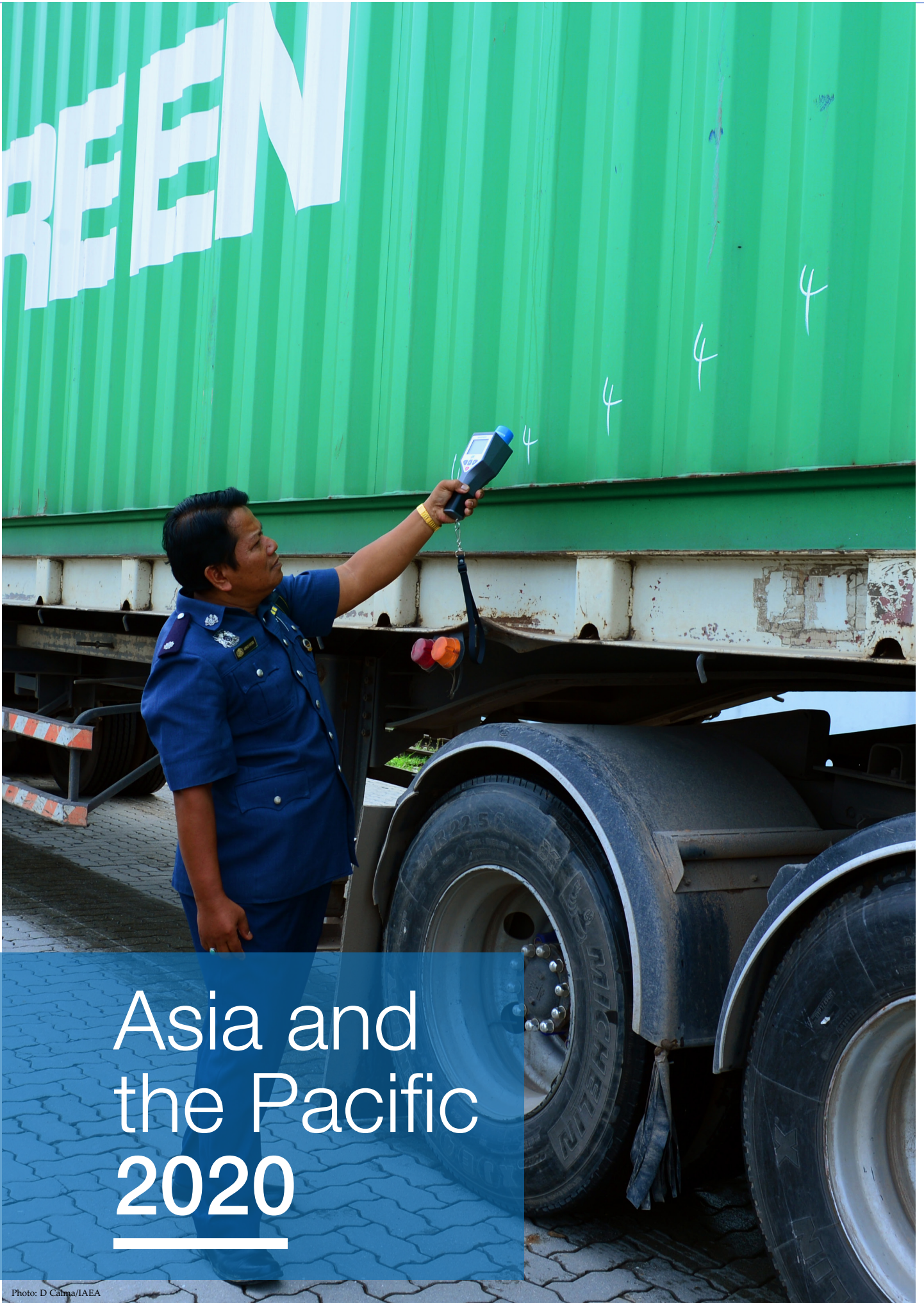
These recommendations and resolutions were presented at the 31st Meeting of AFRA Representatives, held virtually on the margins of the 64th Regular Session of the IAEA General Conference. Attended by State Party representatives, AFRA National Coordinators, representatives of the Vienna-based African Group, partner donor countries and organizations as well as IAEA staff, the meeting endorsed the recommendations of the 31st AFRA TWGM, including the mid-term review of the AFRA RCF 2019-2023 and the AFRA Regional Programme for the 2022–2023 TC cycle. At the meeting, the participants were briefed on the Agency’s response to urgent requests for COVID-19 assistance from across the world, and on how the Agency had maintained essential services to Member States despite multiple recent challenges, highlighting the excellent cooperation developed over the years that allowed the Agency to respond quickly in the African region. The AFRA Annual Report for 2019 was reviewed and endorsed at the meeting, and Benin was endorsed as the next AFRA chair.

Contributions to the AFRA Fund

The total contribution of AFRA State Parties to the AFRA Fund came to €876 383, demonstrating the Parties’ continued commitment to AFRA activities and regional ownership of the programme. The funding will be allotted to AFRA regional projects in 2021 to support the implementation of unfunded activities.

Table 10: Voluntary contributions to the AFRA Fund for TC activities, 2020

Country	Amount received	Country	Amount received
Angola	2 226	Malawi	630
Botswana	10 179	Mali	1 030
Burkina Faso	2 380	Mauritius	14 347
Democratic Republic of the Congo	2 226	Morocco	31 716
Egypt	112 751	Namibia	4 619
Eritrea	1 050	Rwanda	2 588
Ethiopia	2 209	Senegal	14 796
Lesotho	1 046	Seychelles	2 380
Libya	446 976	South Africa	223 234
		TOTAL	€876 383



Asia and the Pacific 2020

Photo: D Calma/IAEA

C.2. ASIA AND THE PACIFIC

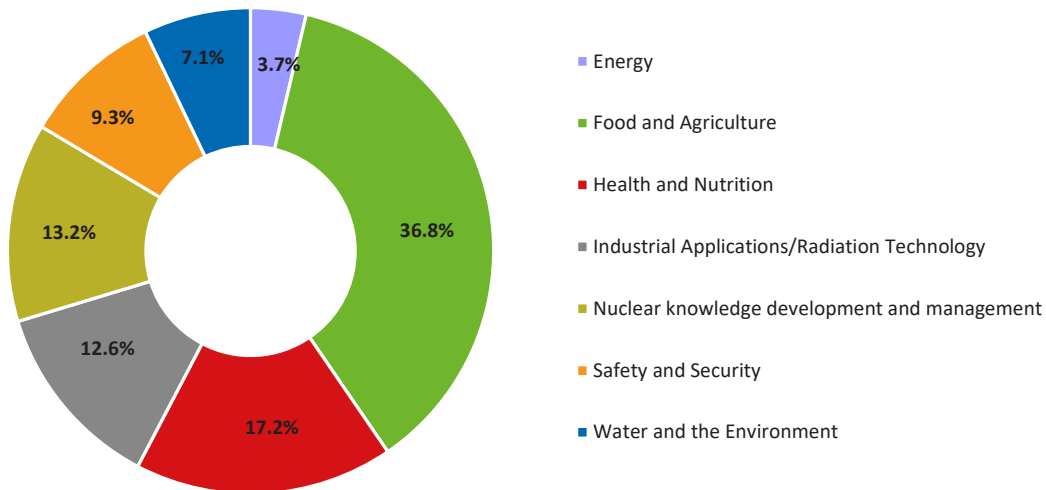
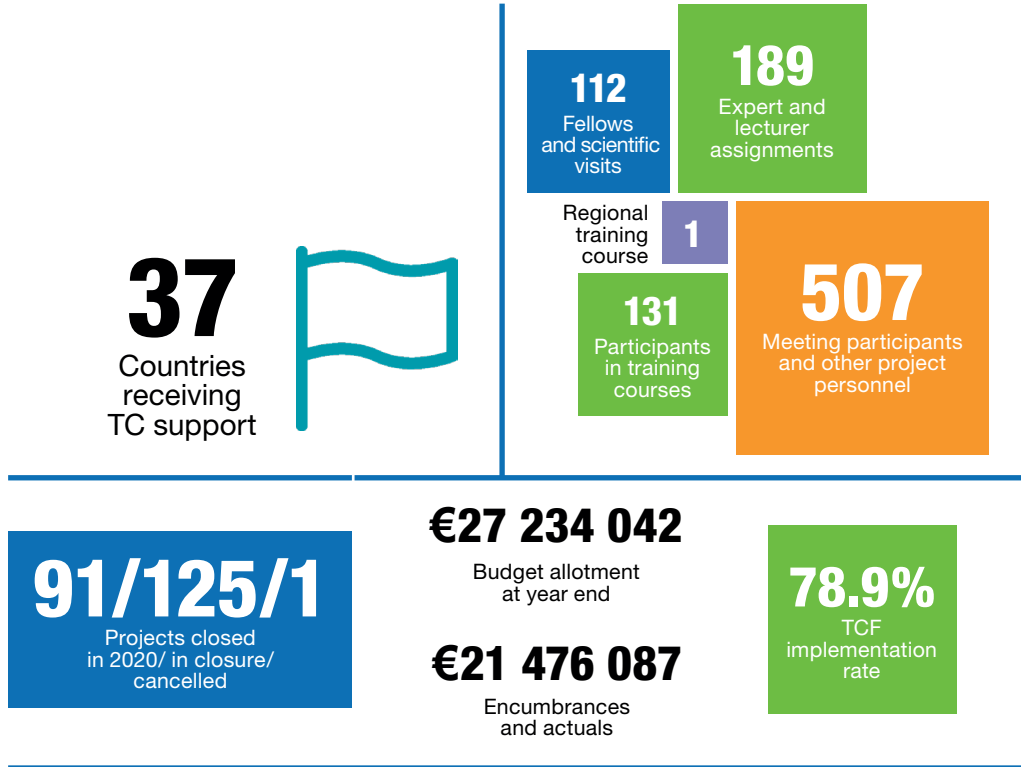


Figure 10: Actuals in the Asia and the Pacific region in 2020 by technical field.

Regional highlights in Asia and the Pacific

In 2020, 37 countries and territories in the Asia and the Pacific region, of which eight were least developed countries, participated in the TC programme through 396 national and 92 regional projects. The programme achieved an implementation rate of 78.9% in the region.

CPFs signed in Asia and the Pacific in 2020

Indonesia

Lao PDR

Two Member States signed CPFs, bringing the total of valid CPFs in the region to 31, with several more under review for 2021.

Throughout 2020, the technical cooperation programme in the Asia and the Pacific region focused on the key thematic areas of food and agriculture, radiation and nuclear safety infrastructure, water and environment, and human health and nutrition.

A virtual meeting of NLOs, NLAs, RCA National Representatives and ARASIA Representatives was held in December 2020 on the theme 'Celebrating Success and Envisioning the Future for the Technical Cooperation Programme in the Asia and Pacific Region', with 120 participants from the region. Discussions focused on work carried out since the last Asia and the Pacific NLO/NLA workshop in 2019, the challenges faced in light of the COVID-19 pandemic, and the strategic response by the Agency through its work with Member States of Asia and the Pacific region to ensure continuity in the delivery of the TC programme. At a special session during the meeting, IAEA Director General

Rafael Mariano Grossi announced the launch of two new publications: *Journeys to Success: A Collection of Success Stories from IAEA Technical Cooperation in Asia and the Pacific*²¹, which presents technical cooperation experiences and achievements from the region, and *Social and Economic Impact Assessment of Mutation Breeding in Crops of the RCA Programme in Asia and the Pacific*²², developed by the State Parties to the RCA Agreement, on their crop mutation breeding programme.

The Philippines celebrated their 48th Atomic Energy Week in December 2020. Held to promote public awareness and appreciation of the beneficial uses of nuclear science and technology, the week-long virtual event showcased national achievements in nuclear science made with Agency support, in fields that included radiopharmaceuticals, food and agriculture, environmental monitoring and industrial applications.



Farmers from RCA State Parties who participated in the mutation breeding programme. (Photo: IAEA)

Project highlights

Progress in human capacity building and infrastructure development support in the Asia and the Pacific region continued in 2020 under RAS5082, 'Managing and Controlling Aedes Vector Populations Using the Sterile Insect Technique', in Bangladesh, Brunei Darussalam, Cambodia, China, Fiji, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Viet Nam. Using virtual expert missions, guidelines were developed for *Design and Evaluation of Mosquito Population Suppression Trials and Including Epidemiological Analysis*. Long-distance expert assistance was also arranged to support Member States in conducting statistical analyses of laboratory rearing data and ovitrap data to monitor the density of adult Aedes mosquitoes in sterile insect technique (SIT) pilot trials. Entomological equipment and consumables continued to be delivered to Member States in the region throughout 2020.

A regional virtual training course on 'Advanced Hybrid Imaging Techniques Including Therapy in Paediatric Patients Children and Young Adults', was organized jointly by the

²¹ <https://www.iaea.org/sites/default/files/20/11/tc-journey-to-success-ap.pdf>.

²² <https://www.iaea.org/sites/default/files/20/11/social-and-economic-impact-assessment-of-mutation-breeding-in-crops-of-the-rca-programme-in-asia-and-the-pacific.pdf>.

European Association of Nuclear Medicine and the IAEA under regional project RAS6091, 'Enhancing the Management of Non-Communicable and Communicable Diseases through Capacity Building under the IAEA Curricula for Nuclear Medicine Professionals'. It was attended by 50 participants, including physicians, scientists, technologists and other professionals working in nuclear medicine. Participants who completed the course were provided with a European Association of Nuclear Medicine certificate of accredited Continuing Medical Education, which will allow them to maintain their professional credentials. A five-day workshop was held in early March in Abu Dhabi, United Arab Emirates, under UAE6009, 'Strengthening Quality and Safety of Radiology, Radiotherapy and Nuclear Medicine Services for Improved Cancer Management', which focused on the application of modern radiotherapy techniques, specifically Lung Stereotactic Ablative Radiotherapy (SABR) and Cranial Stereotactic Radiosurgery/Radiotherapy (SRS/SRT) for brain metastasis.

Over the last decade, the IAEA has supported scientific cooperation in the Middle East through the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME), which enables scientists from the region to cooperate on advanced research projects. The IAEA has facilitated the training of dozens of scientists to support SESAME and to help bring online the region's first particle accelerator. Agency support for SESAME, which is moving from commissioning towards full-scale operation, continued during the year, and was highlighted at the 37th Meeting of the Council of SESAME in December 2020.

The TC programme continued to support Kuwait in addressing SDG 13 on climate action under project KUW7008, 'Studying the Influence of Climate Change on Contaminant Transfer in Marine Organisms and Assessing the Impact of Pollutant Bioaccumulation on Seafood Safety Using Nuclear and Isotopic Techniques'. In 2020, experiments on climate change effects such as ocean acidification were carried out. The study provided the first data on Polonium-209 uptake rates and Polonium-210 concentration in five microalgae species under different pH scenarios, which will help the country understand the impacts of ocean acidification.

Two virtual courses in emergency preparedness and response were delivered in Arabic for more than 100 participants in Bahrain and Qatar tasked as responders for nuclear or radiological emergencies. The courses were supported by BAH9010, 'Ensuring the Sustainability of National Capabilities in Preparedness and Response to Radiation Emergencies', and QAT9014, 'Strengthening National Emergency Preparedness and Response Capabilities - Phase III', respectively.

The first virtual Site and External Events Design (SEED) peer review mission to Viet Nam was organized in 2020 under project VIE1010, 'Promoting the Reactor Safety Development Programme – Phase III', to support Vietnam Atomic Energy Institute with the development of guidelines for the preparation of a Site Evaluation Report and Environmental Impact Report.

In Syria, the TC project SYR7005, 'Assessing Groundwater Quality Using Nuclear and Isotope Techniques', provided support for the determination of the hydrochemical characteristics of groundwater to investigate any possible anomalies attributed to pollution or other factors. The Agency supported Jordan through project JOR7006, 'Enhancing National Capabilities in Investigation and Treatment of Natural Radioactivity in Drinking Water', in strengthening the management of groundwater resources through the procurement and installation of a water cleaning system for the fossil groundwater resource at Manasheer, Jordan.

"The IAEA has facilitated the training of dozens of scientists to support the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME) and to help bring online the region's first particle accelerator."



Studying the influence of climate change on contaminant transfer in marine organisms and assessing the impact of pollutant bioaccumulation on seafood safety at the Kuwait Institute for Scientific Research. (Photo: KISR)

Under national project LAO5004, 'Enhancing National Capability for Crop Production and Controlling Trans-Boundary Animal Diseases', the IAEA built capacities to apply best practices in soil, nutrient and water management to enhance the production of rice, cassava and maize in Lao PDR. The application of the best practices resulted in 35 per cent more rice production, and farmers were trained in how to adopt the practices.



Farmers visiting the demonstration plot in the Sanakarm district in Lao PDR. (Photo: Ministry of Agriculture and Forestry, Lao PDR)

“In Sri Lanka, several years of effort through the TC project SRL5047 have resulted in the establishment of molecular diagnostic services for major vector-borne diseases at a new 740 square metre facility at the Faculty of Medicine, University of Kelaniya, Sri Lanka.”

In Sri Lanka, several years of effort through the TC project SRL5047, 'Establishing a National Centre for Research, Training and Services in Medical and Molecular Entomology for Vector-borne Disease Control', have resulted in the establishment of molecular diagnostic services for major vector-borne diseases at a new 740 square metre facility at the Faculty of Medicine, University of Kelaniya, Sri Lanka. The project also upgraded facilities for research, training and services in medical and molecular entomology at the counterpart institution. Laboratory facilities were developed and project staff were trained. As of August 2020, expertise is fully available in-country.

Under project MAL5032, 'Strengthening National Capacity in Improving the Production of Rice and Fodder Crops and Authenticity of Local Honey Using Nuclear and Related Technologies', online training materials were developed to provide basic to intermediate knowledge and practical experience in the use of isotope ratio mass spectrometry (IRMS) for honey authenticity testing. The materials were delivered via a series of virtual trainings, informal assessments and real-time online support sessions. Over 10 staff members from the Malaysian Nuclear Agency and other end users benefitted from the training, which strengthened national capacities in the authentication and traceability of stingless bee honey – a strategic agricultural commodity in Malaysia.

China continued its efforts to suppress fruit fly populations with the support of the ongoing project CPR5026, 'Applying the Sterile Insect Technique as Part of an Area Wide Integrated Pest Management Approach to Control Two Fruit Flies'. In 2020, essential equipment for the sterile insect technique was provided under this project to support a pilot trial on the validation of the technique as part of an area-wide integrated pest management approach in selected areas of Hainan Province.

In Iran, several virtual training courses provided national counterpart institutions with valuable knowledge regarding the acceptance criteria and limits for fresh nuclear fuel as smart customers/buyers, supported under IRA2015, 'Enhancing Human Capacity for Acceptance Testing to Ensure Fuel Safety and Reliability'. A virtual workshop was also conducted on severe accident analysis. The workshop addressed severe accidents in pressurized water reactors as well as approaches for the development and implementation of severe accident management programmes at nuclear power plants.

The Agency provided support to Fiji, the Marshall Islands, Palau and Vanuatu on the principles of isotope hydrology through several national TC projects. Assistance

emphasized groundwater flow and surface-groundwater interactions, recharge and source typing. In-person fellowships were organized at the University of Quebec, Canada, for some participants. Due to the COVID-19 pandemic, two representatives from Palau and Vanuatu had to be repatriated and a second participant from Vanuatu could not travel. In order to provide continued support to the Member States, virtual training was organized for the repatriated fellows and additional participants. This included lectures, remote training in data analysis and interpretation, and support in drafting technical reports on isotope hydrology. Given the small geographic size of these Pacific Island Member States, understanding groundwater flow and its characteristics is crucial to ensuring adequate water supply. The training activities have equipped the Member States with capacity to analyse and report on isotope hydrology.

The Philippines continued its efforts in energy studies and nuclear power infrastructure development in light of the recommendations of the INIR missions completed in 2018. In 2020, several virtual expert missions were arranged to support the R&D activities of counterparts. A webinar on reactor utilization was attended by 100 lecturers and students from universities in the country, while a webinar on careers in non-power and power nuclear applications was attended by over 150 students from various universities.

Regional cooperation

The Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA) and the Cooperative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology (ARASIA) continued to serve as important mechanisms in 2020 for supporting Member States' efforts to address regional priorities.

In October 2020, the IAEA and the RCA Regional Office (RCARO) signed an Amendment to extend the Practical Arrangements for enhanced collaboration up to 2023. RCA also initiated the process for development of the Medium Term Strategy for 2024–2029 and for the update of its Regional Programme Framework.

The publication *Social and Economic Impact Assessment of Mutation Breeding in Crops of the RCA Programme in Asia and the Pacific* was launched in December 2020. The report assesses the social and economic impact of plant mutation breeding projects under the RCA, focusing on adding value rather than on primary research undertaken by individual countries. Based on this successful experience, the RCA has rolled out a new initiative to develop a social and economic impact assessment study in other areas.

In 2020, the ARASIA-designated Resource Centres in human health were expanded to include secondary standards dosimetry. This strategic approach will increase the visibility and sustainability of the multiple high-level facilities in ARASIA State Parties and will in turn facilitate and enhance access to science and technology for national and regional development across the region. In addition, the State Parties agreed to develop mega projects for the forthcoming programme.

*“The publication *Social and Economic Impact Assessment of Mutation Breeding in Crops of the RCA Programme in Asia and the Pacific* was launched in December 2020.”*



At a virtual meeting of National Liaison Officers, National Liaison Assistants and RCA and ARASIA representatives in December, participants reviewed achievements, assessed evolving challenges and discussed suitable actions for the near future. (Photo: D Calma/IAEA)



Europe 2020

Photo: D Calma / IAEA

C.3. EUROPE

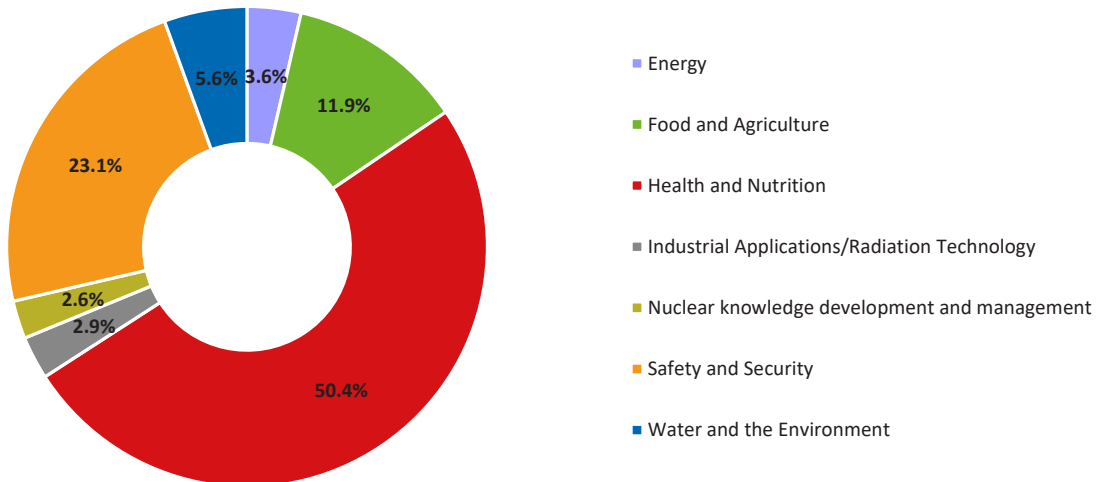
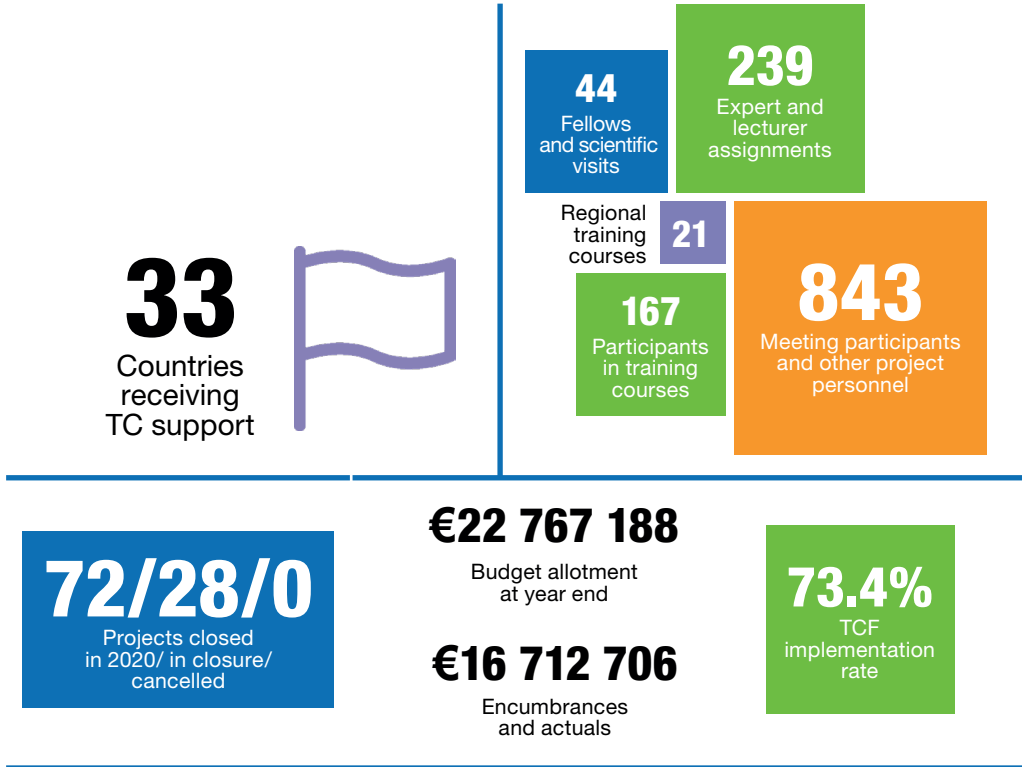


Figure 11: Actuals in the Europe region in 2020 by technical field.

Regional highlights in Europe

In 2020, 33 Member States in Europe and Central Asia participated in the TC programme through 221 national and 56 regional projects. The programme achieved an implementation rate of 73.4 per cent in the region.

CPFs signed in Europe in 2020

Croatia	Republic of Moldova
	Georgia

Three CPFs were developed and signed in 2020, bringing the total number of CPFs in the region to 23.

In line with Member States' priorities, the technical cooperation programme focused strongly on the thematic areas of nuclear and radiation safety and human health, namely radiation medicine including radiology, nuclear medicine and radiotherapy.

The IAEA has a long history of cooperation with the European Society for Radiotherapy and Oncology (ESTRO), and, more recently, with Inholland Academy, supporting the provision of a broad spectrum of training courses on specialized topics for radiotherapy professionals. In 2020, 111 medical practitioners (of which 61% were female) participated in virtual training courses offered by ESTRO and Inholland Academy in areas such as brachytherapy, image-guided radiotherapy and volumetric modulated arc therapy. Cooperation will continue in order to offer medical professionals in the region a wide range of training opportunities, which are an essential part of continued professional development for radiation medicine teams.

Project highlights

Cancer is the second leading cause of death in Moldova. The National Cancer Control Programme 2016–2025 and the National Development Strategy Moldova (2030) aim to reduce the incidence of cancer mortality by 10%, increase the rate of early detection by 25% and improve the quality of life of patients diagnosed with the disease by 2030. Over the past 15 years, Moldova has received Agency assistance to build capacity in the use of new technologies and to improve quality assurance in nuclear medicine, radio-diagnostics and radiotherapy. Under the current project MOL6010, 'Establishing a Radiotherapy Department at the Balti Municipal Clinical Hospital', the Oncological Institute in Chisinau — the only centre providing radiotherapy services to Moldovan patients — was equipped with a new Cobalt-60 source, an upgraded record and verify system, and an updated treatment planning system. A new linear accelerator, co-financed by the Moldovan government, as well as a water phantom, was ordered in 2020. The equipment will significantly improve public access to quality cancer diagnosis, treatment and care.

“Under MOL6010, the Oncological Institute in Chisinau — the only centre providing radiotherapy services to Moldovan patients — was equipped with a new Cobalt-60 source, an upgraded record and verify system, and an updated treatment planning system.”



The IAEA has supported the improvement and validation of the quality of radiological studies of the former Semipalatinsk test site land. (Photo: D Nakipov/ Institute of Nuclear Physics)

The Semipalatinsk Test Site in Kazakhstan, a territory of around 18 000 square kilometres, is the site of nuclear tests conducted between 1949 and 1989. In 2020, the TC project KAZ9014, 'Supporting the Transfer of the Former Semipalatinsk Test Site Land for Economic Use', was completed. The project supported the improvement and validation of the quality of radiological studies to enable an accurate decision on transfer of lands, taking into account national and international standards. By the end of the project, 10 410 square kilometres had been assessed by the country, comprising 57% of the total area to be evaluated. The TC project supported an independent review of the Semipalatinsk Test Site characterization reports, conducted by international experts, which validated the findings.

With the support of TC project LAT0003, 'Strengthening Knowledge and Skills in Radiotherapy Quality and Safety', the Faculty of Medicine at the University of Latvia was able to develop infrastructure to provide practical training on radiation safety and quality for radiotherapy. A laser system for patient positioning, a computed tomography and magnetic resonance imaging simulation software, a patient immobilization set and a treatment planning system for training purposes were provided through the project, enabling the faculty to provide advanced training in enhancing radiation therapy quality and safety and to offer hands-on training for residents and medical physicists. Treatment planning workstations were installed, and remote training was provided on the use of these systems to trainers. In addition, 22 radiography students had the possibility to perform treatment planning and discuss accurate delivery of radiotherapy and radiation protection of patients at each step of the radiation therapy process.

Belarus, the Russian Federation and Ukraine are receiving IAEA support under project RER7010, 'Improving the Remediation and Management of Terrestrial and Freshwater Environments Affected by Radioactive Material of Chernobyl Origin'. In 2020, the project supported the exchange and preservation of knowledge regarding best practices in public information. In addition, specialists from the three participating Member States drafted working materials offering an overview of, and recommendations for, the development of national strategies and programmes for the long-term safe management of radioactive material of Chernobyl origin in the environment.

In Kyrgyzstan, project activities under KIG9006, 'Improving the Regulatory Infrastructure for Ensuring the Radiation Protection and Safety of the Population', are contributing to ensuring radiation protection and safety by sending specialists from Government authorities and from the State Regulation Centre on Environmental Protection and Ecological Safety of the State Agency on Environment Protection and Forestry (SAEPF), and the State Inspection on Ecological and Technical Safety to visit the State Office for Nuclear Safety of the Czech Republic and the Agency of Nuclear and Radiation Safety of Georgia to learn how different regulatory bodies are organized and function. The visits put a special emphasis on how authorization and inspection activities for radiation sources and radioactive waste facilities are carried out.

Under TC project BYE2007, 'Improving Capacity of Operating Organization for Ensuring Safe and Reliable Nuclear Power Plant Operation', several training courses and expert services have been provided to support preparations for the introduction of nuclear power in Belarus. In February and March 2020, an INIR Phase 3 mission took place in Belarus to evaluate various aspects of national readiness to commission the first nuclear power plant, and later in the year nuclear fuel was supplied to the nuclear power plant. Commissioning of the first unit started in 2020, while commissioning of the second unit will start in 2021.

Slovakia is currently decommissioning two different nuclear power plants, A1 and V1, with different radiological characteristics. To ensure that the plants are safely and effectively decommissioned, and that subsequent radioactive waste management in Slovakia is also safe and effective, the operating personnel need to gain hands-on experience in facilities where relevant technical procedures are already being successfully implemented. In 2020, three staff of the State-owned Nuclear Decommissioning Company (JAVYS) received sponsorship under project SLR9014, 'Improving Capabilities and Standards for the Safe Implementation of Decommissioning Activities and Radioactive Waste Management',

"By the end of the KAZ9014 project, 10 410 square kilometres of the Semipalatinsk Test Site had been assessed by the country, comprising 57% of the total area to be evaluated."

"Under TC project BYE2007, several training courses and expert services have been provided to support preparations for the introduction of nuclear power in Belarus."

to attend an international Waste Management Symposium in Phoenix, Arizona, on the decommissioning of nuclear power plants and radioactive waste management. By participating in discussions at the Symposium, the JAVYS staff gained knowledge to conduct the decommissioning of A1 and V1.

In Europe and Central Asia, Member States have prioritized the development of capacities for the planning and implementation of decommissioning plans for large and small facilities. Such facilities, which include nuclear power plants, irradiators, accelerators, pre-disposal waste management facilities, laboratories and small research reactors, require safe decommissioning at the end of their operational lifetime due to the presence of radiological hazards. In 2020, the TC programme supported countries in the region in exchanging knowledge and lessons learned from their own national experiences in decommissioning small facilities. Practical training and guidance were also provided for the development, review and improvement of new and existing decommissioning plans for small-scale facilities.

Within a new Europe regional project on energy planning, 25 countries are being supported to understand and independently apply models that assess energy technologies in order to take knowledgeable decisions on how to shape their future optimal low-carbon energy mix.

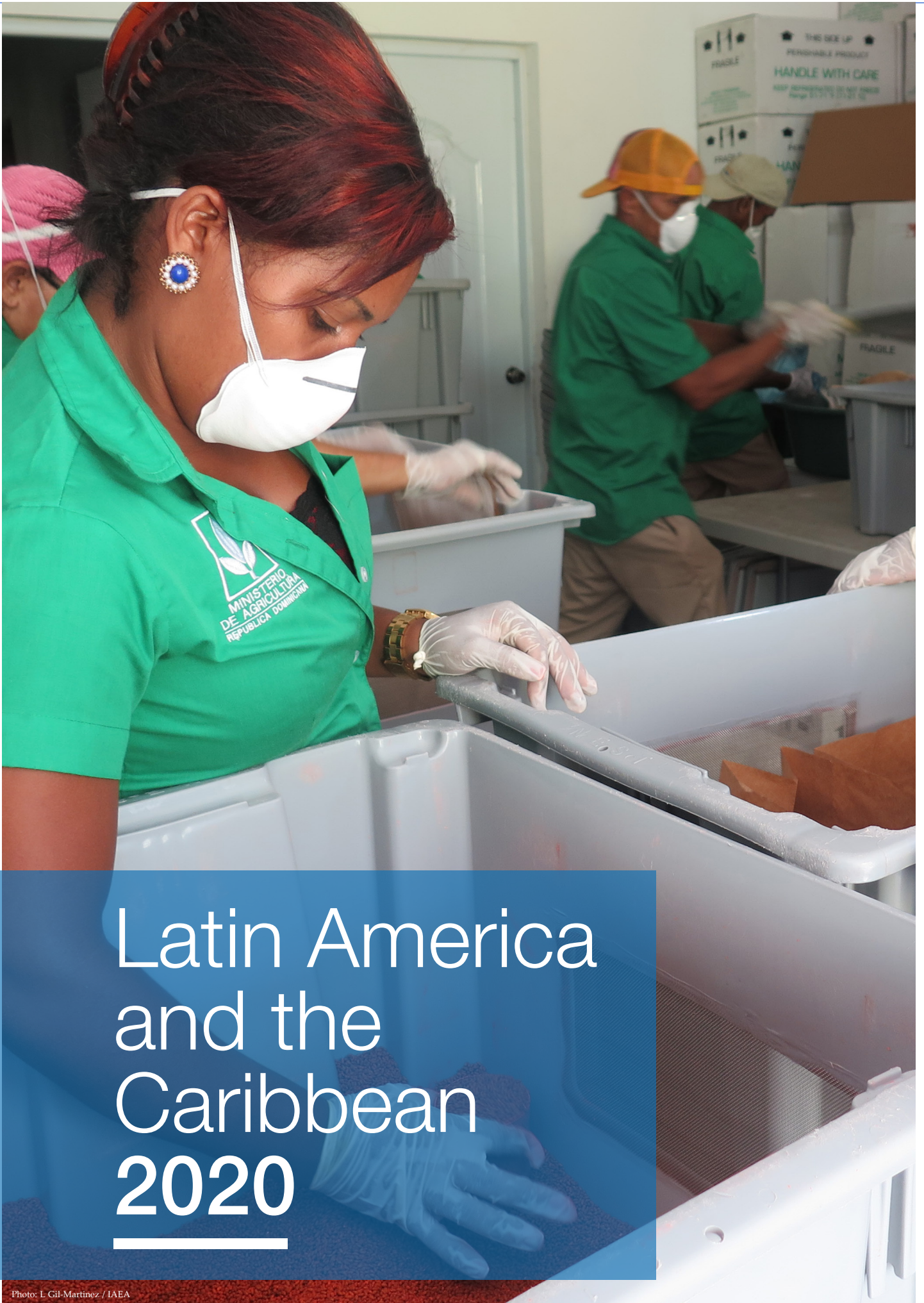
“Within a new Europe regional project on energy planning, 25 countries are being supported to understand and independently apply models that assess energy technologies in order to take knowledgeable decisions on how to shape their future optimal low-carbon energy mix.”

Regional cooperation

Regional cooperation amongst the Member States in Europe and Central Asia is based on two key strategic documents: the *Europe Regional Profile* (2018–2021) and the *Strategic Framework for the Technical Cooperation Programme in the Europe Region* (2019–2025). These documents provided the frame of reference for the coherent national and regional planning and delivery of the TC programme throughout the year. During the virtual National Liaison Officers meeting held on the margins of the 64th IAEA General Conference, Member States agreed to review and update the *Europe Regional Profile* in 2021.



At the virtual meeting of the TC Europe National Liaison Officers, 2020. (Photo: O Yusuf/IAEA)



Latin America and the Caribbean 2020

C.4. LATIN AMERICA AND THE CARIBBEAN

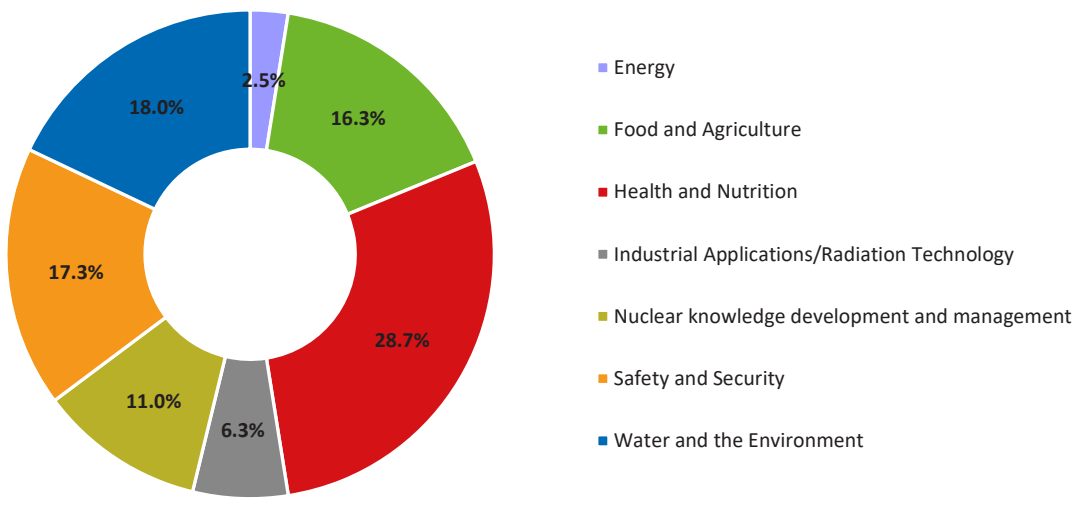
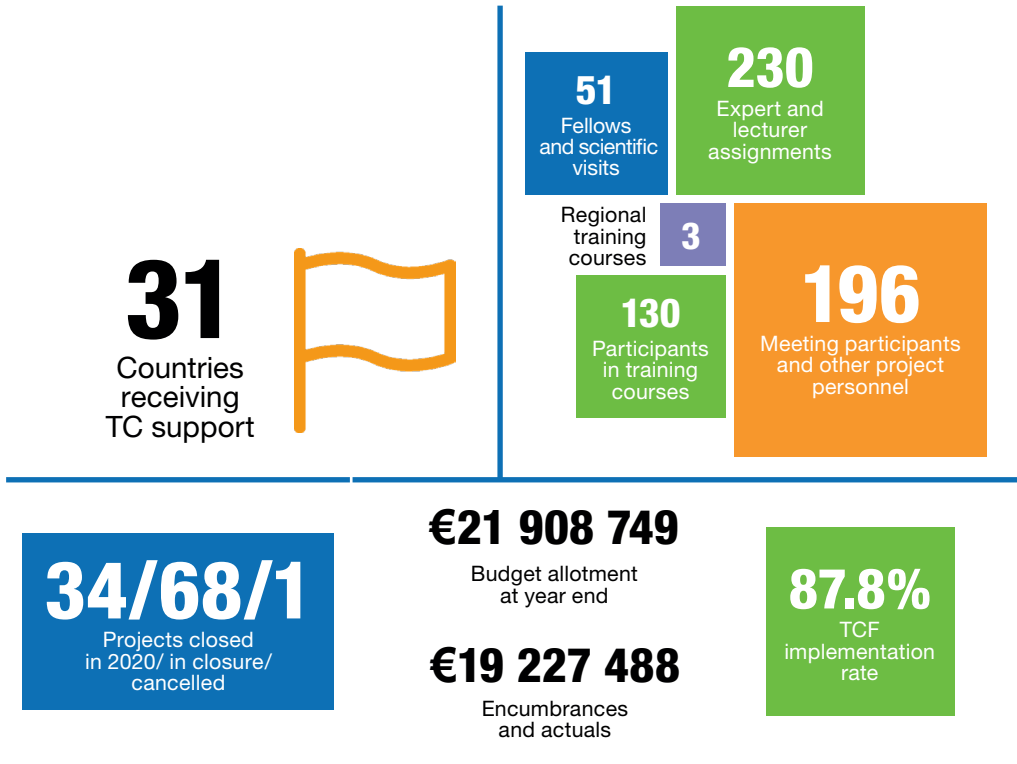


Figure 12: Actuals in the Latin America and the Caribbean region in 2020 by technical field.

Regional highlights in Latin America and the Caribbean

In 2020, 31 Member States, including one least developed country (Haiti), were supported through 221 active national projects and 64 active regional projects. The programme achieved an implementation rate of 87.8 per cent in the region.

Two Member States signed their Country Programme Frameworks, bringing the total number of CPFs in the region to 21.

Technical cooperation support to Member States in Latin America and the Caribbean continued during the pandemic through virtual training events, workshops, webinars, assessments and other meetings. Procurement efforts that could be conducted despite global travel restrictions were prioritized.

CPFs signed in Latin America and the Caribbean in 2020

Chile

Panama



HE Ms Gloria Navarrete Pinto, Ambassador and Resident Representative to the IAEA, and Mr Dazhu Yang, IAEA Deputy Director General and Head of the Department of Technical Cooperation, signing Chile's Country Programme Framework for 2020–2025. (Photo: O Yusuf/IAEA)



HE Mr Federico Alfaro Boyd, Vice-Minister of the Ministry of Foreign Affairs, and Mr Dazhu Yang, IAEA Deputy Director General and Head of the Department of Technical Cooperation, signing Panama's Country Programme Framework for 2020–2025. (Photo: O Yusuf/IAEA)

Project highlights

Member States in Latin American and the Caribbean continued efforts to strengthen human and analytical capacities in the use of isotope hydrology, nuclear tracers and isotopic techniques to monitor the impacts of ocean acidification and other ocean stressors, and to help identify sources of water pollution. With the support of regional project RLA7025, 'Strengthening Capacities in Marine and Coastal Environments Using Nuclear and Isotopic Techniques', the Marine-Coastal Research Network (REMARCO) has continued its efforts to bridge the gap between the scientific community and decision makers in Latin America and the Caribbean. In 2020, the network expanded to connect 18 Latin American and Caribbean countries, focusing on achieving SDG targets related to coastal eutrophication, density of floating plastic debris, and ocean acidification.

Under regional project RLA5068, 'Improving Yield and Commercial Potential of Crops of Economic Importance (ARCAL CL)', new varieties of rice, tomato, quinoa and potato which could boost crop production and improve food security in Latin America and the Caribbean have been developed in the region using mutation breeding techniques. These crops have improved characteristics, including pesticide and disease resistances. The team of researchers assembled through this project has developed a rice mutant line in Brazil that can tolerate weedicides used to control weeds, as well as six improved mutant lines, including tomato (Cuba), quinoa (Peru) and potato (Bolivia), which are in the process of registration.

Over the past 30 years – and across 40 national and 16 regional TC projects, the Agency has assisted countries in Latin America and the Caribbean in strengthening their food safety analytical capacities. With these capacities in place, the IAEA is assisting these countries in the establishment of a data-sharing network to promote risk-based approaches

“New varieties of rice, tomato, quinoa and potato which could boost crop production and improve food security in Latin America and the Caribbean have been developed using mutation breeding techniques.”

to ensure food safety. In 2020, project counterparts of RLA5080, 'Strengthening the Regional Collaboration of Official Laboratories to Address Emerging Challenges for Food Safety (ARCAL CLXV)', in partnership with technical organizations such as the Latin American and Caribbean Analytical Network (RALACA) network, International Regional Organization for Plant and Animal Health, the Inter-American Institute for Cooperation on Agriculture, the Caribbean Agricultural Health and Food Safety Agency and the European Food Safety Agency (EFSA), took steps in the definition of a Data Sharing Committee (DSC) and a technical food safety database. In more than ten virtual regional meetings and workshops, counterparts and partners discussed how to systematically collect and use scientific data as a basis for evidence-based decision-making in the public sector in the region. A regional event held with the EFSA, The Future of Data in Food Safety, was attended by 140 participants who exchanged experiences and lessons learned in regional cooperation on food safety data collection and sharing. The availability of standardized and validated data is necessary for food safety authorities and decision makers to be able to set up preventative or proactive measures to ensure that food is safe for consumption.

National nuclear institutions (NNIs) from Latin America and the Caribbean received training on strategic communication in November and December 2020 within the framework of regional project RLA0069, 'Promoting Strategic Management and Innovation at National Nuclear Institutions through Cooperation and Partnership Building – Phase II (ARCAL CLXXII)'. Delivered in collaboration with Argonne National Laboratory, the course built capacity to strengthen awareness of the contribution of nuclear applications to the SDGs in a variety of stakeholders. Nineteen participants from 13 countries attended, gaining skills that will enable NNIs to engage more effectively with key stakeholders.

Two digital mammography units were procured for Brazilian Navy hospital assistance ships under national project BRA6029, 'Strengthening Human Resources in Molecular Imaging and Radionuclide Therapy'. The ships will travel along the Amazon river, providing much needed breast cancer screening services to the country's remote riverside communities (a population of about 45 000 people). The mammography units have been installed on the vessels 'Carlos Chagas' and the 'Soarer de Meirelles', and will contribute to the Government's long-standing Hospital Assistance Missions. The route the ships will take, forecast to begin in 2021, will cut across approximately 22 000 kilometres of the Amazon river and its distributary channels, stretching from the river delta to the borders of Colombia, Guyana, Peru, Suriname and Venezuela. Over a 30-day journey, beginning and ending at the Rio Negro Naval Station in Manaus, the heart of the Amazon, the ships will offer the screening services alongside existing health, dental, pharmaceutical and laboratory services provided under the government programme.

Jamaica launched its Hazardous Substances Regulatory Authority (HSRA) in October 2020, becoming the first Member State of the Caribbean Community (CARICOM) to establish an independent regulatory body to ensure safety and security in the operation of facilities involving the use of ionizing radiation and nuclear technology in the country. The Authority is responsible for administering the Nuclear Safety and Radiation Protection Act of 2015, a comprehensive act covering nuclear safety, security and safeguards, as well as civil liability for nuclear damage. The Act was developed with support from the IAEA through its legislative assistance programme. The launch of the HSRA constitutes the culmination of a multi-year process, starting with the establishment of the Authority in December 2016, the start of operations in September 2017 and the issuance of regulations in 2019. IAEA Director General Rafael Mariano Grossi participated in the official launch of



The IAEA helps countries in the LAC region to strengthen analytical capacities and to generate scientific evidence for risk-based approaches to food safety. (Photo: LANASEVE, SENASA, Costa Rica)

“Two digital mammography units were procured for Brazilian Navy hospital assistance ships. The ships will travel along the Amazon river, providing much needed breast cancer screening services to the country's remote riverside communities (a population of about 45 000 people).”

the HSRA, alongside representatives of the Canadian Nuclear Safety Commission (CNSC), the US Nuclear Regulatory Commission (NRC) and the International Radiation Protection Association (IRPA). Throughout 2020, the IAEA continued to assist the regulatory body through the provision of expert advice on the elaboration of a roadmap, as well as the necessary equipment, to further strengthen the regulatory body in the discharge of its functions.

Regional cooperation

Ten new ARCAL projects in several fields of activity began implementation in 2020. These projects are in line with the Regional Strategic Profile for Latin America and the Caribbean for the period 2016–2021, prepared and adopted by Member States of the region to contribute to the achievement of the SDGs. Agenda ARCAL 2030, a strategic document that identifies priorities of the region vis-a-vis nuclear applications that can benefit Member States in Latin America and the Caribbean, was also finalized in 2020 and will be used as a reference tool for new project proposals for the period 2022–2030.

At the twenty-first meeting of the ARCAL Technical Coordination Board (OCTA), held virtually in August, National ARCAL Representatives discussed the course of action for implementing projects during the pandemic, and approved the regional concept note for the 2022–2023 TC cycle.

The twenty-first meeting of the Board of ARCAL Representatives was held as a hybrid event in Vienna in September and was attended by ARCAL State Party representatives and Spain, as an ARCAL strategic partner. IAEA Director General Rafael Mariano Grossi opened the meeting, highlighting the importance of the Agreement in the achievement of the SDGs in the region and commending its efforts in promoting gender parity. During the meeting, ARCAL representatives endorsed the new projects proposed for the upcoming cycle and the text of Agenda ARCAL 2030.

Following its endorsement by Member States and CARICOM institutions in November 2019, work continued on developing the Regional Strategic Framework (RSF) for Technical Cooperation with the IAEA–CARICOM Member States 2020–2026. The first of its kind for



IAEA Director General, Rafael Mariano Grossi, opens the hybrid meeting of Board of ARCAL Representatives. (Photo: D Calma/IAEA)

the Caribbean region, the RSF was prepared with the input of Member States, regional institutions and the IAEA, and provided a new opportunity for closer collaboration to advance the region's development agenda. The document was used by Member States as the basis for the development of relevant regional projects for the 2022–2023 TC programme.

C.5. INTERREGIONAL PROJECTS²³

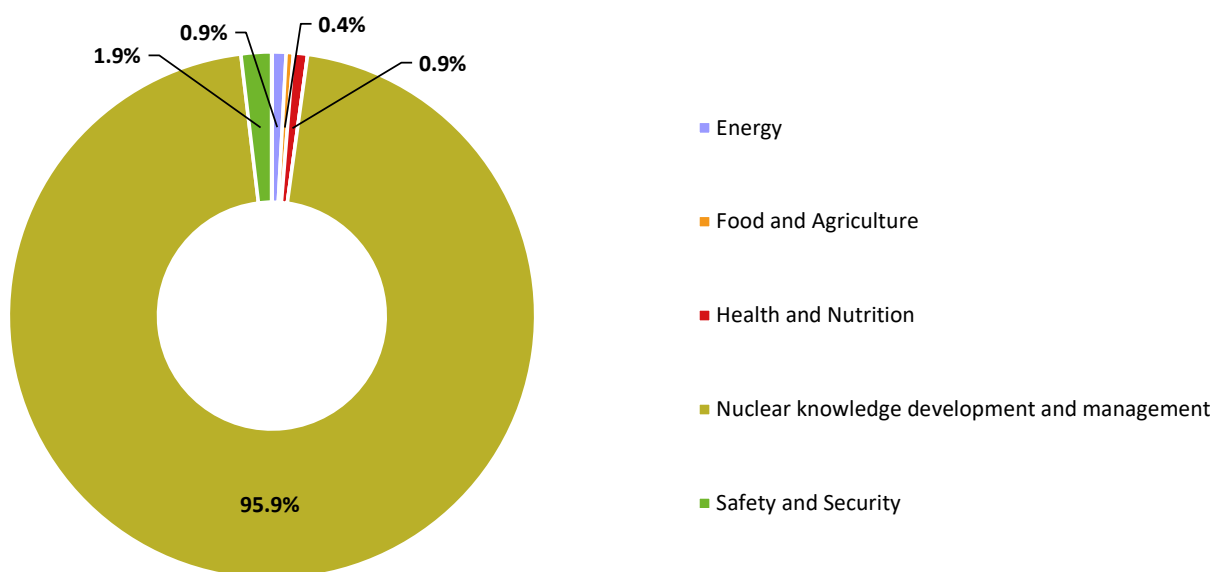


Figure 13: Interregional actuals in 2020 by technical field.

Interregional projects deliver technical cooperation support across national and regional boundaries and address the common needs of several Member States in different regions. In 2020, actuals under interregional projects totalled €26.1 million. Six interregional projects were in closure status at the end of the year.

A key part of containing the COVID-19 outbreak is diagnostic testing. One of the most accurate methods of detecting the virus is a nuclear-based technique called real-time reverse transcription polymerase chain reaction (RT-PCR). The IAEA is providing assistance through INT0098, ‘Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters’, approved as part of the 2020–2021 TC programme cycle, which aims to respond to the needs of Member States in the event of disease outbreaks, emergencies, and disasters. In 2020, 285 national laboratories in 127 countries and territories received support through the project, with 1 950 purchase orders issued for RT-PCR and diagnostic kits and related items, delivered through over 2 500 shipments.

Achievements in supporting exclusive breast-feeding in Benin under INT6058, ‘Contributing to the Evidence Base to Improve Stunting Reduction Programmes’, were highlighted during World Breastfeeding Week. Benin has an exclusive breastfeeding rate of under 50%, so improving the breastfeeding rate is a key aim for the country’s stunting reduction programme. The dose-to-mother technique was used to compare the feeding practices of the women and children involved in the programme with a control group. Analysis after six months showed that the mothers involved in the programme were fourteen times more likely to practice exclusive breastfeeding than mothers not involved.

A four-year interregional project INT2021, ‘Supporting Member States Considering or Planning to Introduce or Expand Nuclear Power Programmes in Developing the Sustainable National Infrastructure Required for a Safe, Secure and Peaceful Nuclear Power Programme’, was initiated in 2020 to create an enabling environment that facilitates

²³ The interregional project INT0098, ‘Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters’, through which the IAEA’s support to Member States in addressing COVID-19 was delivered, is classified under the Field of Activity ‘Nuclear knowledge development and management’.

“The IAEA is providing COVID-19 assistance through INT0098, which aims to respond to the needs of Member States in the event of disease outbreaks, emergencies, and disasters.”

the safe, secure and sustainable introduction or expansion of nuclear power. Four virtual training events were implemented in 2020 with participants from 25 countries. Ten fellows from Ghana, Kenya, Mexico, Senegal and Sudan received support for Master's and Doctoral Degrees in Harbin Engineering University, China. The fellowships are currently taking place virtually from the fellows' home countries. Three fellows from Egypt, Kenya and Nigeria received support for Master's Degrees in Kepco International Nuclear Graduate School, Republic of Korea.

Thirty-eight participants from 26 IAEA Member States in Europe, Africa, Asia and the Pacific, Latin America and the Caribbean took part in a virtual training course in December 2020 under interregional project INT2020, 'Enhancing Capacity Building to Promote Successful Decommissioning and Environmental Remediation Projects'. The purpose of the course was to build understanding of the development and implementation of policy, strategy and regulatory requirements for decommissioning and environmental remediation. Participants were able to assimilate the key concepts and the discussions among group members were very productive.

In November 2020, Member States approved an off-cycle technical cooperation project INT5157, 'Supporting National and Regional Capacity in Integrated Action for Control of Zoonotic Diseases', that will, inter alia, support the Agency's Zoonotic Disease Integrated Action Project (ZODIAC) by building and strengthening technical, human and institutional capacity in Member States through the development of human resources, provision of expertise, and the deployment of new and established technologies and methodologies for detection, monitoring and early warning of emerging or re-emerging zoonotic diseases.

“In November 2020, Member States approved an off-cycle technical cooperation project, INT5157, that will, inter alia, support the Agency's Zoonotic Disease Integrated Action Project (ZODIAC).”

C.6. PROGRAMME OF ACTION FOR CANCER THERAPY (PACT)

PACT highlights in 2020

“imPACT Reviews are designed to support national cancer control planning and decision-making processes along with the mobilization of funds to establish or strengthen cancer services.”

In 2020, the Agency, through PACT, continued to support the efforts of low- and middle-income countries to integrate radiation medicine into national comprehensive cancer control programmes. Activities focused on reviewing national capacities for cancer control, supporting national cancer control planning and mobilizing resources and partnerships. Inputs were also provided to the design of TC projects for the 2022–2023 cycle, and to nine CPFs under preparation, to link IAEA support to comprehensive cancer control efforts.

Seventy countries are participating in the interregional IAEA technical cooperation project for cancer control, INT6064, ‘Supporting Member States to Increase Access to Affordable, Equitable, Effective and Sustainable Radiation Medicine Services within a Comprehensive Cancer Control System’. A series of webinars, in five official UN languages, engaged over 150 cancer control stakeholders across all regions to learn about the opportunities provided by the interregional project and to build relationships for further cancer control efforts. A collaborative space on comprehensive cancer control has been made available under the project to support a community of practice.

imPACT Reviews

imPACT Reviews are designed to support national cancer control planning and decision-making processes along with the mobilization of funds to establish or strengthen cancer services. imPACT recommendations highlight areas where programmatic interventions to enhance national cancer control systems can contribute to the establishment of safe radiation medicine practices.

In 2020, three Member States received imPACT Reviews (Central African Republic, Mali and Senegal). Reviews were also initiated in the Democratic Republic of Congo, Iraq and Nepal. Conducted upon the request of a country’s Ministry of Health, imPACT Reviews draw on the experience and knowledge of international experts nominated by the IAEA, the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC), covering all areas of cancer control.

imPACT review missions in 2020	
Central African Republic	Senegal
Mali	

Improvements to the imPACT Review methodology were consolidated in 2020 in consultation with the PACT partners, WHO and IARC. Efforts were also deployed to increase the gender balance of the experts conducting imPACT Reviews, and to strengthen the capacities of experts from low and middle income countries (LMICs) to lead such assignments.

PACT continued its collaboration with the Union for International Cancer Control on imPACT Review activities, and strengthened engagement with the City Cancer Challenge Foundation around national cancer planning.

Central African Republic

According to IARC’s GLOBOCAN estimates in 2020, the Central African Republic records over 2 500 new cancer cases annually and almost 2 000 cancer-related deaths. By 2030, cancer incidence and mortality are projected to increase to almost 3 500 new cancer cases each year with nearly 2 500 cancer deaths. The imPACT Review offered detailed recommendations for all areas of cancer control, including enhancing medical staff capacity, implementing a human papillomavirus (HPV) vaccination programme, extending hepatitis B vaccination efforts, establishing diagnosis and treatment infrastructures and tumour boards, and palliative care services.

Mali

Like many countries, Mali faces a large cancer burden which is expected to increase in the coming years. Mortality from many cancers can be substantially reduced with appropriate and timely screening, diagnosis and treatment. As a result of the imPACT Review, the Government of Mali now has recommendations to determine a path forward regarding adequate maintenance of all available diagnostic and treatment equipment, as well as on strengthening cancer control governance in the country in order to improve cancer control.

Senegal

Cervical cancer is the primary cause of cancer mortality in Senegal and is among the five leading causes of death overall. Following the imPACT Review, experts made detailed recommendations to improve control of cervical cancer and other cancers by focusing on increasing the training and recruitment of medical staff, extending HPV vaccination efforts to help prevent cervical cancer and ensuring the maintenance of available diagnostic and treatment equipment. At the request of the Member State, the imPACT Review also focused on childhood cancer, in line with the WHO Global Initiative on Childhood Cancer.



imPACT Review team members consult online with the Minister of Health of Mali. (Photo: IAEA)



Equipment at the Idrissa Pouye de Grand Yoff Hospital in Dakar – one of the cancer centres reviewed by the IAEA and its partners as part of an imPACT review in Senegal in December. (Photo: Ministry of Health Senegal)

Development of strategic documents

Preliminary research on the cancer burden, needs and capacities of the six countries that received or initiated imPACT reviews in 2020 was conducted in collaboration with WHO and IARC, to support TC programme planning and implementation, and to provide background information for the imPACT Reviews.

The IAEA contributed to the concept for the WHO-led midterm review of Iran's national cancer control programme, including on radiation medicine components, to strengthen country-level implementation. A joint review and scoping mission of current cancer services was conducted by the IAEA, WHO and IARC in Lebanon. Expert advisory support was provided to Burkina Faso and Sri Lanka in the development of a national cancer control plan, and to Nigeria on cancer policy and planning through a Joint United Nations High-Level Mission on Non-communicable Diseases and Tuberculosis. PACT provided support in developing bankable documents to five Member States. Varying levels of support were

provided to an initial 17 Member States, depending on their readiness, under the Women's Cancers Partnership Initiative.

Progress was made towards establishing a systematic follow up mechanism for countries which have had imPACT Reviews or other cancer assessments. Thirteen countries (Armenia, Benin, Burundi, Ecuador, Lesotho, Mauritius, Myanmar, Niger, Pakistan, Peru, Republic of Congo, Sri Lanka and Togo) received support from a multi-disciplinary group of international experts to review progress towards the implementation of cancer control recommendations. These discussions, held virtually, also sought to identify barriers and additional programmatic support required to advance in areas ranging from cancer prevention to palliative care.



Expert advisory support was provided to Nigeria on cancer policy and planning alongside WHO in the UN Report of the Joint United Nations High-Level Mission on Non-communicable Diseases and Tuberculosis. (Photo: WHO Nigeria)

Advocacy, partnership building and resource mobilization

Partnership building and outreach

Practical Arrangements were signed with the Global Access to Cancer Care Foundation (GACCF) with the aim of helping authorities in low- and middle-income countries (LMICs) train professionals in radiation therapy and nuclear medicine over the coming years. The partnership will also support the mobilization of resources to assist countries in the establishment of nuclear and radiation medicine services and will raise awareness of unequal access to cancer services in LMICs. GACCF is a United States-based global non-profit organization that works with a network of businesses and academia to provide oncology education programmes in LMICs.

In a Memorandum of Understanding signed at IAEA headquarters in Vienna, the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the IAEA agreed to increase collaboration on cervical cancer, recognizing that HIV-infected women are

“Practical Arrangements were signed with the Global Access to Cancer Care Foundation (GACCF) with the aim of helping authorities in low- and middle-income countries (LMICs) train professionals in radiation therapy and nuclear medicine over the coming years.”



Signing of Practical Arrangements with the Global Access to Cancer Care Foundation. (Photo: IAEA)

six times more likely to develop cervical cancer than uninfected women. The collaboration is focused on low- and middle-income countries, where 85 per cent of annual cervical cancer deaths occur.

Existing partnerships with governments, the private sector and international financing institutions were strengthened. For example, the partnership with the Islamic Development Bank (IsDB) was intensified through the implementation of the Women's Cancers Partnership Initiative to increase cancer services for women in 17 common Member States.

Extrabudgetary contributions were mobilized from Belgium, France, Monaco, the Russian Federation, the Sovereign Military Order of Malta, Sweden and the United States of America. Targeted outreach to traditional and non-traditional donors was conducted through a series of virtual meetings, and over 30 donor briefing sessions were held with donor countries and others to present opportunities for contributions to the Agency's cancer-related efforts. Three virtual roundtable meetings were organized by the IAEA and the IsDB, which brought together more than 40 existing and interested supporters of the Women's Cancers Partnership Initiative, ranging from governments to private sector companies, NGOs and foundations. The IAEA and IsDB also jointly organized an event at the 64th IAEA General Conference entitled 'Saving Women's Lives from Cancer.' The event presented the progress of the IAEA-IsDB Women's Cancers Partnership Initiative thus far, including new avenues of collaboration with non-traditional partners and donors to assist common Member States in increasing access to cancer services for women.

PACT contributed to strengthening the formal coordination mechanisms on cancer control with WHO and IARC. A regular consultation mechanism has been established, with annual meetings taking place on a rotational basis between Vienna, Geneva, and Lyon, the headquarters of the three participating organizations. The IAEA participated in the virtual 2020 meeting chaired by WHO Geneva, which included a segment with worldwide cancer control partner organizations that confirmed the role of imPACT Reviews as a reference point for several global cancer efforts. A systematic mechanism for monitoring the implementation of imPACT Review recommendations, efforts to further streamline data collection tools utilized in cancer assessments, and concrete country level collaboration were discussed and are expected in the next biennium. PACT organized detailed discussions with all six WHO regional offices and more than 15 WHO country offices, with a view to reinforcing coordination on cancer control, including the provision of assessments and planning support through a hybrid (virtual/in-country) modality due to the COVID-19 pandemic.

“The Joint United Nations Programme on HIV/AIDS (UNAIDS) and the IAEA agreed to increase collaboration on cervical cancer, recognizing that HIV-infected women are six times more likely to develop cervical cancer than uninfected women.”



IAEA Director General, Rafael Mariano Grossi, speaks with Dr Bandar Hajjar, President, Islamic Development Bank, during a virtual meeting at the Agency headquarters in Vienna, Austria, on 1 October 2020. (Photo: IAEA)

To mark World Cancer Day 2020, the IAEA hosted an event highlighting the Agency's work in cervical cancer. In addition, the Agency participated in an event organized by the Government of Sweden and the private sector company Elekta highlighting the Women's Cancers Partnership Initiative and the ways in which nuclear techniques can support the diagnosis and treatment of women's cancer while helping countries worldwide to achieve better disease management for patients. This event emphasized the importance of effective cancer control programmes to save women's lives.



IAEA Director General, Rafael Mariano Grossi, participated in an event organized by the Government of Sweden to mark World Cancer Day 2020. (Photo: IAEA)

Resource mobilization

Member States, intergovernmental and non-governmental organizations continued to show support for the Agency's cancer control activities. A total of € 549 695 was received by PACT in 2020 in extrabudgetary contributions from Belgium, France, Monaco, the Russian Federation, the Sovereign Military Order of Malta, and Sweden.

In addition, PACT coordinated resource mobilization efforts for the benefit of TC projects, resulting in a contribution of € 417 300. This funding will go towards improving nuclear medicine in Benin. Support from the Sovereign Military Order of Malta has benefited a TC cancer project in Albania. Support from Sweden has benefitted a TC nuclear medicine project in Honduras. In addition, in-kind contributions mobilized from a private donor will benefit a TC project in Cameroon.

List of frequently used abbreviations

AFRA	African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology
Agency	International Atomic Energy Agency
APCs	assessed programme costs
ARASIA	Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology
ARCAL	Regional Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean
CPF	Country Programme Framework
FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
IARC	International Agency for Research on Cancer
LDC	least developed country
NLA	National Liaison Assistant
NLO	National Liaison Officer
NPCs	National Participation Costs
NPP	nuclear power plant
PACT	Programme of Action for Cancer Therapy
RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology
SIDS	small island developing States
SIT	Sterile insect technique
SDG	Sustainable Development Goal
TC	technical cooperation
TCF	Technical Cooperation Fund
UICC	Union for International Cancer Control
WHO	World Health Organization



Annex 1.

ACHIEVEMENTS IN 2020: PROJECT EXAMPLES BY THEMATIC SECTOR



Annex 1. Achievements in 2020: Project Examples by Thematic Sector

Health and Nutrition

REGIONAL HIGHLIGHTS

The TC programme in Africa supports Member State efforts to address cancer, cardiovascular diseases and malnutrition using nuclear and nuclear-related techniques. In 2020, assistance was provided through the programme for radiotherapy treatment, nuclear medicine and diagnostic imaging projects, as well as for nutrition centres and human resource development.

The field of human health and nutrition is a key priority in the Asia and the Pacific region. In 2020, the TC programme helped Member States and territories to address challenges related to human health and nutrition by assisting national efforts to devise comprehensive cancer control programmes and by training health professionals in advanced nuclear medicine, radiation oncology and radiology techniques and procedures.

Member States in Europe and Central Asia also identify human health as a high priority area, with a focus on human capacity building. The safe introduction of new or advanced radiation medicine modalities requires adequately trained human resources for a range of roles. In 2020, the TC programme in the region, in partnership with medical associations, provided Member States with a broad spectrum of training opportunities in the use of modern technologies.

In 2020, the Agency provided assistance to many countries in the Latin America and the Caribbean region affected by both communicable and non-communicable diseases. Assistance included human resource development and the procurement of equipment for radiotherapy, nuclear medicine and diagnostic imaging, while ensuring the protection of workers and patients. Countries in the region also received support to establish plans for enhancing technical capabilities to tackle the double burden of malnutrition.



RADIATION ONCOLOGY IN CANCER MANAGEMENT

Under NER6006, 'Establishing a Radiotherapy Facility', the Agency supported the efforts of the Government of Niger to establish the country's first radiotherapy centre. Following the delivery of medical equipment procured under the project, the supplier's engineers visited the country to install it and to train local staff. A Cobalt-60 source was also delivered to the National Cancer Centre (CNLC) which is expected to open soon.

Under KEN6020, 'Establishing National Capacity for an Integrated Approach to Early Detection, Diagnosis, Management, Prevention and Research on Cancer and Radiation Safety', all equipment including a linear accelerator, a CT scanner and dosimetry equipment was delivered to Kenya's Moi Teaching and Referral Hospital. The Agency provided advice on establishing radiotherapy centres in other parts of the country to improve cancer screening.

Under KEN6023, 'Capacity Building in Radiotherapy at the Moi Teaching and Referral Hospital', a refresher training for three radiation therapists was conducted to enhance the skills of medical staff at the hospital operating the equipment.

Under project RAF6056, 'Supporting Human Resources Development in Radiation Medicine (AFRA)', 13 applicants were selected for long-term fellowship training in radiation oncology, radiation therapy and medical physics. Host institutes have been identified and six students have already been placed. Final arrangements are being made with the hosts to place the remaining candidates in early 2021.

"The Agency supported the efforts of the Government of Niger to establish the country's first radiotherapy centre."

NUCLEAR MEDICINE AND DIAGNOSTIC IMAGING

Under RAF6057, 'Strengthening the Quality of Nuclear Medicine Services (AFRA)', a virtual regional training course 'New Trends in Nuclear Medicine with Focus on Developing Countries Realities' enabled participating countries to stay up-to-date with the latest advances and promoted adherence to the relevant radiation safety measures. More than 60 practicing nuclear medicine physicians and technologists, medical physicists and radiopharmacists from 19 African countries attended.

The Agency continued to support Oman through a national project, OMA6008, 'Enhancing Quality Management Systems for Positron Emission Tomography–Computed Tomography Centers and a Cyclotron Facility'. In 2020, virtual expert missions were conducted, the plans for the renovation of the nuclear medicine department of the Royal Hospital in Muscat were reviewed, and the final draft of the design of the new nuclear medicine department was produced. This will strengthen national capabilities for better, earlier diagnosis of communicable and non-communicable diseases using molecular imaging techniques.

Medical uses of ionizing radiation are amongst the longest established applications of ionizing radiation, and at the same time one of the most rapidly developing areas. The medical benefits are indisputable, but there is an associated risk for patients and medical staff. Quality assurance and dosimetry is a vital component of IAEA support in the field of medical imaging. Under the project RER6038, 'Applying Best Practices for Quality and Safety in Diagnostic Radiology', a comprehensive publication, Handbook of Basic Quality Control Tests for Diagnostic Radiology, has been finalized along with video tutorials on how to use the methodology and practices presented in the handbook. The Agency's assistance benefits 27 Member States in the Europe region.

"In recent years, quality assurance and quality control programmes in radiotherapy as well as diagnostic and interventional imaging radiology in two major regional hospitals in Croatia have been reviewed, harmonized and upgraded."

For more than a decade, Croatia has worked with the IAEA to implement a strategy to improve the quality and safety of the use of ionizing radiation in medicine. This included establishing a comprehensive quality assurance programme and providing training for medical physicists. In recent years, quality assurance and quality control programmes in radiotherapy as well as diagnostic and interventional imaging radiology in two major regional hospitals in Croatia have been reviewed, harmonized and upgraded. This initiative was completed in 2020 and the knowledge was shared with other hospitals in the country, helping to improve the implementation of IAEA standards and guidelines in clinical practice and related national legislation, and to increase patient safety in radiotherapy and radiology practices. A recent IAEA Integrated Regulatory Review Service (IRRS) mission to Croatia confirmed the importance of previous government initiatives to strengthen the role of medical physicists in the country. Croatia's improved delivery of cancer services, which helped to reduce the number of radiation doses patients received for diagnostic purposes, was assessed through a number of comparisons and external audits, and later presented in scientific papers and conferences.

Cancers which occur in children and adolescents differ in incidence, underlying causes and tumour characteristics from those in adults. Prior to the implementation of project MNE6005, 'Improving Paediatric Diagnostic in Computed Tomography Examinations' examinations of children's cancers by paediatric radiologists in Montenegro were limited by technological constraints. The previous computed tomography (CT) system could only examine small volumes of a patient's body at a time, such as a limb or their head. When spiral, full-body scans were deemed necessary, children were often sent to the main Diagnostics Department of the Clinical Centre, whose infrastructure and devices are calibrated for adult patients, complicating quality control and dosimetry measures. Under MNE6005, 'Improving Paediatric Diagnostic in Computed Tomography Examinations', Montenegro's first CT system for children was procured, delivered and installed in the country's main hospital. Inaugurated in August by President Milo Dukanovic and the Minister of Science Sanja Damjanovic, the new machine has been placed at the Clinical Centre of Montenegro in Podgorica. It uses the latest CT technology with low radiation dose and numerous

clinical software programmes and is operated by staff trained by the Agency through the technical cooperation programme. The facility will conduct examinations and diagnoses of children, including cancer patients.

Through online events in 2020, project RER6037, 'Strengthening Nuclear Medicine Capabilities', has continued to support activities that improve nuclear medicine standards in the region. The image-guided radionuclide training organized by the Institute for Applied Medical Physics in September trained 46 participants from 20 countries. For the 33rd Annual European Association of Nuclear Medicine (EANM) Congress in October (held online), 35 participants from 12 Member States were supported by the Agency. The project also supported seven participants in the online European Association of Cardiovascular Imaging Nuclear Cardiology Certification in November. In addition, the project provided 3D brain phantoms to 30 nuclear medicine institutions in 14 countries. The institutes have been provided with the guidance to perform the quality control protocol, and in 2021, will be supported for EANM Research Ltd accreditation of brain PET or SPECT systems.

Radiation medicine continues to be a priority for the Caribbean region. Support provided through regional project RLA6081, 'Strengthening Human Capacities of Caribbean Countries in Radiation Medicine', included the establishment of baselines on the status of existing conditions and needs for improvement related to staffing and equipment, with a specific emphasis on estimating the medical physics staffing requirements for medical imaging departments. In line with these efforts, seven diagnostic radiology facilities in Antigua and Barbuda, Barbados, Guyana, Jamaica, and Trinidad and Tobago were provided with quality control equipment, and 21 personnel from eight Member States in the region were trained in quality assurance and quality control for image optimization and radiation protection of patients and medical staff in diagnostic imaging. Trinidad and Tobago also received assistance to assess the status of three radiation therapy treatment sites to ensure the safety of patients and staff.

Under national project PAR6017, 'Providing Patients from the Public Sector with Early and Effective Diagnosis of Cancer through Positron Emission Tomography Technology', a complementary PET module was delivered to Paraguay to support a combined SPECT/PET/ CT scanner, the first hybrid system of its type in the country. This equipment provides functional information combined with spatial registration in the patient's body in just one session, achieving a more accurate diagnosis while increasing convenience for patients and efficiency in scheduling.

"Seven diagnostic radiology facilities in Antigua and Barbuda, Barbados, Guyana, Jamaica, and Trinidad and Tobago were provided with quality control equipment, and 21 personnel from eight Member States in the region were trained in quality assurance and quality control for image optimization and radiation protection of patients and medical staff in diagnostic imaging."

RADIOISOTOPES, RADIOPHARMACEUTICALS AND RADIATION TECHNOLOGY

Under RAF6054, 'Strengthening and Improving Radiopharmacy Services (AFRA)', five candidates from French-speaking countries in Africa were awarded a two-year fellowship training and started Master's degree programmes in radiopharmacy in Rabat, Morocco. These candidates will be the first qualified radiopharmacists in their countries. Similarly, three candidates from English-speaking countries passed the prequalification exam to start Master's programmes in radiopharmacy in South Africa. These candidates will complete their Master's programme in radiopharmacy in 2022.

NUTRITION

Under project RAF6052, 'Using Nuclear Techniques to Assess Body Composition in Children Previously Treated for Moderate and Severe Acute Malnutrition and Their Medium-Term Benefits and Risks in Six Countries', six African Member States (Cote d'Ivoire, Democratic Republic of Congo, Ethiopia, Malawi, Uganda and Zambia) collected and analysed data on nutritional status, body composition, physical function, immune function, cognitive function and metabolic dysfunction of children who have undergone treatment for malnutrition and of children in a control group. The Final Coordination Meeting of this project took place online in December 2020. The results of the project

were presented, and challenges and lessons learned were discussed during the meeting. Emerging results showed that individuals previously malnourished in childhood tend to be shorter, with a tendency for lower muscle tissue (fat free mass) and tend to have more symptoms of metabolic syndrome compared to those who were not malnourished, indicating the importance of long-term nutritional support for children recovering from malnutrition. The findings of the project will be shared as recommendations to policy makers with the aim of contributing to the improvement of national programmes treating children with moderate and severe acute malnutrition.

“The IAEA supported Syria in upgrading and improving national infrastructure for the application of isotopic and complementary techniques to assess body composition, with the aim of controlling the double burden of malnutrition (mainly in school-age children).”

Under SYR6016, ‘Applying Nuclear Techniques to Evaluate the Nutritional Status of Adults and Young Children’, the TC programme supported Syria in upgrading and improving national infrastructure for the application of isotopic and complementary techniques to assess body composition, with the aim of controlling the double burden of malnutrition (mainly in school-age children). Technical support included the provision of laboratory reagents (ELISA kits) to measure biomarkers of iron status, as well as a high-performance liquid chromatography system for determining vitamin A status. Additional support was provided through the training of staff from the Atomic Energy Commission of Syria in early 2020 and included a fellowship on laboratory tests to evaluate the micronutrient status of school-age children deficiencies (including training on the ELISA technique). Through this project, 917 adolescents (398 males, 519 females, 12-18 years old) participated in a study, with field work completed in 2020.

The project RER6034, ‘Applying Nuclear Techniques to Design and Evaluate Interventions to Prevent and Control Obesity in Adolescents in South-Eastern Europe’, supported experts in 10 countries in South-Eastern Europe to assess body composition by applying nuclear techniques. A scientific article on body composition assessment techniques based on the collected data is under publication. The long term aim is that body composition will be used to evaluate nutrition campaigns and design interventions to prevent and control child obesity. The project has contributed to the prevention and control of non-communicable diseases by improving techniques for measuring body composition and physical activity.

Latin American and the Caribbean Member States continued important work in the area of nutrition with support under regional project RLA6079, ‘Using Stable Isotope Techniques for Monitoring and Interventions to Improve Young Child Nutrition (ARCAL CLVI)’. The goal of the project is to improve malnutrition in children under 5 years of age through the creation of body composition reference tools. Under the project, data was collected in 2020 on 548 infants from 10 participating countries in the region as part of a study to strengthen the evaluation of infant and young child nutrition interventions.

Food and Agriculture

REGIONAL HIGHLIGHTS

In 2020, food and agriculture accounted for the highest disbursement of funds in the TC programme for Africa. Member States are assisted through TC national and regional projects for the peaceful applications of nuclear and related technologies, with the goal of contributing to global food security and sustainable agricultural development.

In the Asia and the Pacific region, food and agriculture also accounted for the highest disbursement of TC funds in 2020, focusing on challenges affecting the region's food supply, safety and security. TC support addressed improved crop and plant varieties using induced mutation breeding, better livestock reproduction and nutrition, enhanced control of animal and plant pests and diseases, better soil and water management, and improved food safety.

Member States in Europe and Central Asia received assistance to enhance the productivity and resilience of major food crops (legumes, cereals and others) to climate change. The use of nuclear technology created new beneficial mutations, followed by mutation breeding to develop improved lines and varieties. By increasing drought and salt tolerance, enhancing productivity and other positive traits, the negative impact of drought on plant productivity has been controlled.

Food and agriculture continue to play a pivotal role in Latin America and the Caribbean. In 2020, TC projects provided equipment to analytical laboratories in the region to improve the evaluation of food safety and establish quality baseline agricultural data for soil, water and nutrient use efficiency. The Agency also partnered with other international organizations to launch a regional effort to fight against vector-borne diseases, including the Zika virus. This effort included building national capacities in the use of the sterile insect technique (SIT) to enhance the region's capability to conduct area-wide insect pest management.

CROP PRODUCTION

With the support of the Agency, in partnership with the Food and Agriculture Organization of the United Nations (FAO), Indonesia has been successfully working on its mutation breeding programmes to develop high quality soybean varieties. Indonesia's National Nuclear Energy Agency (BATAN) has extended its efforts with Agency support, working closely with small and medium sized households to increase soybean productivity. As a result, BATAN has developed 12 varieties of soybean through plant mutation breeding over the last thirty years. Under INS5044, 'Using Nuclear Technology to Support the National Food Security Programme', BATAN was able to develop a soybean variety in 2020 which matures faster than local varieties, leading to enhanced food security throughout Indonesia.

Under BOT5019, 'Improving Selected Legumes and Cereals against Biotic and Abiotic Stresses to Improve Food Production and Security', precision drought-testing or managed-drought stress testing was established in pilot mode in three locations in Botswana in 2020, based on a careful assessment of prevailing environmental characteristics and climate challenges affecting crop productivity. The project aims to develop improved varieties of cowpea and sorghum with tolerance or resistance to drought and to parasitic weeds that devastate crop yields. The precision drought-testing pilot established in Botswana is intended to identify even small changes in crop yield in improved varieties under drought stress, and is planned to be modelled in other parts of sub-Saharan Africa to develop improved mutant varieties that continue to exhibit stable performance under intensifying and frequent drought stress imposed by climate change.



“Indonesia’s National Nuclear Energy Agency (BATAN) has developed 12 varieties of soybean through plant mutation breeding over the last thirty years.”



Speaking with growers of the Mutiara 1 soybean variety in Polman area, West Sulawesi, Indonesia. (Photo: BATAN)

With the support of the Agency and the FAO, Cuba continues to strengthen its mutation breeding programme through national projects and as a participant in regional projects in Latin America. Under CUB5023, ‘Strengthening National Capacities for the Development of New Varieties of Crops through Induced Mutation to Improve Food Security While Minimizing the Environmental Footprint’, the National Institute of Agricultural Sciences has further advanced a new, improved soybean variety in 2020 that has been developed using gamma-ray irradiation. It is currently in the final stage of the national registration process. Considering the advantages of the variety, the government has recently permitted the multiplication and dissemination of quality seed of this soybean variety for cultivation by farmers.

Under CHI5052, ‘Using Nuclear Techniques to Improve the Adaptation and Productivity of Forest Species Facing Climate Change’, the Agency is supporting the first radiation-induced mutagenesis and hormesis project in forest trees at the Forestry Institute of Chile which is implementing the project in collaboration with the Chilean Commission of Nuclear Energy. The project aims to improve the establishment and productivity of forest trees by increasing their ability to withstand drought and disease incidence, using a combination of irradiation and molecular biology. The first part of the establishment of a molecular biology laboratory at the Forestry Institute, and the evaluation of forest tree seed germination under low doses of gamma-irradiation occurred in 2020.

AGRICULTURAL WATER AND SOIL MANAGEMENT

Under RAF5079, ‘Enhancing Crop Nutrition and Soil and Water Management and Technology Transfer in Irrigated Systems for Increased Food Production and Income Generation (AFRA)’, drip irrigation technologies contributed to an increase of 60% in crop yields for farmers in a camp for the internally displaced in Abuja, Nigeria, providing food and a source of income for thousands of people that are refugees within their own country. Under the same project, the IAEA also delivered packages of climate smart improved technologies and practices for water and nutrient management, strengthening capacities in students, scientists and farmers in participating Member States.

In the context of regional project RLA5077, ‘Enhancing Livelihood through Improving Water Use Efficiency Associated with Adaptation Strategies and Climate Change Mitigation in Agriculture (ARCAL CLVIII)’, participating countries in the Latin America and the Caribbean region are implementing field studies on a variety of crops (mainly maize and wheat) to optimize crop yield and water use efficiency. In 2020, countries that had initial data from the field studies (Argentina, Chile, Costa Rica, Dominican Republic, Ecuador and Mexico) received targeted expert support to ensure data quality and to implement FAO’s AquaCrop crop-water productivity model. In addition, a virtual training course with an IAEA expert

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on the use of the cryogenic water extraction line provided counterparts with hands-on, practical training on setup and operation of an extraction technique which is one of the most widely used and accurate methods to obtain plant and soil samples for isotopic analysis.

LIVESTOCK PRODUCTION

Under SIL5019, ‘Strengthening Capacities for the Diagnosis and Control of Zoonoses to Improve Public Health Services and Livestock Production’, laboratory technicians at the Milton Margai College of Education and Technology in Freetown, Sierra Leone, received extensive training on bacteriology using virtual platforms. A *Laboratory Manual in Microbiology for Students* was developed and is now being used for teaching microbiology and practical courses in Sierra Leone.

With support of the IAEA, the FAO and the Sri Lanka Ministry of Livestock and Rural Economy, scientists at the University of Peradeniya in Sri Lanka launched a four-year project in 2016 to provide genetically superior female calves to women dairy farmers in Sri Lanka’s North Central Province. Scientists in Sri Lanka utilized reproductive biotechnologies bolstered by nuclear techniques to deliver superior quality female calves. By the end of 2020, the project team had produced 500 quality calves using embryo transfer and artificial insemination techniques. By harnessing biotechnologies and nuclear techniques, the TC programme is helping the country to boost dairy supply and, subsequently, to increase the income of 100 women farmers.

“By harnessing biotechnologies and nuclear techniques, the TC programme is helping the country to boost dairy supply and, subsequently, to increase the income of 100 women farmers.”



Women dairy farmers in Sri Lanka examining livestock during a TC workshop at the Veterinary Teaching Farm in Sri Lanka. (Photo: S. Anuraj/University of Peradeniya)

Improving the emergency response capacity of national veterinary laboratories which are responsible for early detection of animal diseases is essential for Bosnia and Herzegovina. Early detection of transboundary animal diseases such as bluetongue disease, lumpy skin disease and brucellosis is key to prevent their spread and mitigate negative impacts on the economy. In the past, the country was not equipped to carry out these diagnostic tests independently, and required the support of international reference laboratories which delayed the time of detection, diagnosis and intervention. The Agency, through TC national project BOH5002, ‘Strengthening State Infrastructure for Food and

Animal Food Control and Protecting Animal Health', provided the laboratories with high-tech equipment and consumables, enabling the in-depth understanding of the epidemiology of bluetongue disease and lumpy skin disease using molecular tools such as whole genome sequencing. The laboratories have also been equipped with instrumentation for radiological monitoring, which is required for EU imports of food products from animals. Bosnia and Herzegovina is now better equipped to protect livestock from several animal diseases, an important step for food security in the country and for its economy.

INSECT PEST CONTROL



Argentina's newly recognized fruit fly free areas expedite fresh fruit exports to China. (Photo: F. Lepron/Valle Medio)

Building on the achievements of previous regional projects, RLA5082, 'Strengthening Food Security through Efficient Pest Management Schemes Implementing the Sterile Insect Technique as a Control Method', continued to support countries in the control of fruit flies that negatively affect the production of fruit in the region. In April 2020, project counterparts held the first virtual regional coordination meeting and continued to collaborate virtually throughout the year. Counterparts also produced a manual of harmonized guidelines on fruit flies that might be considered of economic and quarantine importance in Latin America and the Caribbean, an online course on fly trapping in support of the implementation of SIT, as well as an updated online regional trapping database, a requirement for fruit importers to be able to monitor pest status in production areas. Countries participating in the project also made progress in implementing a coordinated communication strategy, including the elaboration of infographics, information material,

web articles and videos to support information campaigns in the region. Through this regional project, together with the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, the IAEA supported the virtual American Congress on fruit flies, attended by 1 500 participants. The Patagonia region and the Central and South Oasis of the Mendoza Province in Argentina were recognized as fruit fly free areas by China, opening up the export of fruits like cherries, once harvested and inspected, without additional post-harvest treatment. The pest free status for these new areas is the result of effective long-term work by the National Food Safety and Quality Service through the National Fruit Fly Control and Eradication Programme, in cooperation with fruit producers. The Agency provided support for the application of SIT.

The IAEA, in partnership with FAO and WHO, launched the regional project RLA5074, 'Strengthening Regional and National Capacities in Latin America and the Caribbean for Integrated Vector Management Approaches to Control Aedes Mosquitoes as Vectors of Human Pathogens, particularly Zika Virus', in July 2016 to build national capacities in the use of SIT to support countries in the Latin American region in their efforts to address vector-borne diseases. In 2020, the project successfully completed two virtual regional workshops to strengthen local staff capacities in field entomological data collection, and in the implementation of communication strategies to engage stakeholders. In addition, some regional insectaries were upgraded with new equipment and supplies to ensure mosquito mass-rearing activities. Mark-release-recapture trials to determine the dispersal and survival of sterile males were completed successfully in some Member States. Countries including Cuba and Brazil, with the additional support of national technical cooperation projects, started small-scale releases of sterile mosquitoes in pilot sites. Guidelines were also developed for mass-rearing and irradiation of Aedes mosquitoes. All these activities contributed to enhancing regional capacities to use and integrate SIT in area-wide insect pest management.



Ground releases of sterile males carried out in March 2020, Brasília Teimosa neighbourhood, Recife, Pernambuco. (Photo: Biofábrica Moscamed, Brazil)

FOOD SAFETY

Under RAF5084, ‘Strengthening Food Contaminant Monitoring and Control Systems and Enhancing Competitiveness of Agricultural Exports using Nuclear and Isotopic Techniques (AFRA)’, 28 Member State institutions received assistance to participate in two sets of interlaboratory proficiency testing schemes on the application of analytical capabilities in order to facilitate the process of accreditation according to ISO 17025:2017. Over 30 participants received support to participate in the third Global Minor Use Priority Setting Workshop, held virtually, which provided them with opportunities to share technical knowledge, and plan for pesticide residue field trials which are critical for setting maximum residue limits that affect the ability to export produce. Member State laboratories also received technical guidance on using radio receptor assay techniques to screen a wide range of residues and contaminants in food.

The Agency continued to provide support to the territories under the jurisdiction of the Palestinian Authority through project PAL5010, ‘Strengthening Capability to Monitor Contaminants in Food and Related Matrices through Nuclear and Complementary Analytical Techniques’. In 2020, the Agency assisted these territories in acquiring equipment to upgrade a laboratory for the testing of organic and inorganic contaminants, including selected radionuclides in food and related matrices. This equipment will help the laboratory protect the public from the risk of exposure to contaminants in food and related matrices.

The analytical capacity of food safety laboratories in St. Lucia and Trinidad and Tobago were strengthened with the provision of equipment under regional project RLA5084, ‘Developing Human Resources and Building Capacity of Member States in the Application of Nuclear Technology to Agriculture in the Caribbean’. It is expected that this analytical capacity can also serve other Caribbean Member States which are not adequately equipped with analytical laboratories. Additionally, valuable baseline data has been gathered on existing capabilities in the Caribbean region in areas of soil, water and nutrient use efficiency, as well as plant mutation breeding and biotechnology, which will inform targeted Agency support to be provided to each Member State.

“The analytical capacity of food safety laboratories in St. Lucia and Trinidad and Tobago were strengthened. It is expected that this analytical capacity can also serve other Caribbean Member States which are not adequately equipped with analytical laboratories.”

Water and the Environment



REGIONAL HIGHLIGHTS

In Africa, the Agency supports efforts to integrate the use of isotope hydrology into national water infrastructure and programmes with emphasis on the characterization and monitoring of groundwater. The IAEA Water Availability Enhancement (IWAVE) approach is being mainstreamed into projects and planning. Under the regional programme, IWAVE has been implemented in Benin, Cameroon, Ghana, Niger and Nigeria. The approach has now been expanded to include Mali, Senegal and Togo. Due to COVID-19 restrictions, the development of so-called hydrological sketches for these countries are being undertaken in a virtual format as far as possible. IWAVE has been used to perform an in-depth situation analysis for Eswatini in preparation for the first isotope hydrology project in that country.

In Asia and the Pacific, the TC programme helps Member States apply isotope techniques to manage their water resources effectively. The projects also promote the use of isotopic techniques to identify and study the sources, extent, quality, interactions and transport of the water cycle. Other projects help Member States measure pollutants and environmental radioactivity in the air, land and oceans, and support the ability of countries to manage and protect marine resources and coastal zones.

In Europe and Central Asia, the TC programme is supporting activities to enhance environmental monitoring and impact assessments for public and environmental protection, with the aim of generating fit-for-purpose, comparable and optimized radiological monitoring data across the region in accordance with international standards. Member States in Europe and Central Asia have been actively cooperating in using nuclear and isotopic techniques to support evidence-based decision and policy making for the sustainable management of water resources and the environment. Several national and regional projects are being implemented focusing on water resource management, air pollution monitoring, and the remediation of uranium legacy sites. One cross-cutting topic addressed by many of these projects is the impact of climate change. However, proficiency in isotope-based techniques and capacity to apply them differs significantly across the region.

Latin America and the Caribbean is sometimes called a 'biodiversity superpower', but the region is experiencing many anthropogenic and climate-related impacts such as ecosystem degradation, coastal pollution and ocean change. Given the significant water and environmental challenges facing the region, nuclear and isotopes techniques have become essential tools for generating quality data that can contribute to evidence-based decision making for resilient, sustainable environmental management. In 2020, the TC programme contributed to strengthening human and analytical skills in the use of nuclear techniques and isotope hydrology in water and environmental monitoring programmes, and to strengthening existing networks of laboratories for the production of harmonized scientific data, enhanced knowledge sharing, and better coordinated collaboration and research.

WATER RESOURCE MANAGEMENT

Under CAF7004, 'Strengthening National Capacities for Assessing the Quality of Water Resources by Using Isotopic Techniques', the Agency supported government efforts to produce the first atlas of groundwater in the Central African Republic. The findings will be presented to the Ministry of Water Resources in 2021, for consideration in regard to draft regulations.

Bangladesh received necessary field and laboratory equipment to carry out analyses of riverbank erosion under BGD5033, 'Using Nuclear Techniques in Assessing Riverbank Erosion'.

“Given the significant water and environmental challenges facing the Latin American and Caribbean region, nuclear and isotopes techniques have become essential tools for generating quality data that can contribute to evidence-based decision making for resilient, sustainable environmental management.”

Support to Syria under project SYR7005, 'Assessing Groundwater Quality Using Nuclear and Isotope Techniques', also continued in 2020. With Agency assistance, Syria was able to determine the hydrochemical characteristics of groundwater in the study area, and groundwater samples were analysed for major ions. Samples were also analysed to investigate sources of nitrate pollution in groundwater, with preliminary findings indicating that the main sources of nitrate pollution in the Ghouta area of Damascus are manure, septic waste and soil organics. This information will contribute to national efforts to establish a plan for treating polluted groundwater.

In January 2020, a four-year TC project, RER7013, 'Evaluating Groundwater Resources and Groundwater-Surface-Water Interactions in the Context of Adapting to Climate Change', was launched to enhance regional capacities in the application of isotope techniques, in support of evidence-based decision-making for the sustainable management of groundwater resources. Project participants were grouped into smaller case study teams, which are expected to enhance cooperation on water and isotope hydrology in the region, build technical capacities and competencies, and provide answers to relevant water management questions under current and future climate change scenarios. Following the project coordination meeting in Vienna in February, the IAEA procured sampling equipment and consumables to enable sampling campaigns for participating Member States. Virtual training courses on isotope hydrology were organized in English and Russian – the latter being the first IAEA course on this topic conducted in Russian.

The Institute of Public Health in North Macedonia upgraded its environmental and emergency radioactivity monitoring and reporting capacity with the support of MAK7003, 'Enhancing National Capabilities of Environmental Radioactivity Monitoring'. Through the project, a staff member from the Institute received fellowship training on radon measurement, and equipment was provided for monitoring radioactivity in water, soil and sediments. The Institute also introduced regular monitoring and an early warning network for nuclear medicine departments and industries working with naturally occurring radioactive materials.

In 2020, in the framework of project RER7014, 'Improving Environmental Monitoring and Assessment for Radiation Protection in the Region', existing technical capabilities and the status of environmental radiation monitoring programmes in the Europe region were analysed, and a strategy was established to enhance regional cooperation and develop environmental monitoring and impact assessment capabilities. Agency support contributes to improving public and environmental protection in different exposure situations by generating fit-for-purpose, comparable and optimized radiological monitoring data according to international requirements and guidelines.

The Central America Dry Corridor (CADC) is severely affected by the impact of climate change, manifested in recurrent droughts, excessive rains and severe flooding that affects agricultural production and local living conditions. The CADC depends heavily on groundwater as a primary water source due to the decline in quality and quantity of surface water resources. Under project RLA7024, 'Integrating Isotope Hydrology in National Comprehensive Water Resources Assessments', a regional initiative started in 2019 to develop understanding of rainfall to groundwater connectivity in Costa Rica, El Salvador, Honduras, Nicaragua and Panama. In



Rain-water sampling in Paraguay. (Photo: Laetitia Montiel/ Counterpart Paraguay RLA7024)

2020, these countries continuously monitored selected isotopes in groundwater and rainfall to identify critical recharge zones and their connectivity with surface water systems. Over 2 000 water samples have been analysed for specific stable isotopes and 60 samples have been analysed for tritium content. Twenty technical staff from the five participating Member States have improved their capacities in isotope hydrology data interpretation. Relevant hydrological information will continue to be generated and presented to relevant national decision makers to support the prioritization of conservation measures in related watershed areas. Also under RLA7024, courses in isotope hydrology were delivered online to train water stakeholders in Colombia and Paraguay on the application of isotope techniques to calculate aquifer recharge and assess hydrological resources.

MARINE, TERRESTRIAL AND COASTAL ENVIRONMENTS

The regional TC project RAF7017, 'Promoting Technical Cooperation among Radio-Analytical Laboratories for the Measurement of Environmental Radioactivity', has built capacity in 32 African countries in the monitoring and assessment of the environmental impact of nuclear and naturally occurring radioactive material (NORM) related industries. A regional training course on marine and terrestrial sampling and pre-treatment of samples for radioactivity measurements was held in Kenya in February 2020, to strengthen the capabilities of more than 20 laboratories in 17 countries for targeted sampling in the field and sample pre-treatment. These core competencies are critical for subsequent analysis and data interpretation, as shown by the recently issued IAEA Guidelines document STI/DOC/010/486. The course further assisted these countries in establishing and improving national radionuclide monitoring programmes. The final coordination meeting, held online in October, brought together key project stakeholders to review the results achieved through the project, assess challenges encountered and identify opportunities for future regional assistance.

“The IAEA has built capacity in 32 African countries in the monitoring and assessment of the environmental impact of nuclear and naturally occurring radioactive material (NORM) related industries.”



A researcher monitors the presence of harmful algal blooms off El Salvador's coast. The IAEA provided assistance to develop capacities in nuclear and isotope techniques to identify biotoxins contained in seafood and in the environment. (Photo: UES)

In February 2020, the regional project RLA7025, 'Strengthening Capacities in Marine and Coastal Environments Using Nuclear and Isotopic Techniques', was launched at a kick-off meeting in the IAEA's Environmental Laboratories in Monaco, and attended by representatives of 18 Member States, members of the executive committee of the

Marine-Coastal Research Network (REMARCO) and experts from GEO Blue Planet and the Intergovernmental Oceanographic Commission of UNESCO. Participants noted that ocean acidification, harmful algal blooms and marine plastics pollution were pressing environmental concerns that would require capacity building and coordinated action. They highlighted the need to share data, and enhance analytical capacities for measuring ocean acidification, eutrophication and marine pollution. Within the framework of RLA7025, REMARCO is continuing to work towards bridging the gap between the scientific community and decision makers in Latin America and the Caribbean. In 2020, experts drafted a regional manual of harmonized techniques for the study of CO₂ parameters in seawater, and for the elaboration of harmonized procedures for sampling, separation, identification, classification and preparation of microplastics in sand beaches, surface waters and sediments in coastal zones for chemical analysis. A virtual workshop was organized in October for Member States and REMARCO experts to discuss the draft harmonized protocols for monitoring microplastics in sand, beach and sediments.

Industrial Applications

REGIONAL HIGHLIGHTS



The TC programme in Africa assists Member States with capacity-building, research and development in nuclear science through its national and regional projects and supports them in using nuclear technology in a variety of practical industrial applications.

In the Asia and Pacific region, the TC programme works to enhance national capacities of Member States in the industrial applications of radioisotopes and radiation technology. Technical cooperation projects provide advice, assistance and capacity building in the use of irradiation facilities and electron beams, as well as X-ray technology for varied applications, including tracking pollutants, treatment of wastewater, sterilization of medical products, disinfection of food grains, carbon dating and the preservation of cultural heritage artefacts.

It is important that Member States in Europe and Central Asia can meet EU and International Organization for Standardization (ISO) standards for radiation processed products. The TC programme assists Member States in strengthening regional capacity for the safe and efficient use of radiation processing to promote efficient use of resources while conserving the environment and maintaining sustainability. The programme also supports harmonization of quality assurance and control procedures in line with international standards. In addition, the TC programme supports the practical application of radiation technologies in various fields such as pollution control and detection, characterization and preservation of cultural heritage artefacts, inspection and certifying the integrity of civil structures, research into nanomaterials for biomedical and industrial applications, and the synthesis and modification of polymeric materials.

Promoting the competitiveness of regional industries with a focus on sustainability is critical for the development of the Latin America and the Caribbean region. In 2020, the Agency supported capacity building in the application of nuclear technologies for material modification, treatment of household and industrial effluents, food surface decontamination and the development of materials and biomaterials. The Agency also provided assistance for radiation and tissue banking activities to broaden actions to treat chronic medical conditions in the region.

RADIOISOTOPES AND RADIATION TECHNOLOGY FOR INDUSTRIAL APPLICATIONS

Under the project MLW1003, 'Establishing Non-Destructive Testing Techniques to Support Local Industry', the Agency supported the establishment and operationalisation of a non-destructive testing (NDT) centre at the Malawi Bureau of Standards. NDT services are usually outsourced to companies not operating in the country. The newly established centre has enabled the Bureau of Standards to provide services such as the assessment of tank integrity at the National Oil Company of Malawi, and to local infrastructure projects including bridges and buildings.

Under the project SYR1012, 'Building National Capacity in the Protection, Conservation and Restoration of Historical Objects and Documents Using Radiation Processing of Monomers/ Polymers', the Agency supported Syria in building capacities to protect, conserve and restore historical objects and documents through fellowship training on the preparation of polymer composites for the restoration of historical objects and the operation of thermal analysers for the characterisation of polymeric materials.

The TC programme supported Kuwait under the project K UW1008, 'Investigating the Hydrodynamics of Large-Scale Reactors for Catalytic Hydro-Processing through Isotope Techniques'. Support from the Agency included the procurement of a scintillation detector

“The Agency supported the establishment and operationalisation of a non-destructive testing (NDT) centre at the Malawi Bureau of Standards.”

and gamma spectroscopy software. The Agency also provided support in the design, fabrication and construction of a physical cold flow model simulator (large reactor). This equipment will be used to assist the oil industry in Kuwait in solving different practical problems using radioisotope nuclear techniques.

Radiocarbon dating is one of the most commonly used methods to determine the age of archaeological artefacts. Of the many archaeological artefacts excavated in Bulgaria each year, most require radiocarbon dating. With the support of project BUL0012, 'Implementing an Integrated Approach for Capacity Building at the Nuclear Regulatory Agency', a laboratory for radiocarbon dating was established in the country, and provided with equipment to analyse large and small quantities of samples. The laboratory staff were trained in sample preparation, measurement and evaluation of data to date finds. The project contributed to the national strategy for cultural and historical heritage, supporting strategic plans for the development of cultural tourism, which is part of the development strategy 'Bulgaria 2020'.

In 2020, national project ARG1029, 'Implementation of Radiation Technology Using Electron Beam for Industry and Environmental Applications', was initiated to support the introduction of e-beam technology in Argentina. Industrial and environmental sectors will greatly benefit from the expansion of services for material modification, treatment of household and industrial effluents, food surface decontamination, polymeric surfaces changes for functionalization, and development of materials and biomaterials. Progress was made with the procurement of equipment and the confirmation of training sites for participating researchers and technologists.

National project PER1016, 'Strengthening Radiation Processing, and Cell and Tissue Banking Activities', builds on previous Agency assistance to Peru in radiation and tissue banking activities. Technology was acquired for processing major cell types for skin, stem cells, and other kinds of tissue. The project has strengthened radiation and cell and tissue banking capacities in Peru, supporting their wider use by the medical community. Additionally, as irradiation technology plays a very important role in processing cells, scaffolds and tissue grafts, Agency support was also provided to the Peruvian Institute for Nuclear Energy (IPEN) to recharge the irradiator so it operates adequately for sterilization

“The Agency has strengthened radiation and cell and tissue banking capacities in Peru.”

RESEARCH REACTORS

Under RAF1007, 'Strengthening the Capacities of Research Reactors for Safety and Utilization (AFRA)', a virtual regional meeting on Regulatory Review and Assessment and Inspection of Research Reactors was organized to assist African Member States that are operating research reactors to enhance their capacities for their continued safe use.

To help increase the use of under-utilized research reactors in Europe, and to preserve the skills of staff, the Agency has launched a new e-learning course for young specialists, technicians and analysts on neutron imaging, a non-destructive technique for analysing the structure of a sample, which is applied using a research reactor.

Energy Planning and Nuclear Power

REGIONAL HIGHLIGHTS



The Agency provides Member States with support at every stage of the energy cycle, from energy planning to reactor operation and on to decommissioning. Nuclear power is contributing to global climate mitigation efforts and is part of the clean energy transition, with IAEA annual projections showing that nuclear power will continue to play a key role in the world's low-carbon energy mix. The nuclear power reactors operating today supply over 10% of the world's electricity, but around one third of all low-carbon electricity.

In Africa, the Agency supports the development of local capacities in energy planning, analysis and knowledge management. The goal is to contribute to sustainable nuclear energy development by supporting existing and new nuclear programmes in Africa.

Many countries in the Asia and the Pacific region are embarking on nuclear power programmes, including Bangladesh, Indonesia, Jordan, the Philippines, Saudi Arabia, Thailand and United Arab Emirates. The region also has the highest number of reactors under construction for the expansion of nuclear energy for power generation. The Agency is supporting the development of national infrastructure for several Member States using the IAEA Milestones Approach. The United Arab Emirates put the first of four units of the Barakah nuclear power plant (NPP) into operation in 2020 using this approach.

Countries in Europe and Central Asia operate the largest fleet of nuclear power plants in the world. In 2020, Belarus achieved a major milestone in ensuring the safe and secure power start-up of the nation's first nuclear power reactor, a result of years of close collaboration with the Agency on building the national nuclear power infrastructure. At the same time, many operating NPPs have already reached the end of their nominal design life, or will do so in the near future. Lifetime extension for their long-term operation is a top priority, and includes issues as ageing management, component resource evaluation and reliability, and the introduction of modern instrumentation and control systems. Countries in the region that plan to initiate or to expand their nuclear energy programmes have asked for Agency assistance to increase their skills to make knowledgeable decisions on Small Modular Reactors that are commercially available for near-term deployment. National, regional and interregional TC projects supported Member States in Europe and Central Asia by providing training and assistance to embark on new nuclear power programmes, ensure continuity of excellence in NPP performance, and make informed considerations of future nuclear power technologies as part of a clean and carbon-low electricity generation effort. A number of projects are supporting Member State efforts to manage their radioactive waste safely, effectively and efficiently. This includes predisposal planning and integrated waste management, storage and final disposal of waste, and the decommissioning of facilities and sites. In 2020, the countries of the region were able to exchange knowledge and lessons learned from their own national experiences in decommissioning small facilities. Practical training and guidance were also provided for the development, review and improvement of new and existing decommissioning plans for small-scale facilities.

“The Latin America and the Caribbean region continues to face growing energy demands and has identified a comprehensive analysis of energy supply and demand scenarios as a priority.”

The Latin America and the Caribbean region continues to face growing energy demands and has identified a comprehensive analysis of energy supply and demand scenarios as a priority. In 2020, the Agency assisted countries in the formulation of national and sub-regional sustainable energy plans, with the intention of developing an overarching sustainable energy plan at the regional level. Ensuring the safe use of nuclear power in the region remains a key priority. New tools are needed to keep nuclear power infrastructure operating safely, while ageing nuclear power infrastructure requires support to keep human resource capacities at sustainable levels.

ENERGY PLANNING

In Botswana, under project BOT2001, ‘Developing Scenario Modelling on Different Energy Sources for Sustainable Energy Development’, the Integrated Resource Plan for Electricity was developed and officially launched. The concept of integrated energy planning and developing an Integrated Resource Plan are central to the planning process in Botswana, as guided by national development plans. Currently, the country is implementing its eleventh National Development Plan, for the period 2017–2023, which focuses on increasing energy self-reliance. The national team were supported in considering various scenarios in developing demand and supply models.

TC regional project RER2017, ‘Assessing the Role of Low Carbon Energy Technologies for Climate Change Mitigation’, assists 25 Member States in Europe and Central Asia in energy planning as well as in determining the role of small modular reactors in helping meet climate targets. Through a series of regional meetings and training courses, the project aims to help countries understand and independently apply models that assess energy technologies in their specific national context so that they can take knowledgeable decisions on how to shape an optimal low-carbon energy mix in the future. For example, in 2020, a virtual regional training course trained 37 energy and climate specialists with the tools and capacities needed to evaluate, prioritize and communicate measures designed to reduce energy-demand related greenhouse gas emissions. Furthermore, some of the participating Member States are developing country-specific case studies for in-depth analyses of energy technologies, such as conducting a socioeconomic evaluation of a potential small modular reactor deployment scenario in their country.

Building on the result of previous phases (RLA2015 and RLA2016), the regional project RLA2017, ‘Supporting the Preparation of Sustainable Energy Development Plans at a Regional Level (ARCAL CLXVI)’, aims to integrate the recently developed national and sub-regional energy studies into an overarching regional plan for sustainable energy development in the Latin America and the Caribbean region. In 2020, the Agency supported Dominican Republic, Ecuador, El Salvador and Honduras in improving their understanding of energy demand analysis, using the IAEA’s Model for Analysis of Energy Demand.

“TC regional project RER2017 assists 25 Member States in Europe and Central Asia in energy planning as well as in determining the role of small modular reactors in helping meet climate targets.”

INTRODUCTION OF NUCLEAR POWER

Under national projects, assistance was provided to Member States in the African region embarking on nuclear power programmes, using the IAEA Milestones approach. Assistance was also provided through national projects to develop research reactor and nuclear power programmes.

The Agency has been supporting Bangladesh through an Integrated Work Plan that bridges a number of TC projects since the country first expressed interest in embarking on a nuclear power programme. Support for the construction of the first Nuclear Power Plant in Bangladesh continued in 2020 under the project BGD2017, ‘Developing Infrastructure and Support Systems for a Nuclear Power Plant During the Various Stages of Construction –Phase II’. The construction of the NPP is progressing despite COVID-19. Infrastructure development was carried out in Bangladesh, as well as the identification of priorities and potential events that could be implemented in a virtual format in 2021.

Saudi Arabia has developed an Integrated Work Plan for nuclear infrastructure based on the IAEA’s Milestones Approach. The Agency continues to support national efforts to develop infrastructure for a nuclear power programme through TC project, SAU2009, ‘Developing the Infrastructure for the Nuclear Power Programme’. Under this project, a workshop was held, focusing on links between grids and NPP reliability, the technical parameters of grids important for reliability of the grid-NPP interface, load frequency and voltage control and planning of integrating nuclear technology in the grid. The workshop was attended by over 30 participants representing different electricity companies, the Electricity and Cogeneration Regulatory Authority and the King Abdullah City for Atomic and Renewable Energy.

In 2020, through project POL9026, 'Strengthening National Infrastructure for Nuclear Power, Nuclear Safety and Radiation Protection', Poland moved forward on the establishment of a strong safety culture. A three-day virtual workshop on safety culture practices provided information on the traits and attributes of a healthy safety culture as well as on IAEA requirements, guidance and services, and shared examples of good practices and lessons learned. An activity plan has been developed for moving ahead in the development of a sound safety culture.

NUCLEAR POWER REACTORS

Under the regional project RER2015, 'Strengthening Nuclear Power Plant Lifetime Management for Long Term Operation', two workshops were conducted in a virtual format for the Europe Member States. The events provided an international forum for discussing and sharing practical aspects and experiences on lifetime and performance management of instrumentation and control (I&C) systems and equipment at nuclear power plants. The participants gained knowledge on long-term operation, ageing and obsolescence management, I&C design principles and issues, lessons learned and practical experiences with I&C system modernization.

NUCLEAR FUEL CYCLE

Sustainable uranium production is critically important for secure, socially accepted uranium fuel security, notably in nuclear 'newcomer' countries, some of which are looking to source fuel from their own uranium resources. Under projects EGY2018, 'Supporting Uranium, Thorium and Rare Metal Evaluation, Production and Purification from Conventional Resources' and RAF2012, 'Enhancing Regional Capabilities for a Sustainable Uranium Mining Industry (AFRA)', the Agency continued to provide assistance on feasibility studies and project management for the development of uranium mines and mills, conventional uranium production (from exploration to closure), environmental management of uranium mining and milling activities, life management and governance of uranium production, and other activities for the sustainable production of uranium involving naturally occurring radioactive materials.

Radiation Protection and Nuclear Safety

REGIONAL HIGHLIGHTS

The use of radiation sources has become widespread in Africa. To fully maximize the contribution of nuclear science and technology as a catalyst for development, radiation safety infrastructure in Member States should be improved to ensure the safe and secure use of such sources. Djibouti and Togo enacted nuclear legislation, having benefitted from bilateral legislative drafting assistance from the Agency.

Radiation safety continues to be a priority for the Asia and the Pacific region, and the TC programme is working with Member States to establish a network of national experts with diverse knowledge and skills, including legislators and regulators, medical professionals, scientists, industry leaders, emergency response personnel and many others. Their common safety objective is to protect people and the environment from the harmful effects of ionizing radiation. In 2020, comprehensive assistance was provided to Member States in the region through training, the provision of tools, and the revision of national nuclear laws and regulations.

Member States in Europe and Central Asia use nuclear techniques and radiation technologies for many different applications, but some countries struggle with issues related to existing exposure situations. Several national and regional projects implemented in 2020 in Europe and Central Asia were dedicated to enhancing and sustaining radiation safety infrastructure in the region and to strengthening national capacities in various aspects of radiation safety. Member States in the region prioritized the development of capacities for the planning and implementation of decommissioning plans for large and small facilities, including NPPs, irradiators, accelerators, pre-disposal waste management facilities, laboratories and small research reactors. These efforts continue to be supported through the programme. In 2020, the countries of the region were able to exchange knowledge and lessons learned from their own national experiences in decommissioning small facilities. Practical training and guidance were also provided for the development, review and improvement of new and existing decommissioning plans for small-scale facilities.

Nuclear safety and radiation protection remain priorities for Latin America and the Caribbean region. A strategic approach to ensure the peaceful, safe use of ionizing radiation is needed as more countries in the region use nuclear science and technology for medical and industrial practices. To this end, the Agency updated the Strategic Planning Tool for national safety and radiation protection projects to continue facilitating the identification of nuclear safety needs in each country in the region. The Agency continues to work with countries to build capacity in radiation safety through the establishment of regulatory bodies for the control of radiation sources — this is a priority for the region, and essential if countries are to have the capacity to respond to radiological emergencies, and to take corresponding actions to protect people and the environment.

GOVERNMENTAL REGULATORY INFRASTRUCTURE FOR RADIATION SAFETY

Under RAF9067, ‘Sustaining the Establishment of Education and Training in Radiation Safety and Human Resource Development — Phase II (AFRA)’, 48 young professionals from English and French-speaking countries began their training as radiation protection officers in November, through two Postgraduate Educational Courses (PGEC) in Radiation Protection and Safety, held in Ghana and Morocco. These six-month regional courses aim to ensure that participants meet the educational and initial training requirements of graduate



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level staff earmarked for positions in radiation protection, including medical physics, in African Member States.

Cyprus has been revising its regulatory framework and enhancing the capabilities of the Radiation Safety Regulatory Body to ensure nationwide radiation safety, including emergency preparedness, is in accordance with the IAEA Safety Standards. Under project CYP9007, 'Strengthening the Regulatory Infrastructure and Capabilities to Ensure Radiation Safety in Accordance with IAEA Safety Standards', a comprehensive evaluation of the needs of the radiation safety regulatory body was conducted, and necessary equipment to enhance its capabilities identified and put forward for procurement.

Lithuania's State Nuclear Power Safety Inspectorate (VATESI) and the Radiation Protection Centre (RSC) hosted a virtual Integrated Regulatory Review Service (IRRS) mission from November to December 2020, supported through LIT9018, 'Enhancing the Effectiveness and Transparency of the Radioactive Waste Management System'. This follow-up mission reviewed Lithuania's implementation of recommendations and suggestions made during the first IRRS mission in April 2016. The IRRS team commended Lithuania for the improved integration of IAEA Safety Standards into the legal framework on radiation protection, and on how graded approaches have been applied throughout the regulatory framework since 2016. An IAEA Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) mission is planned to take place in June 2021.

From 2018 to 2019, the first radon campaign and survey in schools and kindergartens was carried out in Serbia, using radon detectors provided under SRB9006, 'Upgrading National Capabilities and Infrastructure for a Systematic Approach to Control Public Exposure to Radon'. Findings indicated that 97% of the values of the indoor measurement was below 400 Bq/m³, the current defined action level, and the results were published internationally. In January 2020, a draft Radon Action Plan was prepared and reviewed by the Agency, together with the Ministries of Health; Construction; Transport and Infrastructure; Environmental Protection; Education, Science and Technological Development; and Labour. A radon reference level for dwellings and workplaces will be implemented within the new Exposure Situation Management Strategy, expected to be adopted in late 2021.

Regional project RLA9086, 'Strengthening the Regulatory and Radiation Safety Infrastructure', aims to improve regulatory and radiation safety infrastructure in Latin America and the Caribbean, emphasizing regulatory body responsibilities and processes, and the implementation of the IAEA Safety Standards. Throughout 2020, countries in the region reviewed their regulatory situation, identifying specific needs and gaps in their regulatory infrastructure that can be addressed under the TC programme, and worked with the Agency to develop individual action plans under existing and anticipated TC projects.

Under regional project RLA9087, 'Building Capacity and Sustaining the National Regulatory Bodies', support for Caribbean Member States to strengthen their regulatory framework is continuing, as most countries lack adequate regulatory infrastructure. The project seeks to accelerate the establishment of regulatory bodies for control of radiation sources in the participating Member States, and to strengthen radiation safety infrastructure, including capacity for response to radiological emergencies. In 2020, a scenario analysis and hazard assessment were conducted for Guyana which will contribute to the finalization of the National Radiological Emergency Plan. Regulatory bodies in Antigua and Barbuda, Belize, Bahamas, Barbados, Grenada, Guyana, Jamaica, St. Lucia and St. Vincent and the Grenadines were provided with radiation detection equipment to strengthen their capacity to carry out their functions. Under RLA9082, 'Establishing and Strengthening Sustainable National Regulatory Infrastructures for the Control of Radiation Sources', action plans to advance the establishment of national regulatory bodies were developed for Grenada

and St. Vincent and the Grenadines, while the Regulatory Authority Information System (RAIS) software and hardware was procured for Belize, to enhance the country's efforts to establish a robust national inventory of radiation sources.

RADIATION PROTECTION OF WORKERS, PATIENTS AND THE PUBLIC

A series of seven webinars on Regulatory Requirements for Medical Exposure were conducted for the Africa region under RAF9064, 'Improving the Capabilities of States in Radiation Protection of Patients (AFRA)'. On average, 100 attendees registered for each webinar.

Under RAF9068, 'Enhancing Regional Capabilities on Occupational Radiation Protection (AFRA)', a dose management system was developed to assist dosimetry service laboratories in managing dose information for radiation workers.

A comprehensive evaluation of current adherence to the IAEA's Safety Standards for radiation protection in medical exposure by Member States in Europe and Central Asia was conducted under RER9147, 'Enhancing Member States' Capabilities for Ensuring Radiation Protection of Individuals Undergoing Medical Exposure'. Using the IAEA Radiation Safety Information Management System (RASIMS) and other relevant information, the results were presented to Member States at a virtual side event during the 64th IAEA General Conference, demonstrating how and where progress has been achieved by Member States in Europe and Central Asia with TC support, and underscoring persisting challenges.

Countries and counterparts participating in regional project RLA9088, 'Strengthening Regional Capabilities of End Users and Technical Support Organizations on Radiation Protection as well as Emergency Preparedness and Response in Line with IAEA Requirements' conducted two virtual trainings for radiation metrologists working at secondary standard dosimetry laboratories (SSDLs) in Latin America and the Caribbean. The courses, 'Training on Calibration of Radiation Protection Dosimeters', and 'Training on Neutron Calibration at SSDLs', are available on the Network for the Optimization of Occupational Radiation Protection (REPROLAM) website.

The same project also supported the participation of 19 laboratories from Latin America and the Caribbean in the whole body dosimeter intercomparison exercise (IC2020ph), organized by the European Radiation Dosimetry Group. Participation in this intercomparison exercise enabled dosimetry services in Latin America and the Caribbean to test their capabilities to assess occupational exposure for extremity and whole-body dose in line with ISO 17025, as dosimeters were irradiated in an accredited or primary standard European irradiation facility.

TRANSPORT SAFETY

A virtual regional training course on Inspections by the Competent Authority for the Transport of Radioactive Material was organized in December 2020 for participating Member States in Africa, under RAF9063, 'Strengthening Competent Authorities for the Safe Transport of Radioactive Material (AFRA)'. The course aimed to enhance the capacities of frontline staff in national competent authorities who are responsible for the transport of radioactive materials.

EMERGENCY PREPAREDNESS AND RESPONSE

Two virtual regional workshops on developing national radiation emergency plans were organized in September and October 2020 under RAF9066, 'Strengthening Regional Infrastructures for Effective Preparedness and Response to Radiological Emergencies (AFRA)', attended by 37 counterparts. These bilingual workshops (delivered in Arabic and English) contributed to strengthening national and regional capacities for responding to radiological emergencies. They also helped to build Member State capacities to develop national plans and regulations for the implementation of effective radiological emergency preparedness and response.

Cameroon received assistance for the review of its draft national Emergency Response Plan, while Benin received expert advice in the review of its emergency preparedness

"Under RAF9068 a dose management system was developed to assist dosimetry service laboratories in managing dose information for radiation workers."

regulations. In 2020, two webinars were provided by the Agency: the first on medical response to nuclear or radiological emergencies, and the second on new guidance and key lessons in communicating radiological and nuclear emergencies to the public.

Bahrain received support under project BAH9009, 'Building National Capabilities in Naturally Occurring Radioactive Material Policies and Regulations, Control and Waste Management', in the form of several online training courses to build national capacities for first response. One course, 'First Response to Radiation Emergencies for Customs Officers on Emergency Preparedness and Response', was delivered in Arabic and attended by 78 participants from Bahrain Supreme Council for Environment and Bahrain Customs Authority. Another training course focused on medical first responders. The courses support Bahrain's efforts to have in place a trained and operational team for first responses to radiation emergencies.

End users in Latin America and the Caribbean were also able to benefit from a series of webinars on topics related to nuclear and radiological emergency preparedness and response, organized under regional project RLA9088, 'Strengthening Regional Capabilities of End Users and Technical Support Organizations on Radiation Protection as well as Emergency Preparedness and Response in Line with IAEA Requirements', in the latter half of 2020. Organized jointly with the IAEA Incident and Emergency Centre, the first webinar raised awareness on how to develop, justify and optimize a protection strategy for a nuclear or radiological emergency, and reached 120 professionals from relevant authorities. The second webinar aimed to help medical doctors contribute to the management of nuclear or radiological emergencies in an efficient and coordinated manner, using IAEA and World Health Organization co-sponsored publications, and reached 90 medical doctors and emergency medical personnel.

"In 2020, project RER9146 provided the framework for countries in the Europe region to identify pilot facilities for which a decommissioning plan would be developed, including irradiators, accelerators, pre-disposal waste management facilities, laboratories and small research reactors."

RADIOACTIVE WASTE MANAGEMENT, DECOMMISSIONING AND ENVIRONMENTAL REMEDIATION

China is receiving Agency assistance for planning, site selection, geological and hydrogeological site characterization, on-site tests and staff training for the Beishan underground research laboratory under CPR9054, 'Evaluating Underground Research Laboratory Site Characteristics at Depth for High-Level Radioactive Waste Disposal', and earlier TC projects. This assistance has supported the design of the country's first research laboratory for the deep geological disposal of high-level radioactive waste, 400 metres below the Beishan underground research laboratory. Agency support ensures the technical basis for the safe disposal of China's high-level waste, and consequently contributes to the sustainable development of China's nuclear industry.

In 2020, project RER9146, 'Enhancing Capacities in Member States for the Planning and Implementation of Decommissioning Projects', provided the framework for countries in the Europe region to identify pilot facilities for which a decommissioning plan would be

Nuclear Knowledge Development and Management

REGIONAL HIGHLIGHTS

Human resource development is a priority in the African region. In 2020, efforts continued to provide training to skilled mid-level personnel such as engineers and technicians through short- and long-term academic training to build capacities and ensure the availability of skilled staff in African Member States. Due to the COVID-19 travel restrictions, several planned training events were converted into webinars, virtual meetings and e-learning events.

Building, collecting, maintaining, sharing, preserving and utilizing knowledge is important for Member States in the Asia and the Pacific region, particularly in gaining the necessary technical expertise and competencies required for nuclear power programmes and the application of other nuclear technologies. Throughout 2020, the technical cooperation programme in Asia and the Pacific continued to collaborate with Member States to maintain and preserve nuclear knowledge institutional memory by establishing platforms for Member States to exchange knowledge, promote nuclear science and foster interest in nuclear science and technology, including among secondary and third level students.

In the Europe region, efforts continued to support the education and training of professionals in nuclear science and technology at various stages in their careers. The array of nuclear science and technology applications in the region is wide and diverse and there are significant differences in nuclear infrastructure. Nuclear power plays an important role in the region with eleven Member States operating NPPs and four considered as NPP newcomers. Non NPP Member States also make various uses of nuclear applications. For all Member States in the region, human resource development remains a priority to maximize the peaceful use of nuclear science and technology.

Efforts to promote the education and training of young professionals in the field of nuclear science and technology continue in the Latin America and the Caribbean region. The Latin American Network for Education in Nuclear Technology (LANENT) has developed a new educational programme, NUCLEANDO, which will help attract and train the next generation of nuclear scientists. Throughout the year, the Agency also continued to engage in virtual knowledge management visits to assist Member States in maintaining and preserving knowledge in nuclear organizations.

CAPACITY BUILDING, HUMAN RESOURCE DEVELOPMENT AND KNOWLEDGE MANAGEMENT

Under a regional project RAF0052, 'Supporting Human Resource Development in Nuclear Science and Technology (AFRA)', 36 candidates from 28 Member States (of which 13 are least developed countries) were provided with support through a sandwich programme to carry out their PhD research work in foreign universities. This training complements the PhD coursework in the candidates' home country universities and supports completion of their PhDs. Similarly, ten candidates pursued Master's degrees in nuclear science and technology at Alexandria University, Egypt, and the University of Ghana through the two-year AFRA Master's Programme in nuclear science and technology.

Singapore continues to strengthen its knowledge and capacity in nuclear science and technology development with TC support, including in nuclear energy. A webinar on 'The Future of Nuclear Energy' was arranged under TC project SIN0003, 'Building Capacity in Nuclear Power Technology and Safety', in November 2020. Hosted by the Singapore Nuclear Research and Safety Initiative, National University of Singapore, the webinar discussed the prospects of nuclear power in addressing global energy needs and addressing



“The Latin American Network for Education in Nuclear Technology (LANENT) has developed a new educational programme, NUCLEANDO, which will help attract and train the next generation of nuclear scientists.”

the threat of climate change and reducing global carbon emissions, and was aimed at an audience unfamiliar with nuclear energy (i.e. university students, academia, industry and government). Over 150 participants attended.

Several virtual activities were carried out in 2020 under regional project RAS0080, ‘Promoting Self-Reliance and Sustainability of National Nuclear Institutions’, including a regional training course ‘Financial/Economic Feasibility Study of Radiation Technology Projects’. This provided over 20 participants from 10 countries with ‘hands-on’ training on the use of UNIDO’s Computer Model for Feasibility Analysis and Reporting (COMFAR) software for microeconomic assessments (investment) and the IAEA’s Extended Input Output Model for Nuclear Power Plant Impact Assessment (EMPOWER) software for macroeconomic impact assessments of radiation technology projects. Two feasibility study prototypes, on gamma irradiators for industrial applications and on accelerators for radiopharmaceutical productions, were developed under the project. Another regional training and workshop with 15 participants from 12 countries was organized to discuss the Milestones Approach that is being prepared for the development and establishment of irradiation facilities.

Nuclear knowledge development is a priority for the Czech Republic, given an increasing demand for nuclear personnel and at the same time the ageing of experienced staff. Under the national project CZR0009, ‘Strengthening Human Resources Capacity, Nuclear Knowledge, Skills Preservation, Supplementary Enlargement of Knowledge and Expertise in Relevant Fields of the Peaceful Use of Nuclear Energy’, training is provided to ensure the safe, sustainable and reliable operation of institutions and services in the nuclear field. In 2020, the Argentinian National Atomic Energy Commission in Buenos Aires, Argentina, hosted a fellow and enabled a female young professional to build capacities to evaluate environmental impact on electrical components in nuclear power plants.

In Romania, construction of a new surface repository is planned within the Cernavoda nuclear power plant exclusion zone, subject to regulatory approval. It is anticipated that the first phase of the new repository will be built and licensed for waste disposal around 2026. As the design, construction and commissioning of the repository will take years — and in some cases decades — it is important to ensure that there is a mechanism

to ensure knowledge transfer between generations of staff employed at the organizations coordinating the development of the repository. In 2020, a mission to gain an understanding of the national nuclear knowledge management programme, as well as the readiness and status of human resource development strategies and processes for knowledge management, was conducted under ROM9038, ‘Improving the Capacity for Long Term Safe Management of Radioactive Waste and Spent Nuclear Fuel’. This serves as a basis for further implementation of a systematic nationwide nuclear knowledge management approach in line with IAEA guidance and recommendations.

In the framework of regional project RLA0057, ‘Enhancing Nuclear Education, Training, Outreach and Knowledge Management’, the Latin American Network for Education in Nuclear Technology (LANENT) has developed a multimedia educational programme, NUCLEANDO, that equips both primary and secondary school teachers with pedagogic tools and resources, allowing them to introduce nuclear and isotopic sciences into their curricula in an engaging and innovative manner, and to clearly demonstrate the benefits of the

“Nuclear knowledge development is a priority for the Czech Republic, given an increasing demand for nuclear personnel and at the same time the ageing of experienced staff.”



NUCLEANDO is expected to reach around 200,000 young students by the end of 2021. (Photo: CNEA)

peaceful application of nuclear technology to younger generations. The NUCLEANDO programme was first introduced as a pilot course in July 2019 in San José to demonstrate the applicability of the programme to educators in Costa Rica. In 2020, NUCLEANDO was brought to 150 teachers from Chile, Colombia, Mexico and Uruguay, reaching more than 5 000 students in one year.

A Knowledge Management Assist Visit (KMAV) took place at the Chilean Nuclear Energy Commission (CCHEN), in November 2020 within the framework of project RLA0057, 'Enhancing Nuclear Education, Training, Outreach and Knowledge Management'. This integrated IAEA service is designed to assist Member States in maintaining and preserving knowledge in nuclear organizations. The KMAV reviewed the established knowledge management practices at CCHEN and provided the organization with expert advice on further improvement.

The Agency worked with Argonne National Laboratory to deliver a training on strategic communication for nuclear facilities in Latin America and the Caribbean. Conducted through online sessions over a period of six weeks, the course was attended by managers and heads of nuclear installations from 19 countries in the region. The event was organized in the framework of regional project RLA0069, 'Promoting Strategic Management and Innovation at National Nuclear Institutions through Cooperation and Partnership Building -Phase II (ARCAL CLXXII)' which aims to facilitate cooperation between Member States to develop the technical and financial self-reliance of nuclear institutions in the region. The training course enabled national nuclear institutions (NNIs) to engage with key stakeholders more effectively, using purposeful messages that educate and address the priorities of targeted audiences.

Also under RLA0069, the Agency launched a three-month training course in November to strengthen the capacities of future leaders of NNIs in strategic planning and management. Course topics include: stakeholder analysis; threat analysis; action planning and reviewing; facility operations and management; organizational structure and personnel development;

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Annex 2. TC Programme Fields of Activity²⁴

Nuclear Knowledge Development and Management
Capacity establishment, programme knowledge management and facilitation of cooperation among Member States (01)
Building national nuclear legal infrastructures (03)
Industrial Applications/Radiation Technology
Reference products for science and trade (02)
Research reactors (08)
Radioisotopes and radiation technology for industrial, health-care and environmental applications (18)
Accelerator technology (32)
Nuclear instrumentation (33)
Energy
Energy planning (04)
Introduction of nuclear power (05)
Nuclear power reactors (06)
Nuclear fuel cycle (07)
Food and Agriculture
Crop production (20)
Agricultural water and soil management (21)
Livestock production (22)
Insect pest control (23)
Food safety (24)
Health and Nutrition
Comprehensive cancer control (25)
Radiation oncology in cancer management (26)
Nuclear medicine and diagnostic imaging (27)
Radioisotopes and radiopharmaceuticals production for medical applications (28)
Dosimetry and medical physics (29)
Nutrition for improved health (30)
Water and the Environment
Water resources management (15)
Marine, terrestrial and coastal environments (17)
Safety and Security
Governmental and regulatory infrastructure for radiation safety (09)
Safety of nuclear installations, including siting and hazard characterization (10)
Governmental and regulatory infrastructure for nuclear installations safety (11)
Radiation protection of workers and the public (12)
Transport safety (13)
Nuclear security (14)
Emergency preparedness and response (16)
Radioactive waste management, decommissioning and remediation of contaminated sites (19)
Radiation protection in medical uses of ionizing radiation (31)

²⁴ Updated in 2020 for the IAEA TC programme 2022–2023. The field of activity number is shown in parentheses.



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