Technical Cooperation Report for 2017

Report by the Director General

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Atoms for Peace and Development

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Preface

The Board of Governors has requested the transmission to the General Conference of the attached Technical Cooperation Report for 2017, the draft of which was considered by the Board at its June 2018 session.

The Director General is also hereby reporting in fulfilment of the request contained in resolution GC(61)/RES/10 on "Strengthening of the Agency's technical cooperation activities".

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Summary

The Technical Cooperation Report for 2017 provides an overview of the Agency's Technical Cooperation activities during the year and is set out in three parts: A, Strengthening the Agency's Technical Cooperation Activities; B, TC Programme Resources and Delivery; and C, Programme Activities and Achievements in 2017. Annex 1 gives examples of project activities and achievements in specific thematic areas. Annex 2 lists the TC Programme Fields of Activity, grouped for reporting purposes. The report also responds to General Conference resolution GC(61)/RES/10.

Part A.1 provides an overview of the Agency's technical cooperation (TC) activities in 2017, beginning with the global development context for the TC programme. It provides a brief overview of the first international conference on the technical cooperation programme, and outlines where the TC programme can contribute to Member State efforts to achieve the Sustainable Development Goals (SDGs). The report also describes IAEA participation in the global development dialogue, including the 2017 United Nations High-Level Political Forum on Sustainable Development, and in the Ninth Caribbean Community United Nations General Meeting. The TC programme is tailored to respond to the specific needs and priorities of each country and region, and activities in this area are covered in the next section of the report, which describes how Country Programme Frameworks (CPFs) and other national development plans are used to identify Member State challenges and priorities. The report describes efforts to address the needs of least developed countries (LDCs) and small island developing States (SIDS). The report also presents activities carried out in 2017 to develop human resources and build capacities through support for technical cooperation among developing countries. Part A.1 closes with a review of efforts to build awareness of the TC programme.

Part A.2 focuses on the continuing efforts to enhance the efficiency and effectiveness of the TC programme, and describes activities to strengthen the role of the technical cooperation programme within the larger development context by ensuring that projects are linked, where applicable, with Member States' national development plans and other relevant development policies and goals, including United Nations Development Assistance Frameworks (UNDAFs) and the nationally relevant SDGs. In order to maximize the contribution of nuclear science and technology to the achievement of development priorities, the Agency works in close partnership with Member States, United Nations agencies, national institutes and civil society. Practical Arrangements signed in 2017 to support such partnerships are also described in Part A.2, which also provides an overview of the Agency's activities to improve programme quality in 2017 through workshops, training events and quality reviews and assessments. Part A.2 also presents figures on 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 mobilized for the TC programme through the Technical Cooperation Fund (TCF), and through extrabudgetary and in-kind contributions. Payments to the TCF in 2017 totalled €83 million (not including National Participation Costs, assessed programme costs and miscellaneous income), or 97.7% of the TCF target set for the year[1]. New extrabudgetary resources for 2017 came to €21.7 million and in-kind contributions were €0.6 million. Overall, implementation for the TCF reached 86.3% in 2017, and safety and security, health and nutrition, and food and agriculture were the top areas of disbursement for the programme.

[1] Total payments received in 2017 include €4 million either of deferred or of additional payments by eleven Member States. Excluding these payments, the 2017 rate of attainment on payments would have been lower by 4.7%.

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 activities and achievements in technical cooperation in 2017, and presents an overview of the activities of the Programme of Action for Cancer Therapy (PACT).

Project examples are 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.

The Agency's Technical Cooperation Programme in Figures

(as at 31 December 2017)

[2] Including TCF payments, National Participation Costs, assessed programme costs and miscellaneous income.

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

[4] 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.

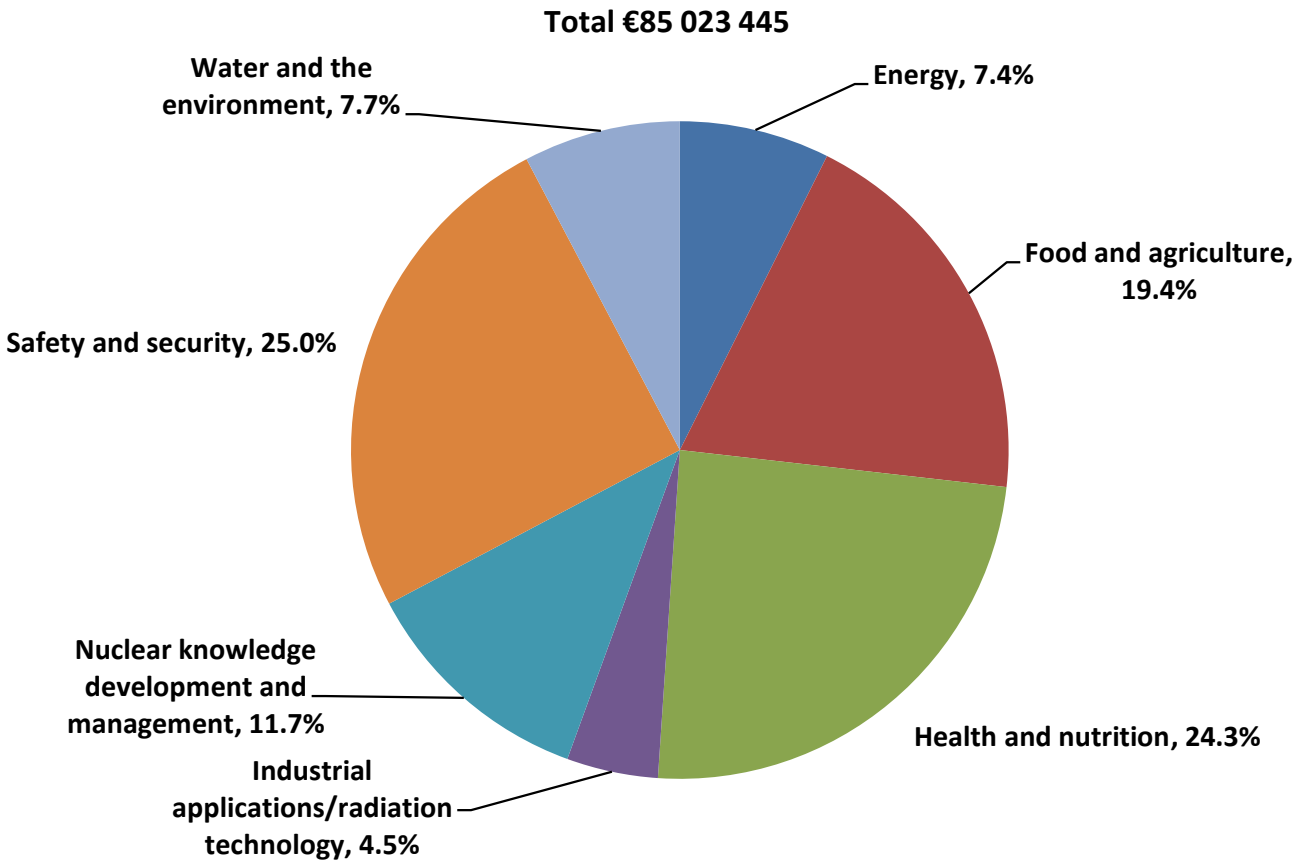


Figure 1: Actuals by technical field for 2017[5]

[5] Throughout this report, percentages in charts may not add up to 100% exactly due to rounding.

Technical Cooperation Report for 2017

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(61)/RES/10.

Part A of the report provides an overview of the progress achieved in delivering the technical cooperation programme in 2017.

Part B reports on the management of financial resources and programme delivery at an aggregate level in the calendar year 2017.

Part C reports on regional activities and programme achievements during 2017.

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 Activities[6]

A.1. TECHNICAL COOPERATION IN 2017: AN OVERVIEW[7]

Global developments in 2017: The context for the TC programme

International Conference on the IAEA's Technical Cooperation Programme

The first ever International Conference on the IAEA's Technical Cooperation Programme, 'Sixty Years and Beyond – Contributing to Development', was held in Vienna, Austria from 30 May to 1 June 2017. The conference highlighted the role of the technical cooperation (TC) programme in helping Member States achieve their national development strategies or plans, and outlined its potential contribution to the attainment of the Sustainable Development Goals (SDGs). It also strengthened partnerships with a wide range of technical cooperation stakeholders and partners, and examined innovative approaches for the way forward for the TC programme.

The conference brought together 1200 high-level decision makers and policy formulators, technical experts at the senior management level, and partners from the United Nations (UN) system and other multilateral entities. One hundred and sixty countries were represented, together with 27 organizations. The conference was also attended by 19 heads of state or government and ministers.

Detailed success stories were used to demonstrate how the TC programme, as the IAEA's main mechanism for providing services to Member States, has transferred technology, supported capacity building and facilitated international cooperation. These stories enhanced programme visibility, increasing awareness of the contribution made by the programme to socioeconomic development at the national and regional levels. Partner organizations also shared their experiences of working with the IAEA, and explored enhanced opportunities for future activities under the TC programme. The conference helped stakeholders in the TC programme, partner agencies and potential collaborators to develop a solid understanding of the contribution that the TC programme can make to Member States' efforts to achieve the SDGs.

The conference provided a good opportunity for Member States, UN agencies and other partners to explore ways of working together to make the benefits of nuclear science and technology more accessible. The IAEA's approach to and guidelines for building effective and productive partnerships with Member States and development organizations were examined in Session 4, 'Global Partnership for Sustainable Development'. This session focused on the IAEA's approach to building lasting and mutually beneficial partnerships with Member States and development organizations. In particular, it highlighted how

"The conference provided a good opportunity for Member States, UN agencies and other partners to explore ways of working together to make the benefits of nuclear science and technology more accessible."

[6] Section A responds to section 2, operative paragraph 2 of resolution GC(61)/RES/10 on strengthening TC activities through the development of effective programmes and well defined outcomes; and to section 5, operative paragraph 2 on promoting TC activities supporting the self-reliance, sustainability and further relevance of national nuclear and other entities in Member States, and enhancing regional and interregional cooperation.

[7] Section A.1 responds to section 2, operative paragraph 4 of resolution GC(61)/RES/10 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; and to operative paragraph 7 on examining characteristics and problems of LDCs and addressing this matter.

the IAEA's technical cooperation programme helps Member States to establish effective strategic partnerships with countries and development organizations, and examined how collaborative modalities might evolve to meet the requirements and imperatives of the new development context of Agenda 2030.

Session 5 'Beyond the Horizon: Paving the Way to the Future', brought together high-level speakers and panellists to examine appropriate approaches and measures to help countries maximize their use of nuclear science and technology in pursuit of the SDGs and targets.

A roundtable session on the margins of the conference was dedicated to the topic 'Role of the Private Sector in Sustainable Development'. Participants explored how collaboration with private sector partners through the technical cooperation programme and other IAEA initiatives can be expanded to increase access to nuclear science and technology.

The Summary of the Conference was circulated at the 61st session of the IAEA General Conference in 2017. The Proceedings of the Conference will be available to Member States in mid-2018. The Proceedings include the main outcomes and the observations expressed as well as the presentations delivered at the Conference.

Agenda 2030 and the Sustainable Development Goals

"The IAEA's technical cooperation (TC) programme, which supports national development priorities and needs, is the main mechanism through which the IAEA supports Member States, including for the achievement of their identified SDGs."

Nuclear science and technology can make a direct contribution to several of the SDGs, and also help Member States to enhance capacities for evidence-based decision-making. The IAEA's technical cooperation (TC) programme, which supports national development priorities and needs, is the main mechanism through which the IAEA supports Member States, including for the achievement of their identified SDGs. In preparing the 2018–2019 TC programme cycle, efforts were made to support Member States in linking TC projects, where appropriate, with SDGs, and thereby to the development priorities of each country.

The SDGs are aspirational and global in nature and Agenda 2030 calls on each government to set its own national targets "guided by the global level of ambition but taking into account national circumstances". The UN continues to support Member States in their multi-stage work to localize SDG targets and indicators and to identify interlinkages between goals and targets as well as gaps.

The 2030 Agenda attaches specific importance to the role of Science, Technology and Innovation towards the achievement of the SDGs. The Technology Bank, provided for in the 2030 Agenda to assist the least developed countries (LDCs), was set up in 2017 in Turkey, marking an important milestone in the global efforts to strengthen Science, Technology and Innovation in line with the principle of "leaving no-one behind".

Financing for Development

The 2030 Agenda provides for the establishment of a new global financial framework for financing sustainable development as a way to align resources and policies with economic, social and environmental priorities. Such comprehensive action is expected to leverage the full potential of both public and private flow to ensure stable and sustainable financing. The integrated approach calls for the effective mobilization and use of domestic public resources, international development cooperation, domestic and international private business and finance, recognizing the close link between public policies and finance to Science, Technology and Innovation and capacity building as key means to support the implementation of the SDGs.

In this regard, the United Nations Economic and Social Council Forum on Financing for Development follow-up held its second annual meeting in May 2017 to review the Addis Ababa Action Agenda and other financing for development outcomes and means of implementation. The forum paid particular attention to setting up monitoring frameworks for the follow-up of the Addis Agenda. Substantive inputs to the Forum were provided by the Inter-Agency Task Force on Financing for Development, of which the IAEA is a member.

Global development dialogue

The 2017 United Nations High-level Political Forum on Sustainable Development (HLPF), the central platform for follow-up and review of the 2030 Agenda and the SDGs, convened in New York in July, to address the theme 'Eradicating poverty and promoting prosperity in a changing world'.

On top of Goal 17, Partnerships for the Goals, which the HLPF consider every year, the forum also reviewed in depth Goal 1, End Poverty; Goal 2, End Hunger; Goal 3, Healthy Lives and Well-being; Goal 5, Gender Equality; Goal 9, Industry, Innovation and Infrastructure; and Goal 14, Life Below Water.

The Agency attended the 2017 United Nations High-level Political Forum on Sustainable Development. Photo: IAEA

The Agency attended the HLPF, using the occasion to highlight the benefits and importance of nuclear science and technology and its contribution to the attainment of the SDGs during the plenary session. With the Permanent Missions of Malaysia and Botswana to the UN, the IAEA co-hosted a side event with the theme 'Science with Impact: Sustainable Development through Nuclear Technology'. The aim of the event was to showcase how nuclear science and technology can contribute to the achievement of the SDGs, and to introduce the IAEA's technical cooperation programme. The participating Member States acknowledged the impact of the IAEA technical cooperation programme in the achievement of key development objectives in areas such as human health, agriculture and food safety and security, animal health, and industry. Bilateral meetings were held with the Under-Secretary-General, Head of the UN Department of Economic and Social Affairs, the Director of the Office for ECOSOC Support and Coordination, the UN Office for South-South Cooperation, and the Ambassador and Permanent Observer of the Caribbean Community to the UN (CARICOM), at which the Agency's contribution to development using nuclear technology was highlighted.

The IAEA also participated in the Ninth Caribbean Community United Nations General Meeting in New York, in July. The meeting was held to discuss how the UN and its associated organizations can better support the strategic goals of the Caribbean region. The IAEA made presentations in the areas of small island developing States (SIDS) and the SIDS Accelerated Modalities of Action (SAMOA) pathway, sustainable ocean based economies and agriculture, as well as on food and nutrition security, non-communicable diseases, and crime and security. As a result of the meeting, the CARICOM-UN Cooperation work plan

The Ninth General Meeting of the Caribbean Community and Associated Institutions and the United Nations System. Photo: United Nations.

was updated, and now includes the IAEA as a contributing organization. The work plan outlines concrete activities to be carried out in cooperation with CARICOM and other UN organizations, within the framework of the UN Multi-Country Sustainable Development Framework in the Caribbean 2017–2021, to which the IAEA has contributed. The UN Multi-Country Sustainable Development Framework supports the realization of the SDGs, the SAMOA Pathway and other international development aspirations, and the national development plans of the individual countries in the Caribbean.

Climate Change

The 23rd Conference of the Parties to the UN Framework Convention on Climate Change, presided over by the Government of Fiji, was held in November 2017 in Bonn, Germany with the aim of advancing the implementation of the Paris agreement which came into force on 4 November 2016. COP 23 saw the launch of the Talanoa dialogue which will take stock in 2018 of how climate action is progressing and which will proceed along-side the global stocktaking exercise laid out in the Paris Agreement.

Recognizing climate change as one of the biggest challenges affecting the planet and humanity, the Agency supports countries to tackle it, through TC projects, using nuclear science and technology through three main approaches: monitoring, mitigation and adaption. Monitoring emissions and environmental changes to the ocean and ecosystems, mitigating sources of greenhouse emissions from energy production and land use, adapting to new climate realities including food and water shortages and ecosystem losses – all are elements of the IAEA's multifaceted approach in support of countries aiming to develop effective plans and policies to address climate change and counter biodiversity loss.

Tailoring the TC programme to Member State needs[8]

The Agency's TC programme is delivered in four regions: Africa, Asia and the Pacific, Europe (and countries in Central Asia) and Latin America and the Caribbean. The TC programme is developed to address the specific needs of each Member State, particularly developing countries and LDCs. These needs are identified from national development plans, sectoral strategies, regional profiles and other relevant programming strategies, such

[8] This section responds to section 3, operative paragraph 1 of resolution GC(61)/RES/10 on strengthening TC activities, including the provision of sufficient resources, based on Member States' needs and priorities, and ensuring that the components of TC projects are readily available.

as the 2030 Agenda, including the SDGs, and United Nations Development Assistance Frameworks (UNDAFs), through the Country Programme Framework (CPF).

The IAEA's assistance concentrates on the development of capacities in nuclear science and technology in Member States with the aim to promote the safe, secure and sustainable use of nuclear techniques for peaceful purposes in key areas aligned with national and regional development priorities. Through its technical cooperation programme, the Agency has a major role to play in addressing Member States' increasing needs and demands in the areas of health and nutrition; food and agriculture; environmental protection including climate change mitigation, adaptation and monitoring; water resource management; energy planning and nuclear power particularly for newcomer States; and safety and security, as well as radiation technology for industrial applications.

During the 61st session of the IAEA General Conference in September 2017, Member States adopted resolution GC(61)/RES/10 requesting the Secretariat to continue to facilitate and enhance the development of nuclear technology and know-how and its transfer to and among Member States for peaceful uses as embodied in the Agency's TC programme, taking into account and emphasizing the importance of specific needs of LDCs in line with Article III of the Statute.

"The IAEA's assistance concentrates on the development of capacities in nuclear science and technology in Member States with the aim to promote the safe, secure and sustainable use of nuclear techniques for peaceful purposes in key areas aligned with national and regional development priorities."

In addition, Member States referred to the Agency's adoption of the 'technical cooperation among developing countries (TCDC)' modality in assisting LDCs, and to its contribution to the implementation of the principles expressed in the Istanbul Declaration, 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. The IAEA's technical cooperation programme also supports the implementation of the New Partnership for Africa's Development (NEPAD).

The main areas to which the IAEA provides support in LDCs are food and agriculture, health and nutrition, and safety and security. In most LDCs, the lack of well-trained and skilled staff remains a common constraint. In view of the relevance of nuclear science and technology in addressing the specific development needs of LDCs, the IAEA continues to work with the UN system to facilitate the integration of TC activities into international and regional development programmes and strategies, such as the UNDAF, and to harmonize the IAEA's CPFs with relevant development policies of its Member States. In 2017, Member States approved a new interregional project for the 2018–2019 TC cycle specifically targeted to enhance the capacities of Least Developed Countries through the effective use of nuclear applications for sustainable development.

In Africa, the TC programme is designed to meet the region's specific national and regional development needs and priorities, as reflected in individual CPFs and in the Regional Strategic Cooperative Framework of the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA). AFRA provides a framework for African Member States to intensify their collaboration through programmes and projects focused on specific shared needs. AFRA's activities cover a broad range of topic areas where nuclear technology can be peacefully applied to address national and regional development goals, with food and agriculture and human health currently the areas of highest priority in the region.

The IAEA, in cooperation with the Food and Agriculture Organization of the United Nations (FAO) and with funding from Japan and the United States of America through the Peaceful Uses Initiative, and AFRA, is currently helping countries use nuclear-derived techniques to diagnose zoonotic diseases and respond to them. For African countries facing the threat of new outbreaks, the IAEA's help in equipping their laboratories and training their scientists in the use of these techniques and the corresponding biosafety measures has been critical. Polymerase chain reaction technology, for example, allows the identification of viruses such as Ebola within a few hours and with a high degree of accuracy. Early diagnosis helps curtail the spread of a disease by making it possible to rapidly isolate and treat infected animals and patients. The ongoing information exchange between various disciplines and different countries is an exemplary case of knowledge transfer under the

UN-supported One Health approach. In August, more than 150 participants from 40 African countries, together with experts from other regions, met in Vienna to share experiences in order to improve national surveillance networks for monitoring and containing the spread of highly contagious viruses, such as avian influenza, Ebola, Marburg, Crimean-Congo haemorrhagic fever and monkeypox.

Producing radiopharmaceuticals in the National Cancer Centre in Cambodia. Photo: IAEA

In the Asia and the Pacific region, the TC programme continued to assist LDCs in 2017 in addressing their basic needs. For example, in health, the programme supported a major effort in cooperation with the Royal Government of Cambodia to establish the first National Cancer Centre, which was set up with the support of the TC programme and inaugurated by Prime Minister Hun Sen last January. The Centre is designed to cover up to 60% of the national demand for cancer diagnosis and treatment. Support was also provided for the National Animal Health Laboratory in Lao People's Democratic Republic, improving capacities for disease diagnosis and control, with the goal of helping the laboratory become a reference and confirmatory diagnostic and control laboratory. The programme also helped Afghanistan to enhance national capacity in effective water resource assessment and management. In Yemen, the programme is helping the country to keep the sole brachytherapy centre functional, focusing on capacity building.

The TC programme is working actively to help SIDS to address their development needs, including the achievement of the SDGs. The SDGs and the SAMOA Pathway cover poverty, hunger, human health, clean water, affordable and clean energy, industry and innovation, as well as climate change, where nuclear science and technology have much to offer. As SIDS face unique developmental challenges in common, linked to geographic isolation, economies of scale and demographic changes, the IAEA is taking a coordinated approach to the provision of support. In March, representatives from SIDS from the Caribbean and the Pacific regions met in Sydney, Australia, to finalize the design of a proposed interregional technical cooperation project for SIDS and to discuss opportunities for partnerships and resource mobilization.

Nuclear technologies are in widespread use in Eastern Europe and Central Asia in sectors such as energy, health, environment and industry, with national and sub-regional differences in the prioritization of their application. Nuclear and radiation safety is a priority across the region. Several national and regional radiation safety projects were implemented in 2017. Although most Member States in Eastern Europe and Central Asia have well-functioning regulatory infrastructures, some countries have yet to fully meet relevant IAEA Safety Standards. In 2017, several TC projects continued to address gaps in this respect. Other priorities are related to human health, in particular cancer diagnosis and treatment. In addition, the decommissioning of old research reactors and nuclear power plants (NPPs), as well as nuclear waste and remediation of old uranium mining sites, are increasingly becoming priorities for many Member States. National and regional projects have been implemented in 2017 to assist Member States in this regard.

In the Latin America and the Caribbean region, tailored responses were made to the emergency needs of Member States in the region. In March, Peru was hit by heavy rains of ten times the normal volume. These caused mudslides, flash floods and river overflow across the country. Thousands of people were displaced, and many houses and hospitals were destroyed across the country. Through the TC programme, the IAEA provided

mobile X-ray diagnostic systems for two hospitals and reverse transcription–polymerase chain reaction systems for detection of the dengue, chikungunya and zika virus, which were of considerable concern due to the amount of standing water in the country.

In September 2017, strong earthquakes hit Mexico, resulting in loss of life and widespread damage to buildings. Through the TC programme, the IAEA offered equipment and expert support to apply non-destructive testing to examine the structural integrity of affected buildings. This will also enable Mexico to prevent and swiftly respond to similar emergencies in the future.

A delegation from the new Jamaican Hazardous Substances Regulatory Authority (HSRA) visited the IAEA in December. The IAEA is working with HSRA to promote cooperation among the Caribbean islands in safety, and HSRA has already begun work, regulating facilities using ionizing radiation and nuclear technology, to protect the people and environment of Jamaica.

Haiti is the only LDC in the Latin America and the Caribbean region. In 2017, the country received tailored support in the areas of nutrition and the agricultural sector. For example, a national project is supporting the building of national capacities through purchase of equipment and training in the areas of soil and water management, and food safety monitoring. The goal is to increase agricultural productivity and exportability through soil and water management and food safety monitoring, respectively.

"Nuclear science and technology can contribute to the achievement of several of the SDGs, and also help Member States to enhance capacities for evidence-based decision-making."

Contributing to the Sustainable Development Goals

Nuclear science and technology can contribute to the achievement of several of the SDGs, and also help Member States to enhance capacities for evidence-based decision-making.

The IAEA, in cooperation with the FAO, has supported Indonesia in the use of radiation for agricultural research and development, including the development of enhanced varieties of seeds for improved production. In September 2017, Indonesia's Ministry of Agriculture selected an improved soybean variety developed using induced mutation as the basis for its national self-sufficiency plan, which aims to increase food security in the country.

With the support of TC project KUW7003, 'Addressing Ocean Acidification and Carbon Export in Marine Waters', scientists at the Kuwait Institute for Scientific Research (KISR) are making tangible progress in using nuclear techniques to analyse the biogeochemical cycle in the Gulf. Their aim is to better understand the impacts of rising temperatures and ocean acidity on the biological life in the region. In connection with the research work supported

KUW7003: Stations to monitor marine water quality have been set up at different locations in Kuwaiti waters. Photo: L.Potterton/IAEA

by the Agency, KISR scientists have developed a new seawater surface sampling device that has recently been awarded a United States patent (9541474 B1). This device is capable of collecting neustonic samples from the top layer of the ocean, where most atmospheric-oceanic interaction takes place. With the support of the technical cooperation project, KISR is able to identify the multiple causes of ocean acidification and explore changes in the complex ecosystem of Kuwait's surrounding waters.

In Latin America and the Caribbean, the regional project RLA5070, 'Strengthening Fruit Fly Surveillance and Control Measures Using the Sterile Insect Technique in an Area Wide and Integrated Pest Management Approach for the Protection and Expansion of Horticultural Production (ARCAL CXLI)', has provided a framework for the continuation of efforts to control and eradicate the Mediterranean Fruit Fly (medfly) in the region. Following two years of intense suppression and eradication efforts, the medfly was officially declared eradicated from the Dominican Republic by the Minister of Agriculture on 7 July 2017. The eradication of the medfly will contribute to enhancing the production of fruit and vegetables, thereby increasing the opportunities for export, employment and economic growth. Other activities have also been carried out in the region in 2017 under RLA5070, including the provision of advice on how to fix and calibrate the x-ray equipment used for insect sterilization; on the application of biological controls with parasitoids in integrated fruit fly management programmes; and on how to improve sterile medfly release systems in participating Member States.

The interregional technical cooperation project INT0093, 'Applying Nuclear Science and Technology in Small Island Developing States in Support of the Sustainable Development Goals and the SAMOA Pathway', was approved in 2017 as part of the 2018–2019 TC cycle. This project will support IAEA SIDS Members in their efforts to achieve the SDGs and the SIDS SAMOA Pathway in areas including marine environment, cancer, nutrition and food security. This is the first IAEA project that brings together countries in Africa, the Caribbean and the Pacific that face similar and unique challenges as SIDS. The interregional technical cooperation project INT0097, 'Contributing to the Development of Least Developed Countries by Building Human and Institutional Capacities in Nuclear Sciences and Technology', also approved as part of the 2018-2019 TC cycle, targets LDCs, and is designed to enhance their capacities through the effective use of nuclear applications for sustainable development.

Developing human resources and building capacities[9]

Concerns about food safety are increasing among African Member States as they strive to ensure both food security and access to lucrative sub-regional, regional and international markets. The use of agrochemicals and veterinary drugs, coupled with natural hazards and poor hygienic conditions during the production, handling and marketing of agricultural products, all contribute to health risks. Under the TC project RAF5078, 'Establishing a Food Safety Network through the Application of Nuclear and Related Technologies, Phase II', the Agency is helping Member States to address the control of chemical and microbial hazards in food. The project is strengthening the capabilities of food safety laboratories in the use of nuclear/isotopic and complementary techniques, and also promotes networking. In 2017, testing programmes for food contaminants, using radio-analytical and complementary techniques, have been initiated or strengthened in 19 countries, with the goal of ensuring effective national programmes for hazard identification and residue monitoring. Also in 2017, the project launched an exchange programme to promote the sharing of scientists' experiences among the 33 countries participating in the project. These activities are carried out through the African Food Safety Network (AFoSaN), a web-based platform that

[9] This section responds to section 2, operative paragraph 1 of resolution GC(61)/RES/10 on facilitating and enhancing the transfer of nuclear technology and know-how among Member States.

Conditioning operation training for radioactive waste in Indonesia. Photo: Suryantoro/ National Nuclear Energy Agency (BATAN).

supports the sharing of technical information on food safety as well as networking and collaboration in the region. The platform also seeks to promote public-private partnerships and the greater involvement of academic and research institutions in sustainable food safety programmes, and to generate new information on food safety and address gaps in this area. Adherence to international standards, a shared issue of regional and international relevance given the globalisation of trade, is also addressed on the AFoSaN platform.

In 2017, nine young scientists from nine African Member States completed their Masters' degree programme in nuclear science and technology at the University of Alexandria, Egypt, and the University of Ghana. Both countries host AFRA regional designated centres for higher and professional education. These studies were supported by RAF9056, 'Strengthening Education and Training in Radiation Safety and Sustaining Human Resources Development and Nuclear Knowledge Management (AFRA)', which supports the training of a new generation of nuclear scientists in Africa. In total, 80 students have received Masters' degrees in nuclear engineering and radiation physics over the past 10 years, and are now contributing to the peaceful use of nuclear technology in their respective countries. Of these, several now hold senior positions in nuclear institutions or are working in national regulatory bodies, while others are helping to develop training programmes related to nuclear science and technology in tertiary institutions.

The Agency provided comprehensive support to Member States in the Asia and the Pacific region for building capacity and strengthening radioactive waste management infrastructure, under project RAS9085 'Enhancing the Radioactive Waste Management Infrastructure in the Asia-Pacific Region'. Through five practical, hands-on training courses on the management of radioactive waste and disused sealed radioactive sources (DSRSs), 116 national personnel were trained and equipped with practical skills that will enable them to address issues related to waste categorization, technical conditioning procedures and pre-disposal considerations in their home countries.

Also in the Asia and the Pacific region, and supported through project RAS1020, 'Building Capacity for Applications of Advanced Non-Destructive Evaluation Technologies for Enhancing Industrial Productivity', a regional training course on Digital Industrial

Radiography and Industrial Computed Tomography, hosted by the Malaysian Nuclear Agency, was attended by 21 participants from eight Member States in September. Thirteen participants successfully passed the theoretical and practical examinations, qualifying for level II Certification in accordance with ISO 9712. This is the first time that a regional training course, coupled with theoretical and practical examinations and leading to internationally recognized certification, has been achieved within the framework of an IAEA/Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) project.

"The Intercontinental Nuclear Institute (INI) training programme took place in July for the third consecutive year. Initially a group fellowship programme for young nuclear professionals from Eastern Europe, INI expanded its mission in 2017 to Member States worldwide and welcomed 28 young professionals from 19 countries."

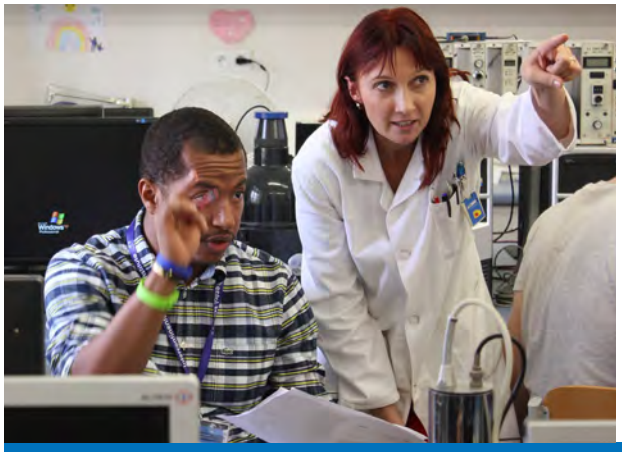
A Train the Trainers course for radiation protection officers working in medical and industrial facilities took place in October in Bangkok, Thailand, within the framework of project RAS9081, 'Providing Education and Training in Radiation Safety in the Asia-Pacific Region'. The course, attended by 20 participants from 19 countries in the Asia and the Pacific region, has contributed to the creation of a pool of potential instructors in the region. A workshop for Radiation Safety Information Management System (RASIMS) national coordinators was supported through project RAS9073, 'Strengthening the Regulatory Infrastructure for Radiation, Transport and Waste Safety', in May 2017. The coordinators, who are mainly senior regulators, were trained in the use of RASIMS, and updated their national radiation safety profiles in the system.

A *Handbook on Quality Control Protocols for Diagnostic Radiology in Latin America* was prepared in 2017 under regional project RLA9075, 'Strengthening National Infrastructure for End-Users to Comply with Regulations and Radiological Protection Requirements'. The document is planned be published as a IAEA Technical Document in 2018.

RLA9075: Expert meeting to elaborate the Handbook on Quality Control Protocols for Diagnostic Radiology in Latin America, December 2017. Photo: IAEA.

Compliance with regulatory requirements was improved in Honduras in 2017 through education and training in radiation protection, policy and strategy. Similarly, compliance with regulatory requirements was improved in Ecuador and Paraguay through support for the training of radiation protection officers in medical and industrial facilities.

The Intercontinental Nuclear Institute (INI) training programme took place in July for the third consecutive year. Initially a group fellowship programme for young nuclear professionals from Eastern Europe, INI expanded its mission in 2017 to Member States worldwide and welcomed 28 young professionals from 19 countries, mostly from the Eastern Europe region but also from Africa, the Middle East, Asia and Latin America. Funded by the US Government through the IAEA's Peaceful Use Initiative, the INI programme is held each year in the Czech Republic and the United States of America, and has become an important IAEA activity for sharing and disseminating intercontinental expertise, balancing advanced technical lectures with practical experience.



Scenes from the third Intercontinental Nuclear Institute, held in the Czech Republic and the United States of America. Photos: INI

Building competence in radiation protection through postgraduate training

The implementation of the IAEA Strategic Approach to Education and Training in Radiation, Transport and Waste Safety 2011–2020 continued throughout 2017. As part of this approach, participants from Member States attended Postgraduate Educational Courses (PGECs) in Radiation Protection and the Safety of Radiation Sources. These courses were first held in 1981 in Argentina. PGECs build the competency of personnel, primarily from national regulatory bodies, enhancing their knowledge and understanding of radiation protection. These courses build a cohort of young professionals who are expected to become, in time, senior regulators, senior decision makers, radiation protection experts or trainers.

PGEC fellows in Ghana, 2017. Photo: M.Edwerd/IAEA.

Under the framework of RAF9056 'Strengthening Education and Training in Radiation Safety and Sustaining Human Resources Development and Nuclear Knowledge Management', 44 professionals from 27 African Member States followed the PGEC on Radiation Protection and the Safety of Radiation Sources. The Algiers Nuclear Research Centre hosted the French-language PGEC from 19 February to 13 July 2017, while the Graduate School of Nuclear and Allied Sciences in Accra, Ghana hosted the English-language PGEC from 27 February to 26 July 2017. Additionally, the project supported Portuguese-language training at the PGEC held in Brazil for four professionals from Angola and Mozambique.

Thirty-five participants from Member States in the Asia and the Pacific region successfully completed the 15th PGEC in Radiation Protection and the Safety of Radiation Sources in 2017. The course was held in Kajang, Malaysia, within the framework of RAS9081, 'Providing Education and Training in Radiation Safety in the Asia-Pacific Region', and the participants are now able to contribute to establishing a sustainable national infrastructure for radiation protection in their respective countries

Thirteen participants from nine Member States in the Latin America and the Caribbean region also participated in a Post-Graduate Education Course in Radiation Protection and the Safety of Radiation Sources. Argentina's Nuclear Regulatory Authority, which supports the PGEC in collaboration with the University of Buenos Aires, hosted an Education and Training Appraisal (EduTA) mission in 2017. EduTA missions are important for Member States as they offer a detailed appraisal of the national provisions for education and training in radiation protection and the safety of radiation sources compared to the requirements in IAEA Safety Standards.

In May, the directors of the PGECs hosted in all IAEA regional training centres in Africa, Asia and the Pacific, Europe and Latin America and the Caribbean met in Valencia on the margins of the International Conference on Education and Training in Radiation Protection, to discuss the results of an evaluation of the impact of the PGEC on the professional career of participants and on the radiation safety infrastructures of Member States. In December, representatives from the regional training centres also participated in the annual steering committee meeting for education and training in radiation, transport & waste safety to discuss, inter alia, assistance to Member States for developing a national strategy in this area.

Technical cooperation among developing countries and networking

A meeting of the Quadripartite Forum among the four regional/cooperative agreements AFRA, ARCAL, ARASIA and RCA was held with the support of the IAEA Secretariat on the margins of the international TC Conference in 2017, and in September 2017. The meetings shared experiences and best practices in identifying regional needs for the development and design of regional programmes, supporting State Parties in addressing SDG priorities, mobilizing resources for regional programmes, and enhancing the sustainability and self-reliance of national nuclear institutions, particularly by following AFRA experience in this area. It was also agreed to share best practices in the commercialization of research and development results, in the implementation, monitoring, reporting and final assessment of regional projects, and in ensuring the sustainability of regional projects after closure. In addition, focal persons of each Agreement were requested to develop a mechanism to enable the participation of candidates in each other's programmes.

"The Agency's regional TC programmes are essential tools to promote technical cooperation among developing countries (TCDC) and triangular cooperation, address common challenges efficiently and effectively, foster the exchange of best practices, and encourage networking."

The Agency's regional TC programmes are essential tools to promote technical cooperation among developing countries (TCDC) and triangular cooperation, address common challenges efficiently and effectively, foster the exchange of best practices, and encourage networking. In Africa, much of this work is done through AFRA. The AFRA project RAF0046, 'Promoting Technical Cooperation among Developing Countries through Triangular Partnerships and Sustaining Regional Ownership of the AFRA Programme', has supported various TCDC initiatives, such as, for example, collaboration in 2017 on the effective use of radiotracers in industry between Morocco and Egypt, Kenya, Sudan and Zimbabwe. This collaborative approach has enabled 16 staff from these countries to attain qualifications according to the standards of the International Society of Tracers and Radiation Applications. Similar triangular partnerships between Morocco and South Africa and Cameroon, Kenya, Sudan and Zimbabwe were implemented in 2017 in non-destructive testing.

The Asian Network for Education in Nuclear Technology (ANENT) is a regional partnership, supported by the IAEA under the regional project RAS0075, 'Networking for Nuclear Education, Training and Outreach Programme in Nuclear Science and Technology in the Framework of ANENT'. ANENT supports cooperation in capacity building, human

resource development and knowledge management in nuclear science and technology in the Asia and the Pacific region, and currently has 21 members from the region. The regional project consolidates the joint efforts of all participating universities, research and development organizations and training institutes to enhance regional education and training capacity, fostering cooperation using the existing ANENT framework. Activities focus on the development of the ANENT web-portal and regional learning management system (RLMS), the organization of e-learning courses, the sharing and development of outreach materials, the provision of access to the Internet Research Reactor Laboratory (IRL), and partnerships between ANENT members and beyond Asia.

In 2017, the RLMS moved from a physical server to the 'cloud', with IAEA support. Extrabudgetary funding was provided by the Korea Atomic Energy Research Institute. The switch to a cloud based service has provided regional users with improved accessibility, internet security and enhanced cost-efficiency in sharing materials and conducting training courses, and further possibilities to address increasing needs to sustain the development of human resources through the RLMS in line with the Strategic Capacity Building Approach to human resource development are being explored. The project also contributed to the development of methodologies and guidance for the design and sharing of e-learning materials and outreach activities. Participating member countries shared their experiences of innovative methods and tools for Massive Open Online Courses, and teaching approaches for science students with disabilities, the promotion of science, technology, engineering and mathematics among students through social networking services, and interaction with young people through 'edutainment' events. Participants recognized the need to help students with visual disabilities and the deaf by providing appropriate tools such as Braille, voice or sign language in e-learning materials.

Legislative and drafting assistance

The Agency provides assistance to Member States in the establishment of adequate and comprehensive national legal frameworks for the safe, secure and peaceful uses of nuclear energy and ionizing radiation. In 2017, this assistance was provided through the regional projects RAF0048, 'Establishing National Legal Frameworks in African Member States'; RAS0071, 'Providing Legislative Assistance on Establishing and Upgrading the Legal Framework for Safe, Secure and Peaceful Use of Nuclear Energy'; RER0042, 'Establishing and Enhancing National Legal Frameworks'; and RLA0055, 'Establishing National Legal Frameworks in Member States'.

The seventh session of the Nuclear Law Institute held in Vienna in October 2017, provided intensive training in all areas of nuclear law to 60 legal and regulatory officers from 53 Member States from Africa, Asia and Pacific, Europe and Latin America and the Caribbean enabling participants to acquire a solid understanding of nuclear law and the necessary skills to draft, amend or review national nuclear legislation.

Four regional workshops were also conducted in 2017 to provide a forum to increase knowledge and awareness on nuclear law and the related international legal instruments, to assess Member States needs in this field and to develop work plans for strengthening or updating national legal frameworks in Member States. Such workshops were conducted for Member States of Africa in Arusha, United Republic of Tanzania (13–17 March) and in Vienna, Austria (31 July–4 August), the Caribbean in San Ignacio, Belize (25–28 April) and Europe in Vienna, Austria (6–10 November). These workshops were attended by 111 participants from 63 Member States. The IAEA also provided bilateral assistance to 20 Member States in the form of written comments and advice on drafting nuclear legislation, and through the conduct of national workshops, training courses, and legislative assistance missions to advice on the development and revision of national legislation for safety, security, safeguards and civil liability for nuclear damage. For instance, national workshops or training courses were organized in Bangladesh, Egypt, the Lao People's Democratic Republic, Montenegro and Peru, which allowed participants to improve their knowledge and exchange experiences on all aspects of nuclear law.

Building awareness of the TC programme

"Outreach to Member States, current and potential partners, donors and the international development community remains an essential area of activity for the Agency."

Outreach to Member States, current and potential partners, donors and the international development community remains an essential area of activity for the Agency. In 2017, considerable attention was given to promoting the first International Conference on the Technical Cooperation Programme: Sixty Years and Beyond – Contributing to Development through a series of web articles, a dedicated issue of the IAEA Bulletin, and through multiple social media campaigns using #Atoms4Dev2017. A video on the TC programme was produced, and several exhibitions were installed for the duration of the conference.

Exhibitions focusing on technical cooperation activities were organized at an International Conference on Radiotherapy in the Dominican Republic and the Caribbean Disaster Emergency Management Agency Conference, among others. At the 61st regular session of the Agency's General Conference, a side event showcased a technical cooperation project on climate-proofing rice production systems, while another provided information on the InTouch+ platform. The technical cooperation programme was also presented at a side event titled 'The IAEA and the SDGs: how nuclear science and technology is contributing to human well-being' on the margins of the 2017 NPT PrepCom.

Over fifty diplomats from forty Permanent Missions attended the annual Seminar on Technical Cooperation in October 2017. The seminar provided participants with a comprehensive overview of the technical cooperation programme.

Annual Seminar on Technical Cooperation, October 2017. Photo: H. Pattison/IAEA.

The IAEA participated at the 2017 RadWaste Summit, which took place in Summerlin, US, in September 2017, with the objective of raising awareness of the need to strengthen operational and regulatory control over radioactive sources. A keynote statement was delivered on the support that the IAEA provides to Member States through project INT9182 'Sustaining Cradle-to-Grave Control of Radioactive Sources', covering the latest developments to ensure that radioactive sources, in particular disused sources, are managed safely and securely.

The first ever African Youth Nuclear Summit took place in Nairobi, Kenya, in March 2017, organized by the Kenyan Young Generation in Nuclear in collaboration with African Young Generation in Nuclear. The event brought together over 300 young and senior nuclear professionals. The Agency participated, delivering a keynote lecture at the

plenary session that emphasized the importance of nuclear science and technology for the sustainable socioeconomic development of Africa.

The Agency also participated in the World Science Forum, which was held in Jordan in November 2017. The Forum, on the topic 'Science for Peace', attracted over 3000 participants from 140 countries representing the scientific community, policy makers, international organizations, and youth. Hosted by the Royal Scientific Society of Jordan, together with the United Nations Educational, Scientific and Cultural Organization, the Hungarian Academy of Science, the International Council for Science, and the American Association for the Advancement of Science, the Forum provided an opportunity to engage the world of scientists and redefine the global potential of scientific communities and policymakers to bring real change to world.

In August 2017, the first National United Arab Emirates Seminar on Technical Cooperation highlighted the achievements of the country made with the support of the IAEA's TC programme. The event increased awareness of the scope of IAEA work in sustainable development, and provided an opportunity to determine opportunities for future collaboration. The opportunities discussed during the seminar provided a basis for enhancing the scope of the CPF for the period 2018–2021, which is currently under preparation. Some topics that arose included the need to model transport of radioactivity in arid environments, especially as regards transport by sandstorms, the importance of databases to detect food fraud, and how Member States can support, develop, maintain and use databases such as the Global Network of Isotopes in Precipitation.

National Outreach Seminar on UAE technical cooperation with the IAEA. Photo: K.Ahmed/Sheikh Hamdan bin Rashid Al Maktoum Award for Medical Sciences (SHMA).

In September 2017, an outreach event was held in Malaysia, where more than 200 participants discussed how nuclear science and technology could help the country achieve its development objectives. The event was attended by officials from government, academia and non-governmental organizations and focused on several areas, including nuclear techniques for water resource management and environment conservation, and nuclear technology for the promotion of sustainable agriculture.

The Agency's contribution to the fight against cancer continued to be highlighted at high-level global health events throughout 2017. At the World Health Summit and the World Health Assembly, the Agency outlined its contribution in expanding access to quality health care, emphasizing its support to developing countries in the sage and effective use of radiation medicine and related nuclear techniques, and in building essential capacities in medical staff. The Agency expressed its continuing commitment to support Member States in using nuclear technology for health and well-being. The Agency also participated

Mr Dazhu Yang, DDG Technical Cooperation, attended the World Health Summit in 2017. Photo: © S. Kugler/World Health Summit.

in the UN Interagency Task Force on the Prevention and Control of Non-Communicable Diseases, an initiative which monitors the joint efforts of UN agencies and partners to address these kinds of diseases.

With the Agency's move to a new web content system, content on the technical cooperation web site was assimilated into many more pages of the Agency's main web site, enhancing programme visibility. In 2017, 228 news items on technical cooperation were posted online, including 14 photo essays and 24 videos. Throughout the year, the Agency also posted targeted outreach material of relevance to specific UN international days using social media and the web to promote relevant technical cooperation activities.

More than 920 tweets were sent out from the @IAEATC Twitter account, which now has over 3750 followers. The LinkedIn IAEA TC Fellows Alumni Group now has over 1670 members.

A.2. BUILDING A MORE EFFICIENT, MORE EFFECTIVE TECHNICAL COOPERATION PROGRAMME[10]

Revised Supplementary Agreements, Country Programme Frameworks and UN Development Assistance Frameworks[11]

Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the IAEA (RSAs) govern the provision of technical assistance by the Agency. Two Member States, Congo and Swaziland, signed an RSA in 2017, bringing the total number of Member States with a signed RSA to 134 by the end of 2017.[12]

Country Programme Frameworks (CPFs) provide a frame of reference for technical cooperation between a Member State and the Agency. They define mutually agreed development needs and priorities that can be supported through technical cooperation programming.

[10] Section A.2. responds to section 3, operative paragraph 1 of resolution GC(61)/RES/10 on strengthening TC activities, including the provision of sufficient resources, based on Member States' needs and priorities, and ensuring that the components of TC projects are readily available.

[11] This section responds to section 4, operative paragraph 11 of resolution GC(61)/RES/10 on the tools to share CPFs and footnote-a/ project details..

[12] This paragraph responds to section 1, operative paragraph 1 of resolution GC(61)/RES/10 on adhering to the Statute and document INFCIRC/267; and to operative paragraph 2 on the importance of RSAs.

CPFs signed in 2017	
Albania	Jordan
Algeria	Kenya
Benin	Mexico
Cambodia	Philippines
Central African Republic	Rwanda
Cuba	Saudi Arabia
Honduras	Thailand
Hungary	Uruguay
Iraq	Vanuatu
Israel	Zimbabwe

The CPF template is currently being reviewed to enhance the role of the CPF as the main strategic planning tool for the development of national TC programmes for Member States. It will strengthen the role of the technical cooperation programme within the larger development context by ensuring that the proposed programmes are linked, where applicable, with Member States' national development plans and other relevant development policies and goals, including UNDAFs and the nationally relevant SDGs. In 2017, 20 CPFs were signed by Member States. There was a total of 95 valid CPFs by the end of the year.

The UNDAF is a structure for coordinating UN system actions in support of national development goals. In 2017, the Agency continued to focus on greater involvement in the development and implementation of UNDAFs in relevant countries. This process has enabled the Agency to raise awareness about its work and facilitated access to the main national development coordination and planning bodies. In addition, it has assisted in coordination and collaboration with the UN and other partners. In 2017, the Agency co-signed a total of 12 UNDAFs. At the end of 2017, the Agency was a co-signatory of 54 valid UNDAFs, and was participating in 12 UNDAF processes.

UNDAFs signed by the Agency in 2017	
Bahrain	Kyrgyzstan
Bolivia, Plurinational State of	Morocco
Botswana	Nepal
Costa Rica	Republic of Moldova
Dominican Republic	Serbia
Gabon	Viet Nam

Maximizing programme impact through strategic partnerships[13]

The Agency works in close partnership with Member States, UN agencies, national institutes and civil society in order to maximize the contribution of nuclear science and technology to the achievement of development priorities, thus also contributing to the achievement of SDG 17, 'Strengthen the means of implementation and revitalize the global partnership for sustainable development'. The goal is to add value to Agency activities, and to take advantage of synergies to optimize the impact of Agency support. By advancing partnerships, the Agency promotes improved project identification, design, implementation, monitoring and impact, encourages the sharing of resources, and mobilizes resources in support of Member State goals.

"By advancing partnerships, the Agency promotes improved project identification, design, implementation, monitoring and impact, encourages the sharing of resources, and mobilizes resources in support of Member State goals."

In 2017, the Technical Cooperation Partnerships Review and Resource Mobilization Committee (TC-PRC) continued to ensure a coherent and coordinated implementation of the Strategic Guidelines on Partnerships and Resource Mobilization, GOV/2015/35. The TC-PRC is a forum for knowledge sharing on past, current or potential partnerships, and aims to enhance the scope, sustainability and impact of these partnerships. The Committee enhances coordination and cross-divisional learning within the TC Department, and increases synergies and promotes an integrated approach to partners. In 2017, the TC-PRC reviewed 12 partnership agreements.

[13] This section responds to section 5, operative paragraph 1 of resolution GC(61)/RES/10 on consultations and interactions with interested States, the UN system, multilateral financial institutions, regional development bodies and other relevant intergovernmental and non-governmental bodies; and section 5, operative paragraph 3 on developing and facilitating cost sharing, outsourcing and other forms of partnership in development.

Partnerships in education

In April 2017, a cooperation arrangement was signed between the Regional Coordinator of the AFRA Network for Education in Nuclear Science and Technology and Coordinators of other regional educational networks namely the ANENT, the European Nuclear Education Network and the Latin American Network for Education in Nuclear Technology. The objective of this arrangement is to enhance collaboration between regional educational networks through exchange of experiences, best practices and training materials.

Partnerships by region

In September 2017, the Agency signed Practical Arrangements with the National Centre for Nuclear Energy, Sciences and Technology of Morocco. The Arrangements aim to establish a framework for non-exclusive cooperation to enhance TCDC for the effective delivery of the TC programme to Member States. It covers the provision of short and long term training programmes in human health (including radiation medicine, nuclear medicine and nutrition), radiation safety, isotope hydrology and non-destructive testing, through the hosting of fellows, scientific visitors and participants in meetings and training courses, the provision of local experts and lecturers, and the provision of laboratory analytical services, especially for water samples.

In June 2017, the IAEA signed an Agreement with the Secretariat of the Pacific Community for cooperation to support sustainable development in the Pacific region. This agreement aims to act as a catalyst to promote science, technical expertise, research and innovation, address development challenges, and support both economic and social progress in the future. The Secretariat of the Pacific Community is the principal scientific and technical organization in the Pacific region.

The Organization of Petroleum Exporting Countries Fund for International Development (OFID) provided a grant of US $600 000 to support a regional technical cooperation project in Asia and the Pacific aimed at improving farming practices and animal health thus contributing to food security.

IAEA Director General Yukiya Amano and OFID Director-General Suleiman J Al-Herbish at the conclusion of an agreement to increase food security and promote sustainable agriculture in Asia. Photo: OFID

The China Atomic Energy Agency signed an agreement with the Agency on the margins of the IAEA's 61st General Conference, under which China will provide regional training courses and long-term education programmes for students from developing countries in the areas of nuclear energy, nuclear safety and security, and nuclear sciences and applications. Training will be delivered through the IAEA's technical cooperation programme.

A Practical Arrangement between the Agency and the RCA Regional Office was signed in September 2017, demonstrating the RCA's commitment, through its Regional Office, to assist the IAEA in preparing for RCA meetings, thereby allowing the IAEA to focus more on the RCA programme.

A joint meeting of National Liaison Officers (NLOs) from Africa, Asia and the Pacific, Europe and Latin America and the Caribbean was held for the first time in May 2017, just before the opening of the international TC Conference. The meeting was addressed by Director General Amano, who emphasized the key role played by NLOs as primary contact persons between their countries and the IAEA's TC programme, and highlighted their importance in bringing together all national TC stakeholders.

NLOs and National Representatives from the Asia and the Pacific region agreed on a new Strategic Capacity Building Approach in 2016, which aims to provide systematic, harmonized and standardized training programmes to improve the quality of human resources development. To mobilize the advanced regional capabilities needed for this initiative, the Agency signed six Practical Arrangements with hospitals and universities in Australia, Japan, Jordan, Korea, Singapore and United Arab Emirates. The Arrangements support human resource development of nuclear medicine professionals. The Agency subsequently organized several workshops in 2017 to apprise participants of new developments in imaging and therapeutic techniques and their applications, with a particular emphasis on their utility in the fields of neurology and cardiology. Two workshops were organized in Osaka University's Graduate School of Medicine, Osaka, Japan, and a further workshop was held in cooperation with the Korea Cancer Centre Hospital and Seoul National University and Hospital, Seoul, Korea.

'Read with the expert' practical session on nuclear medicine imaging at Osaka University training centre, May 2017. Photo: IAEA

The comprehensive teaching curriculum that underpins the workshops, with its emphasis on the unique needs of the participants, has received international accreditation for its efforts to enhance capacities among IAEA Member States. Having fulfilled rigorous requirements, the workshops were granted European Continuing Medical Education credits by the European Accreditation Council for Continuing Medical Education (EACCME) and the European Union of Medical Specialists (UEMS). This is the first time that a TC training event has received EACCME/UEMS accreditation. As UEMS and the American Medical Association have an agreement of mutual recognition, the workshop certificates are also recognized in the United States of America. Recognition by the international scientific community reflects the Agency's commitment, with its partners, to providing the highest quality training possible, in order to ensure the safe and secure application of nuclear technologies.

The regional partnerships between the IAEA and the European Association of Nuclear Medicine (EANM) and the European Society for Radiotherapy and Oncology (ESTRO) have continued in 2017. EANM and ESTRO provide training courses for which participants from Member States in the Europe region receive sponsorship through the TC programme. This increases the efficiency of technical cooperation activities, and facilitates networking among Member States, professional associations and partner organizations such as the World Health Organization (WHO).

In 2017, the Agency formalized cooperation with three organizations in the Caribbean and Latin American region via Practical Arrangements: the Caribbean Disaster Management Agency (CDEMA); the Caribbean Public Health Agency (CARPHA); and the Pan American Health Organization/World Health Organization (PAHO/WHO). The Practical Arrangements with CDEMA aim to enhance and strengthen technical support in emergency preparedness and response provided to IAEA Member States in the Caribbean, and has a specific focus on Comprehensive Disaster Management. It will allow for collaboration in capacity building, exchange of lessons learned, and raising national and regional awareness regarding preparedness and response to nuclear or radiological emergencies. The Practical Arrangements with CARPHA provide a framework for joint work on the use of nuclear science to prevent disease and promote and protect health. It will allow for collaboration in capacity building, exchange of lessons learned, and in raising national and regional awareness regarding preparedness and response to nuclear or radiological emergencies. Lastly, the Practical Arrangements with PAHO/WHO extended ongoing cooperation by another four years, thus enabling the two organizations to continue working together to assist countries in the region through training and capacity building, strengthening research efforts, and the exchange and dissemination of information. For over 40 years, IAEA and PAHO/WHO have collaborated in medical applications, radiation safety, regulations, nutrition and other related areas of interest. Since 2012, both organizations have concluded agreements to work together more closely, to ensure safety and quality assurance in the areas of radiation medicine, particularly in Latin America and the Caribbean.

The Regional Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL) continues to contribute to the sustainable development of the Latin American and Caribbean region, by supporting cooperation among countries and promoting the peaceful uses of nuclear science and technology to address priorities and needs in the region.

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

Female participation in the TC programme[14]

The TC programme continues to encourage the expansion of female participation in the programme, and Member States are encouraged to nominate female NLOs, meeting and workshop participants, fellows and scientific visitors, and counterparts. The participation of professional women of different hierarchical levels in events and activities supported by national and regional TC projects is strongly welcomed.

While all TC projects are expected to benefit both men and women, several are specifically targeted at women. Fourteen projects in the field of health are currently focused on women's health, and on nutrition for mothers and infants, while a further two focus on women in farming, and women and environmental hazards. For example, a new interregional project INT6062, 'Strengthening Capacity for Cervical Cancer Control through Improvement of Diagnosis and Treatment' has been approved as part of the 2018–2019 TC cycle, to address one of the most prevalent cancers in women. Another new regional project in Asia and the Pacific is aiming to educate secondary students and science teachers on nuclear science and technology – this kind of curriculum development supports the introduction of science, technology, engineering and mathematics subjects to girls and boys. Finally, every TC project design includes a section titled 'Other considerations' under which the team

[14] This section responds to section 2, operative paragraph 3 of resolution GC(61)/RES/10 on promoting gender equality and advancing gender balance in the TC programme.

working on the design of the project is expected to include an assessment of the impact of the project on women.

Senior IAEA staff attended the 2017 Women in Nuclear (WiN) Global Annual Conference, which took place in Beijing, China on 28th August-1st September 2017.

Of the 21 members of the Standing Advisory Group on Technical Assistance and Cooperation, eight are women. Within the Department of Technical Cooperation, women make up 69.1% of the staff overall, and just under 50% of professional staff.

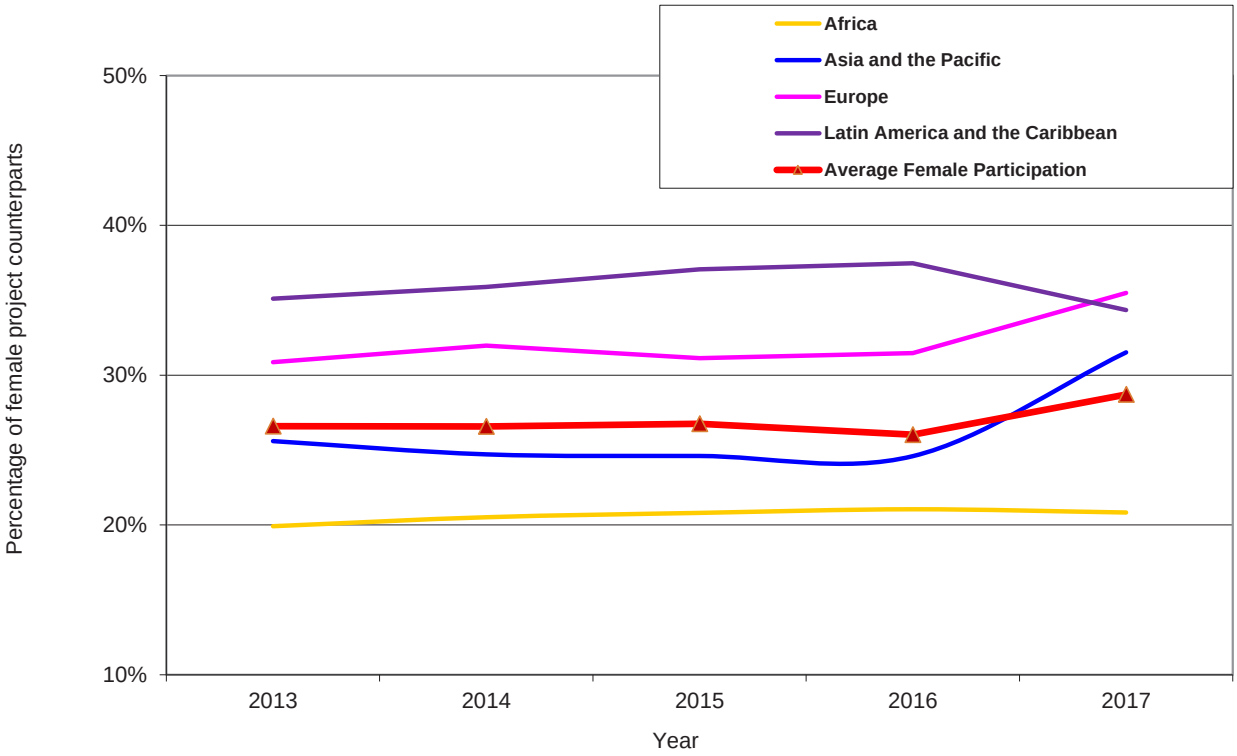


Figure 2: Female project counterparts by region, 2013–2017.

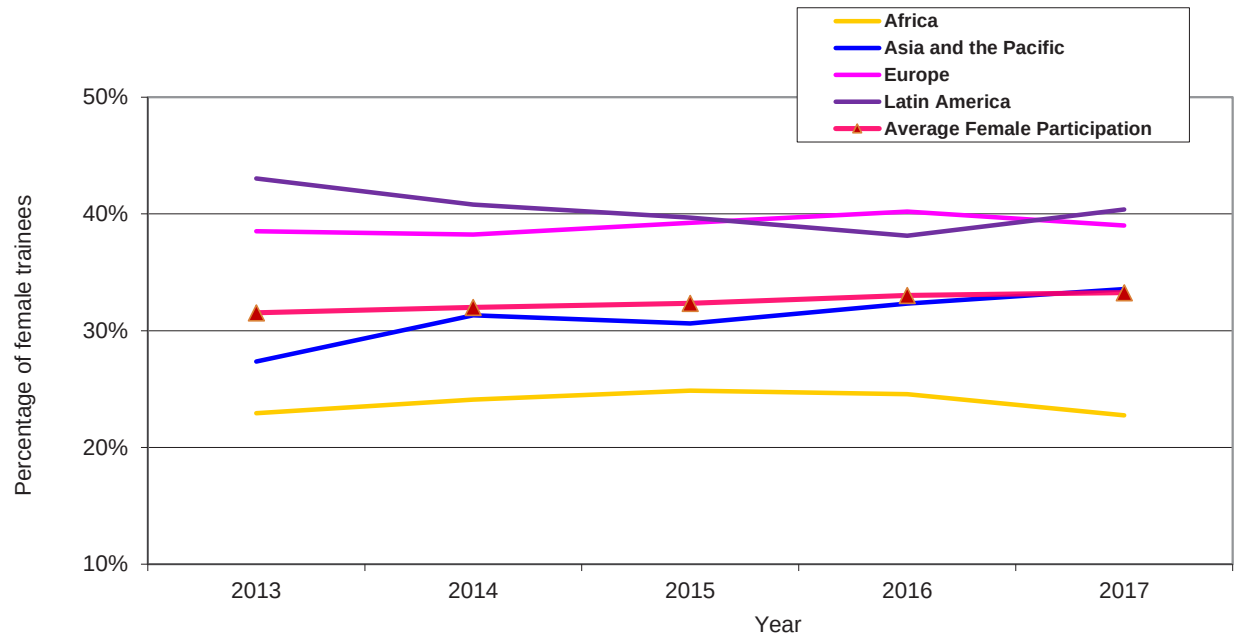


Figure 3: Female participation in training as fellows, scientific visitors, training course participants, meeting participants and other project personnel, 2013–2017.

Ensuring the continual improvement of the TC programme[15]

In 2017, a range of quality assurance activities were undertaken in every phase of the TC programme cycle, aiming to increase the efficiency, effectiveness, and results orientation of programmes and projects during planning, implementation and review. The Agency continued to provide support to Member States throughout the year to ensure that the projects developed for the TCP 2018–2019 cycle were of high quality, with measurable, attainable and timely objectives.

In 2017, 24 workshops, training events and programme briefings were organized for 554 TC stakeholders, including project counterparts, NLOs and National Liaison Assistants, Programme Management Officers and Technical Officers. These were organized both in-house and in Member States, and included TC Orientation Workshops; training in the use of the logical framework approach (LFA) for the design of new projects; country and regional design workshops; specific discussion groups on relevant issues; and targeted training in monitoring and evaluation. The online LFA training (e-LFA) was updated and is available to all TC stakeholders on the PCMF reference desk and the external TC website.

The quality assurance process for the design phase of the 2018–2019 TC programme cycle was completed in October 2017, with a Quality Review exercise that covered the full set of final project design documents submitted by Member States. Throughout the design process, feedback was provided to the project teams at various stages, in order to enhance the compliance of individual project designs with the TC Quality Criteria. At the end of the design process, the review of the completed project designs enabled comparison with previous cycles and highlighted areas for improvement and lessons learned that will apply to future TC cycles. This two-step mechanism for quality assurance continues to apply the Guidelines for Quality Assessment of Project Designs, and builds on the experience and lessons learned from past quality reviews.

All quality reviews entail the assessment of two aspects of project design, namely the extent to which the project design document complies with the TC central criterion, and the extent to which the project design complies with the LFA. Overall, the quality of final project designs for these two aspects has significantly improved when compared to the final project designs of the 2016–2017 TC programme cycle, due to the joint efforts of Member States and the Secretariat. These positive trends, particularly in Project Design Quality (LFA compliance), suggest that understanding of the results based management approach and the related design components has increased.

A key development in the management of the TC programme in 2017 was the successful pilot and full roll-out of an electronic platform for submission of annual Project Progress Achievement Reports (PPARs). The new system enables quicker and more relevant reporting by Member States and feedback by the Secretariat. For the Secretariat, it will significantly facilitate the aggregation and interpretation of PPAR data. Each PPAR requires input from the counterpart, the NLO, the Programme Management Officer and the TO, leading to improved communication and early identification of any factors that may support or hinder effective implementation. The 2017 pilot resulted in a submission rate of 76%, the highest ever for PPARs by Member States, and the awareness of project teams of the relevance and usefulness of stated Outcomes, Outputs and Indicators in the management, implementation and monitoring of projects was heightened.

[15] This section responds to section 2, operative paragraph 8 of resolution GC(61)/RES/10 on PCMF implementation, and making it simpler and user-friendly for effective use; to section 3, operative paragraph 1 on strengthening TC activities, including the provision of sufficient resources, based on Member States' needs and priorities, and ensuring that the components of TC projects are readily available; to section 3, operative paragraph 3 on optimizing the quality, the number and the impact of TC projects; to section 3, operative paragraph 4 on providing Member States with information on project development according to the LFA; to section 3, operative paragraph 5 on submission and guidance of reporting; to section 3, operative paragraph 6 on the results of efforts to implement outcome monitoring; to section 3, paragraph 7 on the two-step mechanism in monitoring the quality of TC projects

The improved PPARs are part of a range of complementary monitoring instruments, including Field Monitoring Methodology and Self-Assessments, which are being reviewed in the drive for more effective monitoring and reporting of results in the TC Programme. Training was also provided to strengthen the capacity of national TC stakeholders to effectively apply result-oriented monitoring and evaluation tools and to monitor the progress of on-going projects using participatory assessments, in order to ensure that expected results are achieved and lead to planned outcomes.

The Department of Technical Cooperation works closely with the Office of Internal Oversight Services (OIOS). In 2017, 30 OIOS recommendations were either closed or considered implemented.[16]

[16] This paragraph responds to section 3, operative paragraph 10 of resolution GC(61)/RES/10 for OIOS and external auditors to evaluate TC projects.

B. TC Programme Resources and Delivery

B. TC Programme Resources and Delivery

B.1. FINANCIAL OVERVIEW

Resources for the technical cooperation programme[17]

At the end of 2017, €84.6 million of the €84.9 million target for the 2017 Technical Cooperation Fund (TCF) had been pledged and €83 million in payments had been received. Total TCF resources including National Participation Costs (NPCs), assessed programme costs (APCs) arrears, and miscellaneous income amounted to €83.3 million (€83 million TCF, €0.6 million NPCs, €0.04 million APCs arrears and -€0.4 million miscellaneous income). New extrabudgetary resources for 2017 came to €21.7 million and in-kind contributions amounted to €0.6 million.

The rate of attainment on pledges, as at 31 December 2017, was 99.6% and the rate of attainment on payments on the same date was 97.7% (Fig.7). Total payments received in 2017 include €4 million either of deferred or of additional payments by eleven Member States. Excluding these payments, the 2017 rate of attainment on payments would have been lower by 4.7%.

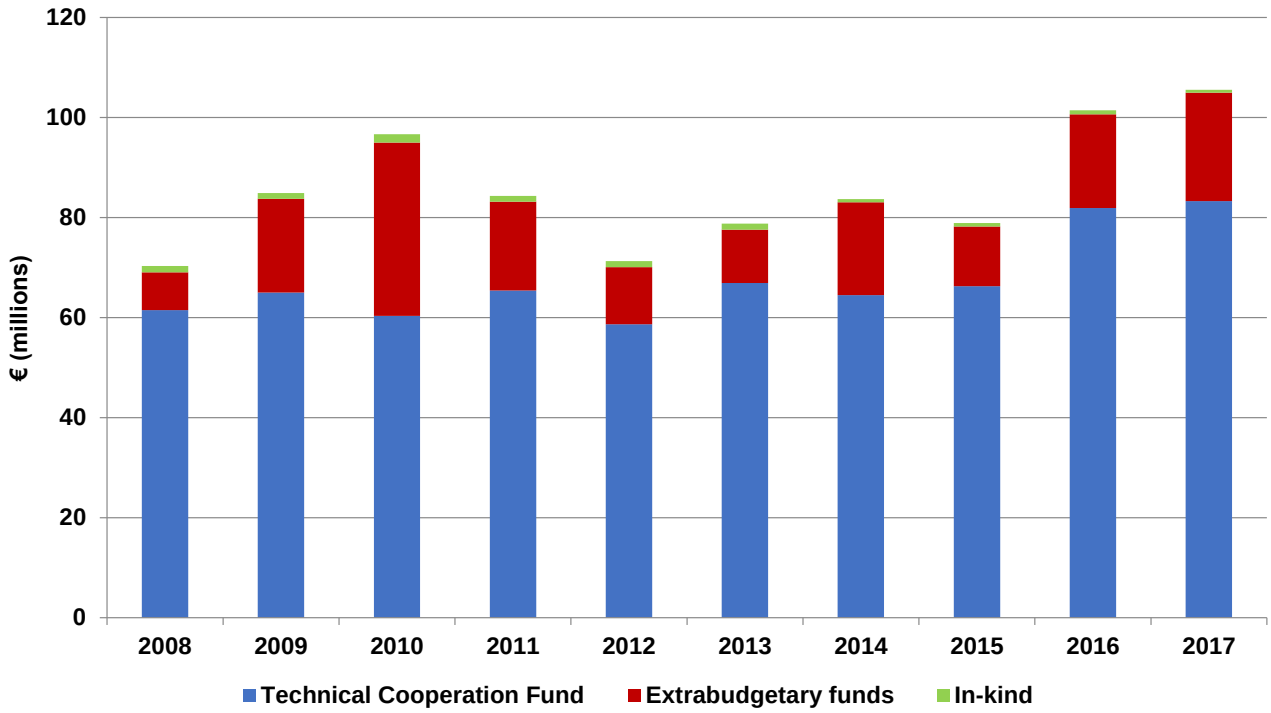


Figure 4: Trends in TC programme resources, 2008–2017.

[17] This section responds to section 4, operative paragraph 2 of resolution GC(61)/RES/10 on the payment of TCF contributions and NPCs, and payment of APC arrears; and to section 4, operative paragraph 5 on timely payments to the TCF.

Table 1: TC programme resources in 2017	
2017 target for voluntary contributions to the TCF	€84.9 million
Technical Cooperation Fund, NPC, APC, miscellaneous income	€83.3 million
Extrabudgetary resources[18]	€21.7 million
In-kind contributions	€0.6 million
Total new resources for the TC programme	€105.6 million

Table 2: Payment of National Participation Costs (NPCs) and assessed programme cost (APC) arrears		
	Received in 2017	Outstanding payments at end 2017
NPCs	€0.6 million	€0.4 million
APCs	€0.04 million	€0.8 million

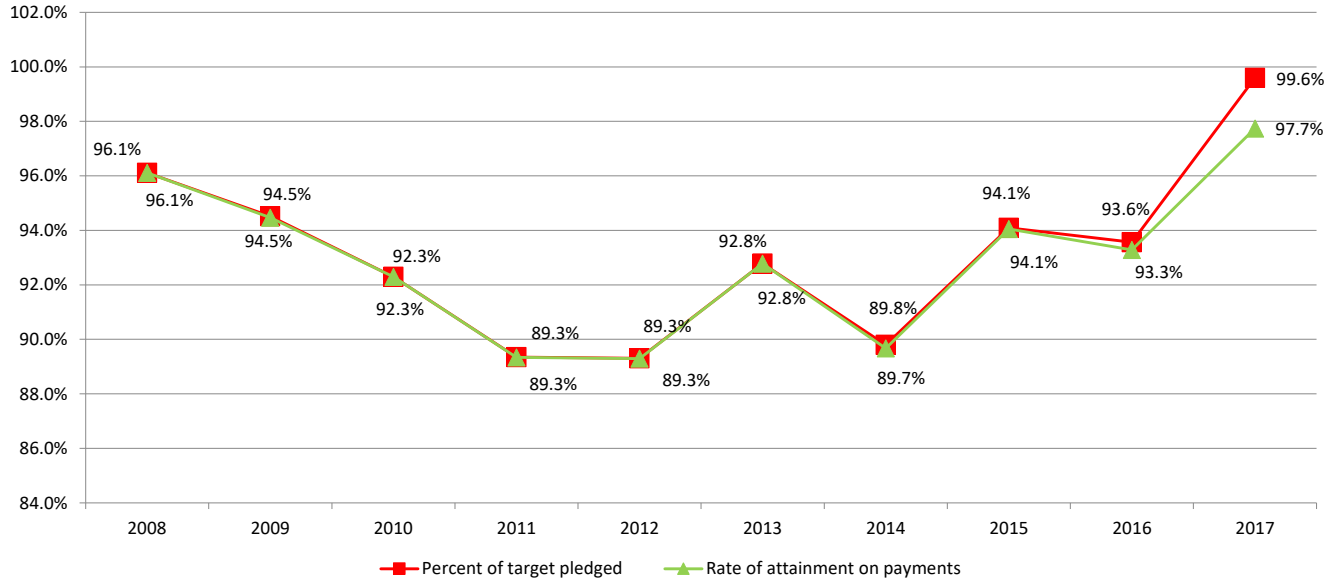


Figure 5: Trends in the Rate of Attainment, 2008–2017.

Extrabudgetary and in-kind contributions[19]

Extrabudgetary contributions from all sources in 2017 (donor countries, international and bilateral organizations, government cost sharing) accounted for €21.7 million. The breakdown of the €21.7 million is as follows: €9.4 million funding for activities where the donor is the recipient (commonly referred to as Government Cost Sharing); €12.3 million from donors (including funding to PACT), of which €8.4 million was received through the Peaceful Uses Initiative mechanism. 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 €0.6 million in 2017.

[18] Please refer to Table A.5 of the Supplement to this report for details.

[19] This section responds to section 4, operative paragraph 8 of resolution GC(61)/RES/10 on seeking resources to implement footnote-a/ projects; to section 4, operative paragraph 9 on voluntary contributions and the implementation of footnote-a/ projects; and to section 4, operative paragraph 10 on extrabudgetary contributions, including the PUI.

Table 3: Extrabudgetary contributions allotted to TC projects in 2017, by donors (in euros)			
Argentina	20 000	Russian Federation	526 040
Australia	27 727	Spain	120 000
Chile	8610	Switzerland	80 000
China	57 518	Thailand	5000
Czech Republic	140 966	United States of America	4 021 477
Japan	5 115 543	AFRA Fund	297 764
Korea, Republic of	171 037	European Commission	1 148 813
Malaysia	9346	For PACT[20]	517 667
Philippines	4685		

Table 4: Funding where the donor is the recipient (Government cost sharing) allotted to TC projects in 2017 (in euros)			
Albania	812 000	Lesotho	999 630
Botswana	157 361	Mauritius	1 400 000
Democratic Republic of the Congo	99 700	Nigeria	152 934
El Salvador	13 185	Pakistan	308 740
Estonia	30 000	Poland	15 000
Ethiopia	1 756 129	Sri Lanka	30 000
Ghana	43 950	Sudan	9 873
Israel	278 000	Uganda	37 595
Jordan	590 394	Uruguay	150 000
Kenya	2 536 155		

Table 5: Extrabudgetary contributions allotted to PACT, 2017	
Donor	Amount (euros)
Belgium	50 000
France	30 000
Korea, Republic of	16 960
Monaco	80 000
Russian Federation	183 279
German Cancer Foundation	6000
IAEA Staff Association	3626
IFPMA	141 450
United Nations Women's Guild	6352
Total	**517 667**

[20] For breakdown by donor country, please see Table 5.

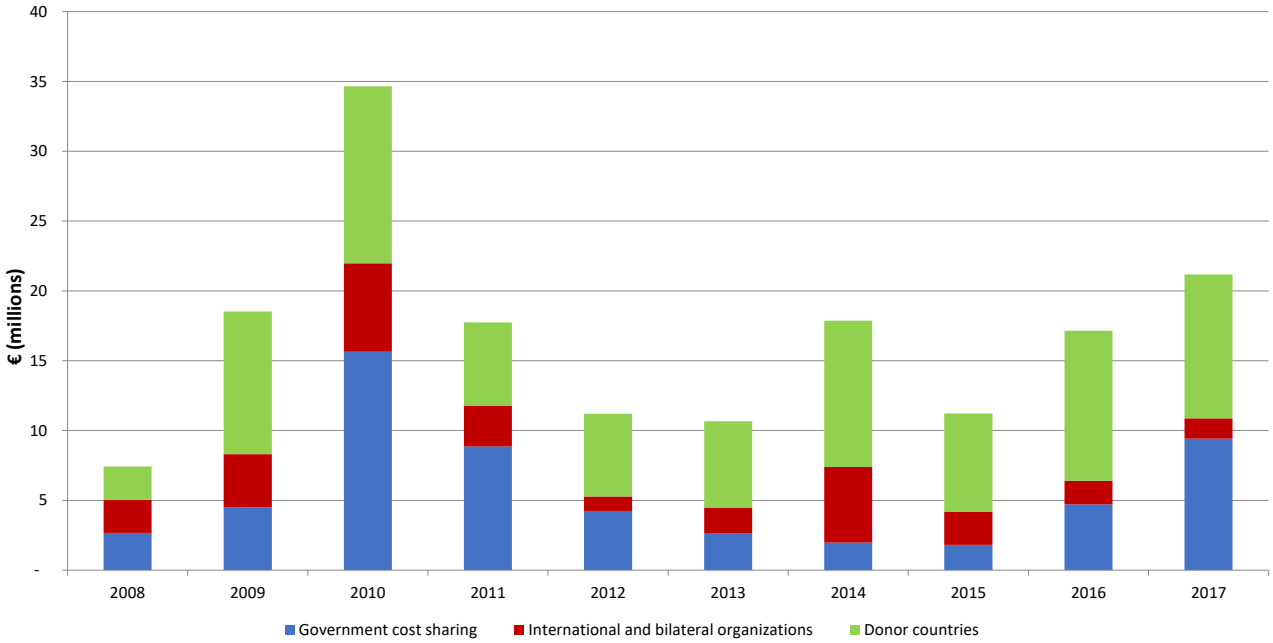


Figure 6: Trends in extrabudgetary contributions by donor type, excluding contributions to PACT, 2008–2017.

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 actuals[21] 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 2017 as at 31 December 2017, reached 86.3% (Table 6).

Table 6: TCF financial indicators for 2015, 2016 and 2017

Indicator	2015	2016	2017
Budget allotment at year end[22]	€80 024 103	€93 737 513	€106 136 533
Encumbrances + actuals	€67 896 353	€79 294 249	€91 570 710
Implementation rate	84.8%	84.6%	86.3%

Unallocated balance

By the end of 2016, the total unallocated balance[23] had amounted to €4.2 million. The total unallocated balance for 2017 as at 31 December 2017 amounted to €8.3 million. In 2017, €8.8 million were received as advance payments for the 2018 TCF. Some €3.1 million of cash is held in currencies which are difficult to use in the implementation of the TC programme.

[21] Terminology has changed with the implementation of the Agency-wide Information System for Programme Support (AIPS/Oracle). Actuals are the equivalent of disbursements.

[22] 2017 budget allotment at year end includes carry-over from previous years of €6.8 million, already allocated to projects.

[23] Total funds not allocated to TC projects.

Table 7: Comparison of the unallocated balance of the TCF (in euros)		
Description	2016	2017
Total unallocated balance	4 186 904	8 252 741
Advance payment in 2016 and 2017 for TCF for following year	8 578 255	8 780 336
Non-convertible currencies that cannot be utilized	14 067	1 377 908
Currencies that are difficult to convert and can only be used slowly	1 934 046	3 069 597
Adjusted unallocated balance	14 713 272	21 480 582

Human resources and procurement

Human resource and procurement indicators show the non-financial delivery of the TC programme. Regarding procurement, a total of 1820 purchase orders were issued in 2017, to a value of €42.7 million.

Table 8: Delivery of outputs: non-financial indicators for 2016 and 2017			
Indicator	2016	2017	Increase/(decrease)
Expert and lecturer assignments	3777	3641	-136
Meeting participants and other project personnel	5820	5913	93
Fellowships and scientific visitors in the field	1701	1979	278
Training course participants	3114	3913	799
Regional and interregional training courses	193	222	29

Table 9: TC procurement in 2017			
Division	Requisitions	Purchase orders issued	Value of Purchase Orders issued
TCAF	629	725	€13 534 712
TCAP	418	434	€9 243 839
TCEU	196	242	€9 391 135
TCLAC	386	416	€10 371 053
PACT	3	3	€191 038
Total	**1632**	**1820**	**€42 731 777**

At the end of 2017, 807 projects were active, and an additional 337 projects were in the process of being closed. During 2017, 240 projects were closed, of which one was cancelled in consultation with the relevant Member State.

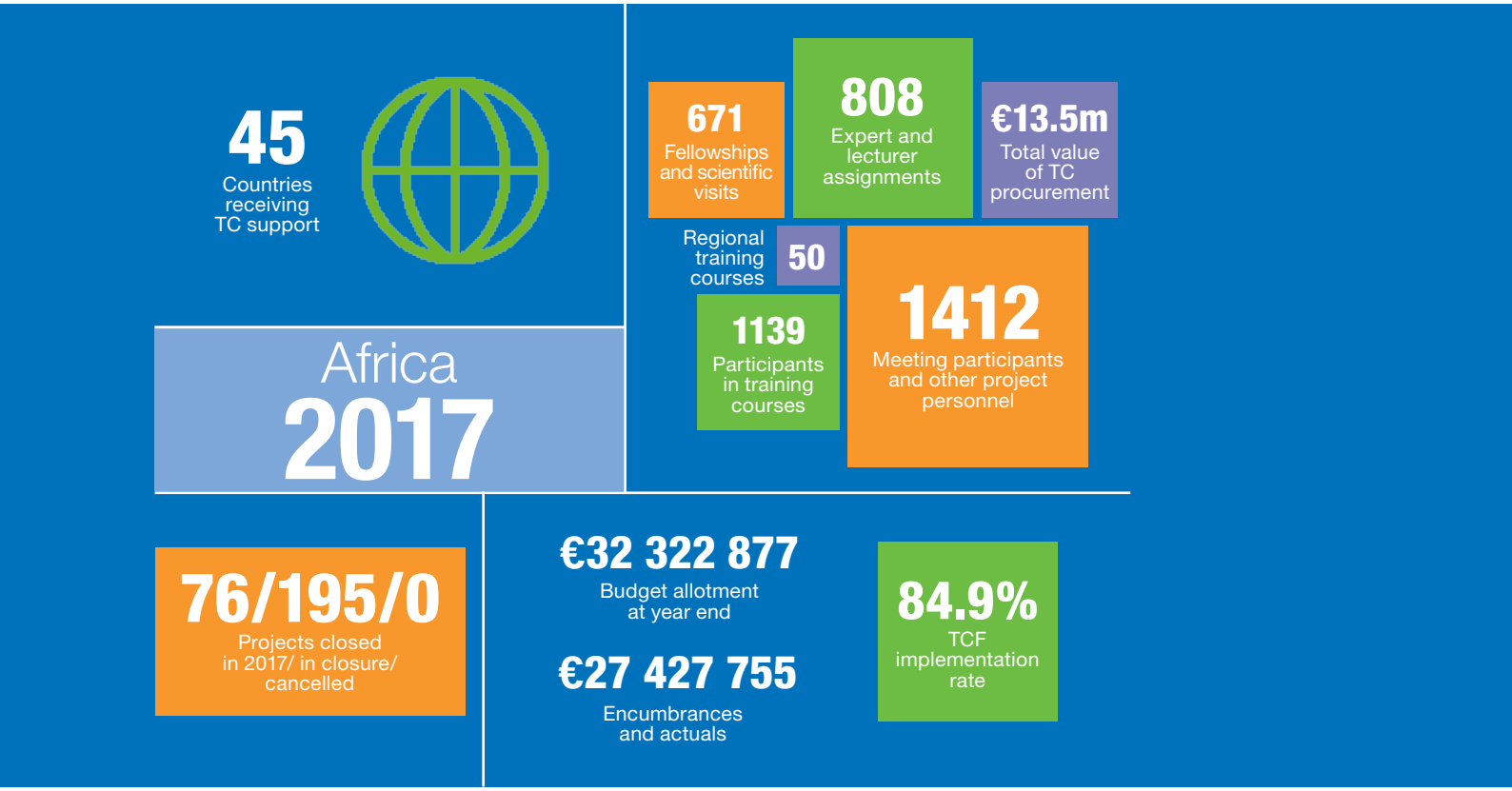
Programme Reserve projects

No Programme Reserve projects were requested in 2017.

C. Programme Activities and Achievements in 2017

C. Programme Activities and Achievements in 2017[24]

C.1. AFRICA



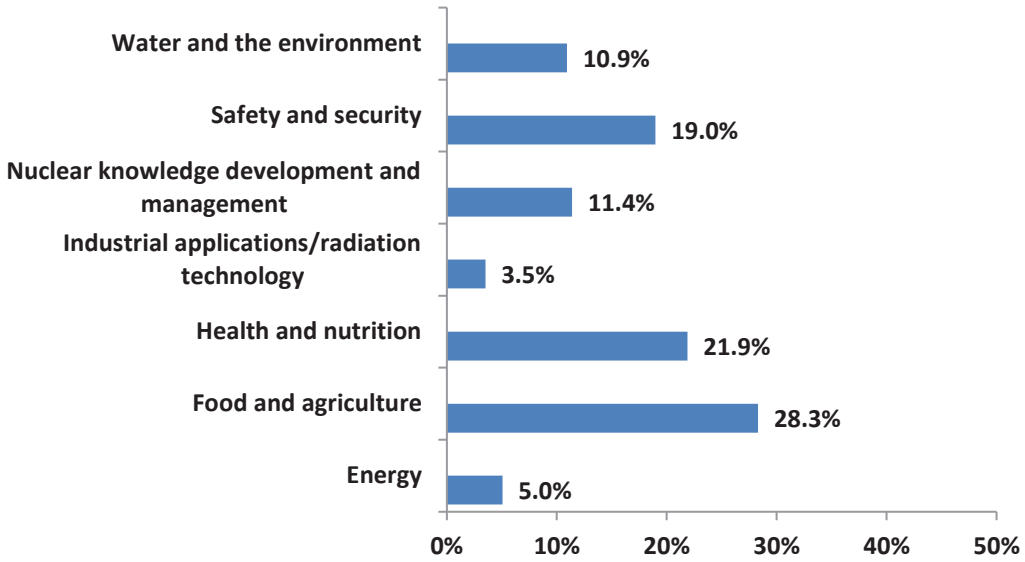


Figure 7: Actuals in the Africa region in 2017 by technical field.

[24] Section C responds to section 2, operative paragraph 1 of resolution GC(61)/RES/10 on facilitating and enhancing the transfer of nuclear technology and know-how among Member States; to section 2, operative paragraph 2 on strengthening TC activities through the development of effective programmes and well defined outcomes; and to section 5, operative paragraph 2 on promoting TC activities supporting the self-reliance, sustainability and further relevance of national nuclear and other entities in Member States, and enhancing regional and interregional cooperation.

Regional highlights in Africa, 2017

In 2017, 45 Member States in the Africa region participated in the TC programme, of which 26 were LDCs. The programme achieved an implementation rate of 84.9%.

CPFs signed in Africa in 2017	
Algeria	Kenya
Benin	Rwanda
Central African Republic	Zimbabwe

Several Member States successfully developed and signed their CPFs in 2017, including Algeria, Benin, Central African Republic, Kenya, Rwanda and Zimbabwe. Similarly, as part of its ongoing efforts to contribute to the development efforts of the UN system at the country level, the Agency continued to participate in the process of the UNDAF, and provided inputs to the formulation and mid-term review of UNDAF documents. In 2017, the IAEA co-signed the UNDAFs of Botswana, Gabon and Morocco.

In 2017, the management of the TC programme in the Africa region focused on the six major priority areas highlighted in the AFRA Regional Strategic Cooperative Framework (RCF) 2014–2018, and the draft regional Strategy of the Division for Africa 2018–2023. These are food and agriculture, human health, water resource management, industrial applications, sustainable energy development, and radiation and nuclear safety. The development of human resources through education and training also formed a major component of the assistance provided in 2017, supporting Member States' efforts to build capacities and ensure the availability of skilled staff in African Member States.

In May 2017, the Agency organized a meeting of NLOs and Focal Points of Regional Designated Centres on the margins of the International Conference on the IAEA Technical Cooperation Programme. The meeting participants reviewed implementation and progress achieved since the 2016 NLO meeting, examining follow-up actions taken with regard to the implementation of adopted recommendations; discussed and adopted concrete, realistic and implementable actions to improve radiation safety infrastructure in African Member States; discussed and adopted a road map to align CPFs with the SDGs; shared lessons learned from the design and formulation of the 2018–2019 TC programme cycle; and heard a briefing on the Regional Strategy of the Division for Africa 2018–2023.

Project highlights

The Mid-Term Coordination Meeting of the regional project RAF9058, 'Improving the Regulatory Framework for the Control of Radiation Sources in Member States', was held in Lusaka, Zambia in November 2017. The meeting successfully brought together several project counterparts and their representatives to review the status of participating Member States regarding improvements made to their regulatory infrastructure to control the use of radiation sources since the inception of the project in January 2016. In 2017, Integrated Regulatory Review Service missions were conducted to Nigeria and Ethiopia. A key success was the classification of Zimbabwe as having reached the level of good progress in regulatory infrastructure.

For over 15 years, the IAEA has been working with Senegal to make the Niayes a tsetse fly-free area, using an integrated pest management approach. The operational phase of the project started in January 2012, when suppression activities were initiated, prior to starting the releases of sterile males. Senegal has now taken the lead in the control of tsetse flies in West Africa. In 2017, the final stage of the operational phase area was reached under the current project SEN5037, 'Supporting the National Programme to Control Tsetse and Trypanosomosis'. Overall, tsetse eradication in the Niayes has reached 95%. The completion of the sustainable eradication of Glossina palpalis gambiensis from the Niayes will be reached by mid-2018.

Côte d'Ivoire, a country of approximately 21 million people, has finalized the construction of its first turnkey radiotherapy centre in the city of Abidjan. Though the project IVC6010, 'Establishing a Radiotherapy and Medical Oncology Centre in Abidjan', the IAEA is supporting the country by providing expert services and fellowship training in various areas for three radiation oncologists and two medical physicists. This support will

be extended in 2018 and training will also be provided for radiation therapists and nurses. The radiotherapy centre was inaugurated and clinical operations started in December 2017.

The project SAF0006, 'Establishing a South African Centre of Excellence for Nuclear Education Science and Technology (SACoE-NEST)', aims to strengthen nuclear science and technology education programmes in South Africa in order to better meet future demands. The SACoE-NEST mechanism will speed up the rate at which specialists can be educated, ready for employment in industrial sectors in need of qualified human resources. The network is based on a strong, national wide collaboration among research, education, industrial and governmental institutions. It will help tertiary education institutions in South Africa to maximize the benefits to the country. In 2017, IAEA experts conducted a mission to South Africa to provide guidance on the application of the IAEA Milestones approach to the development of national nuclear infrastructure for a new research reactor project. They shared IAEA methodology on stakeholder surveys and strategic plan preparation, including feasibility studies.

Regional cooperation

AFRA continues to be the principle framework for promoting TCDC in Africa and for enhancing regional cooperation among its State Parties.

The Congo became an AFRA State Party, following its acceptance of the Agreement in September 2017.

In April 2017, the AFRA Chairperson, in collaboration with the Secretariat, held a series of meetings with Permanent Representatives of the Vienna-based African Group and donor countries in Vienna to share information on AFRA project-related achievements and success stories, and to seek further support for the implementation of the unfunded portion of the AFRA programme, leading to an increase in extrabudgetary contributions. The AFRA Chairperson also encouraged AFRA States Parties to pay their shares to the AFRA Fund, resulting in an increase in contributions.

Within the framework of the formulation of the 2018–2019 TC programme cycle, and with a view to developing fewer but better projects, AFRA rationalized its programme and submitted nine regional projects, aligned with the major themes of the AFRA RCF for 2014–2018. AFRA entrusted responsibility for the formulation of project designs to Project Scientific Consultants, in collaboration with IAEA Technical Officers and Programme Management Officers. The newly approved AFRA programme prioritizes the enhancement of human resource development and the strengthening of existing infrastructure in the region.

The Government of Uganda hosted the 28th AFRA Technical Working Group Meeting in July in Kampala. The meeting was opened by the Prime Minister of Uganda, and attended by the Minister of Energy and Mineral Development and by AFRA National Coordinators from 32 AFRA States Parties. Participants deliberated on issues related to AFRA policy and the AFRA programme, and adopted concrete recommendations to further enhance regional cooperation in Africa.

In September 2017, the IAEA hosted the 28th Meeting of AFRA Representatives on the margins of the 61st annual session of the IAEA General Conference. At this meeting, participants endorsed the 2016 AFRA Annual Report, the 2018 plan of action of the AFRA management committees, the AFRA Chair work plan and the recommendations adopted by the 28th Technical Working Group Meeting.

Throughout 2017, AFRA regional designated centres (RDCs) provided useful services in different nuclear-related areas in the region, and hosted fellowship training, meetings and training courses. Expert services were also provided by qualified staff from these centres. AFRA RDCs help strengthen relationships and the exchange of information between nuclear institutions in the region. In 2017, AFRA launched a process to recognize RDCs in the fields of Academic and Clinical Training in Nuclear Medicine and Medical Physics. Member States applications have been received, reviewed and preselected centres will be audited.

"Throughout 2017, AFRA regional designated centres (RDCs) provided useful services in different nuclear-related areas in the region, and hosted fellowship training, meetings and training courses."

Strategy development

In view of the expiration of the 2014–2018 AFRA RCF, AFRA management organized a Review and Critical Assessment Brainstorming Meeting in October 2017. This meeting, led by the AFRA Chairperson, with the support of the IAEA Secretariat, brought together members of the AFRA management committees to review progress, achievements, success stories and best practices related to the implementation of this RCF. The meeting also reviewed the AFRA mid-term strategy for 2016–2018.

As a result of the review, Terms of Reference and an executive document for the task force meeting for the formulation of the new AFRA RCF for 2019–2023 were developed. The task force meeting will take place during the first quarter of 2018.

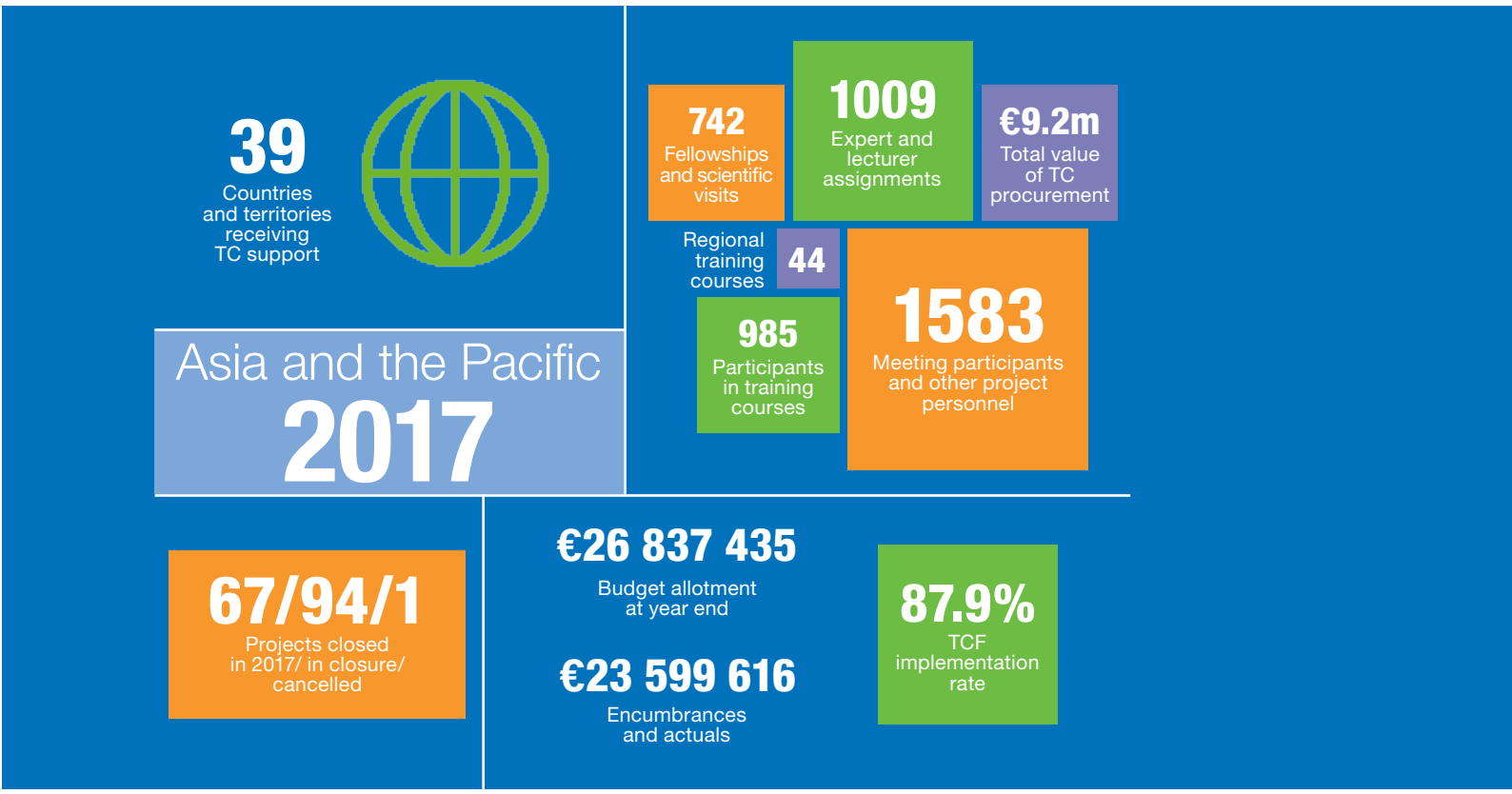
Contributions to the AFRA Fund

In 2017, AFRA State Parties continued to pay their contributions to the AFRA Fund. In total, 17 countries contributed approximately €300,000, which has been allotted to AFRA projects to support the implementation of unfunded activities. Since its establishment in 2009, AFRA State Parties have contributed around €3.0 million to the AFRA Fund. This demonstrates their continued commitment to the Fund and their willingness to further enhance regional ownership of the programme.

Table 10: Voluntary contributions to the AFRA Fund for TC activities, 2017 (in euros)

Country	Amount received	Country	Amount received
Algeria	25 181	Ghana	12 108
Angola	16 368	Kenya	4564
Botswana	6264	Lesotho	329
Burkina Faso	981	Niger	2635
Cameroon	5 973	Nigeria	60 000
Chad	1000	Seychelles	418
Democratic Republic of the Congo	1446	Sudan	21 872
Egypt	115 208	Zimbabwe	5782
Ethiopia	17 635	**TOTAL**	**297 764**

C.2. ASIA AND THE PACIFIC



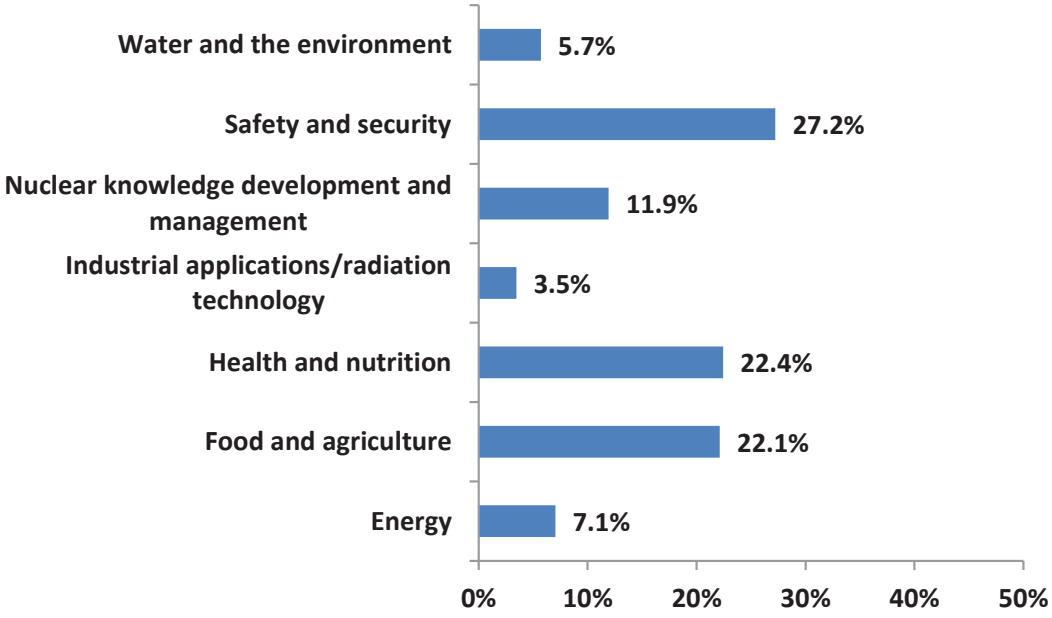


Figure 8: Actuals in the Asia and the Pacific region in 2017 by technical field.

Regional highlights in Asia and the Pacific, 2017

The TC programme provided support to 39 countries and territories in the Asia and the Pacific region in 2017. In 2017, the programme achieved an implementation rate of 88.9%.

The TC programme for the Asia and the Pacific region is designed to meet the strategic priorities of the region's Member States, in line with their national development plans. National programmes are tailored according to the national development priorities set out in the CPFs, and are aligned, where appropriate, with the SDGs. In 2017, CPFs were signed by eight Member States in the region: Jordan, Cambodia, Iraq, Israel, Philippines, Saudi Arabia, Thailand and Vanuatu. The Agency co-signed the UNDAFs of Bahrain[25], Nepal and Viet Nam in 2017.

CPFs signed in Asia and the Pacific in 2017	
Cambodia	Philippines
Iraq	Saudi Arabia
Israel	Thailand
Jordan	Vanuatu

A meeting of NLOs and National Representatives for Asia and the Pacific region was held on 29 May and 2 June 2017 on the margins of the International Conference on the IAEA Technical Cooperation Programme, attended by 54 participants from 34 Asia and the Pacific countries. The key role of NLO in the effective planning, development and implementation of the TC programme, and the importance of strategic planning to ensure that national TC programmes are in line with CPF objectives and positioned to achieve their expected outcomes, was stressed. A number of TC programme planning best practices were highlighted, including the alignment of CPFs with national priorities and SDGs, the importance of taking sustainability into account, and of regular meetings of NLOs with national stakeholders.

An Induction Workshop for new NLOs and National Liaison Assistants (NLAs) for the Division for Asia and the Pacific took place early in 2017, and provided participants with an overview of the TC programme, potential collaborations, and the mechanism for the implementation of the technical cooperation programme. The new NLOs and NLAs, from Bahrain, Jordan, Qatar and Saudi Arabia, visited the IAEA laboratories at Seibersdorf, and held discussions with the implementation team in the Division for Asia and the Pacific, gaining a clear understanding of the support provided by the IAEA to help them carry out their duties as NLO/NLA for their country.

Project highlights

A side event during the 61st IAEA General Conference showcased achievements made with the support of a regional project on climate-proofing rice production systems, highlighting climate-proofing soil and water management for rice production in the Philippines, and climate-proofing plant mutation breeding for rice production in Malaysia. Important training courses were held under this project in 2017 at the International Rice Research Institute, on Rice Breeding for Drought Tolerance, and in Malaysia, on Precision Technology for Sustainable Agriculture and Measurement of Greenhouse Gases under Field and Laboratory Conditions.

The TC programme is helping countries of the Association of Southeast Asian Nations to establish a reliable environmental radioactivity database, to develop sufficient environmental radiation monitoring stations, and to implement emergency preparedness and response systems in order to protect people and the environment. Capabilities for emergency preparedness and response have also been enhanced in Gulf Cooperation Council (GCC)

[25] Bahrain signed a Strategic Partnership Framework (SPF) with the United Nations.

RAS9082: An 'emergency exercise', conducted as part of a practical session on responding to a nuclear or radiological emergency. Photos: IAEA

countries in 2017 through RAS9082, 'Strengthening Capabilities for Radiological and Nuclear Emergency Preparedness and Response in the GCC Member States', both at the regional and national levels, in order to support the implementation of the GCC Draft Regional Radiological and Nuclear Emergency Preparedness and Response Plan drafted under a previous TC project and approved by the GCC countries.

Establishing and implementing national cradle-to-grave control of radioactive sources is important to ensure the comprehensive management of radioactive sources in a country. Thirty-five representatives from waste management operators and regulatory bodies from 16 Member States in the Asia and the Pacific region attended a regional training course on the topic in Tehran in October 2017, organized by the Agency in cooperation with the Government of the Islamic Republic of Iran through the Atomic Energy Organization of Iran and the Iran Nuclear Waste Management Company. Participants received an overview of options for the safe management of DSRSs during the course. The main aim of the course was to provide guidance on the management of DSRSs, as well as practical demonstrations and hands-on training in dismantling devices, removing sources, and conditioning DSRSs of category 3-5. The participants, all of whom are involved in national radioactive waste

RAS9082: An 'emergency exercise', conducted as part of a practical session on responding to a nuclear or radiological emergency. Photos: IAEA

management programmes, were able to observe a real-life conditioning operation at the Iran Nuclear Waste Management Company where local experts demonstrated the conditioning process.

In 2014, the IAEA initiated a pilot initiative under project RAS0065, 'Supporting Sustainability and Networking of National Nuclear Institutions in Asia and the Pacific Region', to introduce nuclear science and technology in secondary education. An assessment of the initiative in 2017 has shown that fifteen teachers were trained through the IAEA fellowship programme and national capacity building activities. These teachers have in turn trained 1 364 additional teachers, creating a critical mass of trained staff in the four pilot countries (Indonesia, Malaysia, the Philippines and the United Arab Emirates) and in an additional two countries (Sri Lanka and Thailand) to support the enhancement of awareness and appreciation of nuclear science and technology in secondary levels. In total, the project reached 24 717 students in secondary schools in just over a year. Teachers trained through the project have successfully developed appropriate lesson and activity plans as a part of their school curricula, and two reference books have been produced in local languages by teachers to effectively communicate appropriate technical knowledge to students. The 2017 assessment noted that innovative, cost effective equipment for classroom demonstrations have been developed for hands-on experiments in classrooms, including a portable user-friendly gamma detector (Hakarukun) and a cloud chamber to illustrate natural radiation in the environment. The pilot countries have successfully adapted programmes from countries with more experience in this area, such as Powerful Opportunities for Women Eager and Ready for Science, Engineering and Technology, Seminar/Workshop for Teachers & Students in Secondary Schools, and Science on Saturday. Three Youth Summits were held in Indonesia and the Philippines. The pilot activity has supported the involvement of students from various disciplines and has provided exposure to various aspects of nuclear science and technology. Member States who participated in the first project are continuing to take part in a follow up project, RAS0079, 'Educating Secondary Students and Science Teachers on Nuclear Science and Technology', which was approved as part of the 2018–2019 TC programme.

Regional cooperation

The RCA continued to provide an effective and efficient mechanism, contributing directly to the attainment of SDGs in the region, and a Practical Arrangement between the IAEA and the RCA Regional Office was signed on 14 September 2017. RCA representatives participated in the international TC Conference and the accompanying exhibition, and in the Asia-Pacific Ministerial Summit on the Environment in Bangkok in September 2017.

RCA projects were well implemented in 2017, fully in line with defined objectives and work plans, and with an implementation rate of over 95%. Furthermore, all RCA PPARs were submitted in time, and all RCA projects were closed on schedule. The RCA has already begun working on the development of project pre-concepts for the 2020–2021 TC programme cycle, demonstrating RCA initiative and ownership in the development and formulation of the RCA programme.

The Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA) is working strongly to promote TCDC among its States Parties. The designation of ARASIA Regional Resource Centres in several thematic areas, with a focus initially on nuclear medicine, will help address some of the challenges common to ARASIA States Parties, strengthen the sustainability of the ARASIA programme, and build self-reliance and mutual interest. In addition, following the adoption of the report of the strengths, weaknesses, opportunities, threats (SWOT) Analysis Working Group by the ARASIA Board of Representatives, the ARASIA National Representatives agreed to set up Technical Working Groups to be entrusted with the responsibility of developing sound project concepts for each major thematic area for consideration in forthcoming TC programme cycles.

Regional cooperation between Israel, Jordan and the territories under the jurisdiction of the Palestinian Authority supported by the regional TC project RAS5059, 'Supporting Area-Wide Integrated Pest Control of Native and Exotic Flies in the Middle East Subregion Incorporating the Sterile Insect Technique (SIT)', laid the foundations for cooperation between the counterparts to address the problem of non-native fruit flies and other pests. Sterile insect technique (SIT) programmes have been successfully implemented in Israel and Jordan, maturing as a major integrated pest management strategy, while classical integrated pest management strategies such as mass trapping and bait spraying have been successfully applied in the territories under the jurisdiction of the Palestinian Authority. A surveillance network has been established for the early detection of pests at high risk locations, using advanced traps for three different fruit flies. The Middle East Non-Indigenous Pests (MEDNIP) database, designed as a dynamic tool to meet the needs of the region in preparing and enabling quick and intelligent actions on the prevention, monitoring and eradication of pests non-native to the region, was established through the project. MEDNIP includes information on the biology, host plants, pathways, surveillance and management of pests as well as on expertise and methods available, and includes a discussion platform to enable proactive, immediate communication.

The IAEA has helped Member States in the Asia and the Pacific region to establish training programmes in nuclear medicine and diagnosis through the technical cooperation projects RAS6074, 'Improving Quality of Life of Cancer Patients through Streamlined and Emerging Therapeutic Nuclear Medicine Techniques'; RAS6075, 'Optimizing the Role of Nuclear Medicine Techniques in the Diagnosis and Clinical Management of Childhood Cancer and Inborn Diseases'; RAS6078, 'Strengthening Nuclear Medicine Applications through Education and Training to Help Fighting Non-Communicable Diseases (ARASIA)'; and RAS6079, 'Strengthening Hybrid Imaging in Nuclear Medicine in Asia'. Expert visits, fellowships, training courses, exchange of information and QUANUM missions, have helped participating countries to assess and improve regional capacity in the management of non-communicable diseases and needs. Training provided to nuclear medicine physicians, radiologists, radiotherapists and medical physicists has contributed to the establishment of high calibre staff, available to address non-communicable diseases including cancer. The regional programme on nuclear medicine and radiotherapy has enhanced the role of molecular imaging and therapeutic nuclear medicine techniques in the management and treatment of relevant non-communicable diseases in adult and paediatric patients in Asia and the Pacific region.

"The IAEA has helped Member States in the Asia and the Pacific region to establish training programmes in nuclear medicine and diagnosis."

C.3. EUROPE

32
Countries receiving TC support

Europe 2017

376
Fellowships and scientific visits

759
Expert and lecturer assignments

€9.4m
Total value of TC procurement

Regional training courses **76**

975
Participants in training courses

1967
Meeting participants and other project personnel

54/14/0
Projects closed in 2017/ in closure/ cancelled

€20 343 056
Budget allotment at year end

€16 829 255
Encumbrances and actuals

82.7%
TCF implementation rate

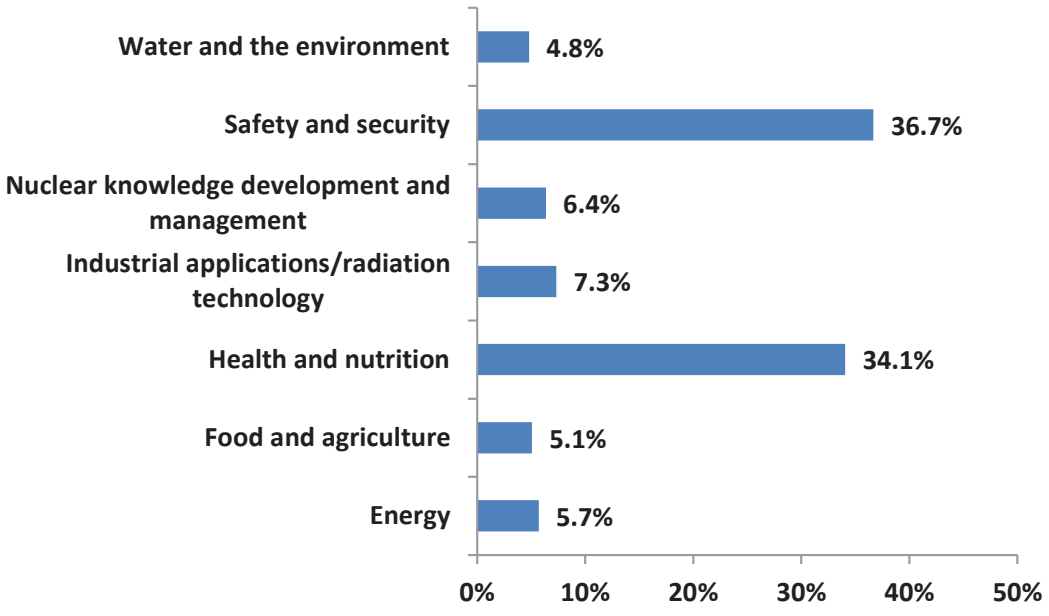


Figure 9: Actuals in the Europe region in 2017 by technical field.

Regional highlights in Europe, 2017

In 2017, 32 Member States in Europe and Central Asia participated in regional projects, with 29 of these Member States having national projects as well. Many Member States also participated in the activities of interregional projects. The year-end implementation rate for the region was 82.7%

CPFs signed in Europe in 2017
Albania
Hungary

Significant financial resources (approx. 40% of total TCF resources) are allocated to regional projects, which underlines the importance of regional activities. The Agency organized NLO meetings in 2017 which helped to foster regional cooperation.

Two CPFs were signed in 2017, for Albania and Hungary, and the Agency co-signed three UNDAFs, for the Kyrgyzstan, Republic of Moldova and Serbia.

In 2017, the TC programme in the Europe region continued to focus on sustainable development in the specific areas of nuclear and radiation safety, human health and nutrition, and isotope technology applications. The development of both institutional and human resource capacities and the enhancement of cooperation among Member States remained important features of the programme.

The thematic priority areas for 2017 were similar to those of previous years. Efforts were concentrated on infrastructure development, capacity building, technology transfer, training for staff from regulatory bodies and operating organizations, and on knowledge development and preservation.

"The development of both institutional and human resource capacities and the enhancement of cooperation among Member States remained important features of the programme."

Project highlights

Two regional training events on mosquito identification, surveillance, trapping methods, and data recording and analysis for area-wide integrated mosquito management were supported through project RER5022, 'Establishing Genetic Control Programmes for Aedes Invasive Mosquitoes'. At the training event in Tirana, Albania, a Mark-Release-Recapture experiment, which included the use of three trapping methods at 40 sites and estimated the mortality, dispersal and competitiveness in the field of 40 Gy irradiated sterile male Aedes albopictus mosquitoes, was conducted. The Mark-Release-Recapture trial successfully provided good estimates of the desired entomological parameters. Member States are continuing their trials and surveillance which will allow them to optimize the effectiveness of SIT to control Aedes mosquitoes in their countries.

RER5022: Identification of sterile male mosquitoes. Photo: E.Dikoli/Institute of Public Health, Albania

RER7008: Installation of an in-situ gamma ray spectrometer on a simulated contaminated site. Photo: S.Tarjan/IAEA.

The project RER7008, 'Strengthening Capabilities for Radionuclide Measurement in the Environment and Enhancing quality assurance/quality control (QA/QC) System for Environmental Radioactivity Monitoring', is developing capabilities in the Europe region to conduct source and environmental monitoring and to improve quality assurance for the measurements and monitoring of radioactivity in the environment in accordance with ISO 17025. In 2017, the project activities helped to build capacities in measuring surface contamination as well as low-activity radio-caesium in freshwater. Training in using proficiency tests for analysing environmental water samples for low level radio-caesium to ensure safe drinking water, and for analysing surface contamination monitoring, was conducted. In addition, expertise was shared on monitoring gaseous and liquid effluents of radionuclides to the environment under normal conditions and during emergencies. The training course participants benefited not only from theoretical courses, but also from practical exercises. Best practices and professional experience on in situ radio-analytical techniques were shared.

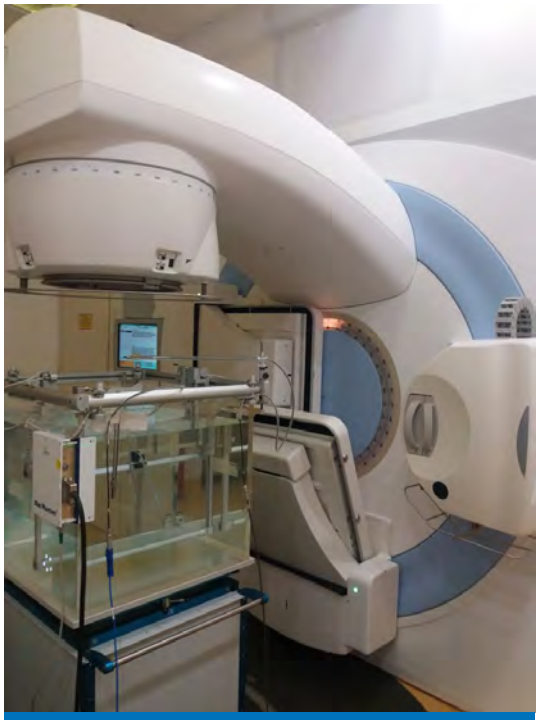
The project RER9136, 'Reducing Public Exposure to Radon by Supporting the Implementation and Further Development of National Strategies', contributed to developing capacities for controlling public exposure to radon in the Europe region, in accordance with the Safety Requirements on *Radiation Protection and Safety of Radiation Sources, International Basic Safety Standards*, as they apply to exposure due to radon in dwellings. One major output in 2017 was the generation of an updated report summarizing progress in each participating country in developing national radon action plans. The report helped to identify cooperation priorities and to establish a baseline for measuring progress in the region for controlling public exposure to radon.

Also under the project, 31 professionals from 21 countries met in Yerevan, Armenia, to share their national experiences of corrective and protective radon measures, including technical solutions and lessons learned. The participants also shared progress made in their national radon programme, presented activities completed during the past three years, and discussed future priorities. The project also supported the participation of 23 building control specialists from national authorities responsible for building standards from 15 countries in the ENUSA Training Course on Radon for Building Professionals in Ciudad

RER9136: Practical training on radon in soil measurements during the ENUSA training course in Ciudad Rodrigo, Spain. Photo: O. German/IAEA.

Rodrigo, Spain. The training provided the participants with practical experience in relation to the control of radon in indoor air and to approaches to minimizing exposure of the public due to radon in homes, both through the development of building codes for the design of new homes, and the application of corrective actions to reduce radon concentrations in existing homes. In 2017, the project also supported the Republic of Moldova and Bosnia and Herzegovina in the development of their National Radon Action Plans.

For Albania, a new linear accelerator was procured with considerable government cost sharing and is under installation at the University Hospital Centre 'Mother Theresa' in Tirana, supported by project ALB6016, 'Supporting the Effective Implementation of the New National Cancer Control Programme – Phase II'. The new equipment is expected to be operational in the second half of 2018 and the IAEA will provide expert support for its commissioning to ensure its effective and safe operation. Radioisotopes and cold kits are currently being delivered on a regular basis to the University Hospital Centre in Tirana.



ALB6016: Albania's new linear accelerator. Photo: University Hospital Center Mother Teresa.

Regional cooperation

The Regional Profile for Europe, which contains the priority thematic areas for technical cooperation and an analysis of regional trends, was updated in 2017. The Regional Profile complements the ongoing consultative process between Member States and the Secretariat, aimed at identifying areas of cooperation. The Regional Profile for 2018–2021 is an update of the previous Regional Profiles (for 2009–2013 and 2014-2017), and was jointly prepared by the Member States and the IAEA Secretariat.

C.4. LATIN AMERICA AND THE CARIBBEAN

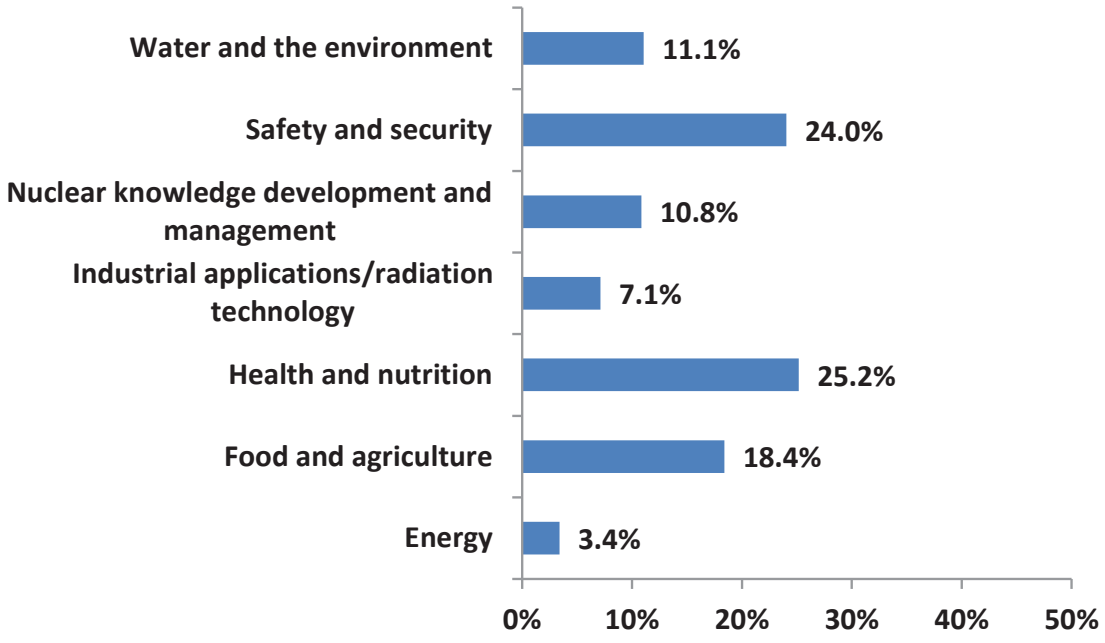


Figure 10: Actuals in the Latin America and the Caribbean region in 2017 by technical field.

Regional highlights in Latin America and the Caribbean, 2017

In 2017, the Agency provided support to 29 Member States in the Latin America and the Caribbean region, of which 25 had national TC projects. Haiti is the only LDC in the region. A total of 165 projects were active during the course of the year, 136 of which were national projects and 39 of which were regional. Nineteen of the regional projects were initiated as part of the 2016–2017 TC cycle, and all were in line with the priorities established by the Regional Strategic Profile 2016–2021. The programme achieved an implementation rate of 90.8%.

Four CPFs were signed in 2017, by Cuba, Honduras, Mexico and Uruguay. The IAEA is taking active steps to involve new Member States from the Caribbean in the TC programme, particularly SIDS. Saint Vincent and the Grenadines became an IAEA Member State in 2017.

The Agency co-signed the UNDAFs of Costa Rica, the Plurinational State of Bolivia and Dominican Republic in 2017.

The Vice President of Panama and Minister of Foreign Affairs, HE Ms Isabel de Saint Malo de Alvarado, visited the Vienna International Centre in February 2017. The Vice President met with representatives of the Agency during her visit. Discussions included issues such as strengthening the country's national regulatory authority for radiation safety. She underlined the importance of the IAEA mandate and expressed gratitude for the important contribution of the Agency's technical cooperation programme to Panama's development, including in the fight against the Zika virus.

CPFs signed in Latin America and the Caribbean in 2017
Cuba
Honduras
Mexico
Uruguay

Vice President of Panama, HE Isabel de Saint Malo de Alvarado meets DDG-MT Mary-Alice Hayward at IAEA Headquarters in February 2017. Photo: D.Calma/IAEA

Round table discussion during the visit of the Panamanian Vice President to IAEA headquarters. Photo: D.Calma/IAEA

Project highlights

The very first public brachytherapy service in Honduras has been set up at Hospital San Felipe in Tegucigalpa, with support from project HON6004, 'Establishing a High Dose Rate Brachytherapy Unit for Cancer Treatment'. The unit was inaugurated in September 2017 at a ceremony attended by representatives from all the institutions involved in the design and implementation of the project, including the public sector, non-governmental organizations and academia. The project provided not only equipment, but also significant assistance to build the capacity of medical physicists, radiation oncologists and nurses to ensure the safe use of this new technology.

In 2017, following a thorough analysis of national situations, needs and challenges regarding radiation safety infrastructure in Spanish-speaking Latin American Member States, 19 Member States defined an innovative strategy to improve regulatory infrastructure and the radiation protection of workers, patients and the public. Specific work plans at national level to increase the effectiveness, efficiency, sustainability and ownership of projects related to radiation safety in the region will be designed in 2018 as a reflection of this new strategy.

Eighteen countries from the region took part in the regional four year project, RLA9076, 'Strengthening of National Capabilities for Response to Radiation Emergencies'. The project has contributed considerably to establishing and improving adequate mechanisms to respond to radiological and nuclear emergencies. Through the project, with financial support from the European Commission, the first two Schools on Radiation Emergency Management took place in Latin America and the Caribbean: in Brazil in 2015 and in Mexico in 2017. The Schools trained more than 60 participants in total, using lectures and practical exercises, in how to facilitate the effective implementation and coordination of EPR arrangements. Furthermore, the project strengthened the capacity of the Latin American Biological Dosimetry Network and enabled the establishment of a strategy that will allow the region to use biodosimetry in the event of nuclear or radiological emergencies involving a large number of people. Special attention was also given to medical response in case of nuclear or radiological emergencies.

"Following two years of intense suppression and eradication efforts, medfly was officially declared eradicated from the Dominican Republic by the Minister of Agriculture on 7 July 2017."

Regional project RLA5070, 'Strengthening Fruit Fly Surveillance and Control Measures Using the Sterile Insect Technique in an Area Wide and Integrated Pest Management Approach for the Protection and Expansion of Horticultural Production (ARCAL CXLI)', has provided the framework for efforts to control and eradicate the Mediterranean Fruit Fly (medfly) in the Latin America and the Caribbean region. Following two years of intense suppression and eradication efforts, medfly was officially declared eradicated from the Dominican Republic by the Minister of Agriculture on 7 July 2017. Its eradication has contributed to enhanced productivity in the fruit and vegetable sector, thereby increasing opportunities for export, employment and economic growth.

Under regional project RLA5074 'Strengthening Regional Capacity in Latin America and the Caribbean for Integrated Vector Management Approaches to Control Aedes Mosquitoes, particularly Zika Virus,' the IAEA is helping the Latin American and Caribbean region to control the population of mosquito species that transmit diseases through the application of the SIT as a component of area-wide integrated vector management. In 2017, several countries selected sites and began preparations for pilot testing. A stakeholder communication workshop was completed for countries planning to initiate and complete pilot testing in 2018. Additionally, equipment for the production of mosquitoes for pilot release was provided to the participating Member States in preparation for the testing.

Regional cooperation

Belize joined ARCAL in 2017 and is the newest State Party to the agreement. During 2017, ARCAL finalized the design of twelve projects proposed for the 2018-2019 programme cycle in several fields of activities, in line with the Regional Strategic Profile. The ARCAL programme was developed taking into account the needs and problems identified in the Regional Strategic Profile 2016-2021, prepared and adopted by ARCAL members, to contribute to the fulfilment of the SDGs.

At the XVIII Meeting of the ARCAL Technical Coordination Board, which took place in Mexico in May 2017, National ARCAL Representatives discussed and planned activities for 2017, approved the ARCAL projects for the 2018–2019 TC cycle, and finalized the call for submission of project concepts for the 2020–2021 cycle. The meeting evaluated and monitored the progress of several ongoing projects in the areas of human health, water and environment, energy, agriculture and food security, and radiation technology, and established a working group to enhance the communication strategy of ARCAL.

Participants at the XVIII Meeting of the ARCAL Technical Coordination Board, Mexico, May 2017. Photo: IAEA.

The XVIII Meeting of the Board of ARCAL Representatives was held on 19 September 2017 on the margins of the 61st IAEA General Conference. This meeting was attended by ARCAL Member State representatives, including Belize as the newest ARCAL State Party. It provided an opportunity for representatives to review activities carried out by different bodies of the agreement and to adopt relevant reports. During the meeting, the Chairmanship of the Board of ARCAL Representatives was transferred from Brazil to Mexico, who will be supported by Cuba as Vice-Chair and Brazil as Secretary.

Senior representatives from the Caribbean Community Climate Change Centre (CCCCC) visited the IAEA and its laboratories to discuss areas for cooperation with the Agency (Monaco and Vienna, 30 October to 3 November 2017). The Centre, which was established in 2002 by CARICOM Heads of Government, plays an important role in coordinating the Caribbean region's response to climate change, by working on effective solutions to combat global warming's environmental impacts through numerous projects and scientific research. The CCCCC took part in an IAEA workshop on 'Climate Change and Nuclear Techniques for the Caribbean Community,' which aimed to establish a base for discussion and partnership development between the CCCCC and the IAEA in the upcoming years, for the benefit of the Caribbean Community.

18th Meeting of the Board of ARCAL Representatives, where the presidency of the Board was transferred from Brazil to Mexico. Photo: J.Carrillo Castillo/IAEA.

C.5. INTERREGIONAL PROJECTS

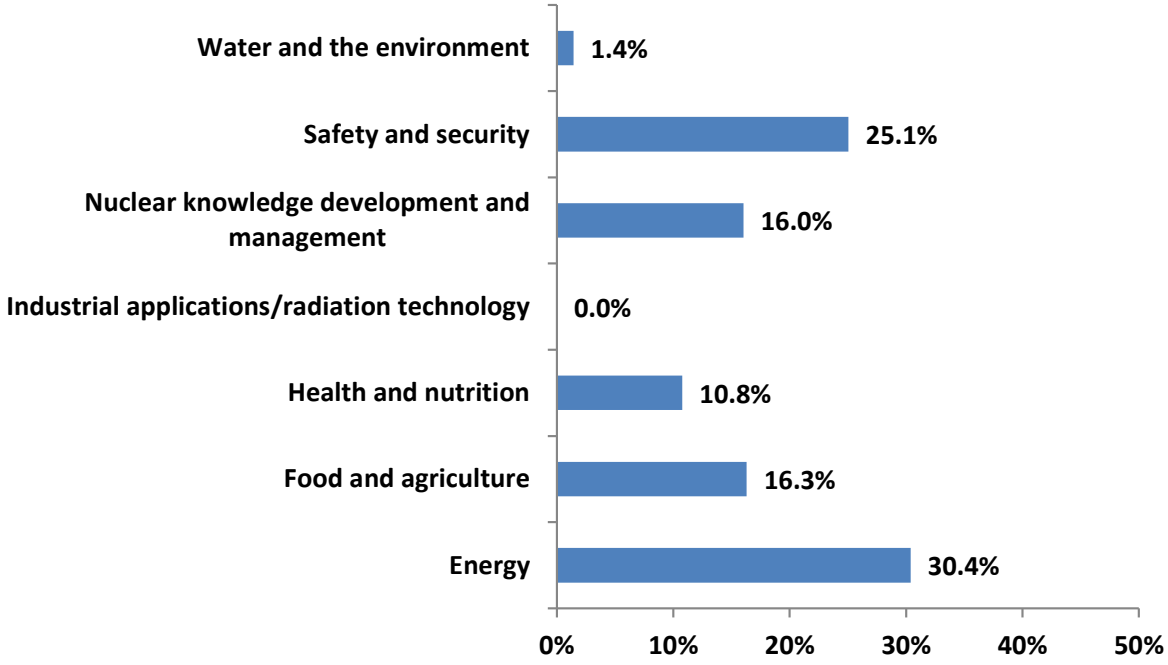


Figure 11: Interregional actuals in 2017 by technical field.

Interregional projects deliver technical cooperation support across national and regional boundaries and address the common needs of several Member States in different regions. In 2017, actuals under interregional projects totalled €7.4 million. Four interregional projects were closed during the course of the year.

Some 60 countries from the Africa, Asia and the Pacific, Latin America the Caribbean and Europe regions are participating in INT2018, 'Supporting Knowledgeable Decision-making and Building Capacities to Start and Implement Nuclear Power Programmes'. This project is the IAEA's main interregional capacity building mechanism for nuclear power infrastructure development. Its primary purpose is to develop the necessary nuclear power infrastructure for the safe and successful launch of nuclear power programmes. In 2017, six training events on various aspects of nuclear infrastructure development for newcomer countries took place under the project. The topics included the licensing process for NPPs, establishing a national position for new nuclear power programmes, safety review and assessment, nuclear energy management and human resource development. The project has benefited from extrabudgetary funding from a number of countries.

The Synchrotron-light for Experimental Science and Applications in the Middle East, otherwise known as SESAME, was inaugurated in May 2017, following a decade of extensive technical cooperation support from the IAEA, including support to the successful commissioning of the synchrotron. IAEA support through a series of three interregional projects over the past ten years has trained 66 fellows, supported 30 meetings and fielded 43 experts, contributing significantly to human resource development. IAEA support has also contributed to the safety review of SESAME. TC support is now focusing on expanding the user community using the beamlines and leveraging SESAME as a regional and international centre for capacity building.

Representatives from SIDS from the Caribbean and the Pacific regions, together with other partners such as the Australian Nuclear Science and Technology Organisation, the Secretariat of the Pacific Community, the Secretariat of the Pacific Regional Environment Programme and the European Investment Bank, met in March 2017 in Sydney, Australia, to finalize the design of an interregional technical cooperation project for SIDS. The new project, INT0093 'Applying Nuclear Science and Technology in Small Island Developing

States in Support of the Sustainable Development Goals and the SAMOA Pathway,' aims to respond effectively to the unique challenges faced by SIDS (such as small economies of scale and geographic isolation) by building capacity for the application of nuclear science and technology to both complement and enhance existing development programmes.

In situ leaching (ISL) and in situ recovery mining has become a standard uranium production method. Its application to amenable uranium deposits has been growing due to its competitive production costs and low surface impacts. An interregional workshop, supported by project INT2019, 'Deploying Technology and Management of Sustainable Uranium Extraction Projects' was held in October 2017 in Beijing, with the goal of exchanging and sharing information on ISL, and reviewing progress made under the project. Over 130 participants and experts from 39 Member States of four regions attended. The workshop enabled participants to understand the current status of ISL for uranium production, and covered life cycle management, technological, safety and regulatory aspects in addition to groundwater protection and restoration. Participants were also updated on general issues and challenges in uranium production.

INT2019: Experts and participants visit the laboratory of Uranium Mining and Metallurgy in Beijing. Photo: BRICEM

Several other training events were conducted under the same project in 2017. Some 100 participants from over 30 countries participated in discussions at the IAEA\United Nations Economic Commission for Europe workshop on 'Unconventional Uranium Resource Assessment, UNFC Classification and Reporting with Particular Emphasis on Uranium as Co- or by Product' in Salta, Argentina, on how the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC–2009) for the uranium production cycle could be used to discover 'new economic resources' associated with uranium mining. The uranium industry has the opportunity to embrace concepts such as 'comprehensive recovery' and 'zero waste' to produce co- and by-products (including rare earth elements, niobium and tantalum and other key elements) in an integrated manner with uranium.

The collection phase of project INT5153, 'Assessing the Impact of Climate Change and its Effects on Soil and Water Resources in Polar and Mountainous Regions', has been completed. The project, which aims to improve understanding of the impact of climate change on cryosphere and land-water-ecosystem quality in high altitude and high latitude regions across the world, has so far produced over 2200 soil, sediment and water samples. The final two of seven expert missions were carried out in May and August 2017 to Huayna-Potosí, the Plurinational State of Bolivia, and Elbrus, Russian Federation. Four young researchers took part in the mission to Huayna-Potosí, and four to Elbrus, for in-situ training. Five individual fellows, hosted by Spain, Austria, Belgium and the Plurinational State of Bolivia, received training in 2017 in the laboratory analysis of samples collected during the expert missions. Of the samples collected, over 1000 have already been analysed for over 70 biogeochemical parameters. The full dataset is expected in 2018.

The mobile hot cell (MHC), a device used for conditioning Category 1-2 DSRS, was upgraded under the framework of project INT9182, 'Sustaining Cradle-to-Grave Control of Radioactive Sources'. The upgraded MHC now allows for direct disposal during conditioning operations. A demonstration of the new capabilities was conducted in South Africa in September 2017. Under the same project, support has been provided to develop the IAEA Mobile Tool Kit (MTK), a mobile facility that will allow for the conditioning of Category 3-5 DSRS. Both the upgraded MHC and the new MTK will facilitate the safe management of DSRS worldwide

C.6. PROGRAMME OF ACTION FOR CANCER THERAPY (PACT)[26]

PACT highlights in 2017[27]

In 2017, the Agency continued to support the efforts of low and middle-income countries to integrate radiation medicine sustainably into national comprehensive cancer control programmes.

Costa Rica, Lesotho, Mozambique, Nicaragua and Rwanda received expert advisory support on the development of their national cancer control plans in close coordination with the WHO, and Mozambique, Nicaragua and Rwanda are expected to finalize these in the coming months. Fiji was also provided with expert assistance to update its workforce development plan and in conducting a detailed costing exercise for its radiotherapy facility.

imPACT reviews[28]

Four Member States received imPACT review missions in 2017, during which multi-disciplinary experts assessed national cancer control capacities and needs. Noting the essential need to protect patients and workers, the status of the national radiation safety infrastructure was also considered during the missions. The resulting recommendations focus on strengthening their capacities, facilitate evidence-based decision-making and help governments to prioritize interventions and investments for cancer control, as well as strengthening the radiation safety infrastructure as appropriate. They also form the basis for dedicated follow-up support by the Agency in cooperation with partners.

imPACT review missions in 2017	
Burundi	Swaziland
Congo	Togo

Burundi: imPACT review mission 20–24 March 2017. Most cancer patients in Burundi are diagnosed at a late stage. Services are further constrained by a shortage of qualified medical staff. Diagnosis and treatment capacities are not adequate to meet the population's needs, especially with no radiotherapy available. Recommendations emphasized the need to strengthen national efforts for cancer control, establish a population-based cancer registry to determine the actual cancer burden, improve access to cancer diagnosis and treatment including using nuclear technology in the short and long term, and establish an adequate radiation safety infrastructure. The national TC projects BDI6001, 'Supporting the Establishment of National Cancer Therapy Services', and BDI9003, 'Establishing a National Regulatory Infrastructure for the Control of Radiation Sources - Phase III', are currently addressing several of the topic areas highlighted in the recommendations.

The imPACT team hold discussions with senior staff at ABUBEF Hospital, Bujumbura, Burundi. Photo: M. Andre/IAEA.

[26] Section C.6. responds to section B, operative paragraph 1 of resolution GC(61)/RES/10 on the development and deployment of systems for the radiation treatment of cancer patients; operative paragraph 4 on the integrated and actionable framework for collaboration with the WHO and the IARC; and to operative paragraph 21 on reporting on the implementation of this resolution (GC(61)/RES/10).

[27] This section responds to section B, operative paragraph 8 of resolution GC(61)/RES/10 on establishing integrated and comprehensive national cancer control plans.

[28] This section responds to section B, operative paragraph 3 of resolution GC(61)/RES/10 on the follow up on the outcomes and recommendations of the high-level meetings on the prevention and control of NCDs.

Meeting staff at the surgery ward of Mbabane Government Hospital, Swaziland. Photo: A Juric/IAEA.

Congo: imPACT review mission 12–16 June 2017. Health services are concentrated in the two biggest cities, and radiotherapy services have not been available since 2015. Recommendations included reinforcing national efforts for cancer control, re-establishing and improving cancer registration structures, restoring and enhancing accessibility to radiotherapy services, and establishing an adequate radiation safety infrastructure. A new national project, PRC9001, 'Establishing the National Regulatory Framework for Radiation Safety', will contribute to address this final point.

Swaziland: imPACT review mission 7–11 August 2017. Swaziland faces major cancer control challenges, with limited capacity for diagnosis and treatment, and a lack of radiotherapy facilities. Swaziland concluded the draft of its first national cancer control plan in December 2016, and established a dedicated cancer control unit within the Ministry of Health and a population-based cancer registry in 2017. Recommendations highlighted the urgent need for specialist radiologists and an adequate legal and regulatory framework.

Togo: imPACT Review mission 10–15 September 2017. Togo is committed to strengthening access to cancer care services, including radiotherapy treatment, as part of a structured and coordinated national approach. Recommendations focused on the need to strengthen cancer control planning and to establish and implement the legal and regulatory framework for radiation safety to ensure the radiation protection of workers and patients. It was also recommended to improve access to cancer diagnosis and treatment services at the national level. The national TC projects TOG6001, 'Establishing a Feasibility Study for the Establishment of the First National Institute for Radio-Oncology', and TOG9002, 'Establishing a Radiation Safety Regulatory Authority and Strengthening Radiation Protection', address several of the topic areas highlighted in the recommendations.

"The Agency and its partners continued to support human capacity building for cancer diagnosis and treatment in developing Member States."

Supporting human capacity building

The Agency and its partners continued to support human capacity building for cancer diagnosis and treatment in developing Member States. In Viet Nam, for example, funded through the Organization of the Petroleum Exporting Countries Fund for International Development, 125 primary health care workers were trained to screen for breast and cervical cancers. In 2017, approximately 10 000 women were screened in the southern Vietnamese region of Can Tho, which encompasses 5 districts and 46 communities.

The Korea Institute of Radiological and Medical Sciences (KIRAMS), in cooperation with the Agency, has provided intensive training for cancer specialists from developing Member States in advanced radiotherapy techniques since 2013. In 2017, KIRAMS enhanced the skills of three additional fellows from Mongolia, Sri Lanka and Viet Nam. The subjects taught are in line with the national radiotherapy priorities of their respective countries. The training institute has so far trained 35 specialists. In addition, to assist francophone African Member States as they scale-up their cancer control efforts, five nuclear medicine physicians were also trained in 2017 at the National Institute for Nuclear Science and Technology of France.

Partnerships and resource mobilization[29]

Partnerships and outreach[30]

"The Agency highlighted its key role in supporting Member States' fight against cancer through participation at well-targeted health and cancer-related events."

The Agency signed Practical Arrangements with the International Federation of Pharmaceutical Manufacturers & Associations. The partnership will assist in strengthening cancer control education and training capacity in low and middle-income countries. The Arrangements will also help improve engagement with the private sector to mobilize resources to address funding gaps in cancer diagnosis and treatment services.

The Agency highlighted its key role in supporting Member States' fight against cancer through participation at well-targeted health and cancer-related events. The World Health Summit in Berlin, Germany, for example, gathered 2 000 representatives from academia, government, the private sector and civil society from 100 countries. Speaking on a special panel at the Summit, the IAEA's Deputy Director General and Head of the Department of Technical Cooperation, stressed the Agency's role in fostering innovation and expanding access to quality health care, including cancer diagnosis and treatment as well as interventions to combat malnutrition using nuclear science and technology. The Agency also underlined the importance of the integration of radiation medicine into sustainable comprehensive national cancer control strategies. In addition, the World Health Assembly, the decision-making body of WHO held in Geneva, provides numerous opportunities for the Agency to engage at a high-level with Member States and other partners to discuss support and cooperation in cancer control.

The Agency also attended meetings of the United Nations Interagency Task Force on the Prevention and Control of Noncommunicable Diseases, an initiative which reviews action and progress in countries to scale up joint efforts by UN agencies and partners to address the growing burden of noncommunicable diseases.

Resource mobilization

Member States, intergovernmental and non-governmental organizations, as well as the private sector continued to show support for the Agency's cancer control activities. A total of €517 667 was received in extrabudgetary contributions from Belgium, France, Monaco, the Republic of Korea, the Russian Federation, International Federation of Pharmaceutical Manufacturers & Associations, the German Cancer Foundation, United Nations Federal Credit Union, the IAEA Staff Association and the United Nations Women's Guild in Vienna. The latter provided funding for dedicated childhood cancer TC projects in Kenya and Mongolia.

[29] This section responds to section B, operative paragraph 5 of resolution GC(61)/RES/10 on advocating and building support for the Agency's work on cancer control; to operative paragraph 7 on harmonizing approaches to help MSs to develop their financial proposals to mobilise resources; to operative paragraph 15 on seeking, strengthening and facilitating the Agency's involvement in international partnerships, to further pursue, develop and implement PACT; to operative paragraph 16 on the continued implementation of PACT's fundraising and resource mobilization strategy; and to operative paragraph 18 on providing adequate financial support for the implementation of PACT.

[30] This section responds to section B, operative paragraph 20 of resolution GC(61)/RES/10 on raising awareness about the global cancer burden and the role of radiation medicine in cancer diagnosis and treatment.

From 20 to 22 March 2017, the IAEA convened a joint meeting with the Organization of Islamic Cooperation (OIC) and the Islamic Development Bank (IDB) in Khartoum, Sudan, to review €337 million in funding requests for national cancer control programmes in 16 Member States common to the three organizations. The meeting provided a platform for national authorities to evaluate the status of their programmes, conduct technical reviews of their financing needs with the IAEA, OIC, IDB and other organizations including the WHO, and present complete proposals to potential donors including the IDB, the African Development Bank (AfDB), and the Arab Bank for Economic Development in Africa (BADEA). The IAEA has been collaborating with the OIC and the IDB since 2011, with the aim of highlighting lack of access to effective and sustainable radiotherapy in common Member States and exploring opportunities to improve cancer control and expand radiation medicine services.

The Agency continued to provide advisory support to Member States throughout 2017, helping them develop robust and targeted proposals to secure concessional loans and grants from the IDB, AfDB and BADEA, and to identify additional potential funding partners in traditional and non-traditional sectors.

Audit of PACT and Follow up Actions

Following the audit of the Programme of Action for Cancer Therapy in 2017, the Director General established an ad hoc Task Force in January 2018, chaired by him and comprising Deputy Directors General and Heads of the Departments of Technical Cooperation, Nuclear Sciences and Applications, and Nuclear Safety and Security, to consider the one house approach by the Agency to cancer control and how PACT should be structured in order to improve internal coordination and deliver better service to Member States.

By the end of April 2018, the Task Force had held three meetings. The Task Force aims to complete its work in about six months from the start of its work, with the aim of implementing the identified measures by the beginning of 2019.

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
LDC	least developed country
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
SDG	sustainable development goal
TC	technical cooperation
TCF	Technical Cooperation Fund
UNDAF	United Nations Development Assistance Framework
WHO	World Health Organization

Annex 1. Achievements in 2017: Project Examples by Thematic Sector

Annex 1. Achievements in 2017: Project Examples by Thematic Sector

Health and Nutrition

REGIONAL HIGHLIGHTS

Human health and nutrition are key development priorities in many African countries. The IAEA is helping several African Member States to establish, expand and enhance national capacities and capabilities to provide high quality human health services to their populations. Treating cancer and other diseases more effectively, supporting national nutrition programmes, enhancing diagnostic and preventive capacities and capabilities, and developing human resources overall are areas of particular attention. The IAEA is also supporting several countries in their efforts to establish or strengthen radiotherapy, nuclear medicine and diagnostic imaging services.

The TC programme continues to support Member States in the Asia and the Pacific region in improving human health and addressing challenges in nutrition. In 2017, the programme focused on enhancing regional capacity to apply emerging multimodality molecular diagnostic imaging and therapeutic nuclear medicine techniques for the management and treatment of non-communicable diseases, including cerebrovascular and neurological diseases, as well as cancer and cardiovascular diseases. The Agency also transferred knowledge in very advanced nuclear medicine techniques such as proton therapy and boron neutron capture therapy. Regional capacity building fostered the quality and safety of the application of nuclear medicine techniques, as well as the dissemination and application of quality management systems.

Human health, including nuclear medicine, radiotherapy, medical imaging and medical physics, also continues to be a priority area for technical cooperation between the IAEA and Member States in the Europe and Central Asia region. Nuclear technologies play an increasingly important role in the diagnosis and treatment of cardiovascular diseases and various cancers. Although there are significant differences in the availability of facilities and the quality of medical services in the region, most Member States recognize the need for training in the safe and effective use of relevant nuclear technologies. Several regional and many national projects are responding to those needs, including quality control in the medical application of X-rays and the use of digital images in diagnosis, the radiation protection of patients (especially paediatric patients that are undergoing computed tomography (CT) examinations), and quality assurance for dosimetry equipment and the calibration of X-ray systems.

Human health continued to be a priority for the IAEA's technical cooperation programme in Latin America and the Caribbean throughout 2017. The IAEA has been assisting Member States by providing technical expertise and training staff in the areas of medical physics and radiotherapy, in order to support Member States initiatives to establish centres for diagnosis and treatment of cancer, including nuclear medicine, cancer radiation treatment and high dose rate brachytherapy units. In addition, the IAEA undertook regional activities such as the first Master's programme on advanced radiotherapy, and regional training courses and expert guidance were provided to strengthen capacities in the diagnostics and treatment of cancer with a comprehensive approach.

"The IAEA undertook regional activities such as the first Master's programme on advanced radiotherapy, and regional training courses and expert guidance were provided to strengthen capacities in the diagnostics and treatment of cancer with a comprehensive approach."

Commissioning the Cobalt-60 teletherapy treatment unit. Photo: Uganda Cancer Institute.

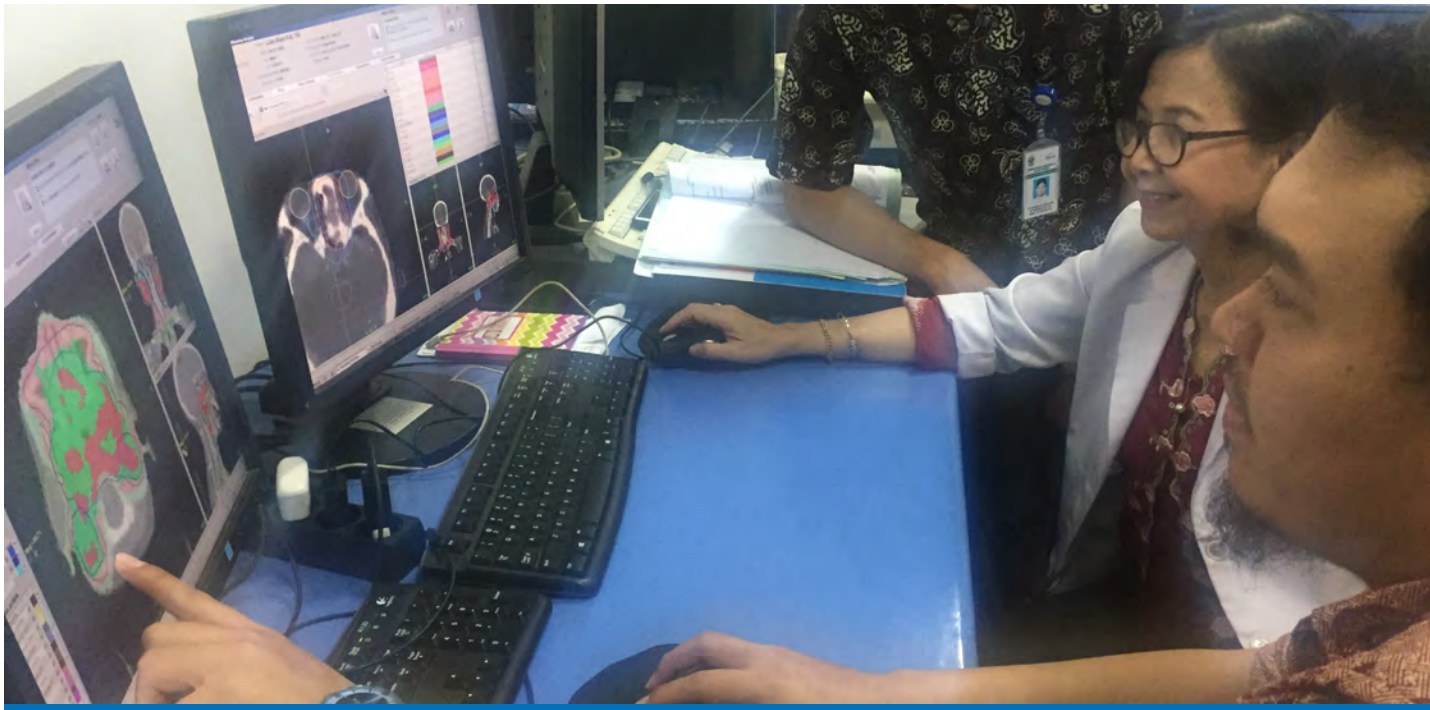
RADIATION ONCOLOGY IN CANCER MANAGEMENT

Building on work carried out in 2016 to support the re-establishment of radiotherapy services in Uganda, the IAEA procured a Cobalt-60 machine with a radioactive source in the framework of project UGA6018, 'Establishing Radiotherapy Services at the Cancer Institute'. Following the refurbishment of the bunker at Uganda Cancer Institute, the Cobalt-60 machine and the radioactive source were delivered and installation was completed in October 2017. Acceptance testing and commissioning of the machine took place in November 2017. The IAEA provided advisory services to the Uganda Cancer Institute for the installation and commissioning of the machine, and the pilot treatment of patients started in December 2017. The official inauguration of the radiotherapy services took place in January 2018, attended by the IAEA Director General.

In Morocco, project MOR6023, 'Improving the Quality of Radiotherapy by Developing Human Resources Capacity through Harmonization of Clinical Training in Radiation Oncology', is helping to enhance the skills of radiation therapists, medical physicists and radiation oncologists in the use of high precision techniques, such as intensity modulated radiation therapy, image guided radiation therapy, volumetric modulated arc therapy (VMAT) and arc therapy, on equipment newly acquired by state hospitals in Morocco.

The Agency has supported the establishment of a teleradiotherapy network in Indonesia under project INS6015, 'Improving Quality for Cancer Management through Improved Medical Physics Services'. Eight medical centres have been linked with the main Cipto Hospital in Jakarta, and can now share diagnostic and treatment plan information. The technical cooperation project provided expertise to design the network and the necessary hardware for teleradiotherapy. Indonesia's radiation oncologists and medical physicists will continue to cooperate on the national scale, but the IAEA's expertise and international network will remain crucial in helping Indonesian practitioners keep up-to-date with new technologies and global trends.

Yemen currently has only one operational brachytherapy system, located in the Brachytherapy Cancer Centre at 48 Model Hospital (Sanaa). With the support of YEM6013, 'Strengthening Capabilities at the Brachytherapy Cancer Centre, 48 Model Hospital', training on brachytherapy for gynaecological and non-gynaecological indications was



INS6015: Sharing diagnostic and treatment plan information through Indonesia's new teleradiotherapy network. Photo: M.Gaspar/IAEA

provided in 2017 to medical doctors and technologists in advanced centres. Fellows received hands-on training on the application of new protocols, proper utilisation of equipment, and processes for all indications of brachytherapy. Safety and radiation protection formed a core component of the training. The trained fellows returned to their hospital. The IAEA assistance has assured the continuity of brachytherapy services provision for cancer patients in Yemen.

In Malta, project MAT6008, 'Developing Human Resources for Implementation of Advanced Radiation Therapy Techniques', aims to enhance knowledge, skills and expertise in the use of advanced radiotherapy techniques, in particular VMAT and image guided radiotherapy (3D image guided radiation therapy). In 2017, two staff from the Sir Anthony Mamo Oncology Centre (SAMOC) received long-term fellowship training in Finland and the United Kingdom in 3D conformal radiotherapy and VMAT planning. In addition, 16 professionals attended ESTRO training courses and workshops at the Abdus Salam International Centre for Theoretical Physics. The training was crucial for the radiotherapy team at SAMOC to establish VMAT and image guided radiation therapy. The technique is now being used for all patients requiring radiotherapy for prostate cancer. So far, 100 patients have received radiotherapy using the VMAT technique, and more than one thousand patients have benefited from kV imaging for positional accuracy verification during their radiotherapy. The team is currently working on implementing the VMAT technique in other clinically relevant sites, and is beginning to carry out internal training within the department, in order to transfer knowledge and skills and to support the preparation of standard operational procedures and clinical protocols as part of an enhanced quality management system.

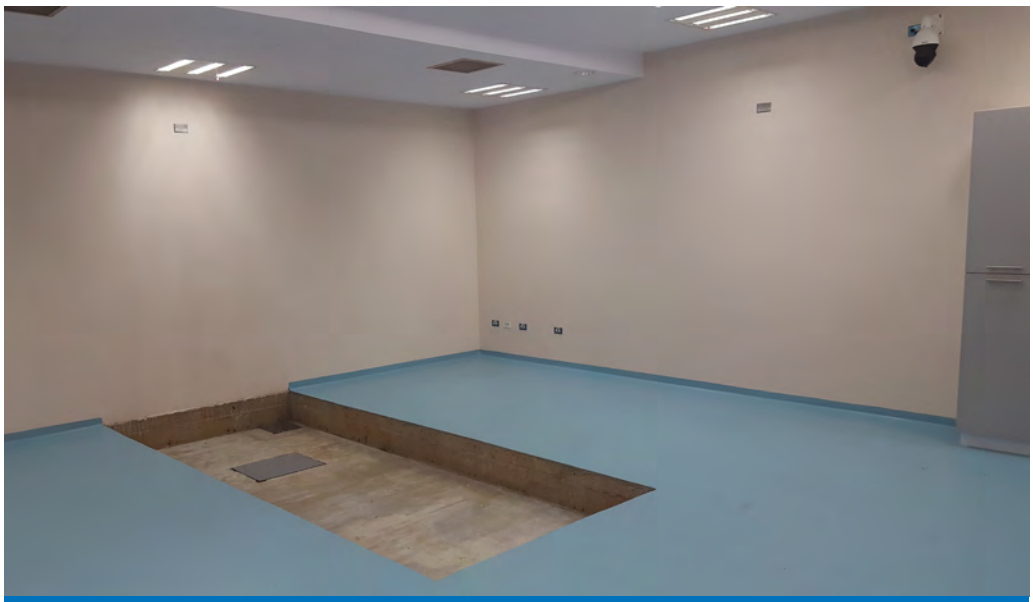
"The IAEA assistance has assured the continuity of brachytherapy services provision for cancer patients in Yemen."

Sir Anthony Mamo Oncology Centre. Photo: Y.Moysak/IAEA

Radiation oncologists and medical physicists in Slovakia have been trained in modern radiotherapy techniques, including 3D-conformal radiotherapy, intensity modulated radiation therapy and stereotactic body radiation therapy with the support of SLR6005, 'Improving Radiotherapy Services'. The introduction of these new radiotherapy techniques has improved patient treatment. Eleven scientific visits have been supported, as has the participation of 10 medical staff in ESTRO training courses carried out under the project. A national training course on extracranial stereotactic radiotherapy and intracranial stereotactic radiosurgery/fractionated stereotactic radiotherapy was also carried out.

The IAEA is helping the National Cancer Centre of Uzbekistan to improve the radiation safety of patients and medical staff by establishing mechanisms and methodologies for the implementation of QA/QC for advanced radiation therapy techniques in clinical use, under project UZB6012, 'Developing a Quality Assurance Programme for the Clinical Use of Advanced Radiotherapy Techniques at the Republican Oncology Research Centre'. Clinical training for seven medical staff from the National Cancer Centre (radiation oncologists and medical physicist) is currently being supported in hospitals in Belarus, Turkey, the Russian Federation and Georgia. The Agency also provided the National Cancer Centre with new radiotherapy dosimetry equipment, and conducted an expert mission to review the Centre's brachytherapy equipment. The brachytherapy equipment is now being upgraded, with cost sharing from the National Cancer Centre, as a result of the review.

Nicaragua reached an important milestone in 2017 under national project NIC6019, 'Building Capacity in Cancer Radiation Treatment', finalizing the construction of a bunker that will host a linear accelerator in 2018. The capacity building and equipment delivered under this project mean that Nicaragua will be able to substantially increase and improve cancer treatment. Also in 2017, a multidisciplinary team consisting of two medical oncologists, two medical physicists and two radiotherapy technicians was trained in peer institutions in Uruguay, Chile and Argentina. Nicaragua is in the process of acquiring the capacities it needs in order to transition from clinical practice, using mainly 2D radiotherapy on a Cobalt 60 machine, to 3D conformal radiotherapy using a linear accelerator.



Construction of a bunker to host a linear accelerator at the National Centre for Radiotherapy in Nicaragua. Photo: R.Cruz/IAEA

The regional project RLA6072, 'Supporting Capacity Building of Human Resources for a Comprehensive Approach to Radiation Therapy' (ARCAL CXXXIV)', has been providing support to Member States since 2014, and in 2017, the project supported a number of expert missions to Panama and Costa Rica to assess quality assurance compliance in the implementation of 3D radiotherapy techniques. A number of regional events, including a regional training course (RTC) on Modern Radiotherapy using Linear Accelerators (held in the USA) and an RTC on the Updating of High Dose Rate for Brachytherapy (held in Chile) have also been supported through the project. A master's programme in 'Advanced Radiotherapy Techniques' for radiation oncologists was initiated in Chile in 2017, with 13 fellows from eleven countries.

NUCLEAR MEDICINE AND DIAGNOSTIC IMAGING

Through the TC programme, the IAEA is contributing to early diagnosis and better management of heart disease and bacterial infection in the Congolese population, through the application of nuclear medicine imaging techniques. Within the frame of project ZAI6013, 'Strengthening Nuclear Cardiology, Infection Detection and Heart Disease Management by Nuclear Imaging Techniques at the University of Kinshasa Teaching Hospital', a single photon emission computed tomography (SPECT) gamma camera was procured and delivered to the hospital to improve the diagnosis, care and treatment of cardiovascular diseases.

A positron emission tomography (PET) centre was officially opened on 26 May 2017 in the former Yugoslav Republic of Macedonia, attended by the Minister of Health of the former Yugoslav Republic of Macedonia and the IAEA Director General. The establishment of the Centre has been supported since 2009 by project MAK6011 'Introducing Positron Emission Tomography (PET) in Clinical Practice', which has provided technical advice, training for the professional staff, and equipment. As the first public PET centre, it will strengthen public cancer care in the country, and the production of radiopharmaceuticals, including for export throughout the Balkans.

Jamaica is finalizing the renovation of its former nuclear medicine facility at the University Hospital of the West Indies with the support of project JAM6012 'Re-Establishing Nuclear Medicine Capacity,' and is ready to receive SPECT-CT equipment which is being procured through the project. The SPECT-CT equipment will make possible functional scans of

Press briefing at the opening of the PET centre, the former Yugoslav Republic of Macedonia. Photo: T.Furusawa/IAEA.

the brain, thyroid, lungs, liver, gallbladder, kidneys and skeleton. Cancer diagnosis and treatments continue to be Jamaica's priority.

Cooperation between the Agency and the Association of Medical Practitioners of Spain (CGCOM) was formalized through Practical Arrangements signed in October 2015, covering cooperation for capacity building in the fields of radiation medicine, including nuclear medicine, diagnostic imaging, radiation oncology, radiation biology and medical physics, as well as in the fields of nutrition and health-related environmental studies. In February 2017, under project RLA6078, 'Improving Coronary Artery Disease Patient Care with Nuclear Cardiology', the CGCOM hosted a meeting in Madrid on diagnosis and risk stratification in coronary artery disease with nuclear cardiology techniques. Twenty professionals from the Latin American and the Caribbean region participated.

Also under project RLA6078, a RTC on Quality Assurance in Nuclear Cardiology was held 23-26 November 2017, at the same time as a meeting organized by the Chilean Society of Nuclear Medicine and the Latin American Association of Societies of Nuclear Medicine and Biology in Santiago, Chile. Thirty-five participants and international experts took part in the course.

A number of activities were implemented during 2017 under regional project RLA6077, 'Taking Strategic Actions to Strengthen Capacities in the Diagnostics and Treatment of Cancer with a Comprehensive Approach (ARCAL CXLVIII)'. These included a RTC for Nuclear and Referring Physicians in the Clinical Applications of Diagnostic and Therapeutic Techniques with Radionuclides with Emphasis on Hybrid Image with SPECT-CT, held in Chile; a RTC on the Implementation of the IAEA-TRS-483 Code of Practice for Small Photon Beam Dosimetry, held in Cuba; a RTC on the Procedures for the Establishment of Oncological Functional Units, held in Panama; a RTC on Uncertainty Estimations for Radiation Measurements, held in Vienna; a RTC on Patient Care for Nurses and Technologists in the Field or Radiation Medicine, held in El Salvador; and, finally, a RTC for Physicians in Paediatric Radiotherapy, held in Costa Rica.

RADIOISOTOPES, RADIOPHARMACEUTICALS AND RADIATION TECHNOLOGY

The regional AFRA TC project RAF6049, 'Strengthening and Improving Radiopharmacy Services (AFRA)' was developed in order to provide continued support to good operating standards and quality systems for hospital preparation of radiopharmaceuticals in AFRA States Parties. Under this project, a postgraduate e-learning programme in radiopharmacy

has been developed and finalized, and will be implemented in the region. This postgraduate programme is a medium to long term sustainable solution, which aims at providing harmonized training curricula in radiopharmacy for competent qualified technicians and radiopharmacists in AFRA States Parties at Postgraduate Diploma and Master's Degree level. Stip University in the former Yugoslav Republic of Macedonia and the University of Ferrara, Italy, are responsible for developing, maintaining and running the e-learning platform, developing training materials and conducting the evaluation and assessment of the trainees. The installation of the e-learning modules in AFRA States Parties will support the training and empowerment of qualified technicians and radiopharmacists, and will thus contribute to improve patient safety in nuclear medicine practice. Two candidates from Kenya and Ethiopia have also completed their Master's Degree in radiopharmacy with the support of the same project. The training and knowledge they have gained will enable them to implement good practices in radiopharmacy in nuclear medicine centres in their countries, improving patient safety.

The implementation of PET in the oncological practice of Belarus is a milestone in improving cancer diagnostics, which leads to increased efficiency in selecting a therapy method. In 2017, under project BYE6011, 'Implementing Positron-Emission Tomography (PET) Including the Production of F-18 and C-11 based Radiopharmaceuticals at the Alexandrov National Cancer Centre', a national training course for radiochemists on the production of F18 and C11 labelled molecules using Synthra RN+ and Synthra MeI+ synthesis modules took place, and six fellowships were implemented: two for accelerator operators, two for radiologists and two for radiochemists. Staff were trained to ensure the safe and reliable operation of the PET centre. In addition, necessary equipment was ordered for the counterpart institution in order to improve measures against the radiation exposure of personnel.

DOSIMETRY AND MEDICAL PHYSICS

In 2012, Romania received an imPACT mission from the IAEA/WHO which recommended undertaking measures to improve the radiotherapy infrastructure including national facilities and equipment. With the aim to fulfil these recommendations, the Government of Romania decided to upgrade radiotherapy equipment in 16 radiotherapy centres throughout the country using loans provided by the World Bank. Under ROM6018, 'Enhancing Radiotherapy Services by Establishing a National Dosimetry Audit Facility', the IAEA has supported Romania's Ministry of Health with four expert missions to these 16 hospitals. The experts evaluated the current situation in all radiotherapy centres and subsequently assisted the Government in developing and finalizing sound technical specifications for public radiotherapy equipment procurement tenders. As a result of supporting robust specifications for the first tender for five hospitals, supplier prices were 35% lower than anticipated. As such, IAEA support led to a cost-effective leverage of public loans for the purchase of new radiotherapy infrastructure.

University hospitals in Croatia, particularly the University Hospital Centre 'Sestre Milosrdnice', the University Hospital Centre in Rijeka and Osijek and the Medical Faculty of JJ Strossmayer University in Osijek, have for many years benefitted from a strong and fruitful cooperation with the IAEA, supported by several TC projects in radiation medicine, including patient protection. The current project CRO6015, 'Upgrading Dose Management and Optimization in Computerized Tomography', was initiated in 2016 to increase the radiation safety of paediatric patients undergoing CT examinations in selected regional hospitals. Through the project, 12 local personnel (radiographers, radiologists and medical physicists) have been trained. Expert missions were conducted to strengthen national capacities in dose optimisation, and QA/QC equipment was procured to upgrade CT scanning procedures. As a result, a recent audit mission in the country noted that the project has had a remarkable effect in Rijeka. Local personnel from the optimisation team have managed to optimise their CT protocols and practices, thus reducing radiation doses, while

maintaining image quality. It was further noted that the level of understanding regarding complex scan techniques was clearly much improved, eliminating multiphase scanning. It is expected that such good practices will be replicated in other regional hospitals of the country. A follow-up project CRO6018, 'Establishing Centres of Competence for Quality Assurance/Quality Control in Diagnostic and Interventional Radiology at Two Distant Regional University Hospitals', will further support national efforts in QA/QC.

NUTRITION

A successful regional training course on Data Management took place in Jimma, Ethiopia, from 24-28 April 2017 within the framework of 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'. Data analysts from eight African Member States were trained on how to design electronic data collection forms and how to ensure data quality, integrity and security in nutrition-related initiatives. Data management remains a major gap and weakness in resource-poor settings in Africa. The training was among the first successful attempts in recent years for African nutrition projects within the IAEA to streamline data management and enable rich exchange between experts from developed countries and counterparts from resource-limited settings.

RAF6052: Distribution of participation certificates, regional training course on Data Management, April 2017. Photo: P. Kaestel/IAEA.

Regional project RLA6073, 'Improving the Quality of Life of Older People through the Early Diagnosis of Sarcopenia,' has provided technical support to IAEA Member States since 2014. Activities under this project include capacity building activities and the strengthening of national and regional research and laboratory capacities to improve the identification of sarcopenia in older adults, using stable isotope techniques. All participating countries have completed the first phase of the study, including deuterium analysis in over 1200 adults. The data incorporated into the common regional database will be crucial for decision makers to understand how sarcopenia can be detected early and managed successfully in the Latin American and the Caribbean region.

In Haiti, project HAI6004, 'Improving Care of Malnourished Children Using Stable Isotopes', has provided technical support to develop national capacities in the use of stable isotope techniques to study iron absorption from fortified wheat flour in a number of Haitian women and children. The new skills obtained in implementing this kind of study and laboratory analysis to measure iron status and *Helicobacter pylori* infection in serum, and to prepare samples for iron stable isotope analysis in blood by mass spectrometry represent a great asset for the country and will be used in future studies on nutrition. The results were disseminated to stakeholders and decision makers in May 2017 at a national workshop. They have provided a basis for defining the level and type of iron fortificant(s) to add to wheat flour in the national fortification programme.

Food and Agriculture

REGIONAL HIGHLIGHTS

Enhancing capacities and capabilities in the area of food and agriculture is one of the main development priorities for African Member States. Reducing food insecurity by increasing the output of staple crops such as rice, wheat or cassava as well as meat or milk, while reducing loses due to diseases or drought, are key areas of focus. Different nuclear techniques applied to plant breeding are helping increase yields by up to 30% in Central and Western Africa, and to develop varieties resistant to disease and adaptable to climate change. For example, artificial insemination and embryo transfer contributes to the selection of cattle better adapted to changing climatic conditions. Nuclear and nuclear-derived molecular genetic approaches help identify parasite-resistant sheep and goats as breeding stocks for sustainable production increase, and animals with superior traits (more and higher quality milk and meat). Improving the food safety of agricultural products for both domestic consumption and for export to lucrative markets in Europe or North America is another priority area benefiting from the application of nuclear techniques. The TC programme has focused on building capacities for the national management of food resources and the control of transboundary animal diseases, contaminants, and other pollutants that might affect food safety.

"Different nuclear techniques applied to plant breeding are helping increase yields by up to 30% in Central and Western Africa, and to develop varieties resistant to disease and adaptable to climate change."

Food security remains a priority in Member States in the Asia and the Pacific region. Extensive support was given to several countries through regional projects to eradicate fruit flies and mosquitoes using SIT, and to climate proofing production systems for staples such as rice through the application of nuclear-related techniques in plant breeding and water management. Regional and national projects have enhanced human capacity in using nuclear and related techniques to achieve improved crop yield. The management of water and soil using nuclear and other analytical techniques was also an area of focus in 2017. New partnerships for regional approaches to address food security and promote sustainable agriculture in Asia were also developed.

In Europe, early detection of animal diseases, as well as the ability to react effectively to potential food safety issues, is of paramount concern to many Member States. Nuclear and nuclear-derived technologies can be used to quickly diagnose animal and zoonotic diseases, which have the potential to spread from animals to animals and from animals to people. In some parts of the region, SIT is used to suppress plant pests, reduce pesticide usage and improve food safety and production. In some cases, TC programme activities are aimed at improving and optimizing SIT to control Aedes mosquitoes. In 2017, training on mosquito identification, surveillance, trapping methods, data recording and analysis for area-wide integrated mosquito management was provided.

In Latin America and the Caribbean, animal production for healthier and more productive livestock, and insect pest control for food security, remained two critical areas of focus. An important milestone was achieved with the eradication of the Mediterranean fruit fly in the Dominican Republic, which had a direct impact on fruit trade. Furthermore, regional capacity was built to reduce parasite infection in sheep, using both conventional and nuclear-derived, innovative molecular techniques for a proper genetic evaluation and selection. Regional capacity for food safety and control was enhanced through laboratory networking and the transfer of nuclear and related methods to control food contaminants.

CROP PRODUCTION

Through the regional TC project RAF5076, 'Improving Crops by Using Mutation Induction and Biotechnology through a Farmer Participatory Approach', the IAEA, in close cooperation with the FAO, helps to enhance the capacities of African Member States in the use of nuclear techniques to develop improved crop varieties. Some examples include new

drought-tolerant and blast disease-resistant rice lines in Egypt, and higher-yielding and drought-tolerant cowpea and sorghum in Namibia. In 2017, Zimbabwe officially released a drought-tolerant cowpea variety superior to local varieties. These new varieties yield resilient crops in greater quantity, and contribute to climate change mitigation.

In Niger, within the framework of project NER5019, 'Improving Sesame Plant Productivity by Obtaining High-Yielding Induced Mutants Adapted to Semi-arid Conditions', Joint FAO/IAEA Division activities in 2017 focused on improving three local sesame varieties that resulted in a wide range of mutant phenotypes being observed in field trials at the University of Maradi. Sesame is an important cash crop providing much needed income to farmers and rural communities in Niger.

AGRICULTURAL WATER AND SOIL MANAGEMENT

Food security is an important concern in Mauritania, a country where the adverse effects of climate change might hit hard. Through project MAU5006, 'Contributing to the Improvement of Rice Crop Yields through the Application of Nuclear Techniques to Water Management and Soil Fertility', rice production has been enhanced. In 2017, the first trials conducted in the country using a combination of nuclear techniques and best practices in fertilization and irrigation led to an increase of 30% in rice production, from 3.5. to 4.6 tons per ha.

Range land in Iraq is of considerable importance as it hosts large numbers of beef, cattle, camel and sheep. These areas are characterized by low rates of precipitation (100 -200 mm/year), and intensive grazing has led to severe deterioration in land productivity, and to loss of biodiversity. Under project IRQ5020, 'Restoring Biomass Productivity of Range Land by Using Nuclear Techniques and Advanced Technology', the IAEA supported efforts to address this problem through the implementation of effective practices to restore land productivity and biodiversity. The Agency, in cooperation with FAO, provided capacity building, and procured spare parts for laboratory equipment. Areas of one hectare were selected in farmers' fields in four districts for this project, and sprinkler irrigation systems were installed in the four locations. Improved soil and water management practices, including irrigation water and nutrient requirements, were applied, using nuclear techniques, at these sites. Wind breaks consisting of salt and drought tolerant shrubs and trees were successfully grown around each area to reduce wind speed and decrease the rate of soil water evaporation. Promising results were obtained in each of the four locations – biomass production increased by an average of 40-45%, and there was a noticeable improvement

IRQ5020: Selection of sites to test practices in restoring the biomass productivity of range land. Photo: Ministry of Science and Technology, Iraq.

IRQ5020: Monitoring soil properties through consecutive soil sampling (North site). Photo: Ministry of Science and Technology, Iraq

COS5033: Experts in the University of Costa Rica's Environmental Pollution Research Centre (CICA) are working with the IAEA to test biochar, San José, Costa Rica. Photo: L. Gil Martínez/IAEA

COS5033: Project team measuring soil emissions at the experimental station Alfredo Volio Mata in Costa Rica. Photo: L. Gil Martínez/IAEA

in soil fertility. In addition, the soil and water management practices introduced resulted in a 20-40 % increase in water use efficiency. The findings of the project, which were well-received by farmers, were presented in August at the International Plant Nutrition Colloquium 2017 in Copenhagen, and will be applied over large areas of the country. The project team is cooperating with the Ministry of Agriculture to apply the improved practices at a large scale level in the north of the country. In 2017, these technology packages were adopted by farmers who can now utilize these lands to improve food security.

In Costa Rica, experts are using nuclear technology to help producers grow pineapple and other crops more efficiently and ecologically. Under project COS5033, 'Assessing and Implementing Biochar Use in Climate Smart and Environmentally Friendly Pineapple Production Using Isotopic Techniques', experts are learning to apply nuclear-derived techniques to test the benefits of biochar, a new type of soil additive that could help cut down the use of pesticides, and fertilizers, and reduce greenhouse gas emissions. Pesticides were labelled with radioactive isotope 14C and applied to soil in controlled laboratory environments, which allows scientists to examine the behaviour of the pesticide. In addition, through the application of 13C stable isotope technique, it can be determined whether or not biochar helps the soil store more carbon, thereby reducing CO2 emissions. In 2017, essential equipment was purchased for pesticide residue analysis, and local staff were trained in pesticide residue analysis through expert missions and national training courses.

In Jamaica, the need to increase food production to ensure food security, together with an excessive use of irrigation water and fertilizers, has resulted in several incidents of reduced water production, of degraded quality due to nitrate pollution, from deep-wells in the lower Rio Cobre basin. TC project JAM5012, 'Optimizing Irrigation Water Management to Improve Crop Output and Water Quality Control', is helping the National Irrigation Commission to monitor irrigation water usage to analyse sources of pollution. The goal is to educate farmers in irrigation best practices that will result in better crop yields, and to implement suitable mitigation actions to ensure water quality. Soil moisture monitoring systems have been set up to determine the efficiency of irrigation management, and the 15N isotopic technique has been used to determine fertilizer use efficiency. A water sampling campaign was conducted to determine stable isotope compositions and major ion ratios, to provide information on potential pollution sources.

LIVESTOCK PRODUCTION

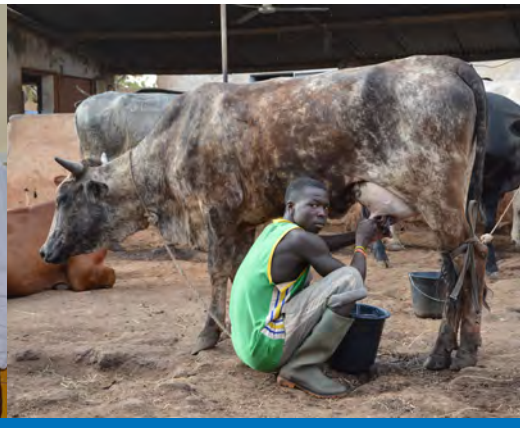
In Lesotho, a country which until recently relied on foreign laboratories, diagnosing animal diseases early and rapidly is now possible. In June 2017, with support from the IAEA and the FAO through national TC project LES5006, 'Enhancing Animal Production and the Health of Sheep and Goats in Lesotho', veterinary scientists in the capital Maseru began using nuclear and nuclear-derived technologies to identify and characterize viruses that affect livestock and humans. With the help of these techniques, scientists at the Central Veterinary Laboratory were able to demonstrate that Lesotho is free of foot-and-mouth disease. IAEA/FAO support continues with the provision of equipment that enables IAEA-trained national staff to verify whether the country is also free of peste des petits ruminants and avian influenza.

In the Democratic Republic of the Congo, FAO/IAEA support through TC project ZAI5024, 'Upgrading Vaccine Production to Protect Livestock from Transboundary Animal Disease' to the Lubumbashi Veterinary Laboratory included staff training and the provision of analytical equipment to upgrade the Vaccine Production Laboratory.

Bio-banking helps researchers understand the epidemiology and evolution of endemic and epidemic pathogens (diseases). Angola was among the first African countries to establish a bio-bank, but in recent years its national capacities did not match national needs. Through TC project ANG5013, 'Applying Nuclear and Molecular Techniques for Diagnosis and Control of Transboundary Animal Diseases', the IAEA in close cooperation with FAO offered a capacity-building programme to train national staff and achieve an optimal level of functionality in facilities such as the Central Veterinary Laboratory in Huambo.

In Burkina Faso, FAO/IAEA support delivered through TC project BKF5017 'Using Modern Animal Breeding Methods, Nuclear and Genomic Tools to Improve Dairy Production in Smallholder Production Systems' has helped the Institute for the Environment and Agricultural Research (INERA) develop laboratory capacities to conduct molecular genetic studies in support of genetic characterization, evaluation, and selection of superior animals for breeding. Specifically, the IAEA supported INERA with equipment, protocols, guidelines, training, and expert services to develop the genetic laboratory, continue animal nutrition research, and strengthen artificial insemination service capacities. As a result, several hundreds of DNA samples from a wide range of animal species including goats, sheep, cattle, chicken, and guinea fowls were analysed. These enhanced laboratory and human capacities have enabled INERA to grow into a regional resource centre, training professionals from neighbouring countries like Niger and Mali. The capacities have also been used to support postgraduate academic programmes on animal genetics.

BKF5017: Genetic laboratory, Institut de l'Environnement et de Recherches Agricoles (INERA), Burkina Faso. Photo: M. Shamsuddin/IAEA.



Livestock from which DNA sample has been taken. Photo: M. Shamsuddin/IAEA.

In Mauritius, IAEA and FAO support to the Food and Agricultural Research and Extension Institute (FAREI) in the framework of TC project MAR5025, 'Improving the Productivity of Dairy Cattle through On-Farm Application of Achieved Research Information on Feeding Practices' helped establish national capacities for the identification and analysis of locally-available feed resources, including the development of a database, and their uses for feed formulation to increase livestock productivity. Laboratory data were used for ration formulation and development of a 12-month feeding calendar with options to fill in all seasonal gaps. Forage cultivation agronomy was also developed to complement the seasonal availability of natural grass and crop residues and the information was disseminated among farmers. A fodder germ plasm centre has been established at the FAREI premises, and is used to distribute seeds and cuttings to farmers. Pilot studies were carried out in 165 farms, and 26 extension agents were trained. Awareness and empowerment of farmers were done by on-farm demonstration of pilot trials. Most farmers reported increased milk production through the optimisation of animal feeding and the development and distribution of an annual feeding calendar.

With IAEA and FAO support in the framework of TC project BEN5010, 'Using Nuclear Techniques for Better Utilization of Local Feed Resources and Improved Reproduction Practices to Enhance Productivity and Conserve Nature', Benin has introduced artificial insemination in cattle. A new bull station and semen laboratory was inaugurated in August 2017 in Parakou, a region in central Benin with the largest livestock population. Scientists there have so far produced more than 2000 doses of frozen semen and carried out more than 200 artificial inseminations.

In the Lao People's Democratic Republic, TC project LAO5003 has helped the National Animal Health Laboratory (NAHL) improve its diagnostic and control activities for various transboundary animal diseases. NAHL has developed the necessary capability for first line immunological and molecular nuclear and nuclear-related diagnoses, important steps towards becoming a reference and confirmatory diagnostic and control laboratory. The lab processes more than 15,000 samples on an annual basis. The Agency has also complemented the government's investment in capital construction of a modern NAHL facility which will house an advanced Biosafety Level 3 Laboratory. The FAO/IAEA contributions under LAO5003 include: training NAHL management and professional staff through a scientific visit and fellowships; expert services to implement molecular diagnostic protocols for the identification of transboundary animal diseases; support for laboratory proficiency and capabilities; provision of training in nuclear diagnostic applications; and provision of

LAO5003: The entry to the National Animal Health Lab, Lao PDR. Photo: M.Kurylchyk/IAEA.

ELS5012: Forage production to improve animal feeding. Photo: M. Shamsuddin/IAEA.

equipment, materials and test reagents. In 2017, this work continued through fellowships and an expert mission to assess project implementation and to support laboratory proficiency and capabilities.

Montenegro has significantly upgraded its capacity in the area of molecular diagnostics with the support of TC project MNE5003, 'Improving Diagnosis of Animal Diseases and Food Pathogens'. Training of the staff of the national Diagnostic Veterinary Laboratory at relevant EU laboratories and the procurement of a real-time polymerase chain reaction machine, together with equipment for end-point polymerase chain reaction analysis, contributed to transfer knowledge and build practical experience in applying diagnostic techniques for different pathogens. Laboratory staff can now detect animal diseases at an earlier stage and react effectively to potential food safety issues. The project also facilitated the harmonization of diagnostic procedures with international and EU standards.

Within the framework of TC project ELS5012, 'Optimizing Livestock Production Systems through Cultivation and Efficient Use of Local Feed Resources, Monitoring of Performance and Reduction of Environmental Pollution through Solid Waste and Biogas Utilization,' the University of El Salvador is applying an innovative low-cost cooling system to reduce heat-stress on cows. Feeding was also improved by supplementing conventional grass and concentrate-based feeds with leguminous forage, helping farmers reduce the use of additional concentrates as protein sources (from a traditional 17% to 15.5% crude protein in the final diet) and reduce the cost of milk production by 7-12%. A computerized recording system has been introduced in six farms, which has already recorded data on 1,800 cattle. These initiatives have resulted in a higher number of parturitions and better total milk yields per cow.

In Latin America and the Caribbean, a number of activities under regional TC project RLA5071, 'Decreasing the Parasite Infestation Rate of Sheep (ARCAL CXLIV)', have enabled participating institutes to apply both conventional and innovative nuclear-derived molecular techniques for the proper genetic evaluation and selection of superior animals for breeding to enhance resistance to gastrointestinal parasitic infections. In 2017, all participating Latin America and Caribbean countries piloted animal identification and data acquisition programmes. Over 60 professionals from twelve countries were trained and laboratory capacities enhanced through provision of equipment, tools and expert services.

INSECT PEST CONTROL

In Uganda, through TC project UGA5036, 'Demonstrating the Feasibility of a Sterile Insect Technique Component as Part of an Area-Wide Integrated Pest Management Approach to Increase Livestock Productivity', the IAEA procured a hexacopter remotely piloted aircraft system (RPAS) and prototype release system to completely automate the process of releasing tsetse flies. This marked the first time a RPAS was used in Africa for insect control. Uganda hosted a Regional Training Course on the application of this environmentally friendly method for tsetse control for participants from six African countries in the Kalangala Islands in Lake Victoria from 28 November to 1 December 2017 under project RAF5077, 'Supporting Area-Wide Tsetse and Trypanosomosis Management to improve Livestock Productivity, Phase III'.

Burkina Faso inaugurated the largest tsetse rearing facility in West Africa in February 2017. The establishment of the facility in Bobo-Dioulasso was supported by the FAO and IAEA under project BKF5018, 'Improving Agro-Forestry and Agro-Pastoral Production through the Use of Nuclear Technologies'. The insectary is a mass-rearing centre to help the region use SIT to reduce tsetse populations and the risk of Trypanosomosis. The insectary will supply sterile males to the SIT programme in Burkina Faso and neighbouring countries.

In Latin America and the Caribbean, TC regional project RLA5070, 'Strengthening Fruit Fly Surveillance and Control Measures Using the Sterile Insect Technique in an Area Wide and Integrated Pest Management Approach for the Protection and Expansion of Horticultural Production (ARCAL CXLI)', has provided a framework for continued efforts to control and eradicate the Mediterranean fruit fly. Following two years of intense suppression and eradication efforts, the Mediterranean fruit fly was officially declared eradicated from the Dominican Republic by its Minister of Agriculture on 7 July 2017. The eradication of the Mediterranean fruit fly in the Latin America and Caribbean region will increase fruit and vegetable production and in so doing boost export opportunities, employment, and economic growth.

In Panama, TC project PAN5025, 'Expanding and Strengthening the Phytosanitary Surveillance System for Fruit Fly, Emphasizing Exotic Species of Quarantine Importance, and Exploring the Use of Nuclear Techniques for Post-Harvest Treatment as a Complementary Action', built capacity at the laboratory for Mediterranean fruit fly diagnostics in Panama's Ministry of Agriculture in 2017, through provision of state of the art equipment and high-level technical advice.

FOOD SAFETY

The IAEA, in cooperation with FAO, has helped the Uganda National Bureau of Standards (UNBS) upgrade its food safety laboratory through staff training, advisory services, and equipment within the framework of UGA5039, 'Enhancing the Monitoring of Veterinary Drug Residues, Related Chemicals and Natural Food Contaminants'. A liquid chromatography tandem mass spectrometer was delivered to UNBS, together with relevant stable isotopes to facilitate routine analysis of food and feed contaminants. This state-of-the-art equipment is now operational, with personnel trained in its use. Uganda is now able to conduct confirmatory analyses following initial testing with tools such as radio receptor assays, also provided by the IAEA. This instrumentation is also available to several other institutions in the country and will greatly enhance service delivery of various stakeholders, such as the beef and dairy industries.

UGA5039: Staff at work in the Food Safety Laboratory, Uganda National Bureau of Standards. Photo: V.Varbanova/IAEA.

In Benin, the IAEA and FAO are supporting a comprehensive food safety programme through project BEN5009, 'Monitoring Safe Food Supply through Total Diet Studies and the Application of Nuclear and Complementary Analytical Techniques'. The project support contributed to the accreditation of the Central Laboratory of Food Safety Control by the Belgian Accreditation Council, thus validating its competence and reliability, so that the country continues to access lucrative EU and other markets for a number of food products, such as pineapples and honey. In Colombia, an inter-institutional working group on pesticide residues in fruits and vegetables was created in 2017 with the support of TC project COL5025, 'Improving Capacity to Diagnose Residual Pesticides and other Contaminants in Exotic Tropical Fruits to Make Food Exports More Acceptable on the International Market'. With the establishment of this group, the project will have an impact beyond capacity building, fostering formal linkages with policy makers and food safety regulators at the national level.

Technological capacity was established or enhanced for food authenticity, to support food traceability and food safety control systems through the use of nuclear and related analytical techniques in a network of 16 countries in the Asia and the Pacific region. TC project RAS5062, 'Building Technological Capacity for Food Traceability and Food Safety Control Systems through the Use of Nuclear Analytical Techniques', assisted countries in the region in their endeavours to ensure food safety and to combat fraudulent practices in trade by implementing sustainable analytical tools that permit independent verification of paper based traceability systems for food commodities. Thirty-eight young scientists from the participating countries attended three training courses to build capability in the application of nuclear techniques for food authenticities. The project also resulted in remarkable success in attracting national funding for research on food traceability in Member States in the region.

Edible bird's nest (EBN) is an important commercial product for Malaysia. As this commodity ranks amongst the world's most expensive animal products for food and medicinal uses, there is strong economic motivation for adulteration. Analytical

methodology was developed by the FAO/IAEA Laboratories and transferred through MAL5030, 'Strengthening National Technical Capability in Food Traceability of Edible Birds Nest through the Application of Nuclear and Related Technologies'. Support included the development of protocols and the training of Malaysian scientists at Seibersdorf, in order to initiate a control system in Malaysia to protect their high quality EBN products.

Strong control over agricultural production in Panama is a national priority. The country produces bananas, rice, corn, coffee, sugarcane, vegetables, livestock and shrimp, which are exported mainly to the US and Europe. Through the establishment of validated analytical methodology under PAN5024, 'Developing Analytical Capabilities for the Detection of Chemical Contaminants in Food and the Quality of Agrochemicals', the pesticide residues laboratory of the Ministry of Agriculture is now a recognized national reference laboratory for pesticide residue analysis. The laboratory provides essential services for the analysis of pesticides, fertilizers, heavy metals and other inorganic contaminants in food and the environment. The laboratory analyses about 3000 samples per year using rapid screening methods and therefore provides quick responses and feedback to food producers, helping to ensure protection of consumers, local retail markets and export commodities.

Water and the Environment

REGIONAL HIGHLIGHTS

In Africa, assistance to Member States in 2017 focused on supporting national efforts to characterize groundwater resources to enhance evidence-based decision-making on the judicious use of groundwater resources. In the Sahel region, efforts were made to publicize results of the regional project on characterizing shared groundwater resources in five basins. Countries ready to undergo the IAEA Water Availability Enhancement methodology were identified and will play an important role in the follow-up Sahel project.

In the Asia and the Pacific region, the TC programme focused on capacity building for the investigation of atmospheric particulate matter and pollution sources in urban environments using nuclear analytical techniques. It also focused on the management of marine and air pollution and groundwater resource management. The information generated will help authorities to plan remedial measures for environment protection and enhancement of life quality.

"In the Asia and the Pacific region, the TC programme focused on capacity building for the investigation of atmospheric particulate matter and pollution sources in urban environments using nuclear analytical techniques."

Member States in Europe recognize environmental and water pollution control as an important priority for the region. Regional projects are enhancing capabilities to develop pollutant models and for monitoring different pollutants using nuclear and complementary analytical methods. The Agency helped build capacity for environmental monitoring and has provided expert services and practical training in geochemistry and isotope hydrology. Within the context of environmental monitoring activities, the Chernobyl situation continues to be a focus of attention.

Sustainable water governance and environmental protection are among the most pressing challenges facing the Latin American and Caribbean region. In 2017, the TC programme focused on building capacity in its Member States in the use of nuclear techniques to provide unique and quantitative data on water dynamics. Groundwater quality was evaluated in the region to improve management of major hydrologic basins. Mining and industrial activities and their effects on water resources were also assessed using nuclear and isotopic techniques; marine and coastal environments were monitored in the framework of a network in the Greater Caribbean countries to support Member States in the region to adopt and implement climate change mitigation and adaptation programmes.

WATER RESOURCE MANAGEMENT

In South Africa, the project SAF7004, 'Using Isotopic Analysis of Groundwater and the Environment in a Joint International Isotopes in Hydrology Programme', supported the strengthening of the capacities of the Accelerator Mass Spectrometry (AMS) facility at iThemba LABS (Gauteng) for C-14 measurements in groundwater and for high-precision measurement of stable isotopes in environmental samples. C-14 measurements are now carried out in minutes rather than hours. The project also helped upgrade the preparation line in the laboratory for collection and processing of samples in high-purity conditions. iThemba LABS (Gauteng) now offers a 100-fold increased throughput of water samples for radiocarbon analysis.

Afghanistan's drinking water supply infrastructure has been damaged or destroyed over the past four decades. Annual precipitation is low, and drought conditions are continuous. Kabul is experiencing huge population growth and, consequently, increased demand for water. Under TC project AFG7001, 'Improving Drinking Water Quality Using Hydrochemical and Isotope Techniques', Agency supported enhancements to Afghanistan's national capacity for effective application of isotope hydrology techniques in water resource

assessment and management. These assessments provided important information to the national authority about the groundwater regime in Kabul basin. Work under this project continued in 2017 with the training of Iraqi fellows specializing in water analysis.

In Latin America, the regional project RLA7018, 'Improving Knowledge of Groundwater Resources to Contribute to their Protection, Integrated Management and Governance (ARCAL CXXXV)', supported the implementation of the IAEA Water Availability Enhancement methodology, enhancing national capacity to conduct water assessments. The project, running from 2014 to 2017, contributed to the identification of national and provincial gaps in hydrological understanding, data, and information. In four pilot areas, national and regional water authorities worked to improve groundwater knowledge as part of their strategic water plans. The project contributed to the development/implementation of the National Water Agendas, which identify a broad spectrum of activities to be taken to protect water resources. Moreover, the establishment of integrated databases, isotope monitoring networks, and the use of isotopic tools to characterize recharge processes, the origins of pollution and groundwater age, helped develop and improve hydro-geological conceptual models. Over 500 professionals benefited over the course of the project, which strengthened national capacities in water agencies for the collection and interpretation of hydrological data and for integrated management of water resources.

INS6015: Sharing diagnostic and treatment plan information through Indonesia's new teleradiotherapy network. Photo: M.Gaspar/IAEA

In Costa Rica, groundwater recharge processes in the Barva-Colima aquifer system were identified using the environmental isotopes 18O, D, 3He, and T, with the support of project COS7005 'Ensuring Sustainability and Water Security in the Central Valley'. With the provision of specialized equipment and the training of human resources, the project has helped establish a long-term (continuous) hydrometric and tracer monitoring network in an aquifer system critical for drinking water supply. The equipment has also facilitated assessment of critical recharge zones in tropical and highly complex mountainous landscapes. Over 25 professionals were trained in various technical fields including isotope hydrology, artificial recharge, numerical groundwater modelling, surface water tracer modelling, and tritium and noble gases dating techniques.

In Cuba, water scarcity stemming from extreme weather events has a negative socioeconomic impact on areas such as public health, fishing, industry, agriculture, cattle husbandry and food safety. National project CUB7009, 'Strengthening Isotope Hydrology Capabilities for Sustainable Management of Water Resources', provided considerable support for the installation of an isotope monitoring network for precipitation in 2017. In addition, local staff were trained in the design and installation of a network for groundwater sampling; chemical analysis of groundwater; measurement of stable isotopes such as D, 18O, and 15N in water samples; and radon applications in hydrological studies. The laboratory is now fully operational and Cuba has the capability to produce and interpret isotopic data to better manage its water resources.

MARINE, TERRESTRIAL AND COASTAL ENVIRONMENTS

In Kuwait, national project KUW7005, 'Upgrading National Nuclear Analytical Capabilities for Environmental and Foodstuff Radioactivity Monitoring', built national capacity in environmental and foodstuff radioactivity monitoring, particularly with respect to the measurement of gross alpha and gross beta to monitor levels of radium in drinking water.

Over 40 participants from Belarus, Russia, and Ukraine participated in a regional field workshop in August 2017 in Minsk, Belarus, within the framework of the regional project RER7007, 'Supporting Radiological Management of Abandoned Areas Following the Chernobyl Accident and Dissemination of Chernobyl Related Information', to share knowledge on Chernobyl-related matters and new developments in the remediation of areas affected by the Chernobyl accident. The participants visited the abandoned territories in the Gomel region and Polesie State Radioecological Reserve, where they observed the management of the exclusion zone and activities conducted within it, including pilot projects on beekeeping and a horse farm. They also visited the research station and obtained information on the current and planned scientific activities and international cooperation.[31]

[31] This paragraph responds to section 2, operative paragraph 7 of resolution GC(61)/RES/10 to render assistance and radiological support to the most affected countries in mitigating the consequences of the Chernobyl disaster and rehabilitating the contaminated territories.

Industrial Applications

REGIONAL HIGHLIGHTS

Industrial uses of nuclear science and technology can bring benefits for many African Member States. Through different national and regional projects, the IAEA helps African countries develop national human resources and technical skills to, for instance, maintain their existing nuclear instrumentation or to provide services to different industries. Targeted support is provided to countries which currently have or plan to install research reactors or multipurpose irradiators for commercial uses.

In the Asia and the Pacific region, the TC programme continues to enhance national capabilities in the industrial application of radioisotope and radiation technology. This includes helping Member States to build capacities in advanced non-destructive testing techniques, and supporting the upgrading of gamma and electron beam facilities. In particular, research reactors are being commissioned and operated with the support of national and interregional projects implemented by the Agency.

In Europe, nanotechnology is a promising and rapidly expanding field of research and development, and may be applied to develop advanced materials. Although good quality accelerators for radiation processing are available in the region, costs must be reduced to achieve broader commercial utilization. TC activities facilitate and strengthen regional cooperation in radiation technology use. Nuclear analytical methods play an important role in object identification (painting, sculpture etc.) and in the selection of preservation methods. In addition, radiation technology can be directly used for the preservation of some types of cultural heritage artefacts.

The TC programme in the Latin America and the Caribbean region helps Member States to develop capacities in the use of radiation technology, with the aim of improving industrial performance and reducing environmental impact, through a mix of regional projects and multiple national projects. National projects under implementation in Argentina, Brazil, Mexico, Panama and Peru include: use of alpha emitting particles radioisotopes as a complementary alternative for targeted therapy of some cancer types; treatment of industrial effluents using electron beam accelerators; production of iridium-192 for use in cancer treatment in accordance with high quality standards; introduction of electron beam/X-ray irradiation technology; investigation of sediment transport in the Panama Canal Basin using tracers; and the application of radiation-processed cells, scaffolds and tissues. A total of 15 professionals in the region completed training and testing to obtain the International Society of Tracer and Radiation Applications certification. An additional 15 professionals were trained on the application of sealed sources and enhanced gamma scanning of columns in industrial processes.

"TC activities facilitate and strengthen regional cooperation in radiation technology use."

RADIOISOTOPES AND RADIATION TECHNOLOGY FOR INDUSTRIAL APPLICATIONS

In Europe, regional project RER1017, 'Using Advanced Radiation Technologies for Materials Processing', supports the application of advanced radiation technologies in the radiation processing of human health care products, environmental remediation, and production of advanced materials. In 2017, project activities focused on the completion of harmonized guidance material and protocols for quality control and quality assurance in radiation processing at the regional level, in order to have better quality products and safer radiation technologies. Professionals from the region were trained in the field of validation and control for electron beam radiation, including the requirements of international standards (ISO 11137) for dosimetry aspects on the electron beam irradiation. Operators and radiation safety officers were trained on the safe operation of gamma and e-beam facilities for radiation processing.

MAT0002: Carbon-14 dating using the automated continuous flow bone ABA cleaning system. Photo: M.Grima/Heritage Malta.

In Malta, three sites are inscribed on the United Nations Educational, Scientific and Cultural Organization Word Heritage List: the capital city, Valletta; the Ħal Saflieni Hypogeum; and the Megalithic Temples. The IAEA provided support for the establishment, reinforcement and operation of multi-institutional facilities and specialized equipment to maximize the quality of education and research in the field of conservation science under TC project MAT0002, 'Strengthening of the Nuclear Science Infrastructure and Application of Nuclear Technologies'. In 2017, three key areas of expertise were enriched, supporting their application to cultural heritage: procedures and analysis for 14C dating; principles and applications of CT imaging in cultural heritage; and K-edge radiography.

MAT0002: CT imaging, with the medium sized CT system (left) and the CT system used for large objects (right). Photos: M.Grima/Heritage Malta.

Under regional project RLA1013, 'Creating Expertise in the Use of Radiation Technology for Improving Industrial Performance, Developing New Materials and Products, and Reducing the Environmental Impact of Industry', the IAEA built capacity in Latin American and Caribbean Member States through the provision of training modules addressing: basic aspects of radiation effects on polymers and characterization techniques; development of radiation crosslinked hydrogels and other polymeric materials for biomedical applications, including up-scaling methodologies and testing protocols; radiation effects on natural polymers for value addition; laboratory scale experiments to demonstrate formation of hydrogels for wound dressing; industrial applications of radiation crosslinked polymers; radiation chemistry of water related to organic pollutants and sludge treatment; radiation effects on effluents containing textile dyes, pharmaceuticals and microbial contaminants; practical aspects of treating industrial waste waters; applications of mobile electron beam accelerators; radiation degradation of pollutants; and general applications of radiation technology for environmental applications. In 2017, 38 people from 10 countries received training.

RESEARCH REACTORS

Within the framework of regional project RAF1005, 'Strengthening the Capacity for Research Reactor Safety and Applications in Africa (AFRA)', the IAEA is helping nuclear operators in African Member States take steps toward the optimal use of research reactor facilities. From 27 November to 1 December 2017 in Rabat, Morocco, the IAEA, in collaboration with the National Centre for Nuclear Energy, Sciences and Technology, held the second AFRA Research Reactor School, offering 26 young professionals lectures and hands-on-training in the area of radioisotope production and use in medical and industrial applications, including radiotracer techniques. The training has enhanced the capabilities of operators in areas such as the production and quality control of various reactor-based radiopharmaceuticals, with special emphasis in good manufacturing practices.

In Jordan, the 5MW Jordan Research and Training Reactor (JRTR) received its operating license on 12 November 2017, supported by TC project JOR1008, 'Enhancing Capacity Building Towards Safe and Effective Operations and Utilization of the Research and Training Reactor'. The JRTR, housed on the campus of the Jordan University for Science and Technology, is a multipurpose research reactor that will provide training to IAEA Member States in many areas, including the production or medical radioisotopes for therapy and diagnostic.

Energy Planning and Nuclear Power

REGIONAL HIGHLIGHTS

The availability of safe, clean, and reliable energy is a priority in Africa. As the continent develops, its energy needs also increase. The IAEA helps its Member States develop national human resources and technical capabilities to assess current energy needs and make accurate projections for the future. With this information, decision-makers can make informed decisions to fuel development in Africa.

The Asia and the Pacific region has the highest number of countries embarking on nuclear power programmes. The Agency is supporting the development of national infrastructure for several Member States that are embarking on building their first NPP, or expanding their nuclear programme. In addition, capacity building for uranium extraction has been enhanced through national projects.

The IAEA continues to support several Member States in the Europe region in implementing national plans related to SDG 7, 'Ensure access to affordable, reliable, sustainable and modern energy for all'. This support takes many forms, including providing guidance to Member States considering the nuclear power option or at advanced stages of constructing their first NPP, and sharing expertise on front-end activities like uranium mining. Member States also receive assistance in strategy development, feasibility, financing, and nuclear power infrastructure programme management related to the nineteen issues identified in the IAEA's 'Milestone' document. Numerous TC events in 2017 focused on building or strengthening human resource capacity and know-how for constructing and managing a NPP.

"The IAEA helps its Member States develop national human resources and technical capabilities to assess current energy needs and make accurate projections for the future."

In Latin America and the Caribbean, the TC programme has supported IAEA Member States in energy planning under regional project RLA2015, 'Supporting the Development of National Energy Plans with the Purpose of Satisfying the Energy Needs of the Countries of the Region with an Efficient Use of Resources in the Medium and Long Term (ARCAL CXLIII)'. Multidisciplinary working groups specialized in energy planning were established in 15 countries that benefitted from training in the use of the IAEA tools Model for Analysis of Energy Demand (MAED) and Model on Energy Supply Strategy Alternatives and their General Environmental Impacts (MESSAGE) for analysis of energy demand and supply. Capacity development in the use of energy planning tools resulted in the formulation of national demand and energy supply studies, including energy projections up to 2050.

ENERGY PLANNING

The IAEA, through the TC national project TOG2001, 'Strengthening and Building Capacity on Energy Planning Using IAEA Tools', is supporting Togolese professionals with on-the-job training in the use of IAEA energy models MESSAGE and MAED, including guidance on compiling and analysing energy data, preparing input data sets for MAED, analysing and interpreting model results, and developing scenarios for future energy demand.

Access to electricity in Rwanda is a priority for the government. The number of households with access to electricity has tripled in the last seven years, with 34.5% of households in the country now using electricity. The target is to provide electricity access to 70% of Rwandan households by June 2018 through a mix of connections to the national power grid and off-grid solutions. Through the national TC project RWA2001, 'Strengthening Energy Planning Capacity', the IAEA is helping Rwandan experts improve their understanding of the country's energy options. In 2017, customized and hands-on training and fellowships centred on analysis of the prevailing situation and emerging scenarios. Using Energy

RLA0054: Antigua and Barbuda energy planning experts and IAEA staff members. Photo: W.Foster/IAEA.

Balance Studio, the Rwandan team established an overview of the contribution of different fuels to Rwanda's economy, and with the energy demand tool MAED, Rwanda developed plausible scenarios for growth in energy demand. Using MESSAGE, the country has analysed energy supply strategies that respond to this growth in demand. These tools have helped Rwandan experts study the influence of social, economic, technological and policy changes on Rwanda's energy and electricity demand.

The IAEA continued to assist African Member States in sub-regional energy planning in 2017 under project RAF2010, 'Developing, Expanding and Reinforcing Energy Planning Capabilities including Nuclear Power (AFRA)'. Groups of countries in Central and Southern Africa updated and verified their national case studies and sub-regional interconnection projects. In addition, they developed sub-regional power supply scenarios and main assumptions. This has resulted in the development of sub-regional power pool models and sub-regional power supply strategies.

Regional project RLA0054, 'Strengthening the Planning, Design and Review of the Programme to Support the Implementation of Strategic Activities for Nuclear Technology and its Applications', is supporting Latin American and Caribbean Member States with strategic energy planning. Under this project, five national experts from Antigua and Barbuda were trained in energy planning at IAEA headquarters in Vienna, Austria, in November 2017. The aim of this training was to discuss strategies to analyse future energy demand, including demand management policies, in Antigua and Barbuda, using the IAEA's analytical tool MAED. In June 2017, a similar training took place in Antigua and Barbuda.

INTRODUCTION OF NUCLEAR POWER

In Bangladesh, the IAEA is supporting the implementation of the national Integrated Work Plan for nuclear power development. During the 2016–2017 TC cycle, the Agency provided support through three national TC projects, namely BGD2014, 'Developing Infrastructure for the First Nuclear Power Plant (NPP): Preparatory Stage Construction and Erection Phase', BGD9016, 'Assisting the Development of a Licensing Programme for Effective Regulatory Oversight of the First Nuclear Power Plant (Phase II)', and BGD9017, 'Strengthening of Radioactive Waste Management (RWM) Capabilities'. Bangladesh began construction of its first NPP on 30 November 2017.

In Turkey, an event was held within the framework of TUR2017, 'Building Human Resources Capacity for Establishing and Managing a Nuclear Power Plant', to share methods and tools designed to meet the challenges related to financing a NPP. Experts delivered presentations across a range of topics including financing and tariff setting, rates of return, risk allocation, sources of financing, the role of export credit agencies, credit enhancement, and key financial modelling metrics.

Polish project team members attended a training session on Nuclear Power Human Resources Modelling Tool for Nuclear Power Programme Development in November 2017 in Vienna, under TC project POL2018, 'Supporting the Development of Nuclear Power Infrastructure'. Under the same project, an IAEA ARTEMIS mission reviewed Poland's National Plan of Radioactive Waste and Spent Nuclear Fuel Management in 2017. The ARTEMIS team of senior experts from IAEA Member States concluded that Poland is well positioned to continue meeting high standards of safety for radioactive waste and spent fuel management in the country.

In Belarus, Phase 3 of the national Nuclear Power Programme is underway. In 2017, in the framework of BYE2006, 'Supporting Human Resources and Infrastructure Development for the Commissioning of the First Nuclear Power Plant', an IAEA expert mission advised national authorities on human resource development and reviewed the training programmes for senior leadership and management, operations main control room staff and field operators, maintenance staff, engineering support personnel, and technical support personnel.

In the former Yugoslav Republic of Macedonia, 15 participants from the electricity company ELEM, the Faculty of Electrical Engineering and Information Technologies at the University of Skopje, and the Ministry of Environment and Physical Planning attended a national workshop on 'Energy Technologies for Climate Change Mitigation and Sustainable Development: Potential Role of Nuclear Power', supported by project MAK2007, 'Preparing for Making a Decision on Entering into a New Nuclear Energy Programme'. Presentations were made on a series of topics, including the evolution of the climate change debate and the Paris Agreement, low carbon technologies, and sustainable development.

NUCLEAR FUEL CYCLE

In Africa, training in the technical and financial evaluation of uranium projects is being delivered with the support of the regional TC project RAF2011, 'Supporting Sustainable Development of Uranium Resources'. Through this project, Member States have enhanced their capacity to review national policies on exploration and mining of uranium resources, and have examined critical gaps in technology from exploration to production. In April 2017, Member States improved their ability to analyse data related to identified resources to create national uranium inventories at a regional workshop in Niger. This will eventually increase their capability to conduct a financial evaluation of commercial uranium projects.

Radiation Protection and Nuclear Safety

REGIONAL HIGHLIGHTS

Nuclear and radiation safety is still an area of high priority in Africa. Member States in the region are applying nuclear science and technology for development, and require IAEA support to ensure this is used in a safe manner. Progress has been made in implementing the International Basic Safety Standards throughout the continent, giving due attention to the different Thematic Safety Areas. The IAEA is continuing to provide support at both regional and national levels in order to develop national capacities in radiation protection and nuclear and radiological safety, and to strengthen the national radiation safety infrastructure.

The use of radiation technology continues to grow in the Asia and the Pacific region. Robust and sustainable radiation safety infrastructure is very important for the appropriate control of uses of radiation sources, and for protection for workers, patients, public and the environment, particularly in facilities in the medical and industrial field. Regional TC projects in radiation safety support Member States in these endeavours, providing focused support based on the status and the extent of radiation usage in the country/entity. The Agency provided various tools to support Member State efforts to manage regulatory activities, protect personnel occupationally exposed to radiation and conduct dose assessments for medical purposes. It also launched a regional effort to enhance emergency preparedness and response at the local, regional and international levels, focusing specifically on using radiation technologies to support the mitigation and recovery of civil structures affected by natural disasters.

It is now widely accepted that leadership and management of safety have a profound influence on the safe performance of nuclear installations, and they are essential in the development of a strong nuclear safety culture. The promotion of a safety culture and harmonised nuclear safety practices is an important priority for regional cooperation in Europe, including effective licensing and oversight processes for NPP design, construction, ageing management, and plant life extensions. In 2017, Agency support was provided to assist Member States in addressing radiation safety priorities in numerous diverse areas, including strengthening regulatory infrastructure, medical, occupational and public exposure control, and the safe management of DSRSs.

Several regional projects in Latin America and the Caribbean provided education and training in radiation protection and safety in 2017. Major initiatives included strengthening the radiation protection of patients and medical professionals, and improving control of radioactive sources and waste management. Another priority for the region was the strengthening of regulatory frameworks and infrastructure for radiation safety in Member States. Nineteen national projects for the 2018–2019 TC cycle, in the areas of nuclear safety and security, were designed in a workshop at IAEA Headquarters from 30 January until 3 February 2017. Another workshop, also in January 2017, defined safety and security regional priorities for the TC cycle 2018–2019, and resulted in the development of two regional projects that cover all IAEA Thematic Safety Areas.

GOVERNMENTAL REGULATORY INFRASTRUCTURE FOR RADIATION SAFETY

In Zambia, equipment to analyse and control food contamination and for personal radiation monitoring was provided to the Radiation Protection Authority under project ZAM9011, ‘Strengthening National Regulatory Infrastructure for Radiation Safety’. This

assistance has contributed to enhancing the regulatory infrastructure for radiation safety in Zambia.

Advisory missions on the establishment of regulatory infrastructure in radiation safety were organized in the Asia and the Pacific region under project RAS9073, 'Strengthening the Regulatory Infrastructure for Radiation, Transport and Waste Safety', for new IAEA Member States and countries/entities who have yet to establish the necessary legal and regulatory infrastructure. The missions increased awareness and understanding among senior officials, and on the basis of their findings, national action plan on the establishment of regulatory infrastructure with reference to the IAEA Safety Standards were provided to Brunei, Papua New Guinea and Vanuatu. As the main use of radiation technology in these Member States is for medical procedures, radiological protection of patients and medical workers is of particular importance.

A workshop on Implementation of Nuclear Knowledge Management Approaches and Challenges was held in Lithuania in April 2017, under the framework of LIT9015, 'Strengthening Competence in the Development and Assessment of the Ignalina Nuclear Power Plant Decommissioning Safety Justification Documents'. IAEA and international experts helped over 30 staff members to identify potential issues and challenges related to the development and implementation of knowledge management systems in Ignalina NPP divisions. A roadmap to establish a knowledge management programme at Ignalia NPP was developed, which will assist INPP in integrating nuclear knowledge management elements into the overall organizational management system.

In Latin America and the Caribbean, regional TC project RLA9079, 'Enhancing Governmental and Regulatory Safety Infrastructure to Meet the Requirements of the New IAEA Basic Safety Standards', provided capacity building to over 60 professionals on the regulatory aspects of new medical technologies such as cyclotron and PET-CT, as well as in radiosurgery practices. Additionally, a regional meeting on 'Leadership and Management for Safety', targeting decision-makers of regulatory authorities, conveyed the latest updates on GSR Part 2.

RLA9079: Facility visit, undertaken as part of the regional training course on Regulatory Control of PET-CT Cyclotron Facilities, October 2017. Photo provided by participant.

SUPPORTING SAFETY IN NUCLEAR POWER PLANTS AND RESEARCH REACTORS

The operational safety of NPPs in the Latin American region, in Argentina, Brazil and Mexico was improved in 2017 with the support of regional project RLA9080, 'Enhancing Nuclear Power Plant Life Management and Safety Culture Practices'. The project has significantly improved the exchange of comprehensive and reliable information on the implementation of a proper long-term operation programme to ensure the safe operation of NPPs until their authorized end of life, in accordance with the IAEA Safety Standards. In 2017, professionals from Latin American regulatory authorities and NPP operators participated in Operational Safety Review Teams and in Safety Aspects of Long Term Operation missions being implemented in other NPPs, facilitating the exchange of best practices for the safe operation of NPPs. Additionally, regional meetings throughout the year on common concerns such as supply chain, environmental qualifications and ageing management enhanced the collaboration and communication between Latin American NPPs. The forum on safety culture and operational safety for Latin American NPPs was also strengthened through several workshops for different audiences on safety culture, including decision-makers from NPPs, regulatory authorities and technical research institutes. This component also included the enhancement of safety culture processes through self-assessment trainings. Senior managers, policy makers (including governmental and regulatory authorities) and NPP personnel of organizations in Latin American Member States are now better informed about the requirements to ensure an acceptable level of safe operation of NPPs at each stage of the life cycle, including ageing management and long-term operation, based on IAEA Safety Standards, international best practices and national policy and strategy.

An Integrated Safety Assessment of Research Reactors (INSARR) follow-up mission, supported through POL1014, 'Implementing Technical Modifications to Enhance the Nuclear Safety of the Research Reactor MARIA', took place in Poland in 2017 to assess the safety of the Maria Research Reactor at the National Centre for Nuclear Research. The mission concluded that a good level of progress has been made to implement the recommendations and suggestions of the 2014 INSARR mission, with 21of 31 recommendations closed and all suggestions closed. The team also made two follow-up recommendations for further improvements.

RADIATION PROTECTION OF WORKERS, PATIENTS AND THE PUBLIC

Despite growing needs, opportunities for professionals in Africa to receive training in nuclear medicine are limited due to a shortage of experienced staff, facilities and equipment. Through the project RAF9059, 'Strengthening Member State Technical Capabilities in Medical Radiation Protection in Compliance with Requirements of the New International Basic Safety Standards', the IAEA is helping Member States to achieve a higher degree of radiation protection and to establish and put in place medical radiation protection programmes throughout the continent. In 2017, the IAEA organized a course in Lusaka, Zambia, for medical physicists, radiologists, technicians and regulators from across the region to improve their technical skills in assuring safety in nuclear medicine.

Radiation protection of workers is also an issue of major concern in many African Member States. Significant steps have been taken to enhance regional capacities and capabilities to monitor the doses received by occupationally exposed workers, with the support of project RAF9057, 'Strengthening National Capabilities on Occupational Radiation Protection in Compliance With Requirements of the New International Basic Safety Standards. In 2017, radiation protection professionals from Africa received training in external and internal dosimetry at several events.

Until 2017, Africa was the only region without an ALARA network. With the objective of improving occupational radiation protection, twenty-five Member States from Africa joined together to create the African ALARA Network (AFAN) in 2017. Following the ALARA principle, AFAN will facilitate the exchange of information, contribute to the harmonisation of radiation protection policies and practices, and promote the implementation of the ALARA principle. AFAN was created under the framework of project RAF9057.

Two 'Training the Trainers' Regional Training Courses for Radiation Protection Officers were offered under RAF9056, 'Strengthening Education and Training in Radiation Safety and Sustaining Human Resources Development and Nuclear Knowledge Management', to provide participants with theoretical knowledge of the roles, duties, and competencies of radiation protection officers in medical and industrial facilities, and the practical skills required to design and deliver a training sequence on radiation protection topics in their home countries. These courses were offered in French, in Côte d'Ivoire, and in English, in Ghana.

Radiation Protection Assessment missions to Palau, Fiji, Marshall Islands and Papua New Guinea in 2017, organized under project RAS9079, 'Strengthening Technical Capabilities in Asia and the Pacific Region for Medical Radiation Protection in Compliance with the Requirements of the New International Basic Safety Standards', and RAS9080, 'Enhancing National Capabilities on Occupational Radiation Protection in Compliance with Requirements of the New International Basic Safety Standards', raised awareness of established international safety standards and provided assistance in identifying strategies to accelerate the establishment of an adequate radiation safety infrastructure, for medical workers and patient protection in particular. National action plans comprising activities that the mission considers fundamental for the strengthening of radiation safety according to the IAEA safety standards was developed and embedded into the work plan of national TC projects for the 2018–2019 TC programme cycle.

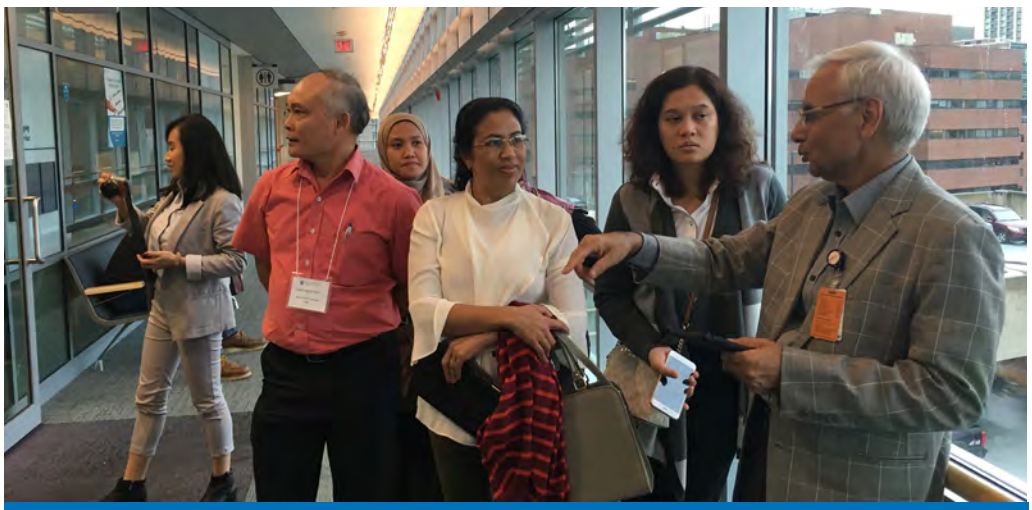
In 2017, 80 participants, including technical support providers, regulators and end users, attended three training modules that had been developed under RAS9080. The training increased the ability of technical support providers to assess occupational exposure, including the establishment of Quality Management Systems, and assisted regulators to

RAS9079 and RAS9080: Radiation Protection Assessment mission to Papua New Guinea and Fiji. Photo: M.Mishar/IAEA

RAS9080: Technical visit to facility for calibration of personal dosimeters in Japan. Photo: Chiyoda Technol Corporation

review and align their regulations on occupational radiation protection with the new GSR Part 3. For end users with activities in high exposure situations, updated information was provided with agreed recommendations to strengthen occupational radiation protection arrangements.

For the first time, a group of 32 national experts from 18 countries in the Asia and the Pacific region had the opportunity to learn and share experiences with the experts of a highly developed medical centre in the USA, the Massachusetts General Hospital, which is affiliated with Harvard University. The participants, including radiologists, medical physicists and technologists, increased their understanding of ways to strengthen the process of justification, the clinical decision support system, and the process to reduce doses in different medical modalities. As the participating experts have key roles in diagnostic radiology, they are contributing to the implementation of the radiation protection framework in medicine in hospitals in the region, and to improving the role of competent authorities in the implementation of proper medical exposure control.



RAS9079: Overview of Radiation Protection Programme for Patients at Massachusetts General Hospital. Photo: M.Mishar/IAEA.

RER9135: Regional Workshop on Patient Safety in Radiotherapy, 12-16 June 2017, Sofia, Bulgaria. Photo: J.Vassileva/IAEA.

RTC on Radiation protection in diagnostic radiology for radiographers, June 2016, Tallinn, Estonia. Photo: B.Brkljačić/ University of Zagreb School of Medicine, Croatia

Medical exposure control and patient protection remains an important issue which Member States in the Europe region have identified as a priority for collaboration with the Agency. Patient exposure is by far the largest radiation exposure to the human population from man-made radiation sources. It has significantly increased in the past decade through the number of examinations using modern equipment. The world's annual per capita collective radiation dose is increasing rapidly, nearly exclusively due to increased medical exposure, to the extent where it now equals or exceeds that from natural background in some countries. While medical uses of radiation bring considerable public health benefits, a systematic approach should be applied to ensure that there is a balance between being able to utilize the benefits from medical uses of ionizing radiation and minimizing the radiation risk to patients and medical staff.

Within the scope of project RER9135, 'Strengthening Radiation Protection of Patients and Medical Exposure Control', the Agency supported diverse activities related to radiation protection of medical staff and patients in 2017. The work was organized around ten priority actions and country-specific action plans were agreed by the counterparts. Standardized data collection tools and guidelines were developed and disseminated, which were used by a number of participating countries to carry out local or nationwide patient dose surveys. Multi-centric dose surveys were carried out in CT, hybrid imaging, dental cone-beam computed tomography and endourology. A large number of medical staff received training in English or Russian, and new training materials were developed and disseminated. A workshop was organized in Ljubljana, Slovenia, for inspectors from regulatory bodies, to share good practice in inspecting the implementation of radiation protection requirements for justification and optimization in medical exposure. Patient safety and prevention of accidental exposure in radiotherapy was the focus of a workshop in Sofia, Bulgaria. Thirty-two qualified radiotherapy medical physicist from 22 countries participated.

Also in Europe, a workshop on Justification and Appropriate Use of Imaging, organized in Zagreb in cooperation with the European Society of Radiology and the World Health Organization, demonstrated the need for flexibility in using certain methods and strategies. Local practices, healthcare technologies and economic issues need to be taken into account. The workshop confirmed the value of bringing together regulators and health professionals from the region. An Agency meeting was organized in conjunction with the 7th Eurasian Radiological Forum, organized by the Radiological Society of Kazakhstan, in collaboration with the Ministry of Health and other institutes. This meeting was the first of its kind and was held in the Russian language. The multidisciplinary participation succeeded in raising awareness of the important and increasing role of professional societies for improving safety culture in medical practice, and the need to bridge the gap between regulators and professional societies. The meeting recommended further targeting the sub-region with specific actions in Russian to strengthen the implementation of the International Basic Safety Standards.

Participants in the IAEA meeting organized in conjunction with the 7th Eurasian Radiological Forum, 10-13 October 2017 in Astana, Kazakhstan. Photo: L.Tokmagambetova/ Committee for Atomic and Energy Supervision and Control

In the Latin American and the Caribbean region, regional project RLA9075, 'Strengthening National Infrastructure for End-Users to Comply with Regulations and Radiological Protection Requirements,' supported workshops and courses to enable countries in the region to gain access to the latest strategies on radiation protection and optimization in dental radiology as well as in HDR brachytherapy, in line with the new IAEA Safety Standards on avoiding unnecessary exposure of patients. Both activities were carried out in end-users venues, health care institutions and in the Faculty of Odontology of Paraguay.

The Agency, with the support of RLA9075 and extra-budgetary contributions, conducted two Occupational Radiation Protection Appraisal Services (ORPAS) missions in Paraguay (May 2017) and Chile (November 2017). The Agency also conducted two preparatory ORPAS missions to Panama (July 2017) and Nicaragua (August 2017). Full missions for those countries are planned for the first half of 2018. Several good practices were identified in the area of occupational radiation protection relating to updating of the national regulatory frameworks based on the new BSS, implementation of quality systems by technical support organizations, increased use of radiation monitoring coverage of workers exposed, and implementation of national dose registries and medical surveillance. These achievements are direct, concrete results of the implementation of RLA9075 in the region.

In addition, substantial progress has been made in the establishment of a harmonized national dose registry in the region: 15 Member States are currently at different levels of implementation. Work is in progress to optimize the national dose registry system based on new IT requirements and regional needs. In addition, project RLA9075 provided for the promotion of a tool for risk assessment (SEVRRA) for radiotherapy and industrial radiography, and for the fostering and promotion of safety culture (GSR Part 2). The tool was developed by the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies.

Capacities in the Europe region for controlling public exposure to radon, in accordance with the new requirements of the IAEA Safety Standard on Radiation Protection and Safety of Radiation Sources as they apply to exposure due to radon in dwellings, were supported in 2017 by RER9136, 'Reducing Public Exposure to Radon by Supporting the Implementation and Further Development of National Strategies'. A major project output was the generation of an updated report summarizing progress in each participating country in the development of national radon action plans. This helped identify cooperation priorities and to establish a baseline for measuring progress in the region for controlling public exposure to radon.

TRANSPORT SAFETY

Following requests for national support in the field of transport safety in the Latin America and the Caribbean region, under the framework of project RLA9079, 'Enhancing Governmental and Regulatory Safety Infrastructure to Meet the Requirements of the New IAEA Basic Safety Standards', a pool of 13 experts from nine Latin American countries were selected to participate in a comprehensive Training of Trainers on Transport Safety of Radioactive Materials in Madrid, Spain in 2017. These experts are now actively engaged in the provision of transport safety support to other Member States in the region.

EMERGENCY PREPAREDNESS AND RESPONSE

A School of Radiation Emergency Management, attended by participants from 26 Member States, was implemented for the first time for African States with the support of RAF9055, 'Strengthening and Harmonizing National Capabilities for Response to Radiation Emergencies'. The school is designed to strengthen national and regional capacity to respond to nuclear and radiological incidents and emergencies, regardless of whether they arise from accident, negligence or deliberate act. Under the same project, a regional training course was organized in Ghana for radiological assessors in nuclear or radiological emergencies. Twenty-three participants from African Member States attended this course, which contributed to improving their preparedness and strengthening their national capabilities to respond to radiological and nuclear emergencies. Three additional schools were held for other TC regions, for example, in Mexico for Latin America, where the course was delivered in Spanish and attracted a high level of participation.

"A School of Radiation Emergency Management, attended by participants from 26 Member States, was implemented for the first time for African States."

RADIOACTIVE WASTE MANAGEMENT, DECOMMISSIONING AND ENVIRONMENTAL REMEDIATION

The regional project RAF9054, 'Strengthening Radioactive Waste Management (AFRA)', aimed to establish or improve radioactive waste management infrastructure in Africa, providing for greater safety and security of all radioactive waste. Activities focused on the improvement of human resource capacities, and both theoretical and practical hands-on-training activities were conducted for the technical staff of waste operators. Training and demonstration exercises were conducted in Morocco and Egypt, providing for theoretical and practical background for the safe management of radioactive waste arising from nuclear application in medicine, industry and research. Capacity is now available in African Member States to conduct operations for waste conditioning and storage of both low activity gamma sources and neutron sources.

An expert mission to Cyprus, supported under RER0041, 'Supporting Overall Programme Management and Sustainability', was carried out to address the safe management of DSRSs. The mission focused on updating the national inventory of DSRSs, including the characterization and categorization of all DSRSs, and on providing feasible options for the management of low and high activity DSRSs. During the mission, some devices containing DSRSs were dismantled and the radioactive sources were removed, characterized and safely stored.

In Georgia, the national project GEO9013, 'Developing Capability of the Waste Processing Facility to Treat Radioactive Waste, Including Liquid Radioactive Waste', is contributing to the development of a radioactive waste management system. In 2017, the Department of Radioactive Waste Management received expert advice from the IAEA on the processing of liquid radioactive wastes and the conditioning of secondary waste. Staff were trained in Romania and Slovakia. The continued support from the IAEA has contributed to improve the radioactive waste management system at the two operating facilities: the centralized storage facility located on the former research reactor site near the city of Mtskheta, and

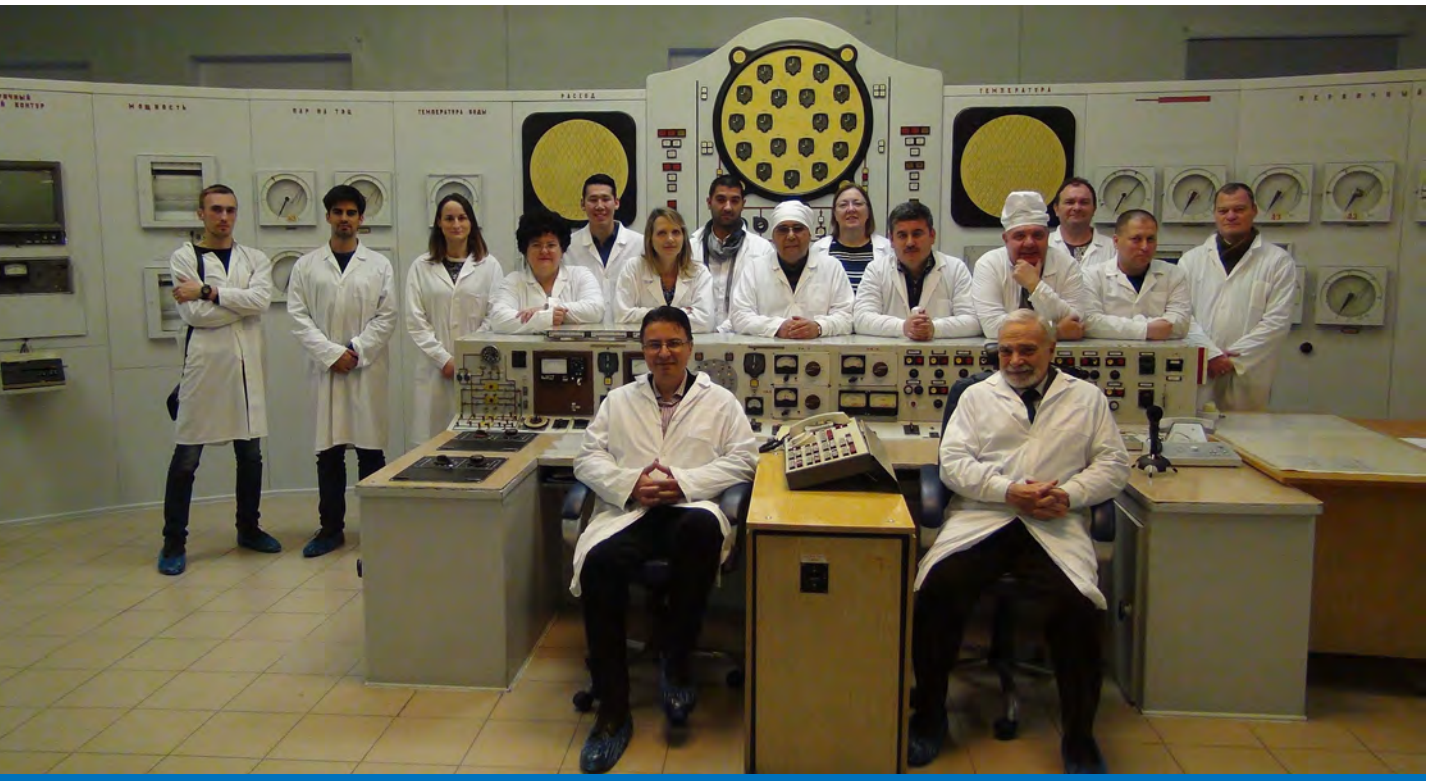
GEO9013: A view of abandoned repository in 2005 (left) and a view of the new cover of disposal in 2017 (right) at the Saakadze site. Photos: M. Ojovan/IAEA and G.Nabakhtiani/Nuclear and Radiation Safety Agency, Georgia.

the 'Radon' type facility located near the Saakadze village which started its operation in the former USSR. With the assistance of the IAEA, the US and EU, sealed and unsealed radioactive sources are being collected from Georgian territory. The centralized storage facility is now equipped with radiation detectors and security cameras on each floor and room. At the entrance there are two fingerprint systems to enhance safety and security, and the site is under 24-hour security police control.

A TC training course on the modalities and rules of site remediation programme management, supported through RER9145, 'Supporting Human Resource Capacity Building for Developing and Implementing Integrated Programmes for Remediation of the Areas Affected by Uranium Mining', took place in November 2017 in Obninsk, Russia. With the support of Rosatom, the project enabled fifteen participants from five Member States in the Europe region (including Central Asia) to benefit from expert lectures and group activities delivered in Russian. The training focused on (1) the principles and radiological criteria used in decision making processes related to the remediation of contaminated sites, (2) the mechanisms for identification and characterization of such sites, as well as (3) the description of the strategies and technologies applied in the remediation process, particularly the Eurasian Economic Community Member States' Inter-State Target Programme for Reclamation of Areas Affected by Uranium Mining. The training was delivered by Rosatom Technical Academy experts, together with IAEA technical officers.

The importance of decommissioning is increasing with the ageing of nuclear facilities such as NPPs, research reactors and nuclear fuel cycle facilities, as well as of medical, industrial and small research facilities. Regional project RER9138, 'Enhancing Capacities

RER9138: Site visit to Chernobyl Nuclear Power Plant during regional workshop on risk management in decommissioning, Slavutich, Ukraine. Photo: State Enterprise Chernobyl NPP.



Site visit to the AM-1 NPP in Obninsk, Russian Federation, during the Regional Workshop on Transition and Management of Decommissioning on a Multi-Facility Site. Photo: Center for NPP Personnel Training Rosatom Technical Academy (Rosatom Tech).

in the Member States for Management of Decommissioning Projects', focuses on specific facility types, advanced technologies, management of decommissioning waste, and decommissioning end-state. Various capacity building activities were carried out under the project through regional workshops and expert missions. Emphasis was placed on issues related to the decommissioning of small medical, industrial and research facilities; the release of decommissioning material and waste from regulatory control; risk management in decommissioning; transition and management of decommissioning on a multi-facility site; and decommissioning end state.

The project supported the participation of more than 50 experts at international events, during which they were able to showcase national achievements, exchange information and get international updates on decommissioning activities. The TC programme sponsored participation in the IAEA Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) workshop; the Second Annual Meeting of the International Project on Irradiated Graphite Processing Approaches; the 10th International Symposium on Exemption and Clearance, and the Annual International Decommissioning Network Forum.

National radioactive waste management capabilities in Latin America and the Caribbean are being strengthened through regional project RLA9078, 'Enhancing the National Regulatory Framework and Technological Capabilities for Radioactive Waste Management'. Three major regional events were organized in 2017. Over 60 professionals from 19 countries in the region enhanced their knowledge of topics including identification and control of existing exposure situations and NORM scenarios, and disposal options for low-level waste and disused sources.

The recovery work of DSRSs in Latin America and Caribbean also continued throughout 2017 under the same project. One of the most relevant cases was that of the El Mochito Mine in Honduras, were gauges were recovered, characterized and prepared for transportation to the national storage facility in Tegucigalpa. The recovered sealed sources will now be either returned to the country of origin for recycling and reuse, or prepared for final disposal by the Honduran authorities. With the implementation of RLA9078, the safety and security

RLA9078: Members of the IAEA expert mission inspecting radioactive material. Photo: IAEA.

of all DSRSs in Honduras has been substantially improved. During the final coordination meeting, it was observed that all project objectives had been achieved and that the region's situation upon completion of the project has consistently improved in terms of Member States' capacity for the management of radioactive sources and the protection of people and the environment.

Nuclear Knowledge Development and Management

Nuclear technology requires a high level of technical expertise and experience that must be developed and kept accessible to current and future generations. Assistance to African Member States in nuclear knowledge management aims to improve knowledge sharing in order to successfully leverage technical knowledge and capacities within Member States. This is achieved through targeted interventions in higher education, training and related research in nuclear science and technology. IAEA TC programme activities also focus on the creation of successful networks that serve as platforms for this knowledge management.

Capacity building, human resource development and knowledge management is key for achieving sustainability and a successful programme in the Asia and the Pacific region. The Agency assists with the development and management of nuclear knowledge in various fora, from promoting nuclear science and building interest in science, technology, engineering and mathematics amongst students, to establishing innovative platforms for Member States to exchange knowledge.

In Europe, the IAEA continues to provide assistance to improve the functioning of national nuclear institutions and other users of nuclear technology. Young professionals from the nuclear industry have been able to strengthen their skills and knowledge in the field of nuclear science and technology and nuclear power technology by participating in the Intercontinental Nuclear Institute.

Knowledge management in nuclear technology in and among Latin American and Caribbean countries is rather limited, and human resource management has posed ongoing challenges. For many Member States, a lack of qualified personnel and an ageing workforce pose very concrete limitations, exacerbated by the long lead times required to develop qualified nuclear science and engineering professionals. This issue is especially important for new Caribbean Member States which require strong support from the Agency in order to build a qualified workforce that is able to keep up with nuclear applications in different areas.

"In July 2017, a regional training course on the development of e-learning materials for teachers was organized by the Latin American Network for Education in Nuclear Technology (LANENT) through the TC regional project."

CAPACITY BUILDING, HUMAN RESOURCE DEVELOPMENT AND KNOWLEDGE MANAGEMENT

Under the TC regional project RAF0047, 'Promoting the Sustainability and Networking of National Nuclear Institutions for Development', representatives of the 12 participating Member States were trained in the development and implementation of Strategic Action Plans to enhance the sustainability of national nuclear institutions (NNIs) in 2017. The participants included managers, high-ranking decision-makers and strategic planners from participating countries, responsible for developing and managing the Strategic Action Plans of their NNIs. Strategic Action Plan development and implementation is part of renewed AFRA efforts to help Member States to sustain their national nuclear infrastructure.

In July 2017, a regional training course on the development of e-learning materials for teachers was organized by the Latin American Network for Education in Nuclear Technology (LANENT) through the TC regional project RLA0057, 'Enhancing Nuclear Education, Training, Outreach and Knowledge Management'. The training, held in Costa Rica, was delivered using a 'blended-learning' modality. This included a pre-training completed through the educational portal of LANENT, followed by in-person training. Twenty-four participants from nine Member States attended the course. In September 2017, the project helped seven professionals from Argentina, Brazil, Cuba, Costa Rica and Nicaragua attend the Joint International Centre for Theoretical Physics-IAEA School of

RAF0047: Participants at the regional workshop on development and implementation of Strategic Actions Plans. Photo: M.Edwerd/IAEA

Nuclear Knowledge Management. The project also supported participation in the Second International Symposium on Nuclear Education, Training, and Knowledge Management in November 2017 in Buenos Aires. Finally, in December, the IAEA supported the Second National Nuclear Knowledge Management School in Argentina, organized by LANENT and the National Atomic Energy Commission of Argentina. Forty-three professionals from the Argentinian nuclear sector attended the school.

Annex 2. TC Programme Fields of Activity[32]

Nuclear Knowledge Development and Management
Capacity building, human resource development and knowledge management (01)
Building national nuclear legal infrastructures (03)
Nuclear Instrumentation (33)
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)
Energy Planning and Nuclear Power
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
Prevention and control of cancer (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
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)

[32] Updated in 2016 for the IAEA TC programme 2018–2019. The field of activity number is shown in parentheses.

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

International Atomic Energy Agency
Vienna International Centre, PO Box 100
1400 Vienna, Austria
Tel.: (+43-1) 2600-0
Fax: (+43-1) 2600-7
Email: Official.Mail@iaea.org

www.iaea.org/technicalcooperation

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