

Technical Cooperation Report for 2015

Report by the Director General



IAEA

60 Years

Atoms for Peace and Development

Technical Cooperation Report for 2015

Report by the Director General

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Preface

The Board of Governors has requested the transmission to the General Conference of the attached Technical Cooperation Report for 2015, the draft of which was considered by the Board at its June 2016 session.

The Director General is also hereby reporting in fulfilment of the request contained in resolution GC(59)/RES/11 on "Strengthening of the Agency's technical cooperation activities".

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Summary

The *Technical Cooperation Report for 2015* responds to General Conference resolution GC(59)/RES/11. It 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 2015. 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.

Part A.1 provides an overview of the Agency's technical cooperation (TC) activities in 2015, beginning with the global development context for the TC programme. It highlights the contribution of the TC programme to the achievement of, inter alia, the United Nations Millennium Development Goals, and the importance of collaborative and intersectoral approaches in addressing the new Sustainable Development Goals, and outlines IAEA participation in the global development dialogue. The report then illustrates how the TC programme is tailored to respond to the specific needs and priorities of each region, describing new areas that require specialised attention, such as the needs of small island developing States. It outlines recent efforts to develop human resources and build capacities through postgraduate training, assistance in drafting legislation, distance learning and networking and technical cooperation among developing countries. Part A.1 also presents a snapshot of TC projects on the industrial use of radiation technology, reflecting the 2015 Scientific Forum topic.

Part A.2 focuses on efforts to build a more efficient and effective TC programme, in particular on ongoing efforts to strengthen the Country Programme Framework template. Progress made in 2015 in maximizing programme impact through strategic partnerships, both with the United Nations (UN) and with other relevant international and regional organizations is presented. Part A.2 also covers actions undertaken in 2015 to improve the TC programme, notably through training in the logical framework approach, quality reviews, and enhancements to the Project Progress Assessment Report. It closes with an overview of outreach efforts.

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 2015 totalled €65.5 million (not including National Participation Costs, assessed programme costs or miscellaneous income), or 93.8% of the TCF target set for the year¹. New extrabudgetary resources for 2015 came to €11.9 million and in-kind contributions were €0.7 million. Overall, implementation for the TCF reached 84.8% in 2015, and safety, health and nutrition, and food and agriculture were the top areas of disbursement for the programme.

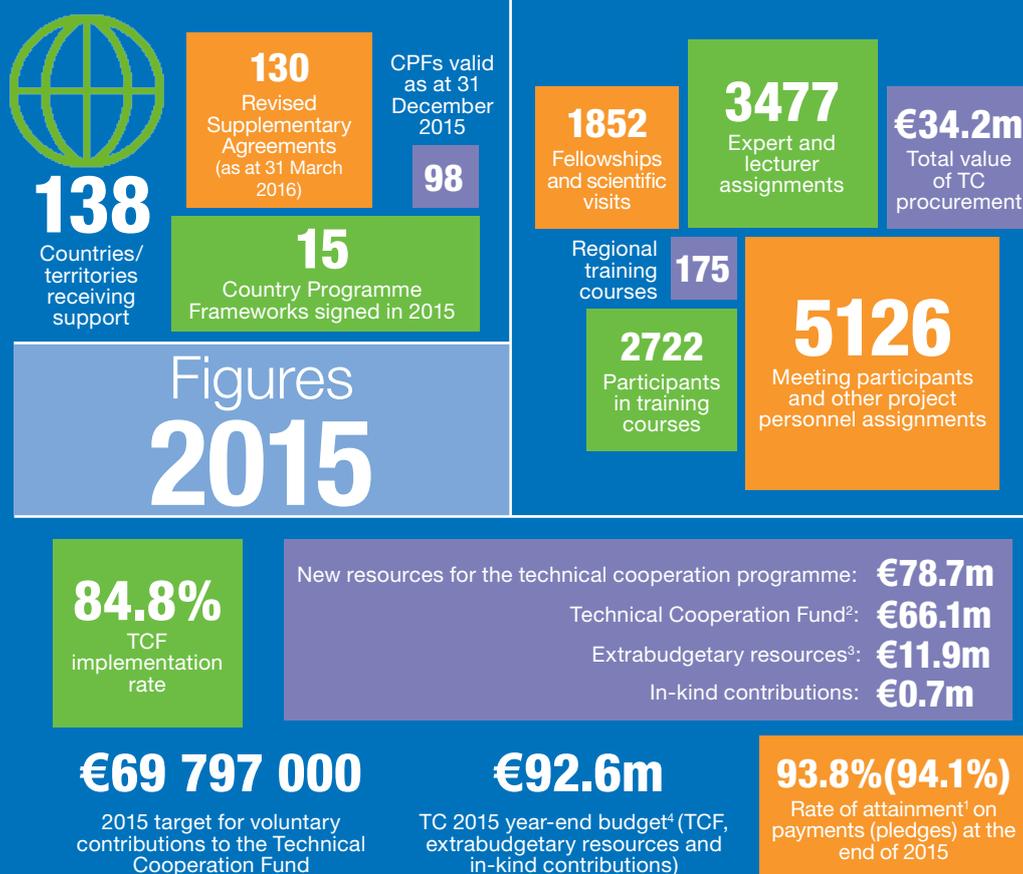
Part C highlights programme activities and achievements, and covers assistance to Member States in the peaceful, safe, secure and regulated application of nuclear science and technology. It highlights regional activities and achievements in technical cooperation in 2015, and presents an overview of the 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.

¹ Total payments received in 2015 include €2.4 million either of deferred or of additional payments by 16 Member States. Excluding these payments, the 2015 rate of attainment on payments would have been lower by 3.4%.

The Agency's Technical Cooperation Programme in Figures

(as of 31 December 2015)



¹ Total payments received in 2015 include €2.4 million either of deferred or of additional payments by 16 Member States. Excluding these payments, the 2015 rate of attainment on payments would have been lower by 3.4%.

² Including TCF payments, National Participation 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.

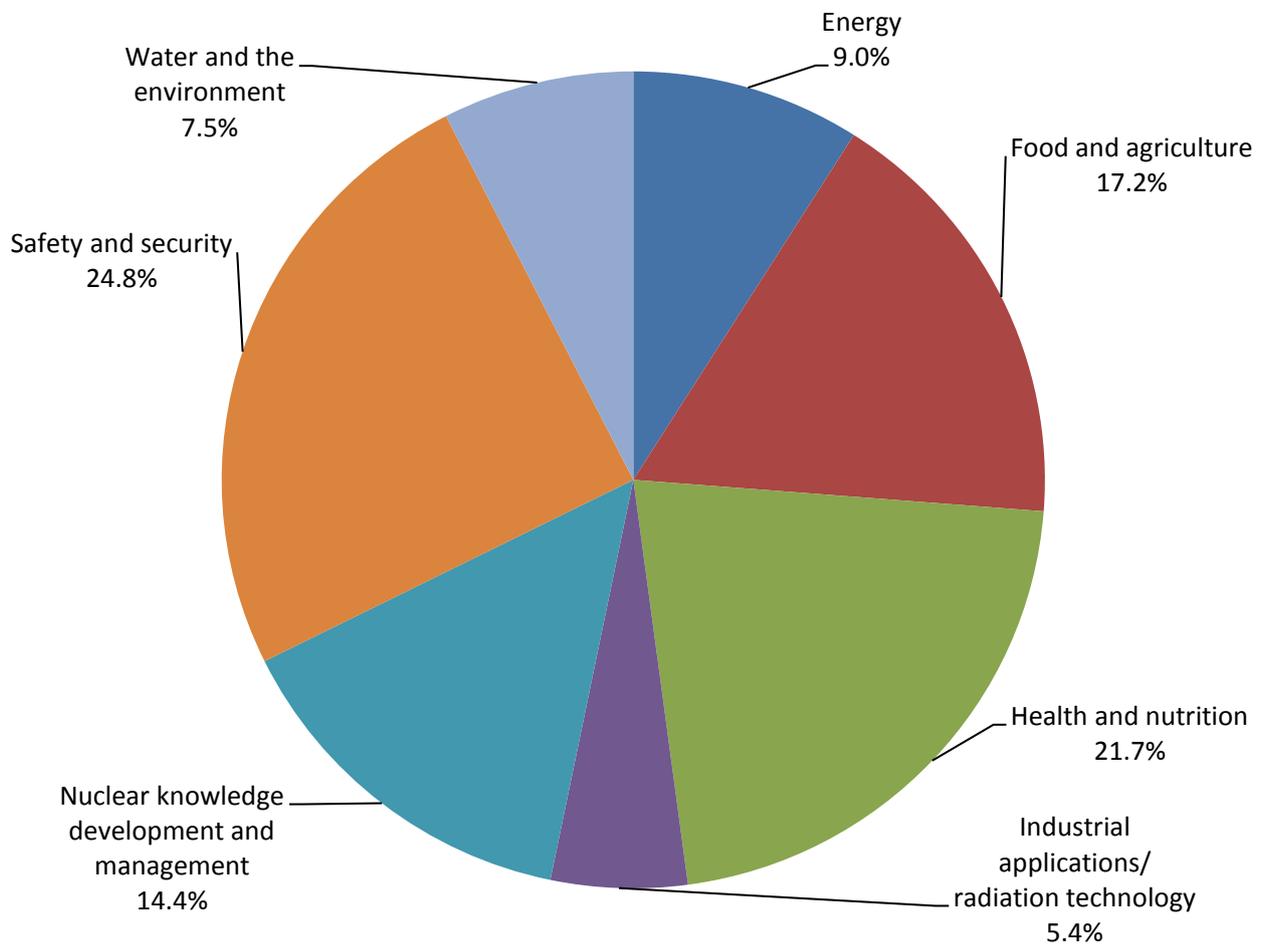


Figure 1: Actuals by technical field for 2015.⁵

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

Technical Cooperation Report for 2015

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(59)/RES/11.

Part A of the report provides an overview of the progress achieved in delivering the technical cooperation programme during the period from 1 April 2015 to 31 March 2016.

Part B reports on the management of financial resources and programme delivery at an aggregate level in the calendar year 2015.

Part C reports on regional activities and programme achievements during 2015.

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 Activities⁶

A.1. TECHNICAL COOPERATION IN 2015: AN OVERVIEW⁷

Global developments in 2015: The context for the TC programme

The IAEA's technical cooperation (TC) programme supports the peaceful, safe and secure application of nuclear science and technology for sustainable socioeconomic development, in full partnership with Member States. The programme is a One House endeavour, developed and implemented jointly by the Department of Technical Cooperation and the technical Departments in cooperation with other Departments and Offices, and uniting both technical and developmental proficiency. It plays an important role in helping Member States to bridge the gap between the achievement of technical competencies, and the application of these competencies for human progress. The programme provides assistance in a wide range of development areas, including health, food and agriculture, water and the environment, and industrial applications. It works in partnership with lead agencies in these areas, in particular United Nations organizations, and with due regard to the global development framework.

The TC programme helps countries gain capacities to use scientific tools effectively in order to understand and tackle their key development challenges. Evidence-based development solutions, backed by credible data, have been vital to the successful achievement of national and international development initiatives such as the United Nations Millennium Development Goals (MDGs), which concluded in 2015. The programme has contributed to national achievements in five of the eight MDGs, namely: MDG 1, Eradicate extreme poverty and hunger; MDG 4, Reduce child mortality; MDG 5, Improve maternal health; MDG 6, Combat HIV/AIDS, malaria and other diseases; and MDG 7, Ensure environmental sustainability. In addition, the TC programme has supported both gender equality and women's empowerment (MDG 3), in particular through its training and education programmes, and the global partnership for development (MDG 8). On average, over the ten years leading up to the conclusion of the Goals, between 40% and 50% of TC funds were disbursed in MDG-related areas.

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The post-2015 Development Agenda and the Sustainable Development Goals

Agenda 2030 and its sustainable development goals (SDGs), approved by the UN General Assembly in September 2015, provide a broad framework that will guide national and international development actors over the next fifteen years. As the successor to the MDGs, the SDGs are intended to build upon previous work in thematic areas such as human health and nutrition, environmental sustainability and education. The SDGs offer,

⁶ Section A responds to section 2, operative paragraph 2 of resolution GC(59)/RES/11 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(59)/RES/11 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.

however, a much more comprehensive framework in terms of the range of thematic issues addressed, as well as in terms of the recognition given to the complex connections and interdependencies between thematic goals and targets. As such, the SDG framework encourages actors to adopt collaborative and inter-sectoral approaches to tackling development challenges. For the IAEA, this provides further impetus to the cooperative approach that the Agency has taken, for example, through the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, the signing of United Nations Development Assistance Frameworks (UNDAFs), and through participation in relevant international networks and fora such as the UN Convention on Combatting Desertification and the UN Framework Convention on Climate Change.

In July 2015, the UN General Assembly endorsed the 'Addis Ababa Action Agenda' of the Third International Conference on Financing for Development. In addition to highlighting ways in which developing countries can increase public sector resources and promote growth and investment, this Agenda explicitly recognizes science, technology, innovation and capacity building as 'integral elements of [...] national sustainable development strategies', and encourages countries to take measures to facilitate technology transfer and support science and technology education. Nuclear science and technology, in particular, have a contribution to make and the Agency plays an important role in making nuclear science and technology available to improve the lives of people everywhere.

Agenda 2030 and the approved SDG framework, among others, reflect IAEA Member States' national developmental priorities and provide a significant impetus to the future direction of the TC programme. Likewise, the 2015 Climate Change Conference in Paris calls for a concerted and globally aligned support to sustainable environmental management and to climate change adaptation and mitigation approaches. One very important strategy for achieving the new development agenda, as reflected in goal 17 of the SDGs ('Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development'), is to mobilize science and technology directed to sustainable development. Here, the Agency will make significant contributions in support of food security and nutrition, environmental management, including marine, terrestrial and coastal resources, human health and cancer control, energy security, and climate change adaptation and mitigation.

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Global development dialogue

The Agency has participated actively in the global development dialogue through such fora as the World Water Forum in Daegu, Korea, the African Union Task Force on Food and Nutrition Development in Johannesburg, South Africa, and the United Nations Convention to Combat Desertification (UNCCD) Conference of Parties (COP12) in Ankara, Turkey. At the World Water Forum, the Agency and United Nations Educational, Scientific and Cultural Organization (UNESCO) brought attention to the Nubian Aquifer project initiative, jointly implemented by the IAEA, UNESCO, United Nations Development Programme (UNDP) and co-funded by the Global Environment Facility (GEF). At the UNCCD COP12 the Agency organized a side event jointly with the Ministries of Environment of Morocco and Madagascar to draw attention to soil research that is contributing successfully to sustainable watershed management in these countries. Cooperation has been strengthened with UNCCD and national UNCCD focal points in Ministries of Environment using project results and scientific data in support of regional soil and water management in Africa, Asia and Latin America and the Caribbean. In the realm of food security and nutrition, the Agency participated in the African Union Task Force on Food and Nutrition Development and introduced TC nutrition activities and research topics that are contributing to the evidence base of national nutrition programmes.

Such meetings provide an opportunity to showcase how the work of the Agency is contributing to the global development agenda, and to forge and enhance operational partnerships with UN organizations, multilateral and bilateral agencies and non-

governmental organizations. Partnering in key areas of IAEA expertise is a critical element of the present and future TC programme. Particular attention has been paid to maximising programme impact by improving interaction and strategic partnerships with UN system organizations.

The Agency is also an active member of the United Nations Interagency Task Force (UNIATF) on the Prevention and Control of Non-communicable Diseases (NCDs). This Task Force, established by the UN Secretary-General in June 2013, coordinates the activities of relevant UN organizations and other inter-governmental organizations to support governments' efforts to meet their high-level commitments to respond to NCDs. The IAEA is collaborating with other UN organizations in the development of two joint UNIATF cancer related projects.

Cooperation with the Scaling Up Nutrition (SUN) movement and Ministries of Health has been enhanced and an interregional project, INT/6/058, 'Contributing to the Evidence Base to Improve Stunting Reduction Programmes', has been formulated together with nutrition research counterparts, Ministry of Health representatives, SUN focal points, the United Nations Children's Fund (UNICEF), the World Bank, Care International, and the Inter-American Development Bank. A pre-project meeting brought together the IAEA and project partners in Vienna in 2015 to develop the interregional project.

Tailoring the TC programme to Member State needs⁸

The IAEA'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. Support is customized to meet the specific needs of individual countries, sub-regions and regions. These needs are identified through Country Programme Frameworks (CPFs), national development plans, regional profiles and strategic frameworks. Interregional projects deliver TC support across national and regional boundaries and address the common needs of several Member States in different regions.

In 2015, the Agency supported 45 African Member States, of which 26 were least developed countries (LDCs), through its TC programme. For the first time in many years, assistance was provided to Liberia within the context of the IAEA response to the outbreak of Ebola virus disease (EVD). Efforts in the region in 2015 focused on continued delivery of support to Member State efforts to alleviate poverty and foster socioeconomic development. The TC programme in Africa is designed to meet the region's specific national and regional development needs and priorities, as reflected in individual CPFs and in the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) Regional Strategic Cooperation Framework. Food and agriculture and human health continue to be the two largest priorities in Africa.

Most African LDC's needs rotate around health, food and agriculture, water and environment issues. Some of the challenges affecting LDC participation in the TC programme include inadequate planning of functions and mechanisms, programme formulation and design, and programme implementation. However, the most critical issue is that skilled staff and well trained human resources are insufficient to meet the region's needs as regards the application of nuclear technology for socioeconomic development. The Agency has made deliberate efforts to address such issues through CPFs, the main planning modality of each Member State, and through regional arrangements, resulting in an enhanced focus on thematic areas of the TC programme that are key to addressing the needs of LDCs.

The Asia and the Pacific region comprises 36 Member States and territories, of which eight are LDCs and five are small island developing States (SIDS). To enhance the

“Support is customized to meet the specific needs of individual countries, sub-regions and regions.”

⁸ This section responds to section 3, operative paragraph 1 of resolution GC(59)/RES/11 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.

effectiveness of TC programme delivery to new Member States, including SIDS, the Agency is developing a sub-regional approach for focused capacity building support that will best meet their specialized development needs. A coordinated approach to SIDS is required as they face unique developmental challenges linked to geographic isolation, economies of scale and demographic changes. As a beginning, national progress in establishing or further developing an effective regulatory infrastructure is being assessed, with the aim of establishing a strong radiation safety infrastructure, including the establishment of an effectively independent regulatory authority and the promulgation of the necessary legal framework.

In 2015, the TC programme in the Asia and the Pacific region focused on building capacity in nuclear safety in 12 countries with the highest needs, through tailor-made comprehensive training programmes for the staff of regulatory bodies, radiation protection officers and users of radiation technology. In addition, close mentoring and guidance by more advanced neighbouring Member States is foreseen, which will include hosting fellows for on-the-job experience, as well as the provision of radiation monitoring equipment to enhance the capacity of both regulatory bodies and users in LDCs and SIDS to monitor external radiation exposures.

In 2015, 32 Member States in the Europe region received support through a total of 127 national and 47 regional projects. The array of nuclear technologies in use in the region is wide and there are national and sub-regional differences in the prioritization of their use. As a result, a number of 'sub regional' projects have been designed to address specific common needs of groups of countries in the region. Due to the widespread use of nuclear technologies in sectors such as energy, health, environment and industry, radiation safety is a top priority in the Europe region. While most Member States in the region have well-functioning regulatory infrastructures, some countries, however, have yet to achieve compliance with relevant IAEA Safety Standards. Several projects are aimed at addressing gaps in this respect. Another focus is related to nuclear safety in the context of new nuclear power plants (NPPs) and lifecycle extensions of old NPPs. In addition, the decommissioning of old research reactors and NPPs, as well as nuclear waste and remediation of old uranium mining sites, are increasingly becoming priorities for many Member States.

In 2015, the Agency supported 28 Member States in the Latin America and the Caribbean region, including new Member States Guyana, Antigua and Barbuda, and Barbados. Haiti is the only LDC in the region. There was a marked increase in the number of Member States from the Caribbean, and a subsequent increase in national TC programmes: the first national programmes for Bahamas, Dominica and Trinidad and Tobago were approved by the Board of Governors as part of the 2016 2017 TC programme. To better reflect the Member States being supported by the Agency in this region, the Director General approved a change to the title of the Division for Latin America (TCLA), Department of Technical Cooperation, which is now the Division for Latin America and the Caribbean (TCLAC). Efforts in the region in 2015 focused on strengthening nuclear and radiation safety in Member States, and on increasing collaboration between national authorities – with a special focus on the Ministries of Health – in order to create positive synergies with the Nuclear Regulatory Authorities to protect patients, workers and public in the face of the rapid expansion of new technologies in the medical and industrial fields. The development of the first national technical cooperation programmes for new Member States, assessing and establishing the initial assistance they required to address national needs in the areas of health, agriculture and regulatory infrastructure, was a highly important achievement. Efforts were also concentrated on emerging issues, such as controlling the fruit fly outbreak in Dominican Republic, and preventing its spread to other countries in the region.

Developing human resources and building capacities⁹

The TC programme is designed to build sustainable Member State capacities in the peaceful, safe and secure application of nuclear science and technology. It focuses on human resource development – delivered through fellowships, scientific visits, training courses, meetings and workshops – and on the provision of expert advice and equipment. A combination of activities in support of capacity building, knowledge sharing, networking and partnership ensures the long-term sustainability of TC projects.

A Strategic Capacity Building Approach (SCBA) was successfully initiated in the Asia and the Pacific region in 2015 to enhance programme efficiency and effectiveness. The SCBA aims to identify training need synergies and complementarities in the region, and to coordinate a systematic approach to the delivery of human resource development. A systematic analysis of training needs for the 2016 2017 TC cycle was made to facilitate the grouping of similar requests, and to encourage the identification of potential resource centres in the region.

Specialized group training was provided in a number of cases in response to specific country needs, using custom-designed group training programmes. For example, arrangements were made with two host institutes in Sweden and Ukraine to train 21 Iraqi fellows, supporting the Iraqi national programme for the decommissioning and remediation of Iraq's former nuclear facilities and sites. In addition, a two-week group fellowship training programme for 20 Iranian senior engineers was organized under IRA/2/012, 'Increasing NPPD's Capability in Planning and Implementing Activities Related to Design and Construction of Two New Pressurized Light Water NPP Units in Bushehr with Emphasis on Safety'. The programme, which utilized governmental cost-sharing funds, was held at the International Construction Training Centre, Beijing, China in August and September 2015. The programme trained the participants to prepare a new nuclear power programme, covering aspects related to pre-construction, construction, management, and pressurized water reactor technology.

In the Europe region two major regional projects were concluded in 2015, providing training opportunities for medical physicists from Russian-speaking countries (RER/6/030 and RER/6/025, 'Building Capacity for Medical Physics in Radiation Oncology in the Commonwealth of Independent States'). Over the past 4 years some 200 experts from different Member States have been trained in courses that were developed and conducted by the Medical Physicists Association of Russia based at N.N. Blokhin Russian Cancer Research Centre. Participants were able not only to improve their skills and knowledge in medical radiotherapy physics, but also to interact with colleagues and to exchange experience on practices and lessons learned. Russian extrabudgetary support amounted to nearly 2 million US dollars.

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Building competence through postgraduate training

A new Agreement between the IAEA and the Abdus Salam International Centre for Theoretical Physics (ICTP) concerning Agency support for the implementation of a Medical Physics Programme at Trieste University and the ICTP was signed in 2015 and implementation was begun. The Agreement provides a framework for Agency assistance to Member States under INT/6/057, 'Establishing a Joint IAEA/ICTP International Post-Graduate Medical Physics Education Programme', offering two years of academic studies with clinical training, at the end of which successful fellows from all TC regions can obtain their MSc in Medical Physics. Twenty-seven students are already participating in the programme: the first group of six students are expected to graduate at the end of 2016, and the second group of 21 started in January this year and are expected to graduate at

⁹ This section responds to section 2, operative paragraph 1 of resolution GC(59)/RES/11 on facilitating and enhancing the transfer of nuclear technology and know-how among Member States.

the end of 2017. The new fellows are from IAEA Member States which lack adequate post-graduate education programmes in medical physics, particularly low- and middle-income countries in the Africa, Asia and the Pacific, Latin America and Caribbean, and Eastern Europe regions.

Post-graduate education courses (PGECs) on Radiation Protection and Safety of Radioactive Sources were delivered in Africa, Asia and the Pacific, and Latin America and the Caribbean to build the capacities of the personnel of national regulatory bodies. Training covered the principles of radiation protection and regulatory control, assessment of external and internal exposures, protection against occupational exposure, medical exposure in diagnostic radiology, radiotherapy and nuclear medicine. The courses provide effective support to the educational and initial training requirements of graduate level staff earmarked for positions in radiation protection, including health physics.

In Africa, PGEC training was delivered in English, French and Portuguese to 40 professionals from national regulatory authorities and bodies in 2015, contributing to increasing the number of qualified radiation protection officers in Africa, and thus enhancing the delivery of technical services of national regulatory bodies. Under the project, a syllabus for a MSc programme on Radiation Protection and Safety of Radiation Sources has been developed and a lecture package prepared and delivered. In Asia and the Pacific, PGEC training in 2015 enabled more than 30 young professionals from the region to acquire a sound basis in radiation protection, as well as a knowledge of related safety fundamentals. In Latin America and the Caribbean, the PGEC training was conducted in partnership with the Argentinian Nuclear Regulatory Authority and the Brazilian Nuclear Energy National Commission, and benefited a total of 12 young professionals from nine countries in the region and one Portuguese speaker from the African region in 2015.

Distance learning

Distance learning initiatives are also important in ensuring both the accessibility and the sustainability of the TC programme. For example, the IAEA Distance Assisted Training Online (DATOL) platform was launched in 2014 as a harmonized, web-based, distance learning programme suited for personal study, continuous professional development, and formal vocational training for nuclear medicine professionals. The platform is now being used in a number of regional projects, allowing increased, sustained and more cost-effective participation. For example, TC project RAS/6/064, 'Building Capacity with Distance Assisted Training for Nuclear Medicine Professionals', and RAS/6/066, 'Reducing the Shortage of Oncology Professionals through an Applied Sciences of Oncology Course (ASOC)', have both used DATOL, taking advantage of the distance learning platform to address specific skill gaps, and facilitate access to knowledge and continued professional development. The DATOL platform is available through the Human Health Campus.

A repository and remote clinical training programme in the area of medical physics for radiation therapy, diagnostic radiology and nuclear medicine has been established under the regional project RAS/6/077, 'Strengthening the Effectiveness and Extent of Medical Physics Education and Training (RCA)'. The training platform, called the Advanced Medical Physics Learning Environment (AMPLE) will support the management of medical physics clinical training centres in the Asia and the Pacific region and will act as a resource for e-learning material in medical physics for the region. The platform will be piloted in selected countries, including the Philippines and Thailand, in collaboration with relevant regional professional bodies. Guidelines for regional standards in accreditation of institutions and certification of individuals for medical physics education and training have been drafted. In addition, targeted surveys have been used to determine current medical physics workforce roles and capacity, which will provide information about regional needs for medical physics in radiation medicine, and the need for recognition of the medical physics professional in the region.

Following the successful completion of the Virtual University for Cancer Control and Regional Training Network's (VUCCnet) pilot phase in 2014, the online cancer training platform underwent a comprehensive assessment with a view to increase its impact and

“Distance learning initiatives are also important in ensuring both the accessibility and the sustainability of the TC programme.”

geographical reach in the future. The review identified a demand for VUCCnet services from medical professionals and the potential for its expansion across Sub-Saharan Africa. A course module on clinical oncology was added to the VUCCnet portfolio.

Technical cooperation among developing countries and networking

The IAEA regional programmes are an essential tool to promote technical cooperation among developing countries (TCDC), foster the exchange of best practices, and promote networks. In Africa, much of this work is done through AFRA. In 2015, AFRA States Parties contributed €289 211 to the AFRA Fund, a voluntary mechanism for AFRA States Parties to provide additional financial resources. In addition, AFRA project RAF/0/038, 'Promoting Technical Cooperation Among Developing Countries (TCDC) in Africa through Triangular Partnerships', has supported several TCDC initiatives. This innovative modality has supported training for postgraduate students in nuclear engineering in Sudan, and the completion of radon sampling campaigns, with sample analysis, in Côte d'Ivoire. Thanks to extrabudgetary contributions made by the US through the Peaceful Uses Initiative (PUI), non-destructive testing (NDT) practitioners in three countries were certified to level 2.

The Agency supports networking among Member States, building on national capabilities and encouraging the sharing of expertise and experience. The Arab Society of Nuclear Medicine has been established under the Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA) project RAS/6/078, 'Strengthening Nuclear Medicine Applications through Education and Training to Help Fighting Non-Communicable Diseases (ARASIA)'. One of the main goals of this society is to strengthen networking to enhance the applications and modalities of nuclear medicine in the region, and to contribute to fighting non communicable diseases (NCDs). The society was officially launched during the 6th Gulf Nuclear Medicine Conference in Doha, Qatar, in March 2015.

In Latin America and the Caribbean, RLA/0/048, 'Networking for Nuclear Education, Training, Outreach and Knowledge Sharing', continued to support the development of capacity for enhanced distance learning. Contributions included the consolidation of a network of collaboration and cooperation in nuclear education and training, the establishment of an educational platform and a database integrating careers, organizations and opportunities, strengthened interaction with other similar networks (Asian Network for Education in Nuclear Technology, AFRA Network for Education in Science and Technology and the European Nuclear Education Network) and increased regional capacity in the management of nuclear knowledge. The cooperation established through the project with the Latin American Network for Education in Nuclear Technology (LANENT) was instrumental in achieving these results. As a result, an educational portal for e-learning activities in nuclear and related issues has been established for the region, which now has 89 registered users, and 255 professionals have been trained through seven courses and in seven work areas or communities.

Legislative and drafting assistance

In 2015, the IAEA continued to provide legislative 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 under regional projects for Africa (RAF/0/044, 'Providing Legislative Assistance for the Preparation of Nuclear Related Law'), Asia and the Pacific (RAS/0/071, 'Providing Legislative Assistance on Establishing and Upgrading the Legal Framework for Safe, Secure and Peaceful Use of Nuclear Energy'), Europe (RER/0/038, 'Establishing National Legal Frameworks'), and Latin America and the Caribbean (RLA/0/051, 'Establishing National Legal Frameworks').

The fifth session of the Nuclear Law Institute took place in Baden, Austria and welcomed 64 participants from the four regions, who received a two-week intensive training in all areas of nuclear law and in drafting corresponding national legislation. In addition,

bilateral legislative assistance was provided to 18 Member States in the form of written comments and advice on drafting nuclear legislation, as well as through the conduct of national workshops and legislative assistance missions to advice on the development and revision of the national legal framework. Scientific visits to Agency headquarters were also organized, allowing fellows to gain further practical experience in nuclear law.

The Agency's legislative assistance has been instrumental for promoting the establishment and maintenance of adequate national legal frameworks in Member States, in line with the relevant international legal instruments, IAEA standards and guidance, and for enhancing national capabilities in assessing, revising and drafting nuclear legislation.

The IAEA provided support in the field of radiation safety to new Member States and SIDS in the Asia and the Pacific region. Under RAS/9/067, 'Strengthening an Effective Compliance Assurance Regime for the Transport of Radioactive Material', a regional meeting on progress and challenges in establishing compliance assurance regime for transport safety was organised in Fiji in December 2015. The meeting provided a grounding for the establishment of an independent regulatory authority and the promulgation of the necessary legal framework. The Secretariat also provided targeted bilateral assistance which resulted in most SIDS initiating work on a draft nuclear law and on establishing a regulatory entity



Participants at the 2015 Nuclear Law Institute, Baden, Austria.

A School for drafting regulations on radiation safety was held in Vienna, Austria, in November 2015, under RAS/9/062, 'Promoting and Maintaining Regulatory Infrastructures for the Control of Radiation Sources', with financial support from the European Commission. Twelve participants from Bangladesh, Lao PDR, Malaysia, Philippines, Sri Lanka, Vietnam and T.T.U.T.J of the Palestinian Authority were provided with support in drafting or revising national regulations on radiation safety, consistent with their national law and with the IAEA Safety Standards. At the end, participating Member States had prepared draft regulations for radiation safety which were ready for approval, following internal discussions and approval process, and further promulgation to ensure effective regulatory control of radiation sources.

Atoms in Industry – Radiation Technology for Development

In 2015, the IAEA's Scientific Forum examined how the use of radiation technology in industry contributes to daily life, raising awareness of its socioeconomic, health, safety

and environmental benefits. The role of radiation technology in cleaning and sterilization, industrial processing and quality control (QC) was discussed, as was its place in safety, non-destructive testing (NDT) and the preservation of cultural artefacts. The TC programme plays an active role in building Member State capacities in all these areas, and this section provides a few examples of this lesser known area of Agency work.

For example, RAF/1/004, 'Supporting Radioisotope Technology as a Diagnostic Tool for Plant Process Performance, Optimization and Troubleshooting (AFRA)', aims to promote the use of radioisotope technology in the optimization of industrial processes in Member States party to AFRA. In 2015, the project supported a regional workshop in Tetuan, Morocco, for participants from seven countries, which introduced the advanced technology of industrial process computed tomography. The project also supported a regional training course on sealed sources applications for column scanning, which took place in the Seibersdorf laboratories in October with participants from ten countries.

In Kenya, KEN/1/004, 'Establishing an NDT Laboratory at the Institute of Nuclear Science and Technology at the University of Nairobi for Training, Research and Service Provision in the Field of NDT Applications', has supported the training of several staff in NDT to ISO 9712 standard at the CNESTEN training centre in Morocco. The project has successfully demonstrated the complementarities and synergies that can be achieved by combining university and training centre NDT training, as well as academic research and private sector activities. Kenya provides a good example of how NDT stakeholders can interact profitably and sustainably. An NDT society has been created in Kenya, which will become the certification body for NDT in the country.

In the Asia and the Pacific region, some fifty advanced radiation grafted materials have been developed through RAS/1/014, 'Supporting Radiation Processing for the Development of Advanced Grafted materials for Industrial Applications and Environmental Preservation'. The materials include adsorbents, ion exchange membranes, catalysts, bioactive carriers, tissue scaffolds, evaporator membranes and active packaging. Two products – Cesium adsorbents for water purification and an adsorbent for silicon wafer cleaning – have already been commercialized and two are at the pre commercialization stage. Over 100 people have been trained through the project.

Following the April 2015 earthquake in Nepal, the Agency launched a Programme Reserve project, NEP/7/002, 'Supporting Recovery of Historical Legacy and Critical Buildings in the Aftermath of Recent Earthquakes in Nepal', to provide immediate assistance for the

“In the Asia and the Pacific region, some fifty advanced radiation grafted materials have been developed through RAS/1/014.”



PHI/1/017: The e-beam facility in the Philippines.

application of nuclear techniques, including non-destructive testing (NDT) methods, radiography and other modalities to test the integrity of critical buildings and structures damaged as a result of the natural disaster. The project was successfully completed and has assisted the country in identifying damage to the priority civil structures affected by the earthquake. Advice has been provided to the Nepali authorities on further actions to enhance the safety of public buildings.

The Philippines now has in place a fully-functional, operational, state-of-the-art 100kW e-beam facility, established with the support of PHI/1/017, 'Using E-beam Technology for Industrial, Environmental and Agricultural Applications'. The new facility will provide important services for the country's growing cable-production sector.

In Europe, junior specialists have received both theoretical and hands-on training on recent developments in irradiation technology for cultural heritage preservation and restoration via project RER/0/039, 'Extending and Diversifying the Application of Nuclear Technology in Cultural Heritage'. This project has created an awareness of the contribution of irradiation technology to the preservation and restoration of historical artefacts and such sites, and has contributed to tourism development.

In the Latin America and Caribbean region, radiation technologies are being increasingly used in industry and the support requested from the IAEA in this field is growing. The TC programme in the region has been focused on building national capacities, and raising awareness of the many benefits these techniques offer and of opportunities to apply them in daily life. Irradiation facilities are being strengthened in Cuba under CUB/1/011, 'Improving the Impact of Irradiation Technology', and CUB/1/012, 'Enhancing Irradiation Services', and in Costa Rica under COS/1/007, 'Establishing Gamma Irradiation Capabilities at the Costa Rican Institute of Technology (ITCR) for the Use of Radiation Processing Technology'. The new capacities established through these projects will support medical applications including the sterilization of medical devices and equipment, bone and human tissues, as well as the production of new materials such as polymers, cosmetics and agriculture products, and the protection and preservation of cultural heritage.

The regional project RLA/5/066, 'Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food', is supporting the adoption of food irradiation technologies such as gamma, electron beam and X-ray, not only to boost food export possibilities, but also to satisfy phytosanitary requirements, ensure the safety of marine products and reduce post-harvest waste by inhibiting the germination of bulbs and tubers.

"In Europe, junior specialists have received both theoretical and hands-on training on recent developments in irradiation technology for cultural heritage preservation and restoration."



RER/0/039: Junior specialists participating in a regional training course 'Recent Developments in Irradiation Technology for Cultural Heritage Preservation and Restoration', Magurele, Romania, December 2015.

A.2. BUILDING A MORE EFFICIENT, MORE EFFECTIVE TECHNICAL COOPERATION PROGRAMME¹⁰

Revised Supplementary Agreements, Country Programme Frameworks and UN Development Assistance Frameworks

Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the IAEA (RSA) govern the provision of technical assistance by the Agency, and must be concluded by Member States participating in the TC programme. The total number of Member States with a signed RSA is now 130. Recent signatories include Antigua and Barbuda, Djibouti, Dominica, Fiji, the Marshall Islands and Togo.¹¹

The Country Programme Framework (CPF) serves as one of the main reference documents and the main planning tool when developing national TC programmes. Efforts to strengthen the analytical content of CPFs continued throughout 2015, with a focus on assisting Member State authorities both to identify relevant national and international partners for their CPF and their projects, and to link TC assistance to national sustainable development priorities. The aim is to deliver impact through projects that are relevant, effective and sustainable, by helping Member States to identify opportunities for collaboration and for building partnerships with relevant technical, operational and financial organizations that could support their national objectives. Apart from facilitating more effective resource mobilization and longer-term partnerships, such an approach encourages a move away from smaller scale, short duration national projects to programmes of larger scope that offer greater opportunities for social and economic benefits and long term national development impact. During 2015, CPFs were signed by 15 Member States, with one additional CPF signed in the early part of 2016. CPFs now include a partnership analysis and plan of action for their implementation. This provides a roadmap for proposed actions to be taken to achieve project outcomes, a list assigning actions to stakeholders, and a detailed analysis which not only identifies potential partners for each project, but also outlines how planned project outcomes can contribute to the achievement of the SDGs. This important linkage ensures that national TC programmes are in line with both national and international development priorities, thus facilitating the search for potential partners and donors.

As the main programming documents between a government and the UN system, UN Development Assistance Frameworks (UNDAFs) describe how various UN agencies can help to address national needs. As such they offer a useful framework for identifying potential areas of collaboration between IAEA and other UN entities, as well helping to ensure minimal overlap and redundancy between the actions of different agencies. It has therefore become increasingly important for the Agency to identify linkages between the goals and objectives of the CPF and, where appropriate, those of the UNDAF, in order to facilitate joint work to address national priorities in sustainable development. The IAEA has signed a total of 42 UNDAFs, nine of which were signed in 2015.

CPFs signed in 2015	
Azerbaijan	Marshall Islands
Bosnia and Herzegovina	Mongolia
Colombia	Palau
Czech Republic	Papua New Guinea
Egypt	Sudan
Fiji	Tunisia
Georgia	Viet Nam
Indonesia	Nepal (in 2016)

UNDAFs signed by the Agency in 2015	
Argentina	El Salvador
Bosnia and Herzegovina	Indonesia
Cambodia	Uganda
Colombia	Uzbekistan
	Zimbabwe

¹⁰Section A.2. responds to section 3, operative paragraph 1 of resolution GC(59)/RES/11 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.

¹¹This paragraph responds to section 1, operative paragraph 1 of resolution GC(59)/RES/11 on adhering to the Statute and document INF/CIRC/267; and to operative paragraph 2 on the importance of RSAs.

Maximizing programme impact through strategic partnerships¹²

Partnerships in food and agriculture

In 2015, the Agency and the Food and Agriculture Organization of the United Nations (FAO) celebrated fifty years of strategic partnership. With the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, the IAEA TC programme is supporting Member States in producing better, safer food in greater quantities. In Benin, for example, collaboration between the FAO, the Agency and different national institutions through projects BEN/5/005, 'Improving Maize and Yam-Based Cropping Systems and Soil Fertility', and BEN/5/007, 'Soil, Crop and Livestock Integration for Sustainable Agriculture Development Through the Establishment of a National Laboratory Network', has led to an increase of over 50% in the production of certain varieties of maize. In Eritrea, the initial development of climate-resistant, high-yield barley mutants from local varieties was initiated with the support of project ERI/5/008, 'Supporting the Livelihood of Barley Farmers through Mutation Techniques and N15 Technology to Improve Malting, Food and Feed Barley Production'.

Partnerships in health

In order to enhance support to countries affected by Ebola virus disease (EVD) and to better coordinate international efforts, the Agency collaborated with the World Health Organization (WHO), FAO, the US Centers for Disease Control and Prevention (CDC), South Africa's National Institute for Communicable Diseases and other international partners. The Agency also launched an extrabudgetary, off-cycle project to enhance regional capabilities to detect emerging zoonotic diseases, including EVD and highly-pathogenic avian flu.

In addition, the Agency, through the Programme of Action for Cancer Therapy, strengthened relationships with a range of strategic partners, such as the African Cancer Registry Network (AFCRN), the African Organisation for Research and Training in Cancer (AORTIC), International Agency for Research on Cancer (IARC), Islamic Development Bank, the Organisation of Islamic Cooperation, Pink Ribbon Red Ribbon and the Union for International Cancer Control. A new partnership has also been established between the Organization for International Economic Relations (OiER) and the Agency, allowing the Programme of Action for Cancer Therapy to leverage OiER's extensive and diverse network of organizations and partners. The collaboration expands the scope for initiatives that maximize programme impact and support resource mobilization.

The Advisory Group on Increasing Access to Radiotherapy Technology in Low and Middle Income Countries (AGaRT) advises on access to affordable, quality and sustainable radiotherapy solutions. An expert meeting in 2015, which included participants from WHO and IARC, considered AGaRT's achievements for the period 2009 to 2014, and proposed ways to capitalize on opportunities offered by global initiatives and partnerships in cancer control for the group's 2016–2020 cycle.

Partnerships by region

Strategic, technical and financial partnerships building continues to be a high priority for the TC programme in Africa, particularly to foster technical cooperation among developing

¹²This section responds to section 5, operative paragraph 1 of resolution GC(59)/RES/11 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.

“With the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, the IAEA TC programme is supporting Member States in producing better, safer food in greater quantities.”

countries (TCDC), promote regional and sub-regional cooperation, and mobilize additional resources to support and complement the TC programme. Additional efforts were made to increase and enhance the effective and efficient management of the programme in the region, including the training of national and regional stakeholders, and the progressive incorporation and application of successful TC and international best practices.

Member States party to AFRA continued to pursue the implementation of their strategy for partnership building and resource mobilization in 2015. In December, a series of meetings took place between the AFRA Chair, the Vienna-based African Group and Permanent Representatives of donor and partner countries in Vienna, with the aim of sharing information on matters related to AFRA policy and the AFRA programme, and strengthening partnerships.

The IAEA also reached out to the African Union-led African Task Force on Food and Nutrition Development in South Africa in March 2015, presenting nutrition interventions in the pipeline in order to better integrate these with national health priorities. Cooperation was also strengthened between the Secretariat and national focal points of the UNCCD in support of sustainable land management in Africa.

Five partnerships in the Asia and the Pacific region were established in 2015 through the signature of Practical Arrangements. These were with the International Center for Biosaline Agriculture, United Arab Emirates, for cooperation in the area of soil, water, crop and nutrient management, the Kuwait Institute for Scientific Research (KISR) for cooperation on marine environmental monitoring and protection, the King Hussein Cancer Centre in Jordan and Chonnam National University Medical School and Hospitals in the Republic of Korea for cooperation on developing IAEA Curricula for Nuclear Medicine Professionals, and the National Oceanic and Atmospheric Administration in the USA on cooperation related to harmful algal blooms.

In addition, significant initiatives were undertaken to strengthen inter-organizational partnerships and cooperation in the region. An agreement was signed with the International Rice Research Institute in the Philippines, for cooperation in the field of enhanced rice productivity. The agreement, on the organization of IAEA fellowships and training activities, ensures that Member States can gain expertise in rice productivity to enhance their food security.

A Memorandum of Understanding was signed between the IAEA and the Government of the Republic of Singapore concerning Third Country Training Programme in January 2015. The objective is to enhance cooperation in the training of participants from developing Member States in Singapore.

In the Europe region, two Practical Partnership Agreements were signed and implemented in 2015 between the Agency and the European Association of Nuclear Medicine and European Society for Radiotherapy and Oncology. This will increase efficiency in relevant TC activities and facilitates networking efforts among Member States, professional associations and partner organizations such as WHO. The parties successfully worked together to arrange training courses in nuclear medicine and radiotherapy.

In Latin America and the Caribbean, a continuing partnership with the European Commission under the Instrument for Nuclear Safety Cooperation supported a number of projects on radioactive waste management, nuclear plant life management and response to radiation emergencies.

Partnerships with the Spanish Nuclear Safety Council, the Spanish Radiation Protection Society, and the Spanish Society of Medical Physics enabled the dissemination of information to counterparts in Latin America and the Caribbean, supporting radiation protection of patients. Also in the area of radiation safety, IAEA-TECDOC-1685, *Application of Matrix Risk Methodology in Radiotherapy*, issued in 2014 by FORO-IAEA provided the basis for a high-level meeting attended by authorities from the Latin America and Caribbean region on regulations in the medical field. The meeting, held in Chile in March 2015, allowed the Agency to successfully advance its work with regulators. In April 2015, the Ibero-American

“Five partnerships in the Asia and the Pacific region were established in 2015 through the signature of Practical Arrangements.”

Forum of Radiological and Nuclear Regulatory Agencies (FORO) and the Agency held a joint meeting at the Tenth Regional Latin-American Congress of the International Radiation Protection Association in Argentina. At the meeting, the results of the collaboration between the two organizations were discussed, creating opportunities for further collaboration between FORO, the Agency and Member States.

Partnerships at the national level are also highly important for TC programme implementation. In the Dominican Republic, for example, a practical arrangement is currently under preparation to formalize cooperation between the Agency and the UNDP office in the Dominican Republic on a project related to the coastal and marine environment. Project DOM/7/004, 'Developing Human Resources and Supporting Nuclear Technology for Addressing Key Priority Areas including Biodiversity and Environmental Conservation', is being implemented in close coordination with UNDP as the executing Agency of a large GEF project. The project results will be used by the GEF project to support policy and regulatory recommendations.

Also in the Dominican Republic, the Agency is contributing technical expertise in the sterile insect technique (SIT) as part of a multi-partner effort to manage the outbreak of Mediterranean fruit fly (medfly) in the country. The key partners, comprising the Moscamed Program in Guatemala/Mexico, the United States Department of Agriculture (USDA), FAO, IAEA, the Interamerican Institute for Cooperation in Agriculture of the Organization of American States (IICA), and the International Regional Organization for Plant and Animal Health (OIRSA), are providing coordinated technical and financial assistance to the emergency response efforts of the country, under the leadership of the Dominican Republic's Ministry of Agriculture.

Finally, the Agency is collaborating with the World Food Programme (WFP) in the area of nutrition, to evaluate the impact of the National Micronutrient Supplementation Programme 'Progresando con Solidaridad'. This initiative of the Dominican Republic has been supported by the Agency through project DOM/6/009, 'Strengthening the National Nutrition Intervention Strategy by Enhancing the Effectiveness of the Micronutrient Supplementation Programme'.

Supporting gender equality: Women in the TC programme¹³

Women are encouraged to participate in every aspect of the TC programme, which, in line with the IAEA's Gender Policy, aims to mainstream gender and enhance gender equality. In 2015, 4173 women from all regions participated in the programme as counterparts, fellows, scientific visitors, meeting and training course participants and international experts and lecturers. This is approximately 27% of all project counterparts, and 32% of all training participants. There are also currently nine women on the Director General's Standing Advisory Group on Technical Assistance and Cooperation (SAGTAC), out of a total of 21 members.

¹³ This section responds to section 2, operative paragraph 3 of resolution GC(59)/RES/11 on promoting gender equality and advancing gender balance in the TC programme.

"In 2015, 4173 women from all regions participated in the programme as counterparts, fellows, scientific visitors, meeting and training course participants and international experts and lecturers."

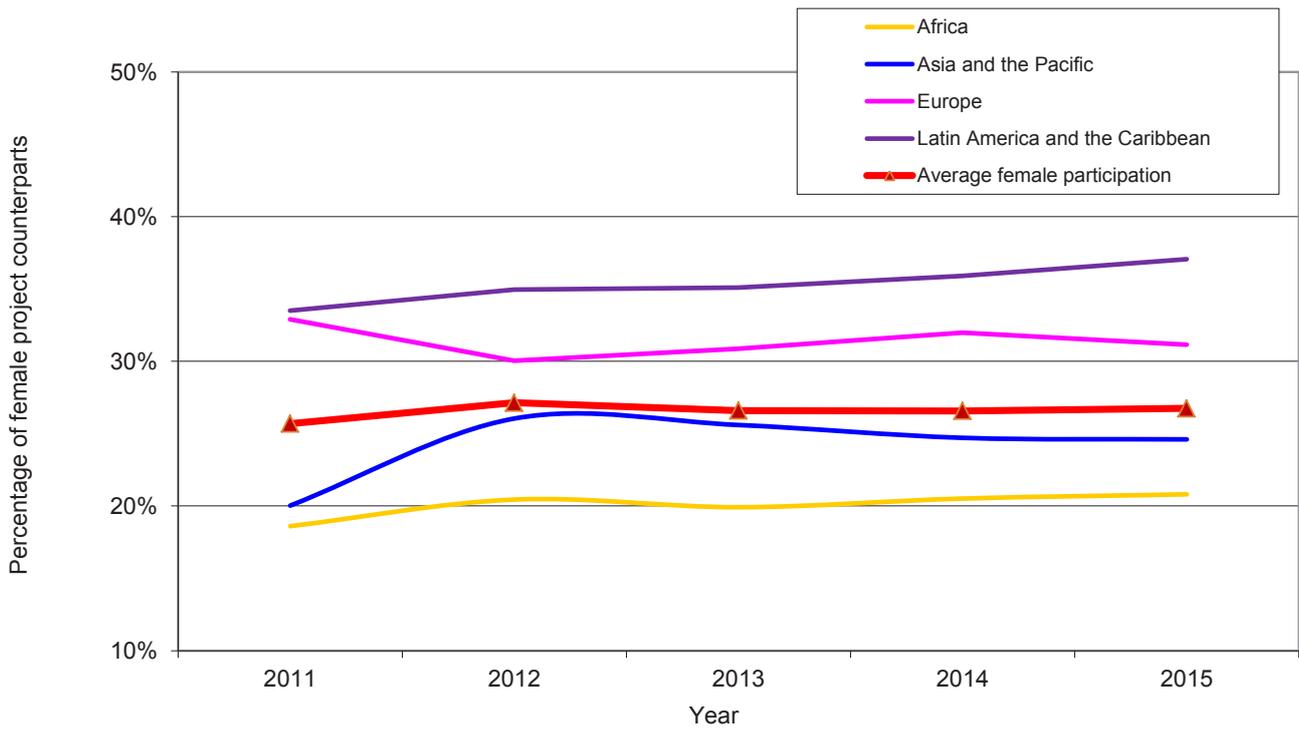


Figure 2: Female project counterparts by region, 2011–2015.

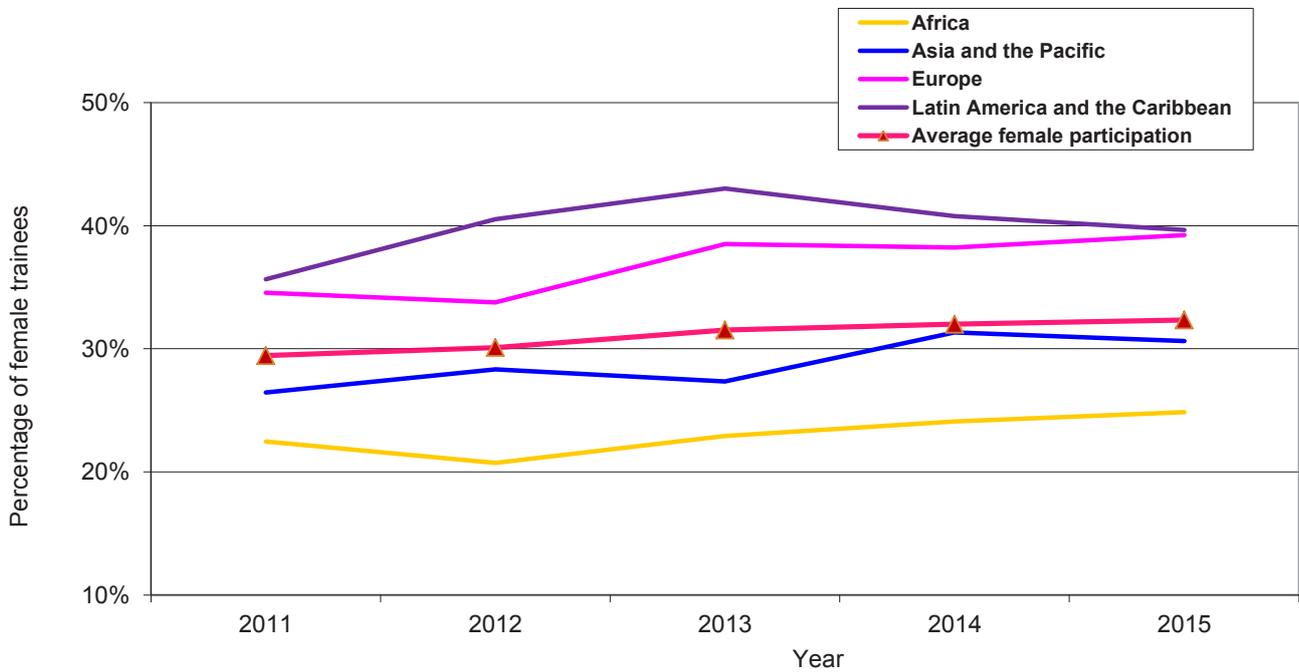


Figure 3: Female participation in training as fellows, scientific visitors, training course participants, meeting participants and other project personnel, 2011–2015.

Ensuring the continual improvement of the TC programme¹⁴

The preparation of each TC cycle requires two years, and targeted upstream work, including strategic planning, the review and development of CPFs and extensive engagement with Member States, had already taken place throughout 2014. This upstream work included country visits and pre-planning missions, as well as coordination meetings with NLOs, national representatives and other programme stakeholders.

Preparations for the 2016–2017 TC cycle continued in 2015. Facilitation workshops on project design using the logical framework approach (LFA) were conducted at national, sub-regional and regional levels in Member States, and within the Secretariat. These contributed to enhancing the project design capacity of a wide range of TC stakeholders (counterparts, National Liaison Officers, Programme Management Officers and Technical Officers) in results based management using the LFA methodology, and in applying the principles and tools for TC project monitoring. Participants received practical guidance on improving the quality of their draft project designs for the 2016–2017 TC cycle, which was subsequently approved by the Board of Governors in November 2015.



The IAEA Technical Assistance and Cooperation Committee (TACC), 23 November 2015.

Two quality reviews of project designs were conducted in January and September 2015. The first quality review considered draft project designs and provided sound and constructive feedback to the project teams on improving the quality of their projects. The second review was conducted at the end of the project development process to obtain an overall assessment of the quality of the 2016–2017 TC programme, to identify areas for improvement and lessons to be learned, and to enable meaningful comparison with previous TC cycles. The results of these two quality reviews demonstrate that the overall

¹⁴ This section responds to section 3, operative paragraph 1 of resolution GC(59)/RES/11 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 results of efforts to implement outcome monitoring; to section 3, paragraph 7 on the two-step mechanism in monitoring the quality of TC projects; and to section 3, operative paragraph 8 on enhancing adherence with the central criterion and all the TC requirements.

quality of the final project designs improved significantly, with regard to both LFA compliance and TC requirements.

Member States have re-emphasized the importance of being able to demonstrate how the TC programme contributes to promoting and improving the scientific, technological, research and regulatory capabilities of the Member States in GC(59)RES/11, which recognizes the efforts of the Secretariat to improve outcome monitoring of the TC programme and requests an increased focus towards results (outputs, outcomes and impact) rather than inputs and activities. The Secretariat is now developing a framework of regular reporting on the implementation and outcomes of TC projects in response. This involves the systematic monitoring of progress made in achieving expected outcomes, both during implementation and after project closure. Specific monitoring and evaluation plans throughout the entire project life cycle have been developed for selected TC projects in the area of human health and nutrition for the 2016–2017 TC programme cycle. Experience gained and lessons learned during this process will provide a basis for expanding the concept of outcome monitoring to a wider range of suitable projects in subsequent TC cycles.

In addition, a range of complementary monitoring instruments, such as Project Progress Assessment Reports (PPARs), Field Monitoring Missions (FMMs) and Self-Evaluations, have been developed in recent years. The Secretariat works closely with all programme stakeholders on continuously reviewing these instruments for effective and efficient utilization.

PPARs provide an effective mechanism for documenting project progress (including outcomes) and identifying areas for improvement. They also enable Project Management Officers and Technical Officers to provide effective feedback to the project team. PPARs identify and communicate lessons learned and provide a valuable snapshot of the status of completion of project outputs. By the end of February 2016, almost 400 PPARs for active projects had been received by the Secretariat, reporting on achievements made in 2015. Member States are encouraged to submit their PPARs in a timely manner, as this enables the identification of issues, and prompt follow up action.

FMMs were implemented in Kuwait and Lebanon in 2015 as a participatory tool to assess the progress of selected projects and to strengthen the capacity of field project team members in applying TC monitoring tools. The FMMs also informed the Secretariat's processes in using the tool within the framework of the comprehensive outcome monitoring and assessment framework currently under development.

An integral aspect of improving the quality of the TC programme is effective knowledge management. In 2015, the Secretariat developed a Knowledge Management Practitioner Manual for Programme Management Officers (PMOs). This manual, which is closely aligned with the IAEA's Corporate Knowledge Management Policy, covers all three phases of the learning life-cycle of a PMO from induction through refresher/preservation to transfer of knowledge. It will be piloted in 2016 and is intended to serve as a model for developing knowledge management practitioner's manuals for other categories of positions within the TC Department.

The effective sharing of best practices for the design and management of TC projects constitutes an additional means of enhancing the quality of the TC programme. The Secretariat's TC Best Practice Mechanism¹⁵ is used to encourage and support stakeholders in information sharing, continuous learning, innovation and networking. It provides an opportunity for the Member States and project teams to share TC programme and project related real-life experiences. The third round of the Best Practice mechanism was initiated in 2015 and will be concluded in the first half of 2016.

With a view to ensuring continual improvement to the TC programme, the Department of TC works closely with the Office of Internal Oversight Services (OIOS) to support effective and efficient implementation of OIOS's internal oversight services. The recommendations stemming from their activities are systematically followed up by the Department of TC.

“The Secretariat's TC Best Practice Mechanism is used to encourage and support stakeholders in information sharing, continuous learning, innovation and networking.”

¹⁵ <https://www.iaea.org/technicalcooperation/programme/Quality/Best-Practices/index.html>

Building awareness of the TC programme

Extensive efforts to build awareness of the TC programme were made in 2015, with outreach to Member States, current and potential partners, donors and the international development community through a range of different communication channels. The Agency also used opportunities offered by meetings, and conferences to showcase its work in specific topic areas and to raise awareness of the TC programme among potential partners.

Exhibitions on the TC programme were organized at the International Conference on Global Emergency Preparedness and Response, the Asia-Pacific Forum on Sustainable Development 2015, the Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure, among others, and at the 59th regular session of the Agency's General Conference. The Annual Seminar on Technical Cooperation for Diplomats, designed to provide Permanent Missions with a comprehensive overview of the programme, was held in October in Vienna, and attended by 55 participants.

The technical cooperation web site was updated with 94 web articles, 9 photo essays and 10 videos during 2015, and now has some 9500 visitors a month. In 2015, the site received over 113 000 visits. More than 900 tweets were sent out from the @IAEATC Twitter account, which now has over 2500 followers. The LinkedIn TC Alumni Group now has over 1400 members. A number of new outreach products were issued, including new technical cooperation project success stories and factsheets on emergency preparedness response and soil conservation. Particular efforts were made to place technical cooperation stories on the main page of the IAEA website, resulting in 32 stories about the TC programme.



Promoting the IAEA's technical cooperation programme at the 2015 Asia-Pacific Forum on Sustainable Development.

B. TC Programme Resources and Delivery



B. TC Programme Resources and Delivery

B.1. FINANCIAL OVERVIEW

Resources for the technical cooperation programme¹⁶

At the end of 2015, €65.7 million or 94.1% of the €69.8 million target had been pledged for the 2015 Technical Cooperation Fund (TCF), and €65.5 million in payments had been received. Total TCF resources including National Participation Costs (NPCs), assessed programme costs (APCs) arrears, and miscellaneous income amounted to €66.1 million (€65.5 million TCF, €0.4 million NPCs, €0.1 million APCs arrears and €0.1 million miscellaneous income), higher than the 2014 figure of €64.4 million. New extrabudgetary resources for 2015 came to €11.9 million and in-kind contributions amounted to €0.7 million.

The rate of attainment on pledges, as at 31 December 2015, was 94.1% in 2015 (89.8% in 2014). The rate of attainment on payments for 2015, as at 31 December 2015, was 93.8% (Fig. 5), reflecting unpaid pledges of €0.2 million (89.5% in 2014). Total payments received in 2015 include €2.4 million either of deferred or of additional payments by 16 Member States. Excluding these payments, the 2015 rate of attainment on payments would have been lower by 3.4%.

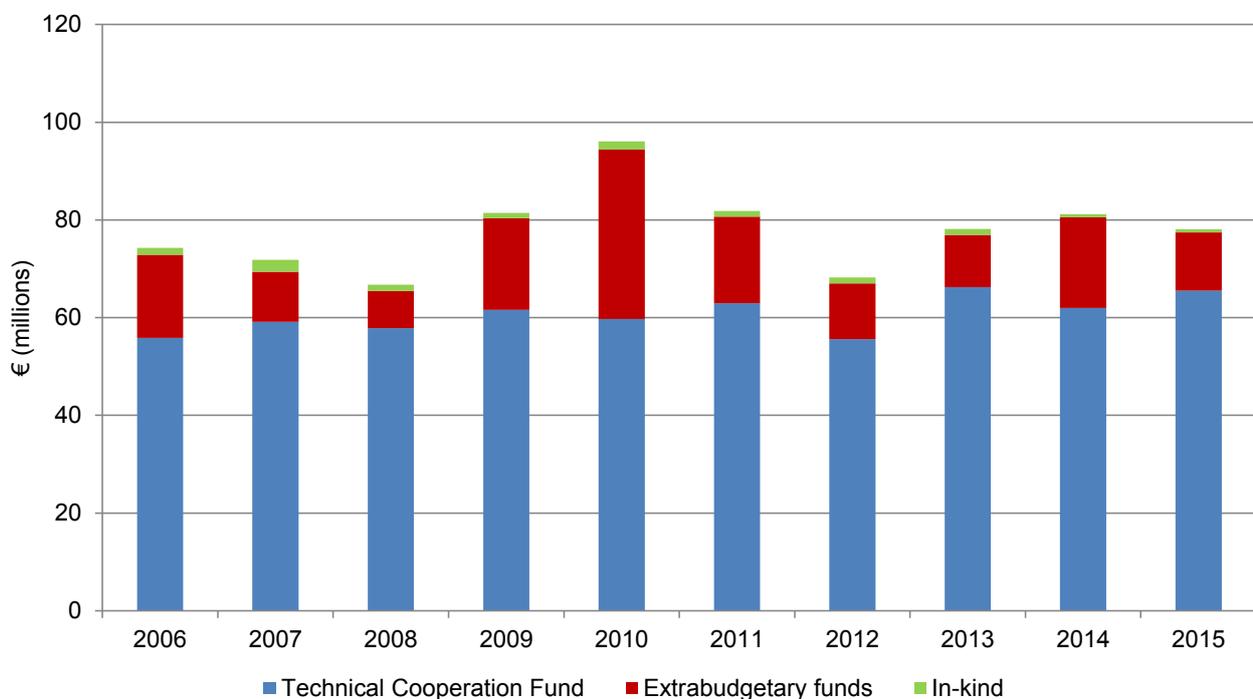


Figure 4: Trends in TC programme resources, 2006–2015.

¹⁶ This section responds to section 4, operative paragraph 2 of resolution GC(59)/RES/11 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 2015

2015 target for voluntary contributions to the TCF	€69.8 million
Technical Cooperation Fund, NPC, miscellaneous income	€66.1million
Extrabudgetary resources ¹⁷	€11.9 million
In-kind contributions	€0.7 million
Total new resources for the TC programme	€78.7million

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

	Received in 2015	Outstanding payments
NPCs	€0.4 million	€0.3 million
APCs	€0.1 million (\$0.1 million)	€0.9 million (\$1.0 million)

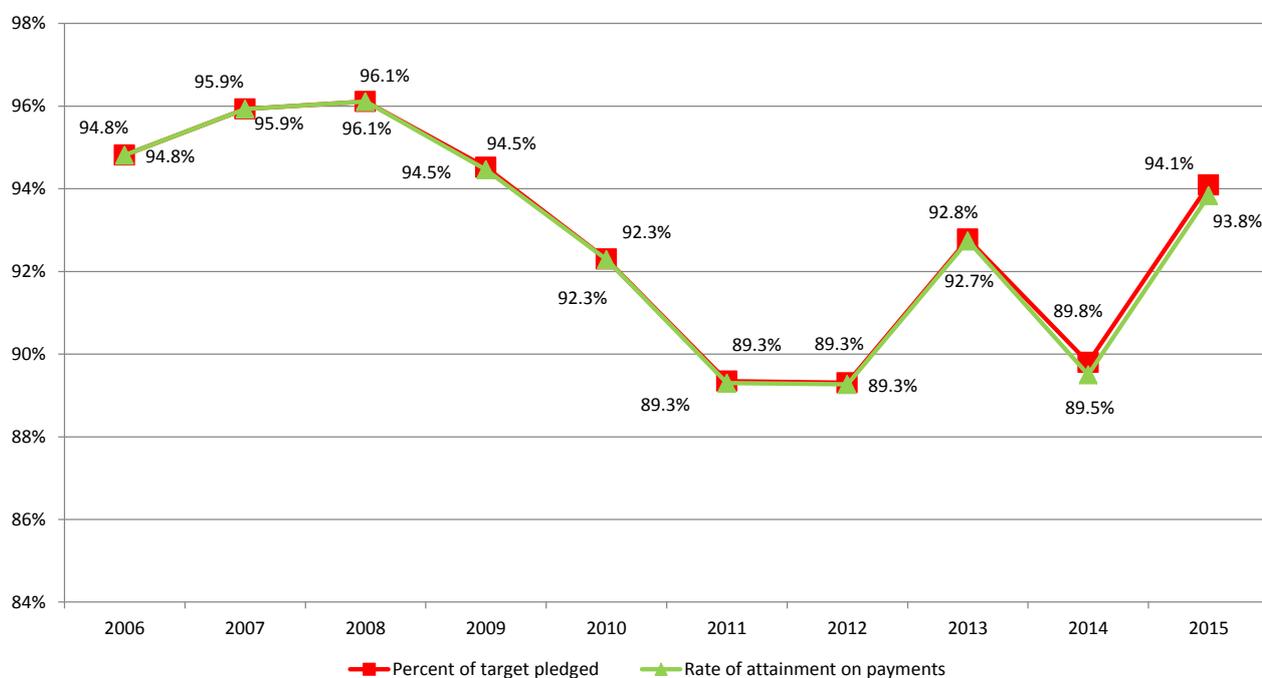


Figure 5: Trends in the Rate of Attainment, 2006–2015.

Extrabudgetary and in-kind contributions¹⁸

Extrabudgetary contributions from all sources in 2015 (donor countries, international and bilateral organizations, government cost sharing) accounted for €11.9 million. More detail is contained in Table 3 (extrabudgetary contribution by donor) and Table 4 (government cost sharing). In-kind contributions accounted for €0.7 million in 2015. Of the total extrabudgetary contributions, €6.5 million was received through the PUI mechanism.

¹⁷ Please refer to Table A.5 of the Supplement to this report for details.

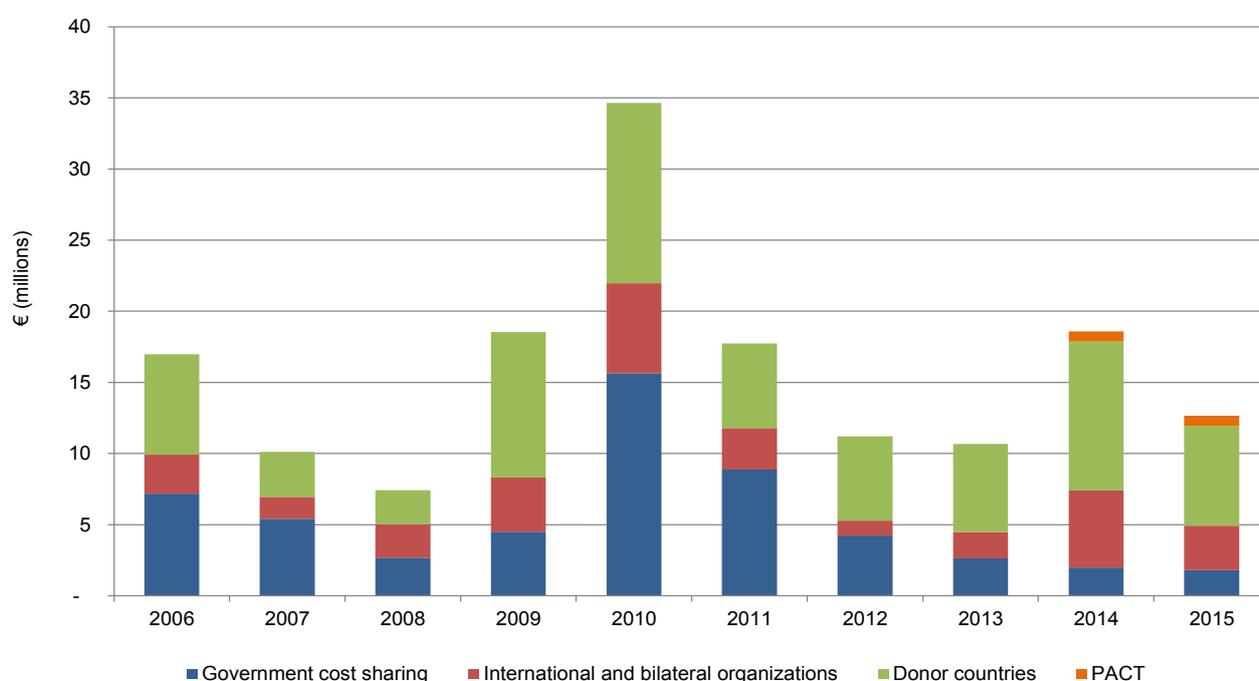
¹⁸ This section responds to section 4, operative paragraph 8 of resolution GC(59)/RES/11 on seeking resources to implement footnote-a/ projects; to section 4, operative paragraph 9 on voluntary contributions and the implementation of footnote-a/ projects; and to section 4, operative paragraph 10 on extrabudgetary contributions, including the PUI.

Table 3: Extrabudgetary contributions allotted to TC projects in 2015, by donors (in euros)

Australia	146 469	New Zealand	50 000
Chile	9 040	Russian Federation	388 080
Czech Republic	91 575	Spain	115 000
France	7 500	Turkey	62 000
Indonesia	7 064	United States of America	3 271 442
Japan	2 285 321	AFRA Fund ¹⁹	289 211
Korea, Republic of	570 795	European Commission	2 097 077
Malaysia	17 820	For PACT ²⁰	719 765

Table 4: Government cost sharing allotted to TC projects in 2015 (in euros)

Albania	130 000	Lithuania	10 000
Cameroon	123 229	Pakistan	373 160
Chile	27 211	Sri Lanka	101 500
Costa Rica	122 500	Sudan	265 000
Croatia	136 000	United Arab Emirates	44 022
Estonia	78 200	United Republic of Tanzania	100 000
Iran, Islamic Republic of	140 000	Uzbekistan	30 000
Kenya	63 638	Zambia	65 000

**Figure 6: Trends in extrabudgetary contributions by donor type, 2006–2015.**¹⁹ Please see section C.1 for details.²⁰ Please see section C.6 for details.

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 actuals²¹ and encumbrances. Non-financial delivery (i.e. outputs) can be expressed numerically in terms of, for example, experts deployed or training courses conducted.

Financial implementation for the TCF, measured against the budget for 2015 as on 31 December 2015, reached 84.8% (Table 5).

Table 5: Delivery of outputs under the TCF: financial indicators for 2013, 2014 and 2015

Indicator	2013	2014	2015
Budget allotment at year end ²²	€86 456 641	€77 075 529	€80 024 103
Encumbrances + actuals	€72 376 048	€60 126 727	€67 896 353
Implementation rate	83.7%	78.0%	84.8%

Unallocated balance

By the end of 2014, the total unallocated balance²³ had been brought down to €0.0. This remains the same at the end of 2015. In 2015, €6.9 million were received as advance payments for the 2016 TCF. Some €1.4 million of cash is held in currencies which are difficult to use in the implementation of the TC programme.

Table 6: Comparison of the unallocated balance of the TCF (in euros)

Description	2014	2015
Total unallocated balance	0	0
Advance payment in 2014 and 2015 for TCF for following year	4 949 610	6 874 950
Non-convertible currencies that cannot be utilized	12 804	13 688
Currencies that are difficult to convert and can only be used slowly	1 216 383	2 914 774
Adjusted unallocated balance	6 178 797	9 803 412

Human resources and procurement

Human resource indicators show the non-financial delivery of the TC programme. Regarding procurement, a total of 1590 purchase orders were issued in 2015, to a value of €34.2 million.

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 2015 budget allotment at year end includes carry-over from previous years of €10.9 million, already allocated to projects.

²³ Total funds not allocated to TC projects.

Indicator	2014	2015	Increase/(decrease)
Expert and lecturer assignments	3461	3477	16
Meeting participants and other project personnel	5285	5126	(159)
Fellowships and scientific visitors in the field	1677	1852	175
Training course participants	2830	2722	(108)
Regional and interregional training courses	187	175	(12)

Division	Requisitions	Purchase orders issued	Value
TCAF	539	652	€ 9 038 265
TCAP	258	324	€ 7 173 469
TCEU	163	182	€ 8 333 492
TCLAC	327	432	€ 9 700 503
Total	1287	1590	€ 34 245 729

At the end of 2015, 807 projects were active, and an additional 278 projects were in the process of being closed. During 2015, 261 projects were closed, of which 3 were cancelled.

Programme Reserve projects

Eight Programme Reserve projects were implemented in 2015, at the request of Burkina Faso, Côte d'Ivoire, Ghana, Myanmar, Nepal, Niger, Nigeria and the Philippines.

Project	Actuals end 2015	Encumbrances end 2015	Total
BKF/5/015 - Enhancing Diagnostic Capacity for HPAI H5N1 Avian Influenza, using nuclear-derived technique	€7 992	€6 224	€14 216
GHA/5/035 - Enhancing Diagnostic Capacity for HPAI H5N1 Avian Influenza, using nuclear-derived technique	€14 644	€ 222	€14 866
IVC/5/037 - Enhancing Diagnostic Capacity for HPAI H5N1 Avian Influenza, using nuclear-derived technique	€9 518	€0	€9 518
MYA/6/031 - Improving Radiotherapy Services in Myanmar	€23 748	€8 436	€32 184
NEP/7/002 - Supporting recovery of historical legacy and critical buildings in the aftermath of recent earthquakes in Nepal	€41 295	€444	€41 739
NER/5/018 - Enhancing Diagnostic Capacity for HPAI H5N1 Avian Influenza, using nuclear-derived technique	€10 707	€4 293	€15 000
NIR/5/038 - Enhancing Diagnostic Capacity for HPAI H5N1 Avian Influenza, using nuclear-derived technique	€9 797	€0	€9 797
PHI/5/032 - The Application of Nuclear Analytical Techniques for Subsurface and Groundwater Cleanup in Typhoon Yolanda/Haiyan Affected Areas in Tacloban City, Philippines	€39 912	€0	€39 912



C. Programme Activities and Achievements in 2015

C. Programme Activities and Achievements in 2015²⁴

C.1. AFRICA

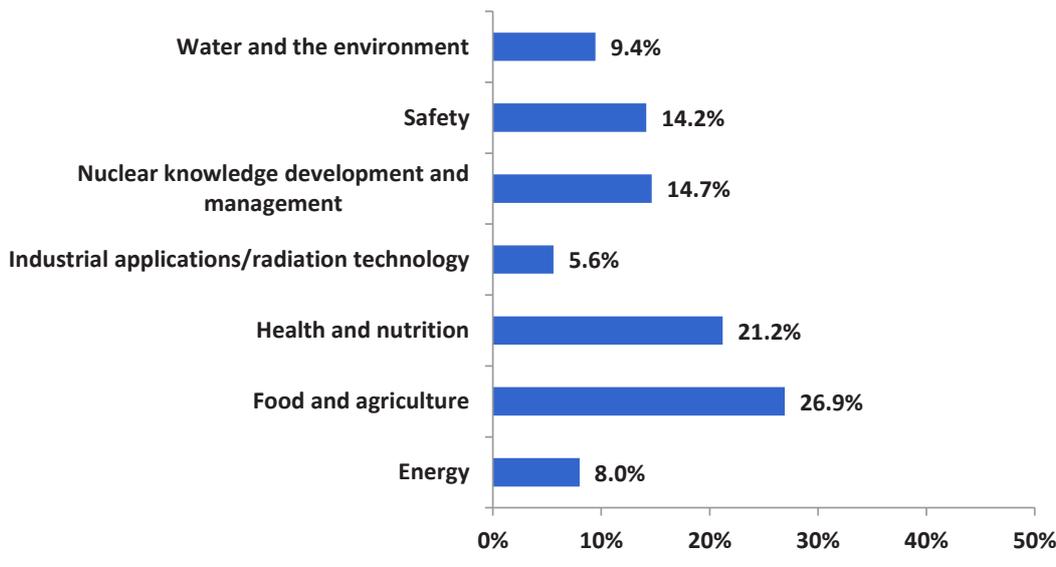
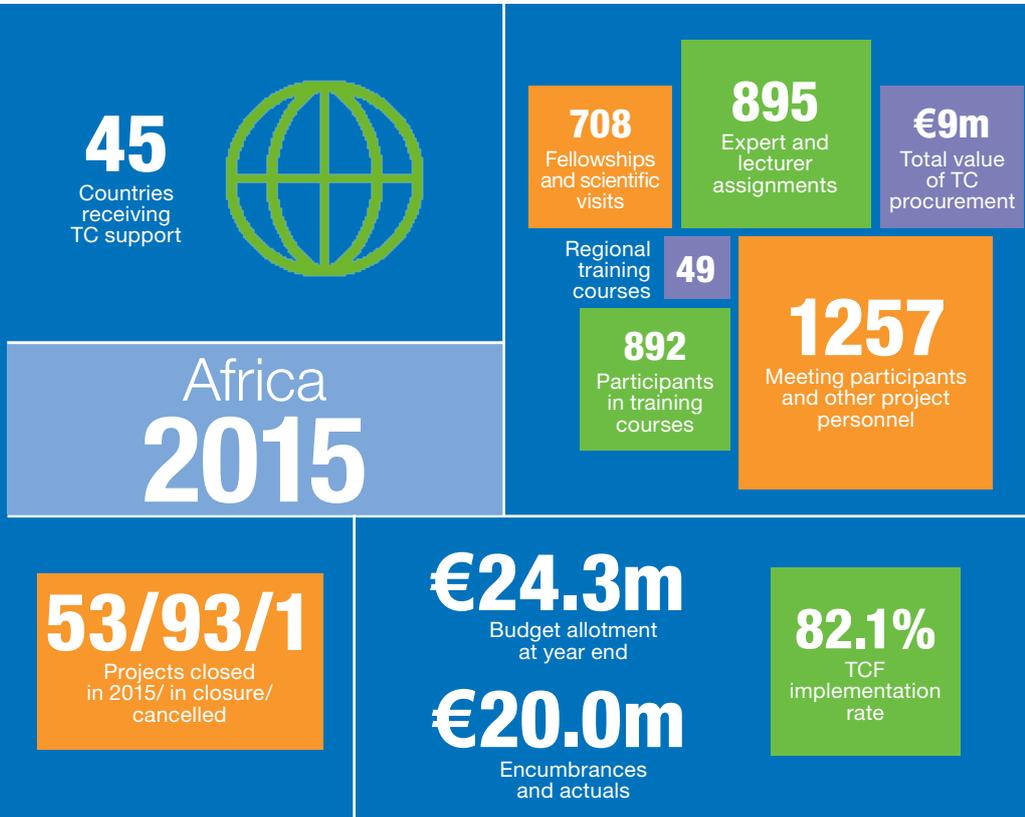


Figure 7: Actuals in the Africa region in 2015 by technical field.

²⁴ Section C responds to section 2, operative paragraph 1 of resolution GC(59)/RES/11 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, 2015

Throughout the year, the Agency worked with Member States in the Africa region to build human and institutional capacity for the sustainable application of nuclear technology for development, and to build partnerships, mobilize extrabudgetary resources and strengthen regional cooperation. The programme achieved an implementation rate of 82.1%, despite a number of challenges, including the ongoing outbreak of EVD and the security situation in a number of countries. Djibouti joined the IAEA in 2015.

CPFs signed in Africa in 2015

Egypt

Sudan

Tunisia

The development of CPFs remained an important focus of attention throughout 2015. Three new CPFs were signed in 2015, by Egypt, Sudan and Tunisia.

By the end of 2015, the Agency was involved in the UNDAF process in 15 countries in Africa, and was forming linkages and become involved in the UNDAF process in other African Member States. In 2015, the IAEA signed the new UNDAFs for Uganda and Zimbabwe.



Egypt signs its new CPF.

Project highlights

Over a year and half has passed since WHO reported a major outbreak of EVD in West Africa. The outbreak, declared over in January 2016, was contained due to extensive national and international efforts to combat zoonotic diseases – diseases that can be transmitted from animals to humans. Working in cooperation with WHO and FAO, the Agency provided training and reinforced existing capacities in the use of reverse transcriptase polymerase chain reaction (RT-PCR) and enzyme-linked immunosorbent assay (ELISA) to detect zoonotic diseases earlier. This capacity enables countries to better anticipate the risk of outbreaks in human populations and to implement appropriate preventive and control measures. Early diagnosis of EVD, if combined with appropriate medical care, increases the victim’s chance of survival and helps curtail the spread of the disease by making it possible to isolate and treat patients earlier.

In March 2015, the IAEA Board of Governors approved the off-cycle TC project RAF/5/073, 'Strengthening Africa's Regional Capacity for Diagnosis of Emerging or Re-emerging Zoonotic Diseases, including EVD, and Establishing Early Warning Systems'. The project aims to strengthen national and regional capacities to monitor wildlife and livestock for EVD and other dangerous viral haemorrhagic diseases such as Marburg virus disease, highly-pathogenic H5N1 avian flu and Crimean-Congo haemorrhagic fever, allowing a better anticipation of outbreaks in human populations. With activities to enhance capacity for the diagnosis of EVD under high bio-safety conditions, the project also supports the establishment of early warning systems and regional networks, supporting the implementation of appropriate prevention and control measures as early as possible.

Following a four-year eradication programme using conventional insect management techniques together with SIT, the tsetse fly, which used to decimate livestock, has been largely eliminated from two major areas in the Niayes region of Senegal. Eradication efforts were initiated in a third area in 2015. The impact of the project, carried out in conjunction with FAO, the International Cooperation Centre of Agricultural Research for Development and the Government of Senegal, can already be seen with a drastic decrease in the prevalence of the disease trypanosomiasis. This will significantly improve food security, and contribute to socioeconomic progress in the Niayes region.

Work continued on the implementation of a large scale project to manage water resources in the Sahel region. The project, covering five major aquifer systems shared by thirteen African Member States, has focused on water sampling and sample analysis, and on training local personnel to use geographical information systems. Results obtained in the five systems are assessed regularly and interpreted in a cooperative manner. The project is scheduled to be completed in late 2016, with the production of a set of recommendations aimed at improved management of the shared water resources. The project has received support through the PUI funding mechanism from Australia, Japan, the Republic of Korea, Sweden, and the USA.

In Africa, increasing industrialization means that industries in different sectors will require more energy to conduct their activities. The projected demand far exceeds current electricity generation capacities in the region. An increasing number of African countries are considering introducing nuclear power to their energy mix. In April 2015, the Agency, together with the Government of Kenya, organized the 'Third Conference on Energy and Nuclear Power in Africa – Assessing African Energy Needs and Planning for the Future' in Mombasa, Kenya. Over 150 senior officials, technical experts and national coordinators from more than 35 African countries gathered to discuss their energy challenges and concerns. The conference focused on the peaceful uses of nuclear technology and how to secure sustainable energy supplies, including nuclear energy, for Africa.

“ In Africa, increasing industrialization means that industries in different sectors will require more energy to conduct their activities.”



Participants at the Third Conference on Energy and Nuclear Power in Africa, Kenya, April 2015.

Regional cooperation

The African Regional Cooperative Agreement for Research, and Development and Training Related to Nuclear Science and Technology (AFRA) continues to be the principle framework for promoting technical cooperation among developing countries in Africa and for enhancing regional cooperation among its States Parties. A new extension of the agreement entered into force on 4 April 2015.

In July 2015, the 26th AFRA Technical Working Group Meeting was hosted in Marrakech by the Kingdom of Morocco. The meeting adopted concrete measures and actions to enhance the implementation of AFRA regional projects and the management of its cooperative activities, and recommended alignment of the 2016–2017 AFRA programme with AFRA's main strategic planning documents. The meeting also adopted the selection criteria to renew the membership of AFRA Committees and the guidelines of the AFRA Troika which is a leadership management model formed by the outgoing AFRA Chairperson, the current AFRA Chairperson and the future AFRA Chairperson. The 26th Meeting of AFRA Representatives took place during the 59th General Conference. The meeting brought together representatives of AFRA States Parties, and adopted the AFRA Annual Report 2014 and the AFRA Mid-Term Strategy 2016-2018. The Strategy is aligned with the SDGs and the Common African Position on the post-2015 Development Agenda (CAP) endorsed by the Council of African Heads of States, and emanates from the review of the AFRA Regional Strategic Cooperative Framework 2014–2018, which provides the frame of reference for the planning and formulation of the AFRA programme.

AFRA also organized an exhibition during the 59th IAEA General Conference to highlight the unique contribution of its 28 regional designated centres (RDCs) in different fields, including human health, food and agriculture, industry, safety, energy and isotope hydrology. The RDCs promote regional cooperation and self-reliance in Africa through the utilization of available expertise and infrastructure for training, analytical services, and contribute to research activities for the development of the region. Posters on display highlighted RDC activities and AFRA's achievements through the TC programme.



Participants at the 26th AFRA Technical Working Group Meeting in Marrakech with Minister Amara, Marrakech, Morocco, July 2015.

Preparations for the 2016–2017 TC programme cycle²⁵

The TC programme for the Africa region for 2016–2017 reflects the evolving priorities of Member States: food and agriculture is the highest priority in the region, followed by health and nutrition, and safety. Two Member States, the Republic of the Congo and Djibouti, have national programmes for the first time.

AFRA finalized the formulation of six project designs in human health, food safety, radiation safety, TCDC and triangular cooperation and AFRA management for the 2016–2017 TC cycle. In line with established procedure, the AFRA Project Scientific Consultants collaborated with the Agency's technical departments to develop the projects. The new AFRA programme prioritizes enhancing human resource development and strengthening existing infrastructure in the region.

An induction workshop for 18 new National Liaison Officers (NLOs) and National Liaison Assistants (NLAs) from the African region was held at Agency headquarters in April 2015. The workshop aimed to build a common understanding of the TC programme and its mechanisms, and to enhance programme implementation and effectiveness. Participants were briefed on a wide range of topics, including strategy and partnerships and the processes for TC programme formulation, implementation and reporting. They were also introduced to the broad scope of nuclear applications, and briefed on radiation safety requirements. At a further event, NLOs were informed about best practices and experiences in the design and formulation of the 2016–2017 TC programme. Discussions were also held on the alignment of CPFs with the Common African Position (CAP) on the post-2015 Development Agenda, and on the SDGs.

Contributions to the AFRA Fund

In 2015, AFRA States Parties contributed a total of €289 211 to the AFRA Fund, demonstrating their continued commitment to the Fund and their willingness to further enhance regional ownership of the programme. The contributions have been allotted to AFRA projects to support the implementation of unfunded activities.

Table 10: Voluntary contributions to the AFRA Fund, 2015 (in euros)

Botswana	10 693	Niger	1 413
Burkina Faso	2 561	Seychelles	2 527
Cameroon	9 977	Sierra Leone	3 425
Mali	4 643	South Africa	180 053
Mauritius	10 295	United Republic of Tanzania	18 918
Morocco	32 947	Zambia	2 951
Namibia	8 808		

²⁵ This section (and in C.2, C.3 and C.4) respond to section 3, operative paragraph 1 of resolution GC(59)/RES/11 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, paragraph 7 on the two-step mechanism in monitoring the quality of TC projects; and to section 3, operative paragraph 8 on enhancing adherence with the central criterion and all the TC requirements.

C.2. ASIA AND THE PACIFIC

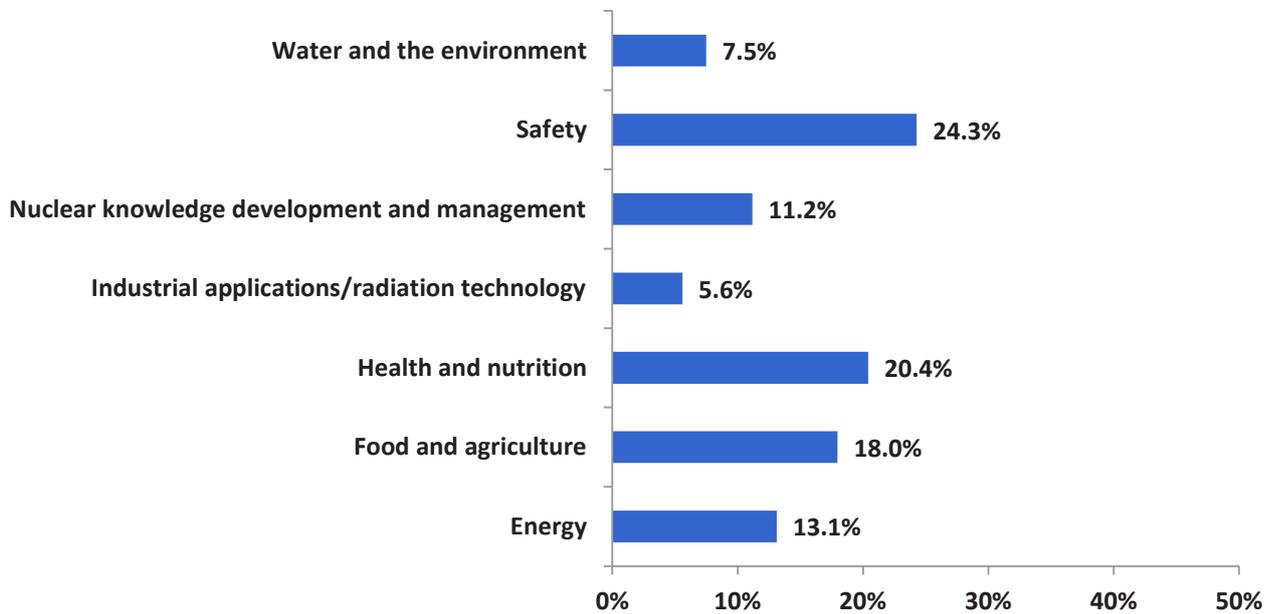
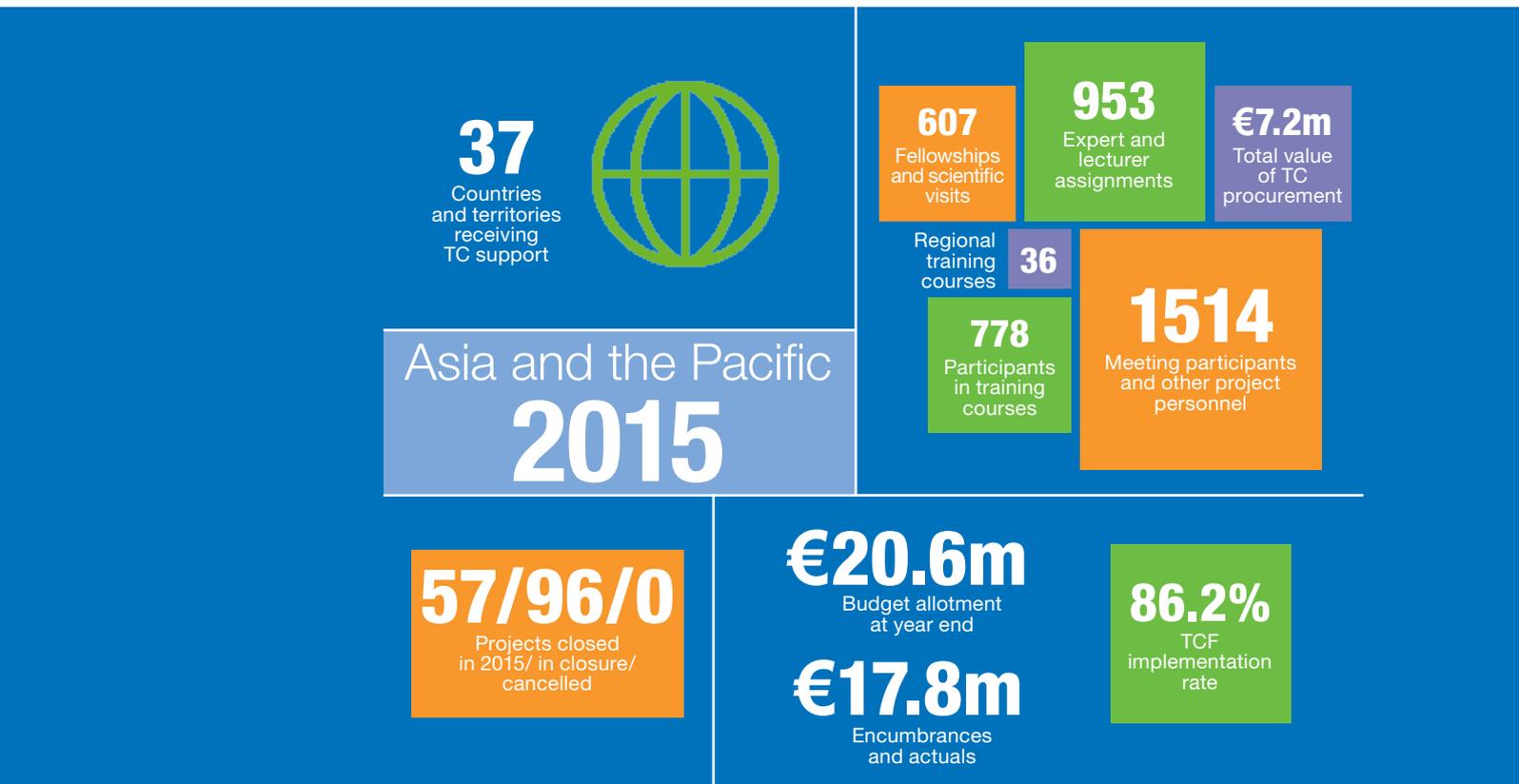


Figure 8: Actuals in the Asia and the Pacific region in 2015 by technical field.

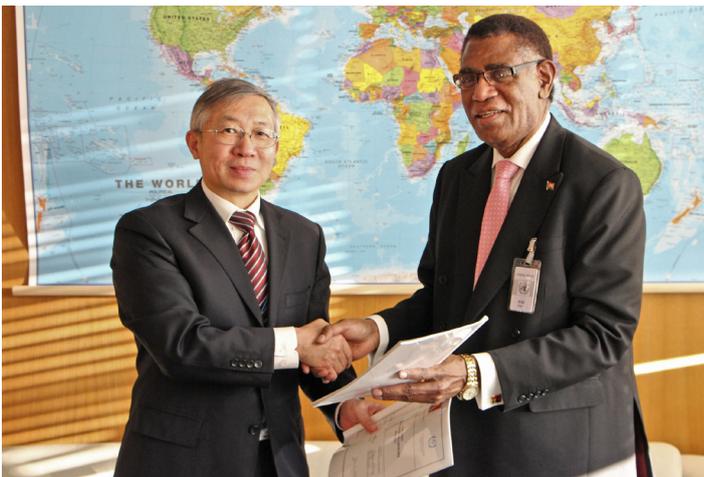
Regional highlights in Asia and the Pacific, 2015

Safety continued to be the top priority area in the Asia and the Pacific region for 2015, followed by health and nutrition, and food and agriculture (Fig. 8). This is not only reflective of the priorities of the large number of developing and LDCs in the region, but also of the rapid socioeconomic changes that are occurring, which encourage Member States to work actively to ensure safety, health and food security. In addition, climate change and sustainable management of the marine environment have gained increasing importance for countries in the region, and this is reflected in both national and regional programming. The implementation rate reached 86.2%.

Each national TC programme responds to the specific needs of the participating Member State, in line with the national development priorities as set out in its CPF. Seven CPFs were signed in the Asia and the Pacific region in 2015, for Fiji, Indonesia, Marshall Islands, Mongolia, Palau, Papua New Guinea, and Viet Nam. A further five CPFs were developed for Brunei, China, Myanmar, Nepal, and Qatar – these are projected to be signed in 2016. Upstream work for the Regional Programme Framework for Asia and the Pacific for 2018–2028 began in 2015, focusing on alignment with the SDGs, and on accommodating the needs of new SIDS Member States.

In addition, the Secretariat participated actively in the UNDAF process at country level, signing the United Nations Partnership for Development Framework of Indonesia in 2015.

CPF signed in Asia and the Pacific in 2015	
Fiji	Palau
Indonesia	Papua New Guinea
Marshall Islands	Viet Nam
Mongolia	



Papua New Guinea signs its first Country Programme Framework (CPF) for 2016–2021.



Palau signs its First Country Programme Framework (CPF) for 2016–2021.

Project highlights

In 2015, two Schools were held for Member States from the Asia and the Pacific region, with the aim of providing unique experiences in education and building competences, as well as worldwide networking opportunities. A Nuclear Energy Management School (NEMS) took place in the United Arab Emirates in March, and a School for Drafting Regulations on Radiation Safety, supported by the European Commission, was held in Vienna in November. Both Schools attracted widespread participation from the region.

The NEMS, funded through project RAS/2/015, ‘Supporting the introduction of Nuclear Power for Electricity Generation and Seawater Desalination’, provided 46 national and international students with a unique educational experience aimed at building capacities in future leaders to manage nuclear energy programmes. The School promoted and fostered knowledge of a wide range of issues related to the peaceful use of nuclear technology, and provided a unique worldwide networking opportunity for future managers in the area of nuclear energy.



Participants at the 2015 NEMS visit the Simulator Training Centre at the United Arab Emirates Barakah NPP construction site.

Regional cooperation

The Agency provided support to the management and coordination activities of the two regional agreements, ARASIA and RCA, to enhance regional ownership of the agreements' TC programmes. Project RAS/0/067, 'Enhancing the Management of the Cooperative Agreement and its Technical Cooperation Programme (ARASIA)', supported activities for the adoption of the ARASIA Strategy and Cooperative Thrusts for 2018–2027, as well as the design of a quality TC programme for 2016–2017. RCA TC project RAS/0/068, 'Enhancing the Management of the Regional Agreement and Programme (RCA)', supported the process for the amendment of the Agreement, as well as the processes for preparing the RCA Medium Term Strategy and Strategic Priorities 2018–2023 and the revision of the RCA Guidelines and Operating Rules. The Agency also provided support to RCA to produce quality projects for the 2016–2017 and 2018–2019 TC cycles.

A framework for participation in ARASIA TC projects for the 2016–2017 cycle has been set up to ensure efficient and effective resource utilization.

The strategic document *ARASIA Strategy and Cooperative Thrusts (2018–2027)* was endorsed at a meeting on the margins of the 59th IAEA General Conference in September 2015.

The document provides strategic guidance for the overall upstream planning of ARASIA activities for the next five TC cycles and serves as a frame of reference for the preparation of specific programmes.

The National Representatives (NRs) of the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) also met on the margins of the 59th IAEA General Conference. The NRs approved the new RCA *Medium-Term Strategy and Strategic Priorities for 2018–2023*, a detailed plan for the preparation of the RCA programme for 2018–2019, and a new template for the RCA Annual Report. The implementation of on-going RCA projects was reviewed as was the preparation of the 2016–2017 RCA programme.



September meeting of the ARASIA Board of Representatives.



National representatives at the RCA meeting, September 2015.

Preparations for the 2016–2017 TC programme cycle

A Regional Meeting on Pre-Project Assistance and Project Design for the proposed ARASIA project concepts for the 2016–2017 cycle was held in March 2015, with the aim of developing and implementing a high quality TC programme. The meeting, attended by 47 counterparts from all ARASIA States Parties, focused on the work plans for eight new TC projects related to human health, emergency preparedness, energy planning, dosimetry and medical physics, radiation technology, radiation safety, and food and agriculture.

Extensive support was also provided to new Member States, including Brunei, Fiji, Marshall Islands and Papua New Guinea, throughout the programme design phase, to ensure the development of results based projects. The Secretariat also organized a sub-regional training course for small islands developing States and Brunei, which provided basic training on establishing a regulatory entity and on preparing high quality TC programmes. Four Member States, Brunei, Fiji, Marshall Islands, and Papua New Guinea have national programmes for the first time.

The Secretariat has assisted Member States in formalizing a Regional Programme Framework for Asia and the Pacific for the period 2018–2028. The document was prepared by experts from the region and was adopted during the NLO meeting held in February 2016. The document sets the priorities for the development of regional programming over the next ten years, complementing other related strategic documents and correlating priorities to the SDGs.

C.3. EUROPE

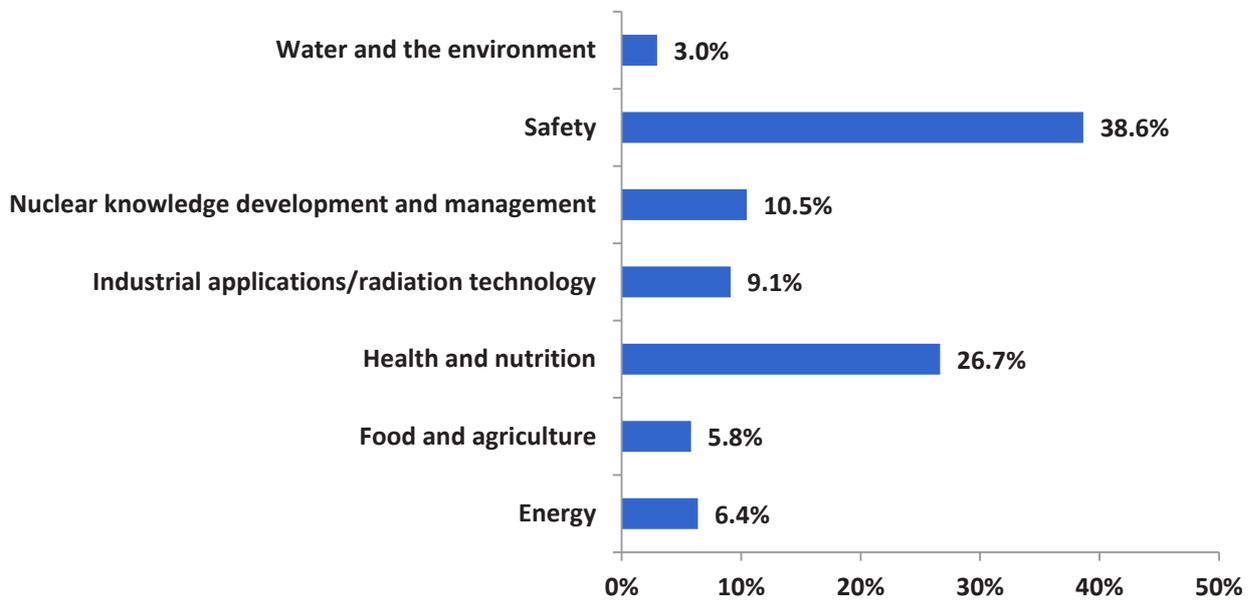
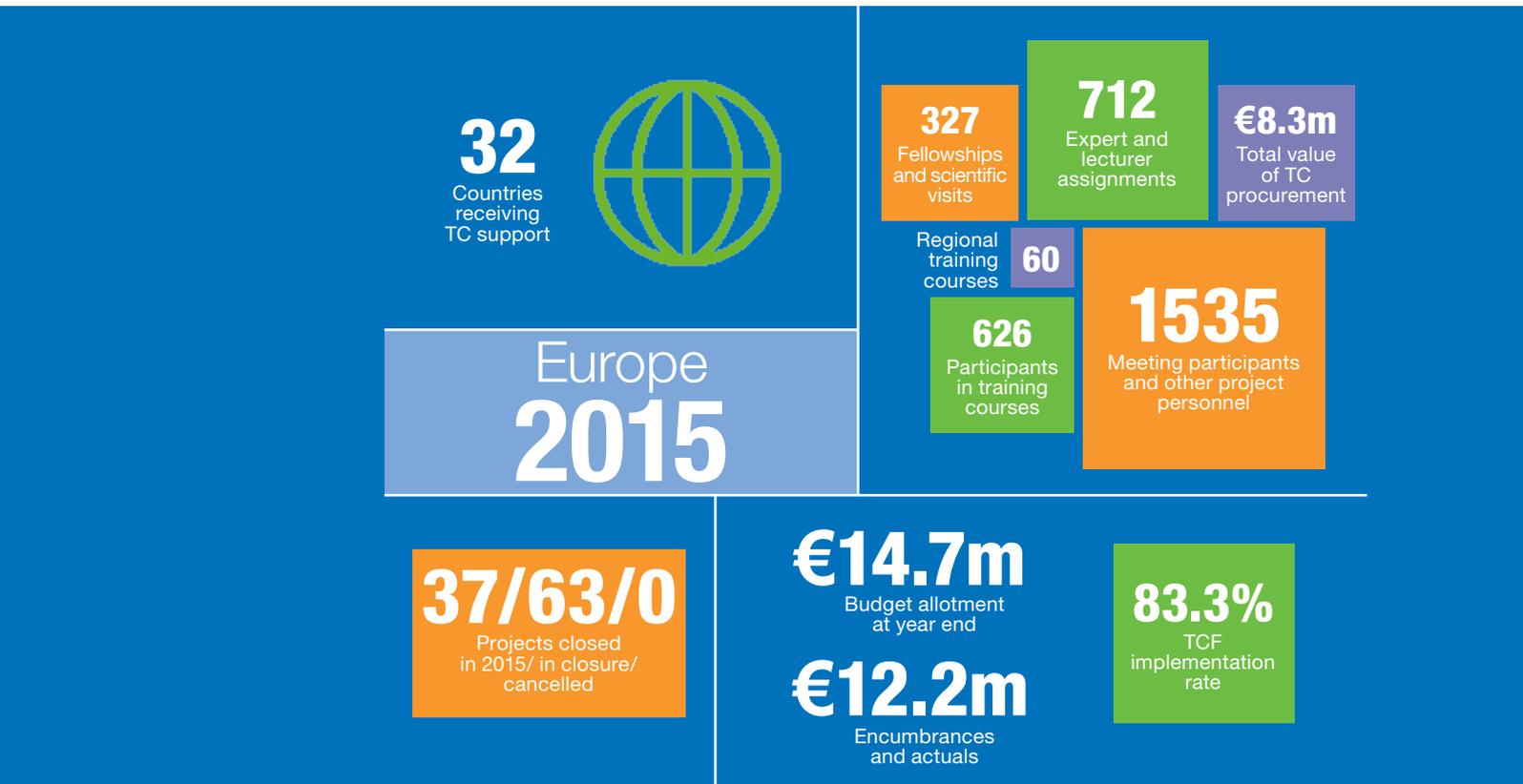


Figure 9: Actuals in the Europe region in 2015 by technical field.

Regional highlights in Europe, 2015

The TC programme in the Europe region focuses on sustainable development in the specific areas of nuclear and radiation safety, human health and nutrition, and isotope technology applications. Development of both institutional and human resource capacities and enhancing cooperation among Member States are important features of the programme.

Of the 32 Member States in the region participating in TC projects, 29 have national TC projects and three participate only in regional TC activities. The programme in the region achieved an implementation rate of 83.3%.

The thematic priority areas for 2015 were similar to those of previous years. In all these areas, most efforts are concentrated on infrastructure development, capacity building, technology transfer, training for staff from regulatory bodies and operating organizations, and on knowledge development and preservations.

In total, 49 training courses were implemented in the Europe region in 2015, including 36 regional courses, four training events under interregional projects and nine under national TC projects. In addition, 419 different expert events were implemented: these were 137 expert missions (including the Integrated Regulatory Review Service (IRRS), Quality Assurance in Nuclear Medicine (QUANUM) and Quality Assurance Team for Radiation Oncology (QUATRO)), 39 staff missions and 243 different expert meetings and workshops.

During 2015 CPFs were signed for Azerbaijan, Bosnia and Herzegovina, Czech Republic and Georgia. UNDAFs were signed for Armenia, Belarus and Georgia in 2015, and programme activities were carried out according to commitments in 12 further UNDAFs.

In Armenia, the UNDAF was signed on 31st July 2015 by UN Agencies, including the IAEA, covering the five-year period 2016–2020. The Agency will contribute through national TC projects to the country's development in two out of the seven outcomes: Health (outcome 6) and Environmental Sustainability and Resilience-Building (outcome 7).

The most recent UNDAF signed by the IAEA in the Europe region is for Belarus. The Agency is providing support for Belarus to reach its SDGs regarding energy security and decrease of greenhouse gas (GHG) emissions (UNDAF Area of Cooperation 3). Through the TC programme, the Agency is helping Belarus to strengthen its human resources for its nuclear power infrastructure and to enhance capacities for efficient regulatory oversight. Under UNDAF Area of Cooperation 4, the Agency will contribute to the creation of a comprehensive, preventive healthcare environment by supporting the establishment of the first Positron Emission Tomography Centre, with autonomous cyclotron-production of radiopharmaceuticals for use in medical diagnostics, at the Alexandrov National Cancer Centre in Minsk.

The Europe region sees very active bilateral and sub-regional cooperation between Member States and among groups of Member States. Many countries are also involved in European Union (EU) and Organisation for Economic Co-operation and Development (OECD) activities, and the Agency is continually looking for synergies and joint actions to enhance programme delivery. The region also includes Member States that participate only in regional TC activities, and that at the same time provide technical assistance or funds to other countries as donors. Regular meetings with all NLOs in the region ensure that the TC programme can respond in a timely manner to new developments and challenges in the region and at the national level.

The Regional Meeting on Medical Physics in Europe: Current Status and Future Perspectives, was held in 2015 in Vienna, with attendance supported partially by RER/6/031, 'Strengthening Medical Physics in Radiation Medicine'. The meeting raised the awareness of national authorities on the role, status, education, training, recognition and accreditation of the medical physicist in European Member States, and of staff shortages. In particular, the meeting discussed the need for the adequate staffing provision of medical

CPFs signed in Europe in 2015

Azerbaijan

Bosnia and Herzegovina

Czech Republic

Georgia



Regional Meeting on Medical Physics in Europe: Current Status and Future Perspectives, Vienna 2015.

physicists to ensure adequate physics services in radiation medicine and enhance patient health care and safety. The meeting stressed the need to recognize medical physicists as an independent health care profession with radiation protection responsibilities. Its results have been broadly disseminated by medical physics professional societies in their bulletins and journal publications.

Regional cooperation

Under the Strategic Framework for Regional Technical Cooperation in the Europe Region, the Secretariat organized one NLO meeting in 2015. A TC Europe Regional Meeting was held during the 59th General Conference, at which the role of nuclear applications in the health sector and nuclear technologies in the context of the Sustainable Development Goals (SDGs) were discussed. The Strategic Framework for Regional Technical Cooperation in the Europe Region will be updated in 2016.

Two Practical Partnership Agreements were signed in 2015 and implemented between the IAEA and European Association of Nuclear Medicine and European Society for Radiotherapy and Oncology, which increases efficiency in relevant TC activities and facilitates networking efforts among Member States, professional associations and partner organizations such as WHO. The Parties successfully worked together in arranging training courses in nuclear medicine and radiotherapy.



TC Europe regional meeting on the margins of the 59th General Conference.

Preparations for the 2016–2017 TC programme cycle

There are 115 new projects in the Europe region for the 2016–2017 TC cycle, of which 28 are regional and 87 are national. The priority thematic areas for regional projects are: nuclear safety and nuclear power, radiation safety, human health, and waste and environment. For the national projects, priorities are as follows: human health, nuclear safety and nuclear power, radiation safety and waste, and the environment. Assistance is also focusing on legislation and regulatory infrastructure for safety, quality control of ionising radiation sources in medicine, infrastructure safety for NPPs and operation, and waste management, decommissioning and remediation.

The 2016–2017 TC programme for the Europe region was formulated in close consultation with Member States, and taking into account both CPFs and the Europe Regional Profile. The programme was guided by the Strategy for the TC Programme in the Europe Region adopted in 2010. The goal of this strategy is to provide an effective and efficient mechanism to support the safe and secure use of nuclear technologies that addresses socioeconomic needs and contributes to sustainable development in the region, and to promote regional cooperation for the same.

C.4. LATIN AMERICA AND THE CARIBBEAN

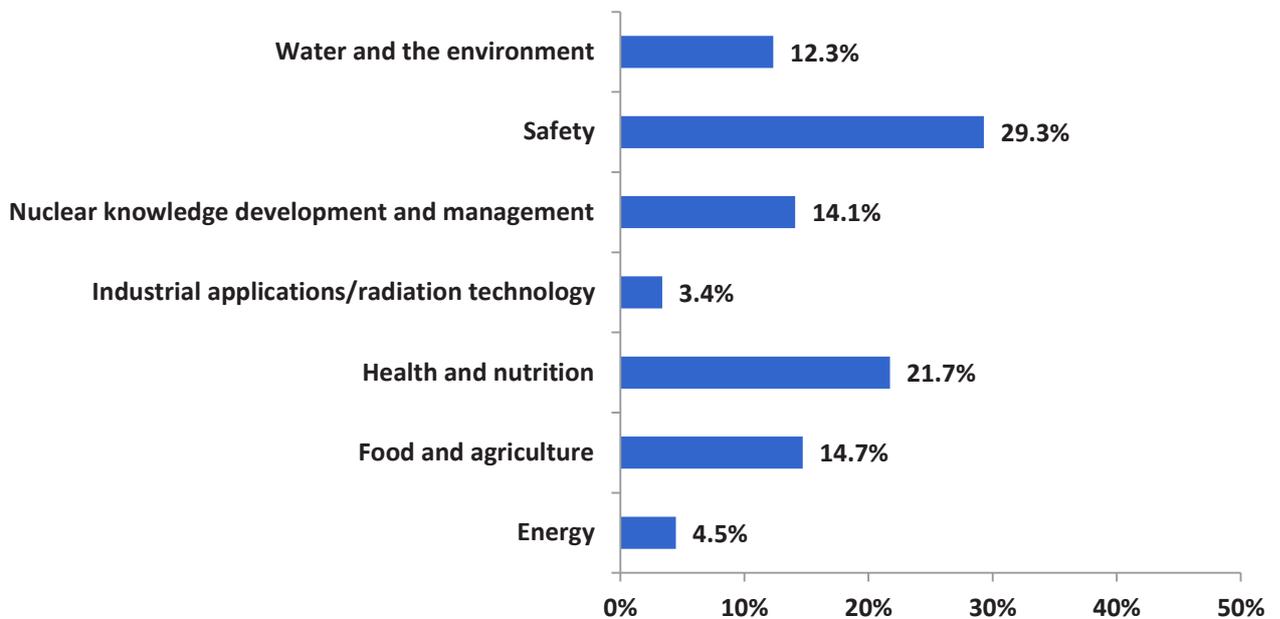


Figure 10: Actuals in the Latin America and the Caribbean region in 2015 by technical field.

Regional highlights in Latin America and the Caribbean, 2015

Considerable attention was given to monitoring project implementation and progress made in achieving expected project results in the Latin America and Caribbean region in 2015, and the TCF implementation rate in the region for 2015 reached 93.2%, the highest rate obtained for the region to date. To ensure that TC programme progress and performance is monitored throughout the life cycle of its projects, Member States are requested to submit PPARs. In 2015, Member States submitted 69.3% of the PPARs expected from the region, demonstrating an increasing commitment to enhancing the quality of the programme.

The priority thematic areas for the Latin America and the Caribbean region in 2015 were safety, health and nutrition, and food and agriculture. These areas received more than 60% of available funds, and will remain a priority in the 2016 budget. The majority of projects were focused on radiotherapy and nuclear medicine, providing training to professionals, capacity building and equipment procurement. The programme also concentrated on enhancing capacities and fostering collaboration for response to radiation emergencies, as well as in the fields of radioactive waste management, insect pest control and food safety. Particular attention was paid to the fruit fly outbreak in the Dominican Republic.

One CPF was signed in the region in 2015, by Colombia, for the period 2016–2021. Eight additional CPFs are in development – discussions between the Member States concerned and the Secretariat are underway to identify areas where nuclear technology can produce sustainable impact. In addition, draft CPFs are being prepared for the new Member States.

During 2015, UNDAFs were signed for Argentina, Colombia, Panama and Uruguay. In addition, the Agency followed up on the implementation of UNDAFs for Belize, the Plurinational State of Bolivia, Cuba, Dominican Republic, Jamaica, Mexico and Nicaragua.

Seventeen new National Liaison Officers and Assistants attended a comprehensive training session from 5–9 October 2015 in Vienna. Participants received a thorough briefing on the TC programme's functions, strategy, roles and responsibilities and processes. NLOs and NLAs are the main channel between the Agency and Member States on matters related to the planning, formulation and implementation of technical cooperation projects. In the next cycle, special attention will be given to providing training for English-speaking countries, and on increasing collaboration with other TC regions regarding support for Portuguese-speaking countries, as well as SIDS.

The Agency carries out many activities to enhance the visibility and impact of TC programmes and projects, developing messages for outreach and using networks of

CPF signed in Latin America and the Caribbean in 2015

Colombia



Signing of the CPF for Colombia for 2016–2021.



RLA/O/052: NLO/NLA Training Workshop October 2015, Vienna, Austria.

partners to increase awareness of the programme. In 2015, 45 articles, six success stories and 12 project-related videos/interviews were produced on TC activities in the region.

Regional cooperation

The Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL), which promotes and coordinates activities for training, development and applications of nuclear science and technology, was extended for the first time for an additional period of five years, effective as of 5 September 2015.

ARCAL continues to play a major role in establishing a robust regional programme to tackle cross-regional issues and challenges using nuclear technology. Currently, of the 28 Member States in the region, 19 are currently Parties to the Agreement.

The ARCAL programme in 2015 consisted of nine active projects. These comprised two projects on food and agriculture, three projects on human health, three projects on water and the environment, and one project on capacity building.

The regional projects submitted by ARCAL for the 2016–2017 TC cycle address the needs and priorities identified in the 2016–2021 Regional Strategic Profile for Latin America and the Caribbean (RSP), IAEA-TECDOC-1763. The RSP serves as a key programmatic tool for the development of the new proposals and is expected to be a valuable instrument for fostering regional cooperation and promoting cooperation among countries. The new ARCAL regional programme consists of 11 new projects which are intended to contribute to the enhancement of human resource development and to strengthen existing infrastructure in the region. These projects were designed with the aim of developing a larger and more comprehensive programme that will achieve greater impact in the States Parties to the Agreement.

In 2015, with Agency support, the Guidelines and Operating Rules for the ARCAL Agreement were revised and updated. This will contribute to strengthening the management of the Agreement and to ensuring high quality in the development and delivery of the ARCAL programme.

Preparations for the 2016–2017 TC programme cycle

In preparing the programme, lessons learned from the design and implementation of previous TC programmes were taken into consideration, particularly as regards the search for relevant partnerships at the political, financial and technological levels, taking into consideration the specific interests and needs of partners and recipients. The programme in the region also took into consideration the CPFs of the participating Member States, and the RSP for Latin America and the Caribbean, and where appropriate, the post-2015 United Nations (UN) Development Agenda, the SDGs and UNDAFs. All proposed projects address priorities indicated in the CPFs or the RSP. Projects in human health and nutrition comprise 25% of the budget for the region's 2016–2017 TC programme, with safety at just over 20%, and food and agriculture at 16%. Three Member States, Dominica, Trinidad and Tobago, and Bahamas have national programmes for the first time.

The launch of the new cycle is focused on the initiation of a smooth programme implementation of the programme, particularly for the new projects. Special emphasis is being given to the integration of new Member States into the regional programme, and to increasing collaboration with other TC regions, in particular to promote cooperation between Portuguese speaking countries and to harmonize approaches to technical cooperation in SIDS. Emphasis is also being placed on providing training for English-speaking countries

C.5. INTERREGIONAL PROJECTS

Interregional projects deliver TC support across national and regional boundaries and address the common needs of several Member States in different regions. In 2015, encumbrances and actuals under interregional projects totaled €4.9 million. As of February 2016, 22 interregional projects are active, with a further seven in closure.

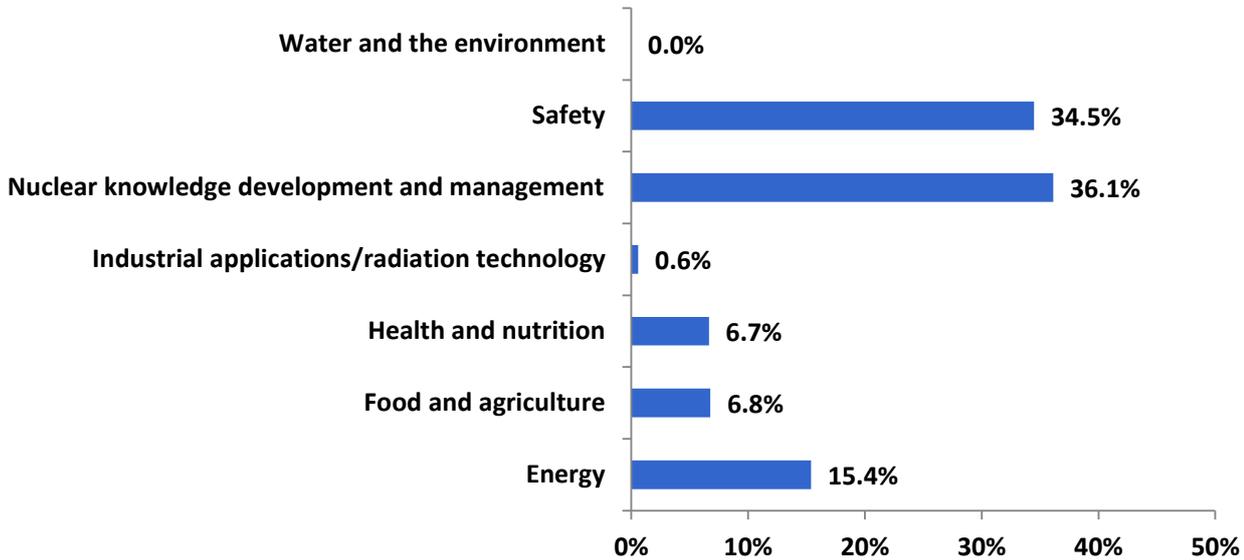


Figure 11: Interregional actuals in 2015 by technical field.

The interregional TC project INT/0/089, ‘Developing Human Resources and Supporting Nuclear Technology’, aims to upgrade and strengthen human resource skills and capabilities and to provide general support within the broad spectrum of nuclear science and technology applications. Every year the project supports the participation of candidates from developing countries in the World Nuclear University (WNU) Summer School, the International Nuclear Law School (INLS) and the annual meeting of Women in Nuclear (WiN). In 2015, the project enabled the participation of 22 candidates in the WNU, 12 candidates in the INLS, and 23 candidates in WiN. In addition, the project supported the participation of ten candidates in the Nuclear Knowledge Management School hosted by ICTP. The project also supports the participation of up to six PhD students from developing countries in the ICTP-IAEA Sandwich Training Educational Programme (STEP), which focuses on the fields of physics and mathematics. In 2015, the project enabled the quality review of the 2016–2017 TC programme, as well as meetings to develop interregional projects for the 2016–2017 TC cycle.

Several activities related to the development of e-learning materials to be hosted on the Connecting the Network of Networks for Enhanced Communication and Training (CONNECT) platform and the promotion and dissemination of e-learning and the tool itself were implemented in 2015 with the support of INT/9/174, ‘Connecting Networks for Enhanced Communication and Training’. Eight new training modules on decommissioning have been developed and are currently under final testing. They will be made available to Member States in March 2016. A paper on CONNECT was presented at the International Waste Management Symposia in Phoenix, USA, which was a good opportunity to promote the platform.

In the context of the interregional project INT/5/153, ‘Assessing the Impact of Climate Change and its Effects on Soil and Water Resources on Polar and Mountainous Regions’ multidisciplinary expert team missions took place for field sample collection of sediments

in Patagonia, Chile; King George Island, Antarctica and Svalbard, Norway with the participation of experts and laboratories from Austria, Belgium, Brazil, Chile, Germany, Spain, Sweden, U.K., Russian Federation and IAEA. For example, the expert mission to the Russian station Bellingshausen on King George Island (Antarctic) was organized in February 2015, and in July 2015 the expedition took place to the Russian scientific centre in Barentsburg (Spitsbergen). Efforts for outreach were also initiated to inform different interest groups particularly through UNEP and UNESCO of the Agency collaborative work with various countries to investigate the effects of climate change. The focus of the project, which is supported by US contributions to the PUI, involve investigations of 13 benchmark sites that are representatives of the major problems and trends of climate impact on cryosphere and land-water-ecosystem quality in polar and mountain regions across the world. The field investigations continue according to the protocols established in 2014 under the project.

The focus of the TC programme with the Synchrotron-Light for Experimental Science and Applications in the Middle East (SESAME) continued to be on human capacity building to support the successful commissioning of the beamlines and magnets, supported through hands-on training of counterparts and expert missions on site. In 2015 alone, nine engineers and technicians received fellowship training on various topics for a total of 36 weeks, including training on beam lines, power supplies, magnets, assembling, installation, mounting and testing of the synchrotron, factory acceptance testing for the solid state amplifiers and practice in high performance computing for synchrotron radiation research in notable facilities of the European Organization for Nuclear Research (CERN), Switzerland; SOLEIL, France, European Scientific Institute; and Elettra, Italy

Efforts are also ongoing to develop potential users of SESAME. Direct contact with the potential SESAME user community has forged synergies and collaborations and opened possibilities for scientific exchanges. TC support to SESAME in 2016–2019 will continue through INT/0/092, 'Building Human Capacity for the Construction, Operation and Use of Synchrotron-Light for Experimental Science and Applications for the Middle East', with the goal of establishing SESAME as a leading research centre of excellence, open to all scientists and thereby fostering science and technology in the region.

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

PACT highlights in 2015

In 2015, the Agency, through its Programme of Action for Cancer Therapy (PACT), continued to support the efforts of low and middle income countries (LMICs) to strengthen national cancer control capacities, with a strong emphasis on the importance of the sustainable integration of radiation medicine in comprehensive national cancer control strategies.

The national cancer control capacities and related priorities of Algeria, Bosnia and Herzegovina, Dominica, El Salvador, Kyrgyzstan, Madagascar, Mauritania and Myanmar were evaluated and relevant recommendations provided as a result of integrated missions of PACT (imPACT) in coordination and cooperation with WHO. The imPACT review methodology and approach were further improved through enhanced interaction and review preparation with national authorities and subject matter experts.

At the end of each imPACT review, preliminary findings and recommendations were provided to the respective Minister in charge of health matters. The active participation of TC Programme Management Officers and radiation medicine and radiation safety experts continued to ensure the effectiveness and relevance of these missions for future IAEA support in relation to radiation medicine. Furthermore, close coordination among all stakeholders facilitated the provision of subsequent advice and support. imPACT review missions were funded with contributions from France, Ireland, Spain and the United States.

Algeria: imPACT review mission 22–27 February. Complementing a first imPACT mission in 2011 that focused on the Capital region, cancer control capacities, facilities and infrastructure were further assessed in six provinces in the south, east and west. Algeria has developed a fully budgeted comprehensive cancer control plan (2015–2019) to address the cancer burden. Recommendations focused on the planned expansion of cancer treatment facilities and corresponding human resources requirements.

Bosnia and Herzegovina: imPACT review mission 22–26 June. Cancer and healthcare professionals in Bosnia and Herzegovina demonstrated a strong overall commitment to the provision of oncology services. Relevant cancer strategies are: the Federation of Bosnia and Herzegovina’s Strategy for the Prevention, Treatment and Control of Malignant Neoplasms 2012–2020, and the Republika Srpska’s Strategy for the Prevention and Control of Non-Communicable Diseases (2003). The recommendations highlighted the importance of consolidated cancer care services to facilitate access.

Dominica: imPACT review mission 19–22 January. The National Strategic Plan for Health (2010–2019) and the draft Non-Communicable Disease (NCD) Policy and Implementation Plan (2014–2019) provide a good basis for comprehensive cancer control and implementation. The review mission findings and recommendations prioritized the advancement of comprehensive national cancer control capacities, including access to cancer treatment to complement primary prevention and early detection activities.

El Salvador: imPACT review mission 20–23 April. The expert team conducted field visits to health facilities at different levels of care and discussed with national cancer control stakeholders, including private sector and non-governmental organizations. The Ministry of Health is working to ensuring greater access to effective cancer treatment, involving a strengthened referral systems and integrating radiotherapy within the public health system. The latter should be aligned with and integrated into a national cancer control strategy.

Kyrgyzstan: imPACT review mission 9–13 March. The mission team met with the WHO Country Office, the Ministry of Health, the National Centre of Oncology, private and

imPACT review missions in 2015

Algeria	Kyrgyzstan
Bosnia and Herzegovina	Madagascar
Dominica	Mauritania
El Salvador	Myanmar

municipal hospitals, and family medical centres. The Ministry of Health is developing a comprehensive national cancer control plan which will take into consideration the findings of the imPACT review.

Madagascar: imPACT review mission 3–7 August. The Government's 2009 National Policy for Prevention and Integrated Fight against Chronic Non-communicable Diseases illustrates the importance Madagascar places on addressing its national cancer burden. A new national cancer control plan (2016–2020) is under development, seeking to improve access to oncology services, particularly to paediatric and gynaecological cancers. A technical cooperation project is supporting the upgrade of the national radiotherapy capacity. Recommendations centered on advancing cancer control, expanding prevention and early detection activities, and facilitating access to diagnosis and treatment services.

Mauritania: imPACT review mission 7–11 December. The mission acknowledged ongoing national activities in the area of cancer control, such as the Strategic Plan on Non Communicable Diseases (2012–2014) and the draft national cancer control plan (2016–2020), the establishment of a National Oncology Centre, and the involvement of relevant national stakeholders in efforts to improve access to cancer-related services. Preliminary recommendations to the Ministry of Health emphasised the importance of prevention, accessible early detection and diagnostic activities and services.

Myanmar: imPACT review mission 28 November - 4 December. The mission assessed cancer control capacities and needs based on discussions held and findings obtained at primary, secondary and tertiary care facilities (public and private), universities, hospices and civil society organizations. The Ministry of Health highlighted national priorities such as developing the medical workforce, and establishing multi-disciplinary tumour boards to improve cancer management. Recommendations focused on advancing radiotherapy treatment services and their alignment with workforce development efforts.



imPACT review mission underway in Mauritania.

PACT Model Demonstration Sites (PMDS)

PMDSs aim to demonstrate synergies achieved between partners, donors, cancer therapy experts and national authorities for effective cancer control planning and implementation. In 2015, Mongolia, Nicaragua, the United Republic of Tanzania and Viet Nam were supported through expert advice, capacity building support and the provision of equipment.

Mongolia upgraded the radiotherapy treatment planning system at the National Cancer Centre (NCC), with funding from Japan and the Principality of Monaco. Additional workstations and a computerized treatment planning system will be able to efficiently handle a larger number of patients as part of the NCC external beam radiotherapy service.

Nicaragua continued to implement a project seeking to strengthen diagnosis of cervical and breast cancer at Bertha Calderon Hospital in Managua, with funding from Spain, and a project aimed at enhancing capacities for early detection, diagnosis and treatment of cervical and paediatric cancers, funded through the Organization of the Petroleum Exporting Countries (OPEC) Fund for International Development (OFID).

Viet Nam initiated a cervical cancer screening campaign in the Hanoi and Can Tho regions. The project, funded through OFID, aims to develop viable screening and follow-up of suspected cases of cervical cancer, and raise awareness of the early signs and symptoms of breast and cervical cancer. A cancer screening training programme was conducted for health professionals, and an expert assessed the project's progress and provided practical recommendations to improve and sustain screening efforts.

Finally, the United Republic of Tanzania continued to enhance palliative care services, funded through OFID.

Advisory Group on Increasing Access to Radiotherapy Technology in Low and Middle Income Countries (AGaRT)

AGaRT currently comprises a wide range of partners with expertise in cancer matters, such as representatives from WHO, IARC, private sector companies, teaching hospitals, national cancer centres, professional societies, public health institutions, academic institutions and non-governmental organizations. Following the completion of the group's 2009–2014 programme, experts and key partner representatives considered the group's potential future areas of work, taking into account emerging evidence for the effectiveness of radiotherapy in LMICs, and the need to ensure an effective response to Member State needs for advice on expanding access to affordable, quality and sustainable radiotherapy solutions.

Virtual University for Cancer Control and Regional Training Network (VUCCnet)

Following the completion of the VUCCnet pilot phase in 2014, a comprehensive review of the online training platform for cancer care specialists was conducted. In response to requests from Member States, the review considered the potential for scaling-up VUCCnet services across sub-Saharan Africa to address some of the most pressing human resource needs of Member States. The study concluded that VUCCnet could contribute substantially to enhancing the availability of the medical workforce and of relevant skills in LMICs, and that it would complement existing national education efforts in cancer control. The findings of this review were reflected in a multi-year business plan for VUCCnet's expansion.

A clinical oncology course was also added to the VUCCnet curriculum. A cancer registry module is in the early stages of development.

Advocacy, partnership building and resource mobilization

The global visibility and recognition of the Agency as a key player in cancer control further increased in 2015. Relationships with strategic partners were established or strengthened, such as the African Cancer Registry Network, the African Organisation for Research and Training in Cancer (AORTIC), the International Agency for Research on Cancer (IARC), Islamic Development Bank, the Organization for International Economic Relations (OiER), the Organisation of Islamic Cooperation, Pink Ribbon Red Ribbon of the George W. Bush Institute, the Union for International Cancer Control and WHO.

Within the framework of the UN Interagency Task Force on Non-Communicable Diseases, preparatory work continued on the design of the joint IAEA/IARC/WHO project on cancer control, which aims to support the planning and implementation of comprehensive cancer control in seven Member States. The structure for a joint workplan was developed to capture the technical support to be provided by each participating agency throughout 2016–2017, including cancer-related technical cooperation projects.

“The global visibility and recognition of the Agency as a key player in cancer control further increased in 2015.”

PACT assisted in the organization of panels on cancer control at key cancer related events, such as the 9th Stop Cervical, Breast and Prostate Cancer in Africa conference in Kenya, the Islamic Conference of Health Ministers, the World Cancer Leaders’ Summit in Turkey, and the Economist War on Cancer Series in Hong-Kong.

A social media campaign highlighted the inequalities cancer patients face in accessing relevant services, particularly in developing countries. The #CancerCare4All campaign, developed with OiER, was launched as an interactive exhibition during the 59th General Conference and disseminated through IAEA, TC and PACT social media channels. A short film was produced, capturing responses to the campaign from Member State Representatives to the IAEA, cancer experts and UN staff.

In parallel, PACT intensified direct resource mobilization efforts by developing funding proposals for various donors, including Australia, Ireland, Switzerland, the UK and US. Potential partnerships were explored with the African Development Bank, the Carter Center, JICA, the Kuwait Foundation and the Kuwait Fund, amongst others, as well as with private sector partners including Boehringer Ingelheim, Novartis and Pfizer . A PACT related funding proposal was developed and launched as part of OiER’s Corporate Social Responsibility Project Fund which mobilizes resources and pools contributions for projects aligned to the UN Sustainable Development Goals from private sector organizations.

PACT has explored or further enhanced relations with key global academic institutions and the private sector, particularly with Roche Pharmaceuticals in the context of VUCCnet. Mckenzie Consultants supported the Programme through a pro-bono consultancy for the development of a business plan to support the expansion of the VUCCnet project.

In support of Member States’ resource mobilization efforts, PACT conducted a training on ‘Resource Mobilization for Cancer Control’ for 15 African Member States. Supported with funding from the Government of France, the workshop was held at AORTIC’s tenth International Cancer Conference in Morocco. It introduced Member States to resource

Cancer survival should not be left to chance.



Prostate Cancer	<div style="display: flex; justify-content: space-around;"> <div style="text-align: left;"> <p><u>AUSTRALIA</u></p>  </div> <div style="text-align: right;"> <p><u>UGANDA</u></p>  </div> </div>	 <p>89%</p> <p>5 Year Survival Rate</p>	 <p>46%</p> <p>5 Year Survival Rate</p>
Breast Cancer	<div style="display: flex; justify-content: space-around;"> <div style="text-align: left;"> <p><u>USA</u></p>  </div> <div style="text-align: right;"> <p><u>JORDAN</u></p>  </div> </div>	 <p>89%</p> <p>5 Year Survival Rate</p>	 <p>43%</p> <p>5 Year Survival Rate</p>
Childhood Leukemia	<div style="display: flex; justify-content: space-around;"> <div style="text-align: left;"> <p><u>GERMANY</u></p>  </div> <div style="text-align: right;"> <p><u>MONGOLIA</u></p>  </div> </div>	 <p>92%</p> <p>5 Year Survival Rate</p>	 <p>34%</p> <p>5 Year Survival Rate</p>

Support expanded access to cancer care. Everywhere.

#CancerCare4All

PACT’s social media campaign #CancerCare4All highlights the inequalities cancer patients face in accessing relevant services. (Picture posed by models)

mobilisation trends, key principles, existing tools, funding partners and mechanisms, and advised on the development of bankable documents and funding proposals. Albania, Lesotho, Namibia and Tanzania also received support from PACT in mobilizing resources for comprehensive cancer control through the development and review of their national cancer-related bankable documents and funding proposals.

€719 765 were mobilized for PACT activities in cancer control in 2015. €718 760 were mobilized in 2014.

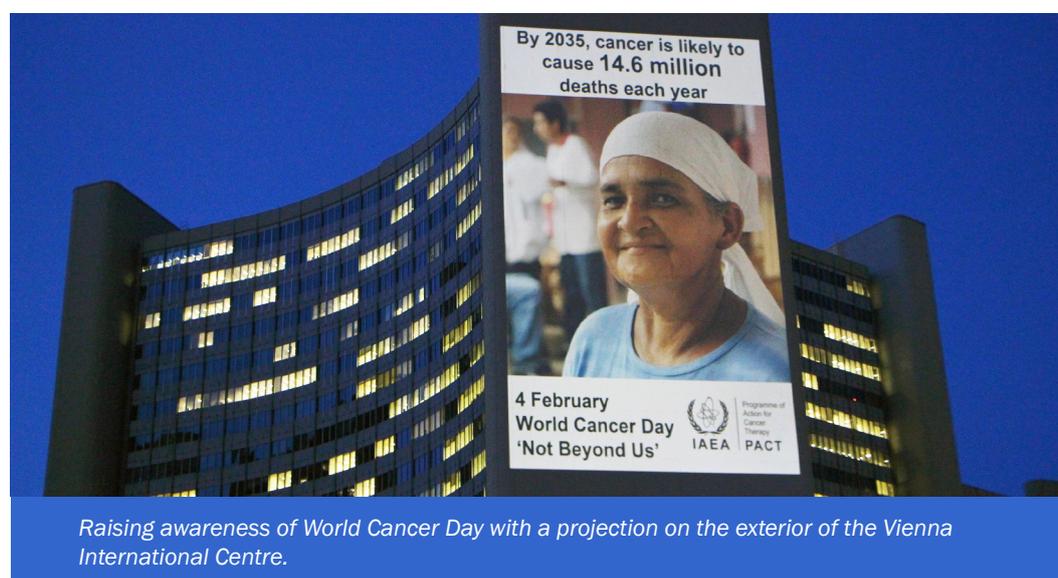
Table 11: Extrabudgetary contributions to PACT, 2015

Donor	Amount (EUR)
Japan	556 875
France	20 000
Korea, Republic of	27 300
Monaco	80 000
United Nations Federal Credit Union (UNFCU)	4 590
UN Women's Guild	16 000
Staff Association	15 000
Total amount received	719 765

Preparations for the 2016–2017 TC programme cycle

PACT advised on the preparation of cancer-related technical cooperation projects for the 2016–2017 TC programme cycle from a comprehensive cancer control perspective. In particular, the potential for maximizing the impact of TC projects through coordinated efforts among partners was appraised, specifically in areas such as cancer control infrastructure and capacities, resource mobilization opportunities and strategies. Furthermore, PACT sought to ensure that relevant recommendations from imPACT reviews were taken into account for national TC projects related to cancer. Similarly, imPACT relevant information was reflected in Country Programme Notes, Country Programme Frameworks, national health plans and UN Development Assistance Frameworks (UNDAFs).

An interregional TC project on cancer control support was designed for the 2016–2017 TC programme to efficiently deliver PACT products, services and activities to Member States in alignment with the TC programme framework. The implementation of planned project activities depends on the availability of extrabudgetary funds, including in-kind contributions.



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	Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean
CPF	Country Programme Framework
EVD	Ebola virus disease
FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
imPACT	integrated missions of PACT
NPCs	National Participation Costs
NPP	nuclear power plant
PACT	Programme of Action for Cancer Therapy
PUI	Peaceful Uses Initiative
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



Annex 1. Achievements in 2015: Project Examples by Thematic Sector

Annex 1. Achievements in 2015: Project Examples by Thematic Sector

Health and Nutrition

REGIONAL HIGHLIGHTS

Human health is a priority area for development and cooperation with the Agency for all African Member States. In addition to the well-known challenges of malnutrition and communicable diseases such as malaria and HIV/AIDS, and the increasing incidence of non-communicable diseases (NCDs) such as cancer, diabetes and cardiovascular diseases, Africa has experienced the emergence of zoonotic diseases that have had a strong impact on some Member States. A shortage of human resources and technical capabilities hampers national and regional efforts to fight these diseases. Answering to the priorities of its Member States, the Agency is supporting counterpart institutions in building human and technical capabilities to detect and treat cancer more efficiently and effectively, in the use of nuclear techniques to strengthen national nutrition programmes, and in building capacities to address the challenges posed by emerging diseases. By paying due attention to maternal and infant health and nutrition, the TC programme has also supported national and international efforts to achieving the MDGs. Efforts made in these areas will also contribute to the future achievement of the SDGs.

Member States in Asia and the Pacific continue to focus efforts on promoting nutritional studies for improved health, and on the use of advanced nuclear technologies in the diagnosis and treatment of diseases, as well as the safe use of ionizing sources and the adoption of quality assurance practices.

In Europe, nuclear technology plays an important role in the diagnosis and treatment of cardiovascular diseases and cancer. Radiotherapy is an indispensable component in the treatment of cancer patients, but there are vast discrepancies in the availability of facilities and the quality of services to provide radiotherapy in compliance with internationally accepted standards. Training in the safe and effective use of relevant technologies and applications is required, and several projects are addressing those gaps in the region.

Member States in the Latin American and Caribbean region have identified human health as a high priority area for development and for cooperation with the Agency, and have shown very strong commitment to enhancing capabilities in radiation oncology, medical physics and nuclear medicine to diagnose and effectively treat cancer. Such capabilities must be embedded in a framework of quality assurance, with human resource education and training and the modernisation of clinical infrastructure in the national institutions responsible for health care and services.

Technology development moves at a fast pace, and the increasing use of digital images in diagnosis and treatment has created a need for capacity-building in Member States so that new equipment and technologies, including hybrid modality machines, can be properly managed and used.

Zoonotic disease

In 2015, the Agency supported global efforts to fight the outbreak of the EVD through RAF/5/073, 'Strengthening Africa's Regional Capacity for Diagnosis of Emerging or Re-emerging Zoonotic Diseases, including Ebola Virus Disease (EVD), and Establishing Early Warning Systems', which aimed to build or strengthen capacities in the Africa region for the early detection of dangerous emerging zoonotic diseases (including EVD) in wildlife and livestock, under appropriate bio-safety conditions, was approved by the Board of Governors in March 2015. These activities received strong support from Japan and the US through the PUI mechanism, and from the AFRA Fund.



“In 2015, the Agency supported global efforts to fight the outbreak of the EVD.”

In February 2015, the Agency organized a first expert meeting in Entebbe, Uganda, in close collaboration with FAO and WHO, during which 20 international experts fine-tuned and agreed on the project work plan. By strengthening capacities for the early diagnosis of zoonotic diseases, and enhancing national and regional mechanisms for disease prevention and control through networking, epidemiological surveillance and information sharing, early warning systems can be established, and regional preparedness to fight possible future viral outbreaks improved. Two EVD-related regional training courses on biosafety/biosecurity and on molecular diagnostics were implemented in Africa in 2015.

In addition, a third regional training course allowed the provision of targeted and timely support to Benin, Burkina Faso, Burundi, Central African Republic, Cameroon, Côte d'Ivoire, Ghana, Niger, Nigeria, Togo and Zimbabwe, improving their molecular diagnostic capacities for the early and rapid diagnosis and control of Highly Pathogenic Avian Influenza during the H5N1 outbreak in Africa. Continued support was provided through delivery of an emergency toolkit of reagents and experts for on-the-spot implementation of diagnostic techniques.

“Although some three-quarters of cancer-related deaths occur in developing countries in Africa and elsewhere, about 80% of the population in Africa does not have access to radiotherapy services.”

RADIATION ONCOLOGY IN CANCER MANAGEMENT

Although some three-quarters of cancer-related deaths occur in developing countries in Africa and elsewhere, about 80% of the population in Africa does not have access to radiotherapy services. Limited availability of human and technical resources makes cancer mortality in Africa higher than in other regions of the world. Many of these deaths could be prevented if the right facilities and trained staff were available to ensure timely cancer diagnosis and treatment. The Agency works with Member States in Africa to build human and technical capacity to diagnose and treat cancer, and promotes and supports an increased and improved access to quality services for local populations, thus contributing to reduced cancer mortality.

In October 2015, 43 medical professionals from 23 African countries attended a regional meeting on strengthening and sustaining nuclear medicine programmes in Africa, coordinated under AFRA project RAF/6/037, ‘Sustaining Clinical Nuclear Medicine Techniques in the Management of Diseases, Including Coronary Artery Disease’. The meeting offered participants an opportunity to share their experiences in enhancing the longevity of nuclear medicine programmes through sustainable policies. Participants also compiled a draft Strategy for Enhancing Sustainability of Nuclear Medicine in Africa, aiming to support Africa’s efforts in line with the SDGs.

The Government of Ethiopia is planning to strengthen and expand oncology services throughout the country: this includes upgrading facilities at the Black Lion Hospital, and building five regional radiotherapy centres in Awassa, Gondar, Hara, Jimma, and Mekele. Qualified professionals will be required to staff these centres. The Agency is supporting Ethiopia’s initiatives to strengthen and expand oncology services through ETH/6/015, ‘Expanding Radiotherapy and Nuclear Medicine Services for the Diagnosis, Curative and Palliative Treatment of Cancer Patients and the Efficient Diagnosis and Treatment of Other Diseases’. Support has included technical assistance to determine the required personnel, develop a human resource development plan and defining the equipment needs. In addition, the Agency has also reviewed the architectural plans for the five regional centres and supported the delivery of clinical services in radiotherapy at the Black Lion Hospital. Technical advice on the operational management and maintenance of these services was also provided. New brachytherapy equipment has been installed, and efforts are underway to procure a new computed tomography (CT) simulator. A capacity-building programme for specialized medical personnel has been conducted through a fellowship training programme. The professionals, who were trained in several African training centres, include radiation oncologists, medical physicists and radiation therapy technicians. A scientific visit to set up a bilateral arrangement between the Universities of Oslo and Addis Ababa with a view to initiating the local clinical oncology training programme was also supported.



GAB/6/005: Staff of the Institute of Cancerology and Radiotherapy of Libreville, with the NLO of Gabon.

In Gabon, under project GAB/6/005, 'Establishing a Nuclear Medicine and Radiotherapy Centre in Libreville', the IAEA is supporting the establishment of the Institute of Cancerology and Radiotherapy of Libreville in Angondjé, using TC funds and extrabudgetary funds provided by the Government of Gabon to strengthen capacities in radiotherapy and nuclear medicine. Several professionals have been trained or are undergoing training in radiotherapy, nuclear medicine, medical physics and radiopharmacy.

In Botswana, under TC project BOT/6/006, 'Strengthening, Developing and Increasing Human Resource Capacities of the Established Radiotherapy Unit', civil works for Botswana's first radiotherapy centre have been finalized. An oncologist has been trained and is now back in the country, while the training of a second is almost complete. Both specialists received their training in South Africa. The country is currently recruiting medical staff, the next step in the larger national project. The inauguration of the radiotherapy centre is expected by late 2016.

The Agency has supported 15 Member States in the Asia and the Pacific region through regional project RAS/6/062, 'Supporting 3D Image-Guided Brachytherapy (IGBT) Services', and the application of 3D IGBT has increased significantly in the RCA region during the lifespan of the project. At least one radiation oncologist and one medical physicist in each participating Member State has been trained and a total of 114 professionals, comprising radiation oncologists and medical physicists, have been trained in the application of 3D image-guided brachytherapy. These new capabilities are now being applied at country level in formulating and conducting national projects. The four regional training courses conducted during the project, together with the compiled RTC teaching materials, were made available through the Agency's Moodle web platform Cyber Learning Platform for Nuclear Education and Training (CLP4NET). A training module for 3D Image-Guided Brachytherapy services is now under development.

In Mongolia, Agency support through MON/6/017, 'Improving Cancer Treatment Through Introducing Advanced Technologies in Radiotherapy and Radionuclide Therapy', has been crucial for the country's cancer control, diagnosis and treatment programme, supporting the acquisition of a gamma beam radiation protection system and an X-ray calibration system. The Agency is also assisting Mongolia in upgrading a computed



MON/6/017: Gamma camera treatment and control rooms.

tomography (CT)–single photon emission computed tomography (SPECT) medical imaging system at the First General Hospital. In addition, there are plans for the future installation of two linear accelerators (linacs), and an advanced 3D brachytherapy facility is under consideration.

Training opportunities for medical physicists from Russian-speaking countries have been provided through RER/6/030, 'Building Capacity for Medical Physics in Radiation Oncology in the Commonwealth of Independent States'. In cooperation with the IAEA, educational courses were developed and conducted by the Medical Physicists Association of Russia based at N.N. Blokhin Russian Cancer Research Centre. In 2015, a group fellowship for five junior medical physicists was organized, as well as four regional training courses covering quality assurance for radiotherapy, brachytherapy, and strategy for radiotherapy modernization and development. In total, over 80 medical physicists were trained. Russian language training materials were prepared to improve the conduct and quality of cancer treatment in the Commonwealth of Independent States region under the same project.

Support has been provided to the former Yugoslav Republic of Macedonia over the last 15 years through the provision of equipment and training of medical practitioners in order to develop radiotherapy capacity. As a result of these efforts, between 1800 and 2200 patients are now being treated with external beam radiotherapy (including intensity modulated radiation therapy (IMRT)) each year, and approximately 400 patients are treated with brachytherapy. The waiting time for receiving treatment has also been reduced.

Also in the former Yugoslav Republic of Macedonia, an upgrade of the imaging system of the third linac was carried out in 2015, under MAK/6/014, 'Strengthening 3D Conformal and Intensity Modulated Radiotherapy at the University Clinic of Radiotherapy and Oncology'. An additional IMRT planning licence was provided through the project to establish image guided radiotherapy and enhance the 3D conformal and IMRT service.

In Azerbaijan, ten professionals received on-the-job training through projects AZB/6/008 'Introducing Cyclotron and Positron Emission Tomography/Computed Tomography (PET/

CT)', and AZB/6/009, 'Improving Quality of Radiotherapy Service at the National Centre of Oncology'. This has contributed to Azerbaijan's ongoing efforts to enhance comprehensive cancer care.

In the Latin America and the Caribbean region, efforts continued throughout 2015 to improve the quality of radiation therapy through ARCAL project RLA/6/072, 'Supporting Capacity Building of Human Resources for a Comprehensive Approach to Radiation Therapy'. Thirty-two physicians, medical physicists and radiation therapy technologists were trained in the basic principles of clinical treatment using linacs for 3D conformal radiotherapy. A further 32 health professionals received training in the selection, purchase, acceptance and commissioning of radiotherapy equipment. In addition, 70 physicians and medical physicists transitioning to high-precision radiotherapy received training in radiosurgery, stereotactic radiosurgery and body stereotactic radiosurgery, and another group of 33 professionals was trained on intense modulated and image guided radiotherapy. These 167 health care professionals are using their newly acquired knowledge for patient treatment with the best possible quality. The training activities were funded through the PUI, with the goal of building human resource capacity in the use of clinical linacs

NUCLEAR MEDICINE AND DIAGNOSTIC IMAGING

Following the inauguration of the first nuclear medicine centre at the National Oncology Centre (CNO) in Nouakchott in 2014, the IAEA has continued supporting Mauritania through MAU/6/003, 'Establishing a Nuclear Medicine and Radiotherapy Centre within the Framework of a National Cancer Programme (Phase2)', and MAU/6/004, 'Developing National Capacity for Nuclear Applications in a Medical and Training Context for Sustainable Improvement of Human Health', building technical capacities and human capabilities to deliver quality nuclear medicine services in the country. The CNO is now operational, with two radiotherapists, three medical physicists and six senior radiotherapy technicians already trained. A number of staff are currently being trained in nuclear medicine: two nuclear physicians, three physicists, three technicians and a radiopharmacist. The equipment installed in the radiotherapy department includes a high-energy electron accelerator, a high-dose-rate brachytherapy (Ir-192) machine used for the treatment of the neck, nasopharynx and oesophagus, and a GE 16-slice scanner.

In Burkina Faso, under project BKF/6/007, 'Building Capacity for the Nuclear Medicine Centre', the Agency is supporting the country in building capacity for the establishment of a cancer therapy facility, which is currently under construction.

The Government of Montenegro adopted the National Strategy for Prevention and Control of Non-communicable Diseases in December 2008, followed by a national programme for the early detection of breast cancer in June 2010. The Agency has been providing support to national efforts through MNE/6/004, 'Upgrading the QA/QC Programme in Diagnostic Radiology for a National Breast Screening Programme'. At the start of the project, Montenegro had 14 mammography units of various ages and technology in operation, all of which used screen-film systems. The Government decided to move towards digital screening, as a first step, established a Breast Cancer Diagnostic Centre at the Clinical Centre in Podgorica.

The TC project supported the provision of a state-of-the-art digital mammography unit with breast tomosynthesis and a breast biopsy system in May 2015. Prior to receiving the new equipment, fellowships and expert missions were used to provide relevant staff (radiologists, radiographers, and a medical physicist) with specialized training to support breast imaging in the country. In addition, a complete set of QC equipment and phantoms has been provided to the country. The new Breast Cancer Diagnostic Centre aims to significantly improve the overall quality of early breast cancer detection in Montenegro.

In the Latin American and the Caribbean region, the regional ARCAL project RLA/6/075, 'Supporting Diagnosis and Treatment of Tumours in Paediatric Patients', has focused



MNE/6/004: Facilities at the newly established Breast Imaging Centre in Podgorica, Montenegro.

on improving human resource knowledge and quality. Thirty-two nuclear medical and referring physicians have been trained in the appropriate use of diagnostic imaging and radionuclide therapies, with a special focus on clinical applications. Another group of 36 nuclear medicine and referring physicians have received training in methodology and clinical applications, including appropriate use for the diagnosis, monitoring, therapy response, and treatment planning of paediatric tumours, with emphasis on lymphomas.

RADIOISOTOPES, RADIOPHARMACEUTICALS AND RADIATION TECHNOLOGY

In Cuba, national capacities for the introduction and development of nuclear technologies in cancer control have been supported under CUB/6/022, 'Implementing Positron Emission Tomography/Computed Tomography Technology in Clinical Practice'. The country has embarked on a project to establish a cyclotron facility with radiopharmaceutical production capabilities, positron emission tomography-computed tomography (PET-CT) facilities and linacs for cancer treatment. Through the TC programme, training and expert advice are being provided to improve human resources and capabilities.

Important advances took place under the ARCAL project RLA/6/074, 'Supporting the Development of Regionally Produced Radiopharmaceuticals for Targeted Cancer Therapy', which aims to make a set of rules, procedures and technical information readily available to support clinical studies of internationally accepted radiopharmaceuticals, with the goal of reaching the highest standards of efficacy, quality, and safety in targeted cancer therapy. A training course on biological, pharmacokinetic and dosimetric evaluation took place in Cuba in 2015, and was attended by 26 professionals involved in the development of therapeutic radiopharmaceuticals.

DOSIMETRY AND MEDICAL PHYSICS

Fourteen sets of equipment (dosimeters and phantoms) have been procured for countries in the Africa region (Mauritius, Madagascar, Zambia, Senegal, Cameroon, Uganda, Tanzania, Niger, Nigeria, Namibia, Kenya, Ghana, Egypt, Tunisia) through RAF/6/048, 'Strengthening Medical Physicists' Capacities to Ensure Safety in Medical Imaging, with an Emphasis on Paediatric Imaging Safety (AFRA)', with the goal of improving national capacities in dosimetry and quality control procedures for Computed Tomography.

ARASIA has established an arrangement whereby certain centres in the region provide the structured educational and clinical training programmes required to qualify medical physicists for their future careers at radiation oncology departments. The initiative was supported through two ARASIA projects. RAS/6/054, 'Upgrading Medical Physics Services in ARASIA State Parties through Education and Training', supported the educational component to train a group of graduates to the level of MSc. in Medical Physics at the University of Jordan. The second part of the initiative, the clinical training programme, was implemented under RAS/6/068, 'Supporting a Pilot Regional Clinical Training Programme in Medical Physics for Radiation Oncology in Saudi Arabia'. Here, the MSc. qualified fellows underwent two years of training at King Faisal Specialist Hospital and Research Centre, rotating to different specialized areas within a modern radiation oncology department in preparation for their future careers.

Three regional training courses and one workshop took place in the Europe region in 2015 on topics related to quality assurance in diagnostic radiology, supported by RER/6/028, 'Establishing Quality Assurance/Quality Control in X Ray Diagnostics'. The events were attended by a total of 64 professionals from the region.

In Cambodia, the planning and implementation of a new radiotherapy and nuclear medicine service at Calmette Hospital has been supported under KAM/6/001, 'Improving Access to Radiotherapy and Establishing a Plan for Nuclear Medicine Services'. Expert advice has been provided through the TC programme on planning the radiotherapy and nuclear medicine facility, while long-term fellowships in medical physics, radiation oncology and nuclear medicine have strengthened human resource capacity in preparation for the opening of the new service in 2016. A medical physicist from Cambodia completed a two-year IAEA fellowship in 2015, during which he obtained a Master's degree in Medical Physics from the University of Malaya and completed six months of clinical training in radiotherapy medical physics at the University of Malaya Medical Centre.



RER/6/028: Practical session on mammography QC.

NUTRITION

Nutritional deficiency, particularly in children and women, is of great concern in many African countries. One person in four in sub-Saharan Africa is undernourished, and about a quarter of children in Africa go to school hungry. Vitamin A deficiency affects 190 million children younger than six years of age worldwide, but occurs most frequently in Africa and Southeast Asia. Approximately 13 million children die every year in developing countries from infectious diseases, and many of these deaths are related to malnutrition. The retinol isotope dilution technique is the preferred method for determining vitamin A status and for assessing the efficiency and effectiveness of intervention programmes aimed at improving vitamin A status. The IAEA is helping African Member States through the regional project RAF/6/047, 'Using Stable Isotope Techniques to Monitor and Assess the Vitamin A Status of Children Susceptible to Infection (AFRA)', to build capacity to apply the retinol isotope dilution technique and to monitor vitamin A status of children who may be susceptible to infections, thus supporting the long term sustainability of activities to assess national nutritional initiatives.

Seychelles has prioritized addressing the growing obesity epidemic in the country through the promotion of a healthy and more active lifestyle among children and adolescents, with the long term goal of preventing the future NCD morbidity. To evaluate the effectiveness of its nutritional programmes, Seychelles requested IAEA support to build national capacity in the application of stable isotope techniques, enabling effective evaluation of the progress of national interventions to prevent overweight and obesity, and to provide an indication of the magnitude of the childhood obesity epidemic. With Agency support through project SEY/6/003, 'Developing Capacity for the Utilization of Stable Isotope Techniques for Evaluating an Intervention Programme on Obesity and Obesity Related Risk Factors in Children, laboratory technicians were trained and key equipment (including a Fourier transform infrared (FTIR) spectrometer) and consumables were



SEY/6/003: Analysis of deuterium enrichment by Fourier transform infrared spectrometry.

procured and installed at Victoria Hospital laboratory. The laboratory can now to perform body composition assessments using stable isotope (deuterium dilution) techniques. From January 2016 onwards, the laboratory will also be used to assess the prevalence of obesity in children aged 7 to 9 years.

In the Asia and the Pacific region, project RAS/6/073, 'Using Stable Isotope Techniques to Monitor Situations and Interventions for Promoting Infant and Young Child Nutrition', aims to improve infant and young child feeding practices up to the age of two, and to contribute to a reduction in NCDs in later life, using the deuterium oxide dose-to-mother technique to collect information on exclusive breastfeeding. Participating Member States will initiate programmes to collect breastfeeding information data for analysis of comparative nutrition scenarios of infant and young child feeding to identify commonalities and differences in the Asian contexts. This will lead to further concerted efforts to improve the situation in the region.

In Kuwait, child overweight and obesity are public health problems, with long term consequences. In support of national efforts to address this issue, the doubly labelled water technique to assess total daily energy expenditure and body composition of school age has been established at KISR, supported through KUW/6/006, 'Evaluating a Trial Intervention to Promote Healthy Lifestyles of School Children (Phase II)'. A pilot study has been carried out on 35 children, to inform the design of programmes to address the issue of childhood obesity.

In Bahrain, capacities to measure body fat, total body water and bone mineral content have been established through BAH/6/001, 'Applying Nuclear Techniques for Childhood and Adolescent Obesity Interventions'. The project aims at building capacity to provide accurate situation assessments on body composition that will inform the design and improvement of interventions aimed at reducing childhood and adolescent obesity. Necessary equipment, such as a BOD POD, a Dual-Energy X-Ray Absorptiometer and a Fourier Transform Infrared Spectrophotometer, has been provided and commissioned. A protocol for measuring body fatness in adolescents using a four compartment model has been developed and submitted to the ethical review board.

The Agency is assisting the Ministry of Health of the Dominican Republic in evaluating the impact of the National Micronutrient Supplementation Programme *Progresando con Solidaridad* through DOM/6/009 'Strengthening the National Nutrition Intervention Strategy by Enhancing the Effectiveness of the Micronutrient Supplementation Programme'. The project has supported training in measuring body composition, and the standardization of anthropometric and skinfold measurements. The project is being implemented in close collaboration with the WFP, which is the Agency responsible for distributing micronutrients. WFP is also providing logistical support for the fieldwork needed to conduct nutritional surveys.

Food and Agriculture

REGIONAL HIGHLIGHTS



Food security and agriculture production are high priority areas for many countries in Africa. Growing populations and industrialization are placing soil and water resources under stress, and more unpredictable weather associated with climate change adds risks to well-known challenges such as pests, or plant or animal diseases. All these factors threaten food security in Africa. The TC programme helps Member States in Africa to produce more and better crops, to reduce the impact of pests, to increase the quality and quantity of agricultural products for national and international markets, to better manage soil and water resources, to better control animal diseases, and overall to increase food safety in the continent through capacity-building and technology-transfer programmes.

Food safety also remains a critical issue for economies in Africa. Regional laboratories have been assisted in strengthening their capacities and capabilities to ensure effective programmes for hazard identification and residue monitoring. Through its activities in the area of food and agriculture, the TC programme has contributed to the achievement of the MDGs in Africa, and will contribute to the achievement of the SDGs.

In Asia and the Pacific, food security and soil productivity continue to be key priorities for Member States. Throughout 2015, technical cooperation efforts focused on improving yield and quality by enhancing the diversification and adaptability of crops through mutation breeding programmes. Several Member States focused on reducing pesticide use and decreasing the crop losses caused by pests and diseases, as well as on overcoming phytosanitary barriers to trade.

In 2015, the technical cooperation priorities of the Latin America and Caribbean region in the area of food and agriculture focused on soil and water management to support agricultural practices, enhancing food safety and security, and increasing the control of insect pests. Specifically in the area of soil and water management, support was provided for evaluating soil fertility, assessing the effect of agriculture on the production of GHGs, supporting the production of palm oil, improving agricultural sustainability, and establishing environmental management systems.

In the field of food safety and security, cooperation with the IAEA is enhancing the capabilities of countries in the region in the analysis and control of contaminants and residues in foodstuffs, the conduct of chemical risk analysis, and the tracing and verification of food origin authenticity. Emphasis is being placed on introducing the use of electron beam and X-ray technologies for food irradiation to help ensure food safety and for phytosanitary purposes.

CROP PRODUCTION

Maize is the most important grain crop in the agricultural economy of Benin. It occupies nearly 54% of the 1.1 million hectares of food crop production. More than 50% of the national maize harvest is produced in the southern region, where rainfall patterns allow two harvests per year. However, yield remains low and addressing soil fertility and increasing crop productivity is a priority for the Government.

The Agency's TC programme, in collaboration with the Faculty of Agronomic Sciences of the University of Abomey-Calavi and the National Institute of Agricultural Research in Benin (INRAB) is supporting two TC projects, BEN/5/005, 'Improving Maize and Yam-Based Cropping Systems and Soil Fertility', and BEN/5/007, 'Soil, Crop and Livestock Integration for Sustainable Agriculture Development Through the Establishment of a

"In 2015, the technical cooperation priorities of the Latin America and Caribbean region in the area of food and agriculture focused on soil and water management to support agricultural practices, enhancing food safety and security, and increasing the control of insect pests."



BEN/5/005: Crop production in Benin.

National Laboratory Network'. These projects have improved crop yield and soil fertility, using dual-purpose grain legumes, such as soybean and groundnut, integrated with crops and livestock systems. Inoculation and phosphorus application have enabled the highest possible level of nitrogen fixation. As a result, maize yield has increased by 50% (from 1325 to 2097 kg/ha) in rotation with legumes, and soybean production has increased by 210%. For the farmers, this increase in output has led to a more than fourfold increase in income. For Benin as a whole, the production increase is contributing to enhancing food security.

Barley, the predominant crop in Eritrea's highlands, contributes significantly to farm income and national food security. However, in recent years, climate change and related environmental problems such as recurrent droughts during the late production season have resulted in low yields, jeopardizing farmer livelihoods and the food security of the country. Project ERI/5/008, 'Supporting the Livelihood of Barley Farmers through Mutation Techniques and N15 Technology to Improve Malting, Food and Feed Barley Production', aims at growing stronger, climate-resistant and high-yield varieties of barely with relevant protein levels for various uses. The project has supported the procurement of equipment and the development of capacities in mutation breeding. Through the project, climate-resistant, high-yield barley mutants have been developed from the seeds of two local varieties, called Kulih and Halhale. Asmara Brewery Factory has assessed the progress of the malting barley and found the protein content and plumpness of the barley mutants to be very promising. The developed mutant variety will undergo further evaluation, followed by national approval process, and is expected to be released to farmers in 2016. With the newly developed seeds, the barley farmers of Eritrea will be able to grow healthy and strong barley for food, animal feed and malting, even under adverse climate conditions.

A regional AFRA project, RAF/5/066, 'Improving Crops Using Mutation Induction and Biotechnology through a Farmer Participation Approach', is supporting Member States in improving crops using mutation induction and biotechnology through a farmer participation approach. Participating countries are undertaking studies of major crops. A number of crops are at an advanced mutant stage (M4, M5, M6, M7 and M8) with some crops at the stage of multi-location trials and pre-release. Since 2007, several varieties have been official released. These include three mutant sesame varieties and two mutant safflower varieties (spineless, high seed yield, high oleic acid content and resistant to pest and diseases) in Egypt, two tomato varieties in Sudan, one Lachenalia and one Ornithogalum in South Africa, one wheat variety in Morocco and two Ug99 resistant wheat varieties in Kenya. In addition, several advanced mutant lines are in the pipeline (Sorghum, lablab bean, rice,



BGD/5/028: Fields of mutant plants varieties developed using nuclear techniques, Bangladesh.

groundnut, cowpea, cassava, wheat, and yam) for release in the near future. During 2015, two regional training courses were organized in Accra, Ghana, on *Mutation Induction on Vegetatively Propagated Crops and on Induced Mutation in Seed Propagated Crops*. In addition, related materials and equipment were purchased for participating Member States in order to facilitate implementation of activities at the country level.

In Bangladesh, rice mutant varieties with high tolerance to salt and drought conditions are being developed with the support of BGD/5/028, 'Assessing Crop Mutant Varieties in Saline and Drought Prone Areas Using Nuclear Techniques'. The development of a number of different high yield crop varieties has helped farmers to adapt to changing climatic environments, thus mitigating the disastrous effects of failed or low-yield harvests. The project has successfully addressed two different environmental challenges affecting crop yield – drought and saline soil conditions – which require different crop mutations for ideal climatic adaptation. A total of 59 different crop varieties have been developed through the application of mutation breeding techniques. This has already had a positive impact on the livelihoods of farmers in the country, through increased food and resulting economic security.

“The development of a number of different high yield crop varieties has helped farmers to adapt to changing climatic environments.”

In the Asia and the Pacific region, 15 Member States have been assisted to enhance their capacities in mutation breeding through RAS/5/056, 'Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change'. Over the course of the four year project, 28 mutant varieties have been developed, officially released as new varieties and disseminated to farmers. In addition, most of the participating countries have produced peer reviewed publications on work carried out under the project. Collectively, there are 96 peer reviewed publications to date. A total of 39 MSc and 17 PhD students have graduated based on work carried out in relation to the project. As a direct outcome of the project, most of the counterparts have enhanced their national, regional and interregional collaborations on the use of mutation breeding.

Bulgaria is among the top ten countries in the world in terms of vegetable production per capita, based on long-standing traditions of vegetable growing and the favourable climate. The objective of project BUL/5/013, 'Supporting Laboratory Upgrade for Improved Food Crops through Nuclear and Molecular Techniques', was to ensure food security and well-being of farmers. Staff at the Laboratory of Molecular Biology at the Maritsa Vegetable

Crops Research Institute were therefore trained in various techniques and topics related to mutation induction and in the use of molecular techniques for mutant characterization, development of molecular markers for tolerance to drought stresses, and in doubled haploid techniques to shorten the breeding cycle and their application in breeding programmes. Also, the laboratory's infrastructure was upgraded to use modern nuclear and molecular techniques.

Collaboration with the IAEA allowed nuclear and biotechnologies to be combined to induce and accelerate the development of improved mutant varieties in pepper, tomato, potato, bean, pea, onion and watermelon, increasing crop productivity and reducing the negative environmental effects of other agricultural practices. The initiated mutation breeding programmes will continue to develop new varieties of targeted crops with good performance and high yield for the benefit of small and medium scale producers.

AGRICULTURAL WATER AND SOIL MANAGEMENT

Soil erosion rates in Africa are high, and unsuitable agricultural practices mean that the trend will continue, jeopardizing food security and biodiversity, threatening global food prices, and endangering small scale farmers whose livelihoods depend on healthy and productive soil. In addition, erosion has significant off-site impacts, leading to eutrophication and pollution of water resources, as well as silting in reservoirs. Other major off-site impacts can include mudslides or flows which threaten human infrastructure and habitations.

The Agency, through RAF/5/063, 'Supporting Innovative Conservation Agriculture Practices to Combat Land Degradation and Enhance Soil Productivity for Improved Food Security', is contributing to enhanced regional capacity for sound assessment of land degradation using fallout radionuclides, in particular the Cs-137 technique. Capacity building has been delivered through regional training courses, fellowships and scientific visits. Regional analytical facilities have been further developed and laboratories have received necessary equipment. During the first phase of the project, the Cs-137 technique for assessing soil erosion and sedimentation magnitudes has been successfully transferred to all ten participating African countries. The project output and results have been disseminated through conferences and peer-reviewed publications. For example, counterparts from Morocco and Madagascar have presented project achievements at an IAEA side event on sustainable land management at the 12th session of the Conference of the Parties (COP) to the UNCCD, Ankara, Turkey, which took place in October 2015. The knowledge and expertise already gained by the ten participating countries will be strengthened through a second phase, to be implemented within the framework of RAF/5/075, 'Enhancing Regional Capacities for Assessing Soil Erosion and the Efficiency of Agricultural Soil Conservation Strategies through Fallout Radionuclides'.

Through the regional TC project RAS/5/055, 'Improving Soil Fertility, Land Productivity and Land Degradation Mitigation', Member States including China, Malaysia Philippines, Pakistan and Viet Nam have been assisted in enhancing their national capabilities for the application of fallout radionuclides (FRN) and compound-specific stable isotopes (CSSIs) techniques to assess both the quantitative impact of soil erosion and the effectiveness of applied soil conservation measures. The project has enhanced the understanding of stakeholders of the utilisation of both FRN and CSSI in quantifying existing land degradation levels, and has also supported the development of skills for the evaluation of soil erosion causes with the aim of implementing targeted soil conservation measures. In addition, the regional project has promoted sustainable knowledge management practices by engaging not only the primary project counterparts but the broader community as well. Networks have been established for the dissemination of knowledge related to the causes of land degradation, including deforestation, overgrazing and urbanisation. Techniques available for the prevention and mitigation of land degradation have also been shared, empowering

local communities to actively counteract one of the main causes of environmental decay, groundwater contamination and decreased land productivity.

LIVESTOCK PRODUCTION

With the support of TC project MLW/5/001, 'Strengthening the Essential Animal Health and Veterinary Infrastructure for Disease Control and Management Services in Urban and Rural Areas', the infrastructure and management services for the control of animal diseases has been strengthened in both urban and rural areas of Malawi. The Central Veterinary Laboratory can now be considered as a location for training fellow African scientist in serology.

Supported by CMR/5/019, 'Using Nuclear Techniques to Improve Milk Production', Cameroon is using nuclear and nuclear-derived procedures such as radioimmunoassay (RIA) and enzyme-linked immunosorbent assay (ELISA), molecular diagnostics and genetic screening in reproduction and breeding, artificial insemination and disease control programmes for livestock. In collaboration with the IAEA and the Food and Agriculture Organization of the United Nations (FAO), the National Veterinary Laboratory (LAVANET) and the country's Institute of Agricultural Research for Development are engaged in training technicians on disease control and artificial insemination to improve cattle productivity and breeding management. Veterinarians, veterinary extension services and breeders in the region have access to tested bull semen and are receiving training in artificial insemination, breeding management and animal health control. The methodology assists technical staff in improving the reproductive management of cattle farms and in obtaining more calves, meat and milk than with traditional farm management. The application of progesterone RIA in artificial insemination helps in identifying 20-40% more cows for breeding than conventional methods that involved watching behavioural signs. It can subsequently increase the conception rate by between 5% and 50%. On the other hand, artificial insemination allows scientists to improve the genetic make-up of the offspring, leading to up to five times more milk produced per cow.

In Algeria, TC assistance provided through ALG/5/027, 'Strengthening Animal Health and Livestock Production to Improve Diagnostic and Reproductive Capacities in Animal Breeding and Support Expertise for the Feasibility Study of a Biosafety Laboratory, Level 3 (BSL3)', has built the capacities of the National Veterinary Medicine Institute (INMV) through training on epidemiology and the diagnosis of abortive diseases. Equipment has also been provided to enhance the Institute's work on pathogens affecting fertility, protocol for oestrus synchronisation and embryo transfer. Agency support provided to the laboratory has contributed to significant achievements, resulting in INMV's certification in December 2014 under ISO/CEI 17025:2005 regarding the Laboratory's research activities on the diagnosis of animal pathologies, in particular HI TEST Newcastle.

Specialized laboratories for the processing and evaluation of semen from selected rams and bucks have been developed and enhanced in most countries participating in ARASIA project RAS/5/063, 'Improving the Reproductive and Productive Performance of Local Small Ruminants by Implementing Reliable Artificial Insemination Programmes'. The Artificial Insemination Laboratory at AlMusherfeh station-Alkarak, Jordan, is now able to provide training and educational programmes on artificial insemination (AI). An AI system/programme has been established in the majority of the participating countries. In addition, electronic animal identification and the monitoring of animal performance using database applications have been introduced and some countries are planning to extend it on a governorate or national basis.

The Agency has also helped Mongolia through project MON/5/019, 'Enhancing Analytical Equipment for Animal Disease Prevention, Diagnosis and Surveillance', to strengthen its laboratory capability to analyse environmental contaminants that may be associated with animal diseases, and that may possibly affect public health as well. Institutional capacity has

"The Agency has also helped Mongolia... to strengthen its laboratory capability to analyse environmental contaminants."



RAS/5/063: At work in the artificial insemination laboratory, Jordan.

been built at the biogeochemistry and toxicology laboratory of the State Central Veterinary Laboratory through staff training, expert missions and laboratory modernization with relevant instrumentation and equipment.

A new polymerase chain reaction diagnosis laboratory has been inaugurated in July 2015 at the Belize Agricultural Health Authority (BAHA). The laboratory has been completed with the support of BZE/5/007, 'Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority'. BAHA provides the first line of diagnosis for transboundary animal (livestock and fish) diseases in Belize. The newly completed laboratory has already helped to detect and control the outbreak of Avian Influenza LPAI-H5N2 in the country.

INSECT PEST CONTROL

Tsetse flies continue to present significant economic challenges in Africa. Within the framework of RAF/5/070, 'Supporting Area-Wide Tsetse and Trypanosomosis Management to Improve Livestock Productivity and Enable Sustainable Agriculture and Rural Development (Phase II)', several training and capacity building activities were conducted in 2015 on topics such as geographic information systems (GISs) and data management for tsetse and trypanosomosis control programmes, as well as on population genetics and GIS to identify isolated tsetse populations. In order to support the scaling up of pupae production in regional insectariums, tailored fellowships and scientific visits on mass rearing techniques was provided to six professionals. An expert mission to Zambia took place in December 2015 to support the operationalization of a tsetse and trypanosomosis control unit laboratory which will facilitate the processing of 2000 samples of tsetse flies that have been collected since 2012 through investigative tsetse surveys in various tsetse infested locations. The analysis of the collected samples will be used to generate information on the distribution of tsetse and trypanosomosis in Zambia.

The Agency is supporting Senegal in its efforts to eradicate *Glossina palpalis gambiensis*, a species of tsetse fly, from the Niayes area near Dakar through SEN/5/033, 'Supporting the Operational Phase of Eliminating *Glossina palpalis gambiensis* from the Niayes Area by Promoting the Development of Integrated Stockbreeding'. The project is being implemented in cooperation with the Directorate of Veterinary Services of the Ministry of Agriculture and Rural Equipment of the Government of Senegal, and the Senegalese Institute for Agricultural Research. Significant technical and financial support has been received from the United States and France. The entire project area of 1000 km² was divided into three operational blocks. The impact of the removal of the tsetse fly from Block 1 and the circa 98% reduction in the fly populations in Block 2 can already be seen in the prevalence



SEN/5/033: Insect capture in Senegal.

of the disease: serological tests on cattle sera showed a reduction in the prevalence of trypanosomosis from 40-50 % in 2009–2010 to less than 10% in 2013. Suppression activities in Block 3 (Dakar and Thies) began in 2015.

The Islamic Development Bank has agreed to fund the purchase of a gamma irradiator for sterile insect technology applied to mosquitoes in Sudan under project SUD/5/034, 'Supporting a Feasibility Study on the Suitability of the Sterile Insect Technique As a Strategy for the Integrated Control of *Anopheles arabiensis*'. The agreement was reached at a meeting organized by the Agency with the IDB, the Tropical Medicine Research Institute, the Sudanese Permanent Mission to the United Nations and other International Organizations in Vienna and Sudan Atomic Energy Commission. A plan for an extensive recruitment programme was also agreed at the meeting.

Under regional project RLA/5/067, 'Supporting Capacity Building for Evaluation of Feasibility of a Progressive Control Programme for New World Screwworm', Agency support is being provided for capacity building and feasibility assessments in relation to the development of a progressive control programme for the New World Screwworm, which currently affects most South American and Caribbean countries. Support is also being provided to establish detection and emergency response capacity in Central American countries already free from this pest as a result of a successful SIT eradication programme.

In late 2014, an outbreak of Mediterranean fruit fly (medfly) was detected in the Dominican Republic. As a result of the outbreak, medfly-free countries importing horticultural products from the Dominican Republic closed their markets partially or completely, causing hardship



RLA/0/052: IAEA is a key partner in the emergency response efforts for the Mediterranean fruit fly outbreak in the Dominican Republic. Photo credit: Moscamed .

and major economic loss to producers and exporters. In 2015, the Ministry of Agriculture of the Dominican Republic launched an emergency response programme and requested Agency assistance. The Agency (through RLA/0/052, ‘Strengthening the Planning, Design and Review of the Programme to Support the Implementation of Strategic Activities for Nuclear Technology and its Applications’), the Moscamed Program in Guatemala/Mexico, USDA, along with the FAO, the Inter-American Institute for Cooperation in Agriculture of the Organization of American States (IICA), and OIRSA are providing coordinated technical and financial assistance to national emergency response efforts. Based on these efforts, a national eradication campaign has been established and the expanding pest outbreak was contained. To enhance suppression efforts in the outbreak area, to eliminate the remaining fruit fly populations and to prevent the establishment of new populations, the Agency supported application of the SIT is being integrated with bait sprays and destruction of infested fruit.

The stable fly (*Stomoxys calcitrans*) is a pest that affects livestock farms, mainly cattle, horses, pigs and poultry. Since its appearance in Costa Rica in 1987, its incidence has increased progressively in the Northern and Atlantic regions of the country. Over the past decade the fly has caused substantial damage to livestock production. The support of COS/5/030, ‘Supporting Biological Control of Stable Flies (*Stomoxys calcitrans*) through the Use of Parasitoids Reproduced on Fruit Flies’, has enabled the establishment of capacity in rearing the stable fly parasitoid *Spalangia endius* (Walker) in order to control the pest. Technology and knowhow for mass rearing using a nuclear component and for field releases of the parasitoid have been transferred, validated and established, contributing to the biological control of stable fly, reducing the damage and economic impact on livestock industry.

FOOD SAFETY

Botswana’s livestock sector is an important part of the national economy, in particular the export of beef and beef products to international markets. International food standards require that such beef products are free from chemical contaminants and from veterinary



PAK/5/048: The team of the Nuclear Institute for Agriculture and Biology (NIAB) laboratory at work.

drug residues, but an inspection by trading partners identified deficiencies in the country's ability to conduct residue analysis, largely due to the lack of established capacities. Under BOT/5/010, 'Enhancing Veterinary Drug Residue Monitoring Capabilities', and in cooperation with Botswana National Veterinary Laboratory (BNVL), the Agency supported a knowledge-transfer programme, as well as the procurement of laboratory equipment and supplies for BNVL, enhancing capacities acquired in prior training courses. A pool of trained scientists, capable of establishing and validating analytical methods for residues and conducting routine testing, is now available in the country, and a comprehensive veterinary laboratory able to analyse several drug residues and other chemical contaminants has been established. Botswana has now successfully developed the competencies needed to facilitate the export of beef products to international markets.

Enhancing food safety and security remains a high priority for the Asia and the Pacific region. A total of 17 Member States have participated in project RAS/5/057, 'Implementing Best Practices of Food Irradiation for Sanitary and Phytosanitary Purposes', which aimed to enhance national and regional capacities in applying best practices in different processing techniques and technologies in the region. A major achievement of the project has been the publication of the *Manual of Good Practice in Food Irradiation: Sanitary, Phytosanitary and other Applications* as a technical report series No.481²⁶. This publication plays an important and lasting role in building capacity to apply food irradiation technology and in disseminating good practices in the region and beyond. It aims to help operators of irradiation facilities to appreciate and improve their practices and it provides detailed technical information for stakeholders such as food regulators, manufacturers and traders on good practices.

Pakistan has developed the necessary analytical capacities to detect and monitor food contaminants with the support of PAK/5/048, 'Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs'. Protocol standardization has been formalized, staff have been trained in analytical techniques, and essential laboratory equipment has been procured. This has led to the first ISO certification of a Pakistan laboratory, allowing health officials to test for harmful contaminants in foods intended for both national and international markets.

²⁶ Available online at <http://www-pub.iaea.org/MTCDD/Publications/PDF/trs481web-98290059.pdf>

In Qatar, national analytical capabilities have been enhanced with the upgrade of the Central Food Laboratory under project QAT/5/004, 'Upgrading the Central Food Laboratory'. The laboratory can now provide radioactivity monitoring for imported foodstuff and drinking water in conformity with international requirements. Through the project, the laboratory was supplied with a liquid scintillation counter, and staff were trained in sample preparation and analysis. A second phase of the project during the 2016–2017 TC cycle will focus on ensuring food safety for the public through monitoring the contamination levels of imported food, according to national and international regulations.

In Latin America and the Caribbean, a regional meeting in collaboration with the Mexican National Institute for Nuclear Research (ININ) in the area of food irradiation processing using electron beam and X-ray technologies has been carried out under the umbrella of project RLA/5/066, 'Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food'. The meeting examined the current situation regarding the regulatory, technical, and commercial status of irradiation as a phytosanitary treatment, and discussed the experiences of countries in the region where phytosanitary irradiation is already used. Some 90 representatives from the public and private sectors of 16 countries attended. Participants learned about the opportunities offered by electron beam and X-ray irradiation for food processing. The establishment of collaborative work among the key public, private, and international sectors represented at the meeting is considered a cornerstone for enabling the introduction of these technologies, which will facilitate international trade of fresh produce and food security in the region.

In Costa Rica, capacity to monitor food, water and environmental samples has been developed with the support of COS/5/029, 'Strengthening of Good Agricultural Practices (GAP) for Food Safety and Security and Environmental Protection'. An education programme on Good Agricultural Practices has been started to educate farmers about ways to reduce the environmental impact of agriculture, while at the same time enhancing food safety and improving water quality. Using the information obtained from the sample analyses, a campaign was launched to raise awareness among farmers, community members and governmental officials of the detrimental effects of indiscriminate and improper agrochemical use. As a direct result of the monitoring activity and the education and awareness programmes launched, concrete changes in agricultural practice have been made, and improvements in the quality of ground and river water in the Cartago region of Costa Rica have been confirmed.



QAT/5/004: Inside the upgraded food laboratory in Qatar.

Water and the Environment

REGIONAL HIGHLIGHTS



Thirty percent of the population in sub-Saharan Africa lacks proper access to clean and safe water, and the efficient management of water resources is imperative to ensure sustainable livelihoods and to complement efforts to enhance human health, or food security and agriculture. Environmental monitoring is also important to complement and complete these efforts. The TC programme in Africa has a particularly strong focus on the sustainable management of water resources in areas such as the Sahel, where every drop counts. The programme also supports Member State efforts to improve control of pollutants in air and water.

In the Asia and the Pacific region, management of marine and air pollution, as well as ground water resource management using nuclear analytical techniques, continues to be a high priority.

The strengthening of air and water pollution control is an important priority in Europe. Monitoring of different pollutants using nuclear and complementary analytical methods, and the development of pollutant models is therefore a priority. International cooperation in the region will help both in upgrading technology and equipment.

Latin America and the Caribbean face the most unequal distribution of water. Rapid urbanization without full consideration of the environmental impact has had a negative effect on the environment and water resources. Among the factors affecting water resources in the region are inadequate land use and deforestation, uncontrolled discharges of domestic and industrial wastewater into surface water bodies and coastal areas, inadequate solid waste management, ground and surface water pollution, and loss of urban aquifers recharge due to less vegetation cover. The region therefore needs to strengthen its capacities in water governance and to increase social participation.

WATER RESOURCE MANAGEMENT

Striking a balance between economic development and the preservation of water resources in an arid country like Niger contributes to improved economic sustainability. Activities carried out under NER/7/001, 'Studying Groundwater Recharge from the Catchment Area of the Town of Tera' (Tilabéri region, South Maradi), are a starting point for efficient water resource management. Through the project, the Agency has provided equipment, expert services and on-the-job training to strengthen national capacities in geochemistry and isotope hydrology. The project has also supported a study to evaluate groundwater recharge rates in the Téra city area, including a determination of the hydraulic exchange between the catchment area and surface water, and the identification and geochemical characterization of the aquifer levels of the entire system including monitoring of chemical elements.

TC project GAB/7/001, 'Carrying Out Isotopic and Geochemical Characterization of Water: The Case of Libreville', is supporting the geochemical and isotopic characterization of water in the Estuaire Province of Gabon. The project aims to identify and evaluate new sources of drinking water in the country. Capacity building activities, including scientific visits, have included laboratory organization, arrangement and management, as well as fellowships focused on surface water and groundwater, sampling strategies, and in-situ parameter measurements (pH, conductivity, and alkalinity). A technology-transfer programme was implemented in 2015, and sampling campaigns have been undertaken.

Final sampling campaigns will be carried out in 2016, and it is expected that a hydrological mapping of the estuary's surface water and groundwater will be completed by the end of the year.

In the Central African Republic, the Agency is supporting the evaluation of water recharge and eventual traces of pollution of the hydrogeological sandstone formation used as source of drinking water in the towns of Boda, Nola and Yamando through the project CAF/7/002, 'Evaluating Water Resources in the Berbérati Sandstone Formation using Isotope Techniques'. A number of sampling campaigns have been undertaken and a workshop for the interpretation of the data was carried out in November 2015, supported with international expertise, in order to support counterparts in the synthesis of the results obtained.

The risk of groundwater contamination associated with rapid urban and industrial development is ever present in Kuwait. Through K UW/7/004, 'Managing Groundwater Resources Using Stable and Radioactive Isotopes', two groundwater sampling campaigns have been carried out to collect water samples from the two main aquifers of Kuwait, namely, the Kuwait Group and Dammam formation aquifers. The information gathered on sources of groundwater contamination is important for groundwater resource management in Kuwait, and for identifying regions that experience nitrate problems where remedial actions are needed. National capabilities in isotopic characterization were enhanced, allowing KISR staff to identify sources of nitrate, sulphate and radioactive materials in Kuwait's groundwater.

“In the Central African Republic, the Agency is supporting the evaluation of water recharge and eventual traces of pollution of the hydrogeological sandstone formation used as source of drinking water in the towns of Boda, Nola and Yamando.”



KUW/7/004: Carrying out a groundwater sampling campaign in Kuwait.

A number of Member States in the Asia and the Pacific region have introduced radioactive and stable isotope techniques to their study of groundwater aquifers and surface water interaction for the first time, with the support of ARASIA project RAS/7/027, 'Using Environmental Isotopes and Natural Radioactivity in the Assessment of Ground Water Quality'. This project facilitates long term study of resources, which is important to ensure a sustainable supply of drinking water in the region, given the increasing demand from expanding cities. The study will provide data for a better management plan to protect non-renewable sweet water reservoir sources.

Following on from the achievements of RAS/8/104, 'Assessment of Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA)', and RAS/8/108, 'Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA)', TC project RAS/7/022, 'Applying Isotope Techniques to Investigate Groundwater Dynamics and Recharge Rate for Sustainable Groundwater Resource Management', has enabled the 13 participating countries to undertake more intensive investigations that will provide quantitative information for end-users. A major achievement of the project is that the national investigations have generated data and information that will be available for use as a basis for policy making in groundwater resources management. The uptake of end-users of the results of national activities implemented in all Member States has improved, leading to agreements on further collaboration, and the integration of isotope techniques in national programmes. In addition, academic degrees at both Bachelor and Doctorate level have been completed in Bangladesh, Indonesia and Viet Nam using the data generated through the project. Papers have also been published in scientific journals by some participating States.

A 2009 survey under the auspices of the United Nations Economic Commission for Europe (UNECE) -Water Convention has discovered that numerous wells in Georgia have not been in operation since the 1990s and have to be reactivated. This finding applied particularly to regions facing increased water scarcity, such as eastern Georgia. Building on the successful completion of earlier national TC projects in this area, TC project GEO/7/002, 'Using Isotope and Hydrochemical Techniques for the Assessment of Water Resources', supported the first isotope-hydro-chemical assessment of the karstic-fractured recharge in the confined Caucasus systems. The project aimed to compile a hydrogeological model for the originating areas of drinking water.

Water parameters, water balance and the risk of pollution were evaluated and the capacity of the Tbilisi State University/Institute of Geophysics and the Georgian Geothermal Association for the assessment of groundwater resources in karstic aquifers was enhanced. The results obtained offer a knowledge base for groundwater management plans along the Southern slope of the Greater Caucasus. The outcome of the project complements and expands the current drinking water investigations in areas along the North-eastern Greater



RLA/7/018: Water needs identification and water management training, Argentina. Photo credit: Emilia Bocanegra (Argentina).

Caucasus, which is confronted with both the over-exploitation and the deterioration of groundwater.

The methodology of IAEA Water Availability Enhancement (IWAVE) is being implemented through TC project RLA/7/018, 'Improving Knowledge of Groundwater Resources to Contribute to their Protection, Integrated Management and Governance (ARCAL CXXXV)', in four lead countries (Argentina, Brazil, Ecuador and Nicaragua) in the Latin America and the Caribbean region. The methodology identifies gaps in each country that can later be addressed by TC or country projects. Training opportunities and the project results are being shared by all countries participating in the project. The lead countries have presented initial results, sharing their experiences in consolidating water management at country level. Lessons learned in each country are complex: some needs are regional and some will have to be solved at the national level. At present, national or provincial gaps in hydrological understanding, data and information have been identified, as well as gaps in institutional and technical capacity. Future activities will address these identified gaps.

In Colombia, the environmental authorities, Regional Autonomous Corporation of Sucre (CARSUCRE) and Corporation for Sustainable Development of Uraba (CORPOURABA) have strengthened their capacities in integrated management of water resources with the support of COL/7/001, 'Improving Water Resource Development in the Gulf of Morrosquillo (Sucre) and the Gulf of Uraba (Antioquia)'. Specialized equipment for monitoring the hydrological cycle has been provided, and the staff have received training through fellowships and the visits of experts in hydrochemistry, isotopic hydrology and aquifers modelling.

In Brazil, project BRA/7/010, 'Sustainable Water Resources Management in a Uranium Production Site', aims to contribute to improved water management in a centre of uranium production. Project activities include sampling and analysis (a) to understand the sustainability of water use in the mine area, as well as the nature of natural and anthropic radionuclide concentration in groundwater, and (b) for risk assessment. A hydrological database has been created by combining data from the mine operator and primary data from sampling/monitoring carried out under the project over the course of two years. Several monitoring stations have been established, and seven field campaigns have been implemented to characterize the chemistry of surface and groundwater. The water dynamics and a quantification of water balance components are being evaluated using isotopic techniques and mathematical modelling. Once analysis is complete, the information will be presented to key stakeholders, including the mine operator, the regulator and community leaders from the mine operation area.



COL/7/001: Improving water resource development by supporting the acquisition of specialized equipment for monitoring the hydrological cycle. Photo: CARSUCRE.

MARINE, TERRESTRIAL AND COASTAL ENVIRONMENTS

The Agency has furthered Sri Lanka's capabilities to use isotopic techniques in pollution management, through the establishment of a suitably equipped marine laboratory and the provision of specialized expertise and knowledge. This has been carried out through project SRL/7/005, 'Establishing a National Centre for Marine Pollution Control'.

The regional project RAS/7/021, 'Marine Benchmark Study on the Possible Impact of the Fukushima Radioactive Releases in the Asia-Pacific Region' has enabled participating Member States to enhance their marine sampling competencies, and has improved analytical capabilities and knowledge and practice on radio-ecological risk assessment, modelling and quality management systems. One of the major achievements of the project has been the establishment of close and effective regional cooperation between advanced countries, less experienced countries, and relevant international initiatives such as the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the IAEA Modelling and Data for Radiological Impact Assessments Programme (MODARIA) and the International Commission on Radiological Protection (ICRP). The volume of data in the Asia Pacific Marine Radioactivity Database (ASPAMARD) has increased more than 20-fold since the start of the project, with data submitted by 14 countries. Several participating countries have successfully established a baseline data for marine radioactivity around their coastlines.



RAS/7/021: Collecting sediment samples using grab sampler, Guimaras Strait, Negros Occidental, Philippines. Photo: Philippine Nuclear Research Institute.



RAS/7/021: Processing fish samples for analysis using Gamma spectrometry, Philippine Nuclear Research Institute. Photo: Philippine Nuclear Research Institute.

Project counterparts are working on the validation of an analytical nuclear-based method for rapid and accurate determinations of toxins in fish to enable early warning of the presence of toxins produced by the algae, supported by RAS/7/026, 'Supporting the Use of Receptor Binding Assay (RBA) to Reduce the Adverse Impacts of Harmful Algal Toxins on Seafood Safety'. The method will be submitted to an international body for certification and to promote its application as a regulatory method. The project will promote effective communication and information dissemination on applied methodologies for monitoring programmes to control and mitigate the negative socioeconomic impacts of toxic harmful algal blooms (HABs).

In Oman, a reference laboratory has been established under TC project OMA/7/001, 'Establishing Reference Laboratory for Harmful Algal Blooms', to assess and mitigate



RAS/7/026: Sample collection during a workshop in Tahiti, French Polynesia, March 2015.

HAB biotoxin impacts on ecosystem services, and to provide early warning to decision makers and stakeholders. Support under this project has enhanced national capabilities in HAB management, in particular on algal species identification and biotoxin detection using the nuclear receptor binding assay (RBA) and other isotopic techniques. The processing and analysis of field samples – and thus the initiation of a pilot HAB monitoring programme – can be now undertaken by the laboratory staff.

The Agency has continued to assist Member States in the Asia and the Pacific region in the development of a sustainable air pollution monitoring programme. Fourteen Member States have taken part in RAS/7/023, ‘Supporting Sustainable Air Pollution Monitoring Using Nuclear Analytical Technology’, and as a result, regional capabilities in source apportionment and fingerprinting of air particulate matter pollution in urban areas from ± 50 degree latitude have been enhanced through the use of nuclear analytical techniques. The data generated, covering the period 2003–2015, constitutes the region’s first fine particulate database. It has been utilized by national authorities to support decision-making and the revision or updating of air quality regulations and guidelines.

In the same region, the ARASIA project RAS/0/072, ‘Evaluating and Mapping Air Pollutants Using Nuclear Analytical Techniques’, aims to establish an ARASIA network for air quality monitoring, focusing on the establishment of a regional database of aerosol measurements in the ARASIA region. In order to harmonize the work of all participating States, a protocol for Atmospheric Aerosol Sampling was jointly developed. Human capacity to support aerosol sampling and analysis activities was enhanced through training courses and group scientific visits. As a tangible result of this regional cooperation, a paper entitled *Evaluation and mapping of PM_{2.5} Atmospheric Aerosols in ARASIA Region Using PIXE and Gravimetric Measurements* has been published in the international peer-reviewed scientific journal *Nuclear Instruments and Methods in Physics Research* (NIMB).

The overall objective of regional project RLA/7/020, ‘Establishing the Caribbean Observing Network for Ocean Acidification and its Impact on Harmful Algal Blooms, using Nuclear and Isotopic Techniques’, is to establish a robust science-based monitoring network in

the Greater Caribbean to support Member States in the region to adopt and implement programmes of climate change mitigation and adaptation. The project aims to establish an observing network on ocean acidification and HABs, to enhance regional capacities for HABs and related biotoxin monitoring in the Caribbean coastal zones, and to validate scientific and outreach information on the baseline and trends of ocean acidification and HABs. This four year project has been in operation for two years. So far, 20 participants have received training in the appraisal of ocean acidification in coastal ecosystems and sampling strategies and analyses. A further training course for eleven fellows was completed in June 2015 at the International School of Foraminifera Urbino. This included training on how to identify and extract organisms from sediment samples for later analysis of radioisotopes to track paleo records of temperature and pH of the water at the time of their formation.



RLA/7/020: Training on sampling and analysis.

Also in the Latin America and the Caribbean region, project RLA/5/069, 'Improving Pollution Management of Persistent Organic Pollutants to Reduce the Impact on People and the Environment (ARCAL CXLII)', is supporting the investigation of the impact of harmful persistent organic pollutants in the environment, human exposure to these toxic substances and mechanisms to mitigate their impacts on human beings and the environment using isotopic and related techniques. Initial data had indicated the presence of high amounts of residues in people, and the project was thus deemed to be of very high priority by countries in the region. Nine countries are participating in this project, which aims to provide data and a comprehensive plan of action that will enable governments to act to reduce human exposure and to develop environmental clean-up plans to mitigate the impact of these toxic contaminants.

The Agency is supporting the development of human resources for the management and conservation of the coastal and marine environment in the Dominican Republic under project DOM/7/004, 'Developing Human Resources and Supporting Nuclear Technology for Addressing Key Priority Areas including Biodiversity and Environmental Conservation'. The project, which started in 2015, is already generating information on

"The Agency is supporting the development of human resources for the management and conservation of the coastal and marine environment in the Dominican Republic."

carbon sequestration and coastal and soil erosion. Expert advice and training has been provided for assessing the impact of pollution on biodiversity, as well as the impact of tourism in coastal ecosystems. Support for the elaboration of an environmental monitoring strategy to support biodiversity has also been provided. The project is being implemented in close coordination with UNDP. Information delivered by the project will contribute to the objectives of the GEF project 'Conserving Biodiversity in Coastal Areas Threatened by Rapid Tourism and Physical Infrastructure Development'. UNDP is the executing Agency of the GEF project, and a partnership arrangement is currently being prepared to formalize the technical partnership between the Agency and the UNDP Office in the Dominican Republic in the field of the marine environment. Project outputs will provide valuable information to the GEF project, supporting recommendations on appropriate measures to be incorporated into the policy and regulatory frameworks to conserve and sustainably use biodiversity.

In Costa Rica, it was neither possible to measure emissions and capture of GHGs from agriculture, nor to assess the effects of agricultural practices on local emissions, due to a lack of human resources, equipment, and a national laboratory that could facilitate intersectoral action in the country. TC project COS/5/031, 'Consolidating a National Reference Laboratory for the Measurement of Greenhouse Gases', aimed to define the baseline for GHG emissions, as this was necessary to implement national plans and actions to achieve carbon neutral agricultural production in Costa Rica by 2021. Through the TC project, the analytical capabilities of the staff at the Centre for Research in Environmental Pollution (CICA), University of Costa Rica (UCR) were strengthened with training and with improvements to the physical infrastructure, enabling the Centre to measure GHGs from different landscapes and soil types. The data generated by the project will help design policy change in the country, and will strengthen and promote the sustainability of the agricultural sector and the sustainable management of natural resources, in order to reduce the impacts of climate change and global warming.

The University of El Salvador (UES) has received support to to strengthen national analytical capabilities at its laboratories (LAB-UES) through ELS/7/007, 'Enhancing National Capability for the Assessment of Contamination in the Marine Environment and Conservation of Endangered Species'. The laboratory, which focuses on environmental conservation of ecosystems, specifically red tide and marine ecology, has now established capacities in RBA for harmful algal toxins, a monitoring system for red tide.



COS/5/031 aimed to define the baseline for GHG emissions necessary to implement national plans and actions to achieve the objectives of carbon neutral agricultural production in Costa Rica by 2021. Photo: AG Perez, CICA/UCR.

Industrial Applications

REGIONAL HIGHLIGHTS

As African Member States develop stronger industrial, medical, agricultural and research sectors, the relevance and importance of nuclear technologies is increasing. Proper maintenance and repairing services are also in increasing demand, and effective solutions are needed in sectors such as nuclear medicine. The TC programme supports African Member States in building human and technical capacities to meet local demands in a sustainable and effective manner.

In the industrial sector in Europe, projects focus on enhanced industrial and environmental safety, productivity and quality assurance.

The TC programme in the Asia and the Pacific region continued to focus on enhancing regional capabilities in using innovative techniques for industrial systems, and in capacity building in non-destructive testing technology for enhancing industrial productivity.

In the Latin America and the Caribbean region in 2015, one of the top priorities in industrial applications was providing support for capacity building in irradiation services via national projects. These projects aimed to enhance and improve the use of irradiation in biotechnology, pharmaceutical, and agricultural industries.



RADIOISOTOPES AND RADIATION TECHNOLOGY FOR INDUSTRIAL APPLICATIONS

In Africa, in Nigeria, under project NIR/1/010, 'Deploying a CERD Accelerator to Support National Economic Development Programmes', ion beam accelerator (IBA) technology is being used to perform a range of experiments and trainings critical for achieving economic and social benefits in Nigeria. The IBA facility at the Center for Energy Research and Development (CERD) is used for testing and characterization of materials from diverse fields, such as bio-medicine, pharmaceuticals, agriculture, environment, and cultural heritage objects, amongst others. The IBA also serves as a major national facility that provides important analytical services on the education and the research training of the next generation of graduate students, post-doctoral fellows and other emerging researchers in the physical, chemical, materials and biological sciences.

In the Asia and the Pacific region, through regional project RAS1012, 'Enhancing the Regional Capability in using Innovative Radiotracer and Sealed Source Techniques for Investigation of Complex Industrial Systems' participating countries have enhanced their capability in the effective use of advanced nuclear techniques in diagnosing complex industrial processes. A number of countries, including China, Indonesia, Malaysia, Korea and Vietnam, have established very good facilities of gamma CT and SPECT. Vietnam's Centre for Application of Nuclear Techniques in Industry (CANTI) has developed a first generation gamma CT system (GORBIT), which has been supplied to various countries in the region. The Industrial Applications Group at the Pakistan Institute of Nuclear Science and Technology (PINSTECH) has successfully tested this system for visualization of two phase air-water flow developed across 90° horizontal and vertical bends. The Group has also developed a computational fluid dynamics (CFD) based model of this two phase flow system and compared the results with gamma CT. India, Malaysia and Korea have developed facilities for the radioactive particle tracking (RPT) technique, while Korea has also developed expertise in Monte Carlo simulation for CT, SPECT, RPT and the design of radiotracer experiments. Pakistan has developed its expertise in residence time distribution (RTD) analysis integrated with CFD simulation.

"In the Latin America and the Caribbean region in 2015, one of the top priorities in industrial applications was providing support for capacity building in irradiation services."

Participant countries have also made significant progress in the development of new radiotracers for use in multiphase flow systems. The development of various facilities and expertise regarding innovative radiotracer and sealed source techniques has also resulted in excellent technical cooperation among developing countries.

Knowledge and awareness about cultural heritage sites and their contribution to tourism development in the Europe region has been enhanced with the support of RER/0/039, 'Extending and Diversifying the Application of Nuclear Technology in Cultural Heritage'. In 2015, the project supported hands-on and theoretical training for junior specialists, which covered irradiation technology for cultural heritage preservation and restoration.

Also in Europe, a range of activities were undertaken under the umbrella of CRO/1/006, 'Upgrading the Cobalt-60 Panoramic Irradiation Facility', in the Radiation Chemistry and Dosimetry Laboratory of the Ruđer Bošković Institute in Croatia. The project aimed to improve the safety and quality of medical and food products to protect human health, and to preserve cultural heritage objects. It also supported the application of radiation techniques in many areas of scientific research in Croatia and neighbouring countries, including radiobiology, solid state physics, radiation synthesis and modifications of advanced materials and nanotechnology and polymer chemistry.

Within the scope of the project, and with financing from Croatia and the IAEA, approximately 60 kCi (2220 TBq) Cobalt-60 sources have been delivered and installed. This additional capacity has improved irradiation conditions, and has enabled the processing of 13 000 m³ of medicinal and foodstuff products per year. It has also enhanced opportunities for scientific research and regional cooperation.



CRO/1/006: Manipulation with transport container.



COS/1/007: At work in the laboratories of the Costa Rican Institute of Technology.

In Cuba, the TC programme has continued its support for the revitalization of irradiation services through CUB/1/012, 'Enhancing Irradiation Services'. The goal is to increase the availability and quality of products from the biotechnological, pharmaceutical and food industries. The project supports specialized training and expert advice for the management of irradiation facilities, including plant construction, installation, control processes and operation. In 2015, the main activities focused on providing guidance to convert Cuba's Food Industry Research Institute into a multipurpose irradiation facility.

Costa Rica has acquired gamma irradiation capabilities which will enhance the areas of biomedical, biomaterials and agricultural applications, through project COS/1/007, 'Establishing Gamma Irradiation Capabilities at the Costa Rican Institute of Technology (ITCR) for the Use of Radiation Processing Technology'. With Agency support for human resource training and the transfer of technology, two laboratories with the capacity to grow human cells have been established.

With the new gamma cell procured under the project, skin ailments and burns can be treated, as gamma irradiation guarantees the sterilization of tissues. Additionally, staff gained experience in the design and construction of polymeric matrices used as a human tissue substitute and for drug delivery. Services will also be expanded to irradiate seeds to support the development of new crop varieties through mutation

RESEARCH REACTORS

In Africa, the TC programme has enhanced capacity in the use of research reactors (RRs) through the on-going project RAF/1/005, 'Strengthening the Capacity for Research Reactor Safety and Applications in Africa (AFRA)'. Specifically, Member States have been trained in neutron activation analysis (NAA), with special emphasis on quality assurance and quality control (QA&QC). Participating countries have also been trained on computational methods and tools for neutronic and thermal-hydraulic analysis.

The Agency is also supporting related activities in the establishment of Jordan Research and Training Reactor (JRTR) through two national TC projects (JOR/1/005, 'Enhancing National Capabilities for Safety Assessment and Effective Use of the Research Reactor', & JOR/1/006, 'Building Capacity for the Construction, Commissioning, Safety and Utilization of the Jordan Research and Training Reactor (Phase II)'). Fuel loading for the JRTR is expected to take place in 2016.

The IAEA promotes networking, coalitions and regional collaboration to improve the safety, and efficient and sustainable utilization of research reactors. A number of RR coalitions and networks have been developed with IAEA support through RER/1/007, 'Enhancing Use and Safety of Research Reactors through Networking, Coalitions and Shared Best Practices', as a new model to better utilize RRs and facilitate access for Member States without such facilities. The coalition/network concept involves putting in place cooperative arrangements among RR operators, user entities and other stakeholders. A number of meetings and training activities took place in 2015 to facilitate and promote these activities.

The Caribbean's research reactor is located at the University of West Indies in Jamaica. It has gone through a conversion to low enriched uranium (LEU) fuel as part of a joint effort between the governments of Jamaica and the United States, with assistance from the Agency. The TC programme provided experts in emergency preparedness and response, transport of radioactive materials and reactor instrumentation to support the conversion process and to contribute to the enhancement of the reactor's utilization in the country.



JOR/1/005: Jordan Research and Training Reactor under construction at Irbid, Jordan.

Energy Planning and Nuclear Power

REGIONAL HIGHLIGHTS

Sustainable, reliable and clean energy is necessary for successful, sustainable social and economic development. Concerns over security of energy supply, climate change and environmental impacts are making energy accessibility, availability and affordability one of the biggest development challenges in Africa. Although the continent has abundant energy resources that can help it meet its current and future energy needs, some 60% of people in Africa still live without reliable access to electricity. Expanded and enhanced local expertise is needed to develop these energy resources to their full potential, and to move towards reduced dependency on imported energy and increased energy security. The TC programme offers tailored assistance to its African Member States to develop national and regional human capabilities and establish the technical capacities needed to set up solid energy planning programmes. Some Member States also receive targeted assistance related to the effective management of uranium and other resources.

In the Asia and the Pacific region, several Member States are continuing to show interest in nuclear power, and a number have taken concrete steps towards constructing their first NPPs. Agency assistance provided through national and regional projects focuses on strengthening national capabilities for developing national nuclear power infrastructures in embarking countries as well as supporting countries operating NPPs.

In Europe, nuclear power plays and is expected to continue playing an important role in the energy mix in the region as several Member States are operating NPPs, others are expanding existing nuclear power facilities, and some are considering the introduction of nuclear power for the first time. Several regional TC projects are therefore focusing on strengthening national safety infrastructures and the operational safety of existing NPPs, as well as on providing guidance to Member States that are considering expanding their nuclear power programmes or introducing nuclear power for the first time.

In the Latin America and the Caribbean region, the Agency supported the three Member States with nuclear power through regional project RLA/9/080 'Enhancing Nuclear Power Plant Life Management and Safety Culture Practices'. This project provided operators with information and support regarding the long term operation and aging management of NPPs, as well as a forum for learning from the experiences of other member states in the region.



“In the Asia and the Pacific region, several Member States are continuing to show interest in nuclear power, and a number have taken concrete steps towards constructing their first NPPs.”

ENERGY PLANNING

The Agency is supporting energy planning in a wide range of countries around the world, for example in Burundi through BDI/2/002, 'Supporting Capacity Building in Energy Planning', in Cambodia through KAM/2/001, 'Developing National Capability in Energy Planning and Economics', and in Nepal through NEP/2/001, 'Enhancing National Capacity to Develop a Sustainable Energy Policy'.

Angola provides a good example of the kind of energy planning support provided by the Agency. Energy poverty is widespread in the country – only about 26% of the population has reliable access to electricity, and blackouts occur frequently. Some 80% of Angolans rely on biomass for most of their energy needs, leading to severe local deforestation around most large cities – for example, deforestation now extends over a radius of 200–300km around Luanda. Additionally, the use of biomass for energy production is highly polluting, and generates high levels of carbon dioxide. The project ANG/2/001, 'Using Long-Term Planning to Enhance Secure Energy Supply and Environmental Sustainability (Phase I)', supports the improvement of local expertise in sustainable energy planning so that national

institutions are capable of designing strategies, policies and action plans for the sustainable development of the national energy sector. National experts have been trained on energy demand analysis using the IAEA tool Model for Analysis of Energy Demand (MAED) and on energy supply analysis using the IAEA tool Model for Energy Supply Strategy Alternatives and their General Environmental Impacts (MESSAGE), and the tools are now in regular use. National analytical competencies to ensure access to suitable, affordable and secure energy services have increased.

INTRODUCTION OF NUCLEAR POWER

The interregional project for nuclear newcomer states, INT/2/013, 'Supporting Nuclear Power Infrastructure Capacity Building in Member States Introducing Nuclear Power', has successfully enhanced and harmonized human resources capabilities for the introduction of nuclear power. By establishing a global network and forum for information exchange, transferring knowledge related to milestone issues and developing specific training mechanisms for human resources development, integrated management systems and project management, the TC programme has supported newcomers in their endeavours to support the safe and sustainable development of nuclear energy. This project was supported with PUI contributions from the USA and the Republic of Korea, which have enabled implementing an average of 14 events each year, in areas including stakeholder involvement and communications, legal and financial issues, nuclear power infrastructure capacity building, energy policy planning and programme management, reactor technology assessment methodologies, as well as on regulatory infrastructure requirements. The beneficiaries include executives in nuclear newcomer countries which have key decision-making roles in government agencies, ministries, regulatory bodies, operators, utilities, research and development organizations, as well as education and training institutions.

Under project CHI/0/016, 'Strengthening Human Resource Development and Nuclear Technology Support' the Agency provided a national level training course on Understanding the Physics and Technology of Advanced Passively Safe Water-Cooled Nuclear Reactors using Basic Principles Simulators in May 2015. In December 2015, under project INT/2/014, 'Supporting Member States to Evaluate Nuclear Reactor Technology for Near-Term Deployment', the Agency organized an interregional training course on Understanding the Physics and Technology of Water-Cooled Reactors through the use of Basic Principle Simulators at Texas A&M University in College Station, Texas, USA.

Under project RAF2/0/10, 'Developing, Expanding and Reinforcing Energy Planning Capabilities including Nuclear Power (AFRA)', the *Third Conference on Energy and Nuclear Power in Africa, Assessing African Energy Needs and Planning for the Future* was organized in Kenya in April 2015. With reports indicating that nearly 620 million people in sub-Saharan Africa live without electricity, enhancing energy security and eradicating energy poverty are major issues for many African countries. Improving energy production, limiting traditional, unreliable and contaminant primary sources such as biomass (widely used by nearly 730 million people throughout the continent) are key policy areas. Senior level participants explored six major issues, namely national energy planning, legal considerations, leadership training, funding, regional networking and other non nuclear aspects of nuclear power development. Subjects including sustainable energy development in Africa, national and regional energy planning for nuclear power development, legal considerations, leadership and management, funding of a nuclear power programme in its early stage, as well as the benefits of regional networking were addressed during the Conference.

In 2015, three African countries (Kenya, Nigeria and Morocco) hosted Integrated Nuclear Infrastructure Review (INIR) missions, covering the comprehensive infrastructure required for building a nuclear power programme. The missions included a team of international experts, who have direct experience in specialized nuclear infrastructure areas, and specialized IAEA staff. Building on a Member State's self-evaluation, the mission team

reviews the infrastructure status through interviews, site visits and document reviews. Suggestions and recommendations are provided in a report to the Member State, enabling it to update its national action plan accordingly. These were the only INIR missions conducted by the IAEA in 2015, which underscores the regional interest in developing nuclear power.

Many African countries have begun revisiting the nuclear option over recent years with a view to establishing long term sustainable energy supplies. Recognizing the long lead times associated with the establishment of nuclear power programmes, several countries have launched energy demand and supply assessments.

In Algeria, assistance has been provided to the Algerian Atomic Energy Commission (COMENA) to establish a nuclear engineering structure aimed at supporting the introduction of nuclear power in Algeria through project ALG/2/008, 'Contributing to the Establishment of a Nuclear Engineering Centre (CIN) for the Progressive Introduction of Nuclear Power and the Design, Production and Maintenance of Several Required Nuclear Power Systems'. CIN will support the design, production and maintenance by COMENA and its partners of systems required in the field of nuclear techniques and technology, thus ensuring progressive national integration for the introduction of nuclear power. With the training and equipment provided through the project, CIN has appropriate expertise and competence, as well as specific tools, and efficient and validated hardware and software architecture. The Centre is responsible for the study, design and development of nuclear facilities and processes, and anticipates providing long-term functionality and support for radiation and nuclear safety.

Under EGY/2/012, 'Developing Human Resource Capacities for the Nuclear Power Plant Project During Contracting and Early Construction Stage', TC assistance has helped the Nuclear Power Plants Authority develop human resources for the nuclear power programme. Management and technical staff have been trained to execute the activities in phase II and early phase III of the first NPP project including managing stakeholder involvement, the bidding process, bid evaluation activities, negotiation and contracting with the selected vendor.

In Ghana, within the framework of GHA/2/002, 'Establishing Nuclear Power Infrastructure for Electricity Generation (Phase II)', the IAEA is assisting with the development of the infrastructure for a safe, secure, and peaceful national nuclear power programme. As one of the critical aspects for the development of a nuclear power programme, the Agency has supported the establishment of the nuclear energy programme implementing organization (NEPIO), and the development of a roadmap to facilitate implementation of key activities. The Agency has also supported the strengthening of the country's regulatory infrastructure through training fellowships and scientific visits.

In the United Arab Emirates, the Agency has provided direct support to various areas of the nuclear power programme through numerous national TC projects since 2008. The ongoing UAE/2/003, 'Supporting the Development of National Nuclear Power Infrastructure for Electricity Generation - Phase II', has assisted United Arab Emirates in developing the nuclear regulator and its legal framework, and in building human capacities to assure sustainability in ensuring the safety of the nuclear power programme. Currently, all four nuclear power units at Barakah are under construction. Unit 1 is scheduled to begin operation in 2017.



UAE/2/003: Construction activities at Barakah units 3 and 4.

A Third Coordination Meeting on the UAE Integrated Work Plan (IWP) for Nuclear Power Programme was held in April 2015. The meeting reviewed the progress of the nuclear power programme in United Arab Emirates and the implementation of the agreed-upon IWP related to IAEA support to the nuclear power infrastructure development of United Arab Emirates in 2014, and finalized future plans for Agency assistance to the United Arab Emirates nuclear power programme



Third Coordination Meeting on UAE Integrated Work Plan for Nuclear Power Programme, Vienna, April 2015.

Viet Nam has received comprehensive support within the framework of VIE/2/012, 'Developing Nuclear Power Infrastructure Phase III'. Following the IWP agreed for 2011–2015, the country has taken considerable steps to develop a national nuclear power infrastructure to meet the requirements of Phase 2 preparations. The project has provided significant capacity building support and has strengthened coordination among national institutions involved in the nuclear power programme. It is also supporting the establishment of policies and strategies related to human resource development.

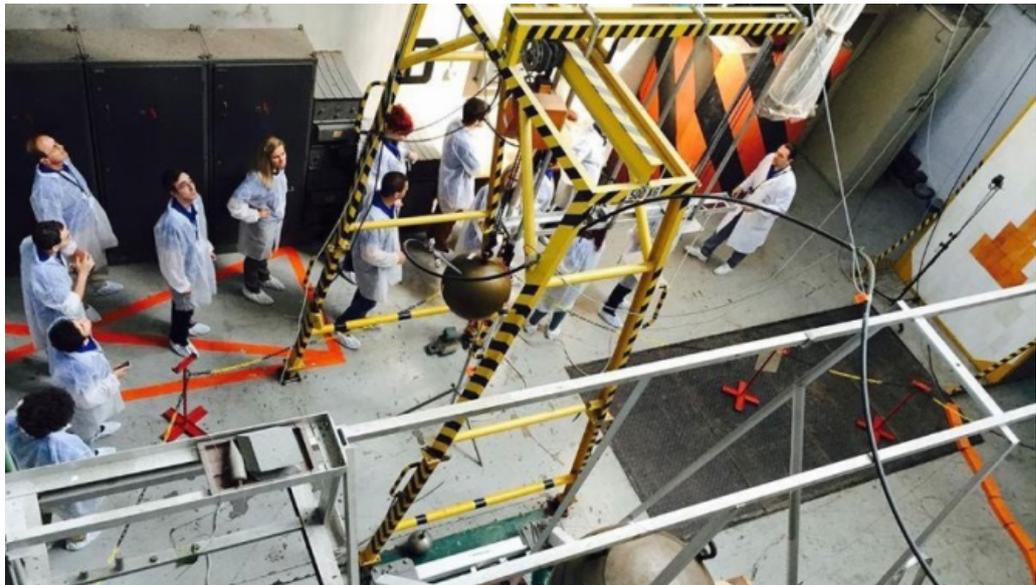
The Agency is continuing to support Jordan in the development of a nuclear power programme through six national TC projects (JOR/2/007, JOR/2/009, JOR/9/010, JOR/9/011, JOR/9/014 and JOR/9/015). These cover human resource capacity building, infrastructure development, regulatory infrastructure development and the national radioactive waste management system. Jordan has sent several groups of nuclear engineers and regulatory officials to the Russian Federation and the Czech Republic to gain experience in water cooled, water moderated power reactor type operational NPPs. Japan and USA have also provided funding through the PUI mechanism. Jordan has made reasonable progress and has gathered sufficient experience to make a final decision on a site and to start the evaluation of the construction offer by the NPP vendor, State Atomic Energy Corporation 'Rosatom'. The Jordan Nuclear Power Company has been established as the future NPP operator, and an International Advisory Group has been established to oversee the progress of the national nuclear power programme. In November 2015, under JOR/2/009, 'Developing Nuclear Infrastructure for the Construction and Operation of a Nuclear Power Plant', the Agency provided a national training course in Amman on Understanding the Physics and Technology of PWRs using Educational Basic Principles Simulators.



Jordan nuclear power plant site under construction.

The Agency is providing assistance to Bangladesh through BGD/2/012, 'Establishing Infrastructures for the Introduction of a Nuclear Power Plant', and BGD/2/013, 'Developing National Infrastructure for the first Nuclear Power Programme Phase II', complementing the national effort to develop nuclear power infrastructure. Bangladesh has taken significant steps, having promulgated the new Atomic Energy Regulatory Authority Act in 2012. In February 2013, the Bangladesh Atomic Energy Regulatory Authority was established as a structurally separate entity. Agency support was provided to build the capacity of the NPP management and to strengthen the regulatory infrastructure. Bangladesh is establishing a national nuclear technology training centre to support the NPP programme and, through the project, the Agency procured a PC based simulator and trained the Bangladeshi experts. Following a successful pre-delivery factory acceptance test the simulator was delivered in October 2015.

The Polish Government has included nuclear power development as one of six main goals in Polish energy policy to 2030, with the goal of having the first unit of the first NPP operational in 2029/2030. Through POL/2/016, 'Supporting Nuclear Energy Infrastructure Development', the Agency has organized workshops, technical meetings, expert missions and personnel training in support of the country's goal to develop the infrastructure for nuclear power in a relatively short period of time. A Pre-INIR Mission and an INIR mission have been undertaken, and several key recommendations were made for Phase 1 as well as for Phase 2. The project has supported in-depth discussions through various meetings, and Polish experts have participated in technical meetings on Strategic



RER/0/035: INI fellows visiting facilities at the Research Centre REZ, Husinec-Řež, Czech Republic, June 2015. (Photo: B. Benešová/CNCC, Czech Republic).

Supply Chain and National Industrial Involvement for Nuclear Power, Comprehensive Approaches to Managing the Back-End of Nuclear Fuel Cycle and Proliferation Resistance, and Safeguardability Assessment Tools. A National Waste Management Strategy has been developed for approval in 2016. National capacities, capabilities and readiness in areas relevant for the introduction of nuclear power in Poland have been increased, and the country has now qualified capabilities to make progress in decision making on technology and site selection.

In 2015, through the PUI-supported regional TC project RER/0/035, 'Supporting Enhanced Sustainability of Programme Activities', 23 young engineers and scientists were able to gain unique hands-on experience at the new Intercontinental Nuclear Institute (INI), a four-week, joint programme by the U.S.-Czech Civil Nuclear Cooperation Center in Prague and the University of Massachusetts-Lowell in the United States. INI was designed with a special focus on combining classroom learning with practical experience, providing fellows with the opportunity to learn from leading experts from industry, research and technology organizations and universities, and introducing them to physical facilities and activities. The cross-Atlantic nature of the programme enabled fellows to familiarize themselves with different types of technologies.

NUCLEAR POWER REACTORS

The Europe region hosts a fleet of power units commissioned some thirty or more years ago and still in operation. These units require a set of particular operational skills. Efforts to prepare for the long term operation of NPPs beyond their original designed lifetimes have been supported through RER/2/010 'Strengthening Capabilities for Nuclear Power Plant Lifetime Management for Long Term Operation', as well as on earlier successful projects. Four workshops – on instrumentation and control, buried piping, fire protection, and supply chains – were held in 2015, bringing together experts from European countries that operate NPPs.

Through RLA/9/080, 'Enhancing Nuclear Power Plant Life Management and Safety Culture Practices' regulatory authorities and technical and research organizations in Member States of Latin America and the Caribbean that operate NPPs have been informed of the requirements to ensure an acceptable level of safe operation of NPPs at each stage of the life cycle, including aging management and long term operation, while taking

into account IAEA Safety Standards, international best practices and national policy and strategy.

Notable achievements during the first two years of project implementation include the development of the license renewal application for Laguna Verde (Mexico). The project provided support on aspects of safety during long term operation, as well as in training, and for participation in national and international workshops on ageing management. The project also supported participation in technical meetings for the development of international generic ageing lessons learned. The license renewal application for an additional 30 years of operation of Laguna Verde was accepted by the national regulator in August 2015.

Project RLA/9/080 has also enabled Nucleoeléctrica Argentina, the Argentinian NPP operator, to receive peer review missions on operational Safety Aspects of Long Term Operation. These missions will provide the Argentinian operator with concrete recommendations to guarantee all safety requirements will be in place once the NPP starts operating beyond its end of life in 2018. Finally, Angra NPP in Brazil has already undergone an Operational Safety Review Team (OSART) peer review mission. The recommendations and suggestions for operational safety improvement are being addressed.

NUCLEAR FUEL CYCLE

Some twenty countries in Africa are in the process of assessing the potential socioeconomic contribution of uranium and related energetic minerals such as rare earths and phosphates to sustainable development over the medium and long term. A change in uranium extraction project design, management and execution capabilities will enable projects to transition from the current traditional uranium mining and processing approach to an innovative, 'smart' model, consistent with national socioeconomic development goals and attractive to responsible operators and investors. The Leadership Academy model envisages a triple bottom line approach, namely: the generation of social capital, enhanced infrastructure and social returns; long term economic viability/ profitability for both shareholders and stakeholders and environmental sustainability within the context of safe, socially accepted good practices. The regional TC project RAF/2/011, 'Supporting Sustainable Development of Uranium Resources', is supporting capacity building on this topic in participating Member States in the region.



RAF/2/011: Workshop visit to Minjingu phosphate mine near Arusha.

Radiation Protection and Nuclear Safety

REGIONAL HIGHLIGHTS



Nuclear and radiation safety remains a priority area for technical cooperation in Africa. In order for Africa to fully benefit from the application of nuclear science and technology, African Member States have to aim at satisfying all the requirements of the International Basic Safety Standards for Radiation Protection, along with other Safety Standards as appropriate. The Agency continues to work together with other international partners to enhance the radiation safety infrastructure on the continent. In 2015, regional projects addressing the key elements under the seven Thematic Safety Areas were implemented, with a strong focus on education and training, and building the appropriate radiation safety infrastructure. Support from the European Commission (EC), Japan, and USA was fundamental to ensuring more comprehensive Agency assistance to African regulatory bodies.

In the Asia and the Pacific region, substantive work was carried out in 2015 in the area of safety. The Agency provided assistance to Member States to strengthen the effectiveness and sustainability of their national regulatory infrastructures, built capacity for the establishment of radioactive waste management infrastructure, and supported the upgrade of radiation safety infrastructure, including occupational protection and patient protection. Human capacity building was a priority in this area: an important example is the annual regional Postgraduate Educational Training in Radiation Protection and the Safety of Radioactive Sources course held in Malaysia.

In Europe, the TC programme supported environmental remediation activities related to uranium production legacy sites, radioactively contaminated soil, and in the context of the Chernobyl accident. Projects also supported improvements in waste management systems including waste minimization, quality assurance and optimization of integrated waste management systems. Projects also assisted both operators and regulators in the safe management of radioactive waste and decommissioning of nuclear facilities.²⁷

In 2015, several Latin America and Caribbean regional projects focused on education and training in radiation protection and safety. The major initiatives included supporting the first International School of Radiation Emergency Management (ISREM), strengthening the radiation protection of patients and medical professionals, control of radioactive sources and waste management. Another priority for the region is strengthening the regulatory framework and infrastructure for radiation safety in the Member States.

GOVERNMENTAL REGULATORY INFRASTRUCTURE FOR RADIATION SAFETY

The Final Coordination Meeting of the AFRA regional project RAF/9/042, 'Sustaining the Regulatory Infrastructure for the Control of Radiation Sources', was held in Accra, Ghana, in November 2015. The meeting brought together project counterparts and their representatives to review the progress made by participating Member States on radiation safety infrastructure over the past four years. In summary, as a result of the project, African Member states experienced an overall improvement in their regulatory infrastructure. Other notable results from the project were an increase in the knowledge of regulators to carry out core regulatory functions and the promotion of sharing experience and lessons

²⁷ This paragraph responds to section 2, operative paragraph 7 of resolution GC(59)/RES/11 to work actively to render assistance and radiological support to the most affected countries in mitigating the consequences of the Chernobyl disaster and rehabilitating the contaminated territories.

learned amongst participating African Member States. Furthermore, IRRS Missions were carried out in the United Republic of Tanzania (2015) and Zimbabwe (2014), enabling a thorough peer review of the countries' regulatory functions. The recommendations will prove useful as Tanzania sets out to outline its regulatory infrastructure in line with the IAEA Basic Safety Standards.

In Europe, a preliminary assessment of national radiation and nuclear legislation in various Member States has shown that existing legal frameworks needed to be enhanced to make them consistent with relevant IAEA safety standards and other binding and non-binding international instruments. This applied equally to countries with limited nuclear applications involving only radiation sources and to those that were interested in introducing or developing further their respective nuclear programmes (e.g. power or research reactors).

In Slovenia, a national workshop was organized on the technical aspects of the defence in depth (DiD) safety concept and safety margin assessment under project SLO/9/015, 'Strengthening Regulatory Capabilities of the Nuclear Safety Administration'. The workshop provided insights into key DiD issues, and supported discussions with the Slovenian Nuclear Safety Administration (SNSA) on the conduct of self-reviews and improved systematic safety margins evaluation. In addition, several scientific visits were organized to familiarize the staff of the regulatory body with international experiences and best practices, and to strengthen SNSA with state-of-the-art knowledge to enhance nuclear and radiological safety in the country.

TC project LIT/9/012, 'Strengthening the Nuclear Safety Regulatory Authority and Other Institutions for the Possible Licensing of a New Nuclear Power Plant', has contributed to the June 2015 achievement of the Lithuanian State Nuclear Power Safety Inspectorate (VATESI), which has been awarded the ISO 9001:2008 certificate for its management system. This highlights the progress made by Lithuania over the years to continuously improve its licensing system in the nuclear power sector.



LIT/9/012: VATESI staff holding ISO/9001:2008 certificate, Vilnius, Lithuania, June 2015.

In Latin America and the Caribbean, regional TC project RLA/9/071, 'Establishing Sustainable National Regulatory Infrastructures for the Control of Radiation Sources in Haiti, Belize, Jamaica and Honduras', has been key in helping Honduras and Jamaica to follow the necessary steps to establish and improve their regulatory infrastructures in accordance with relevant IAEA safety standards and international guidelines. Through the project, and with the contribution of the United States Nuclear Regulatory Commission, the National Autonomous University of Honduras has established the first personal dosimetry laboratory in the country, providing services for occupationally exposed workers. The Bureau of Standards of Jamaica has received assistance in the evaluation of safety documents related to the conversion of its Slowpoke research reactor to low enriched uranium (LEU) fuel.

SUPPORTING SAFETY IN NUCLEAR POWER PLANTS AND RESEARCH REACTORS

The TC project RAF/4/022, 'Enhancing Research Reactor Utilization and Safety (AFRA)' (co funded by the EU), supports African Member States in the effective application of the Code of Conduct on the safety of research reactors. The project supports the building of capacity for safety infrastructure for research reactors, in particular in relation to enhancing regulatory supervision of research reactors, developing capabilities to perform safety assessments, enhancing safety management at research reactor operating organizations, establishing and implementing effective operational safety programmes, enhancing the safety of experiments and standard operating procedures, and enhancing emergency planning, including emergency response capabilities. In addition, a Regional Advisory Safety Committee for Research Reactors in Africa (RASCA) has been established with the support of the Agency. RASCA acts mainly as an advisory group, and aims to help solve significant safety issues in the region and improve the functioning of the operating organizations' national safety committees.

In 2015, within the framework of EGY/9/039, 'Establishing a National Decontamination Operational Unit for Hot Laboratories and a Waste Management Centre', the staff of the Department of Waste Management of the Egyptian Atomic Energy Authority developed capacities to respond to any decontamination and decommissioning needs during normal operations. Equipment was also procured through the project for the establishment of a Waste Decontamination Centre which was commissioned in May 2015. The centre is now fully operational, and local operators have been trained in its use and maintenance. Since its entry in operation, the centre has been processing equipment from petroleum and chemical industries, and thus supporting income generation for the Egyptian Atomic Energy Authority.

Also in Egypt, TC assistance was provided to the Egyptian Nuclear and Radiological Regulatory Authority (ENRRA) through EGY/9/042, 'Strengthening the Regulatory Inspection of Nuclear and Radiological Installations', on authorizations and inspections to strengthen its regulatory functions. ENRRA also received assistance on safety issues related to Egypt's nuclear power infrastructure development. This included the review of regulatory requirements and completeness of documents for site permit. In addition, it provided support for training on performing safety systems Walk Down and Inspection techniques for regulatory bodies, using the Zwentendorf Nuclear Power Plant.

RADIATION PROTECTION OF WORKERS, PATIENTS AND THE PUBLIC

The use of radioactive sources is growing in Cameroon, especially in the medical and industrial sectors, where they are used, inter alia, in radiotherapy, nuclear medicine, diagnostic radiology, NDT, well logging and in nuclear gauges. Cameroon holds



RAS/9/075: Practical session on strengthening radiation protection infrastructure and technical capabilities for the safety of workers, patients and the public.

approximately 180 sealed radioactive sources registered in the source inventory. The National Radiation Protection Agency is in charge of arranging the necessary actions when a unit needs to be removed or dismantled. The regulation on radioactive waste management is included in the draft law under review by the competent national authorities. With the support of CMR/9/007, 'Establishing a National Radioactive Waste Management System', Cameroon is setting up an appropriate infrastructure for effective radioactive waste management. Through the project, equipment for monitoring, treatment and storage of radioactive waste has been acquired, and competencies in the management of radioactive waste, search and securing of orphan radioactive sources, naturally occurring radioactive materials, and decommissioning of nuclear facilities have been established.

New Member States in the Asia and the Pacific region require focused support on safety standards for the protection of health. A kick-off event has been organized under RAS/9/075, 'Strengthening Radiation Protection Infrastructure and Technical Capabilities for the Safety of Workers, Patients and the Public', to provide such countries with information and strategies to support the development of national infrastructure for the safety and protection of the public, patients and workers from the risks of ionizing radiation. Brunei, who became an IAEA Member State in 2014, hosted the event in Bandar Sri Begawan in November 2015. The workshop provided information, guidance and tools to assist key personnel in developing a systematic approach to identifying, understanding and managing the relationships between the various elements of radiation safety infrastructure.

A regional TC project in Latin America and the Caribbean, RLA/9/075, 'Strengthening National Infrastructure for End-Users to Comply with Regulations and Radiological Protection Requirements', is focusing on strengthening radiation protection of patients and workers, and on promoting the sustainability of national education and training initiatives in radiation safety. In 2015, national training events were carried out for medical professionals from hospitals in over 10 countries where gaps in radiation protection were identified. A specific methodology was developed for these national trainings, which provide a core group of trained medical practitioners with a concrete action plan for optimization of radiation exposure for patients and exposed medical workers. The project has also facilitated national courses for the implementation of a risk matrix in radiotherapy. Due to the impact of this project, end-user institutions in eight countries have received equipment to reinforce their capacities for technical support related to individual and workplace monitoring, calibration, and advisory services. Furthermore, five countries have established a national dose registry for internal and external dosimetry.



RLA/9/075: Participants in a course on radiation protection in medical practice, hosted in Paraguay. Photo: L. Canevaro/CNEN Brazil.

TRANSPORT SAFETY²⁸

The Agency is providing support in the field of radiation safety to both new Member States and small islands developing States. A regional meeting on progress and challenges in establishing a compliance assurance regime for transport safety took place in Fiji in December 2015, under the project RAS/9/067, 'Strengthening an Effective Compliance Assurance Regime for the Transport of Radioactive Material'. The meeting provided participants with the groundwork for the establishment of an independent regulatory authority and the promulgation of the necessary legal framework. Participants expressed support for the formation of a Regional Network for Transport Safety in the Pacific Islands, and a Regional Action Plan developed during the meeting outlined the next steps for the formation of this network. Targeted bilateral assistance has also been provided in the region, as a result of which most SIDS are working on a draft nuclear law and on establishing a regulatory entity.

EMERGENCY PREPAREDNESS AND RESPONSE

Under the regional Africa project RAF/9/052, 'Strengthening and Harmonizing National Capabilities for Response to Radiation Emergencies', three Emergency Preparedness Review (EPREV) missions have been conducted in Ghana, Kenya and Nigeria. EPREV missions are international peer reviews for Member States; they provide an opportunity for Member States to have their emergency preparedness and response programmes and capabilities independently reviewed against international standards. National and local stakeholders include emergency-related organizations, first response organizations and regulatory authorities. A further EPREV mission in the Asia and the Pacific region was carried out in the United Arab Emirates.

Also under RAF/9/052, the Agency supported a radiation emergency exercise conducted in Botswana, providing planning support and training local stakeholders, while Botswana's

²⁸ This section responds to section 4, operative paragraph 6 of resolution GC(59)/RES/11 on the shipment of radioactive materials and IAEA Regulations for the Safe Transport of Radioactive Material.



RAF/9/052: EPREV mission to Nigeria in June 2015.



RAF/9/052: Staging for a transport accident exercise, Botswana.

Radiation Protection Inspectorate conducted a transport accident exercise. The event was opened to participants from all RAF/9/052 African Member States in the role of international observers.

The Cooperation Council for the Arab States of the Gulf (GCC) has undertaken a significant effort to establish a coordinated regional EPR capability to prepare for and respond to nuclear and radiological emergencies. This regional approach allows the Member States to leverage collective experiences and resources for the benefit of the region. Through the project RAS/2/015, 'Supporting the introduction of Nuclear Power for Electricity Generation and Seawater Desalination', the Agency has provided support to the establishment of the first Regional Radiological Emergency Response Plan and Regional Disaster Management Centre for GCC Member States.

EPR in case of a radiological or a nuclear accident/incident was also addressed under TC project OMA/9/004, 'Strengthening Capabilities for Radiological and Nuclear Emergencies Preparedness and Response in Oman'. The project aims to mitigate the harmful effects of any radiological or nuclear accident on the environment and the population and implement remediation measures, and resulted in the development and finalization of Oman's Emergency Preparedness and Response Plan as well as its Implementation Strategy. Additional support to improve national capabilities to respond to nuclear and radiological emergencies in the area of medical response to radiation emergencies, as well as to manage radiological or nuclear emergencies and to prepare Standard Operating Procedures was provided through scientific visits and national workshops.

In the Asia and the Pacific region, national emergency response capabilities were improved under RAS/9/076, 'Strengthening of National Capabilities for Response to Nuclear and Radiological Emergencies'. This project enhanced understanding of hazard assessment needs with respect to the development of National Radiological Emergency Plans. Participating Member States were informed of the concepts for a sound protection strategy based on accurate hazard assessment. The project also laid out the initial steps for enhancing region capacity in medical response to radiological emergencies through the identification of potential capacity building centres (CBCs) in the region. The CBCs are expected to serve as focal points for education, training and information sharing activities in the area of response to radiological emergencies, and are expected to cooperate closely with the Agency in Member State capacity building activities.

An early warning radiation monitoring network is in place in Latvia, consisting of 22 stations located across the country. Technical upgrades including the replacement of old monitoring stations and the addition of new aerosol monitoring stations to ensure fast and reliable data collection and to expand data exchange within the European platform for radiological data exchange EURDEP have been implemented using funds from EU. The Agency has provided



RLA/9/076: Training in the use of anticontamination clothing during the first ISREM in Latin America and the Caribbean. Photo: IRD/Brazil and Mais Resultados.

assistance through LAT/9/010, 'Improving the Radiation Monitoring Data Collection System to Enhance Emergency Response Capabilities', including personnel training and the procurement of a monitoring system with related IT equipment and software for data collection, analysis and presentation. These joint activities have improved the data collection system and enhanced emergency response capabilities in Latvia.

The first school of radiation emergency management (ISREM) in Latin America and the Caribbean has taken place in Rio de Janeiro, Brazil in November 2015, supported by regional project RLA/9/076, 'Strengthening of National Capabilities for Response to Radiation Emergencies'. The school, organized with the financial support of the European Commission, provided participants with a comprehensive grounding in the basic principles of EPR to radiation emergencies, based on IAEA safety standards and guidelines. A first pilot course was conducted at the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, in September 2015. The Brazil exercise is the first full-scale EPR training of this magnitude hosted by the IAEA, and will serve as a model for other regional efforts in EPR training.

RADIOACTIVE WASTE MANAGEMENT, DECOMMISSIONING AND ENVIRONMENTAL REMEDIATION

TC project RAS/9/071, 'Establishing a Radioactive Waste Management Infrastructure', has made significant contribution to institutional frameworks in participating Member States in the Asia and the Pacific region. Several countries, including Bangladesh, Jordan, Malaysia and the Philippines have developed their own radioactive waste management

policy and strategy with the assistance of the project. The development of the policy and strategy is underway in many other countries, including Mongolia, Oman, Pakistan, Sri Lanka, Thailand and Viet Nam, and the project is also supporting the formulation of a radioactive waste safety regulatory framework in other countries. Significant progress has been achieved in the development of human resources needed for the formulation of policy, strategy and regulatory frameworks.

Also in the framework of RAS/9/071, Bangladesh, Fiji, Malaysia, Philippines, Sri Lanka and Thailand have carried out the collection, characterization, dismantling and conditioning of Category 3-5 disused sealed radioactive sources (DSRSs), solving a long standing problem in the above-mentioned countries. As well as activities to manage DSRSs, relevant infrastructure for DSRS conditioning operations have been developed, and the staff of operator organizations have received hands-on training, helping to ensure the sustainability of DSRSs management activities in those Member States.

In Europe, Member States have demonstrated great interest in joining activities that aim to increase preparedness capabilities for the safe and cost-effective implementation of environmental remediation projects. During the implementation of RER/9/121 'Supporting Environmental Remediation Programmes', more than 240 participants from 16 countries, from national resource management agencies, operators of facilities needing or undergoing large scale clean-up actions, regulatory bodies and national research organizations, attended 14 workshops and meetings.

The project also supported the provision of assistance in developing policies and strategies for remediation at the national level, and gave guidance on the use of state-of-the-art technologies and on the adoption of suitable remediation practices to be considered early in the life-cycle of a particular facility. Close international cooperation was established through the project, expediting and enhancing experience sharing and information transfer between countries with more advanced remediation programmes, and those that need to implement such projects.

“In Europe, Member States have demonstrated great interest in joining activities that aim to increase preparedness capabilities for the safe and cost-effective implementation of environmental remediation projects.”



RAS/9/071: Disused sealed sources in Malaysia.



RAS/9/071: Safe handling of sources in Sri Lanka.

In Georgia, all disused radioactive sources and other unconditioned waste were collected in a centralized storage facility. Upon closure of this facility, the country had to identify solutions for new waste and disused radioactive sources. One option, implemented with the support of GEO/9/011, 'Establishing Radioactive Waste Processing for Simple Treatment and Conditioning of Waste Including Disused Sealed Sources', was to establish a waste treatment facility to reduce the volume of waste already stored in the storage facility, and a simple facility to treat and condition all radioactive waste generated in Georgia was set up. The facility is also handling the radioactive waste generated during the decommissioning



RER/9/121: Participants at a workshop on environmental remediation.

of nuclear research reactor IRT-M Tbilisi. Waste can now be stored in safer conditions, and the volume of waste has been reduced. The storage facility operator, the regulatory body of the Georgian Ministry of Environment and Natural Resources Protection, all waste generators in Georgia and the country's population as a whole are benefiting from the project.

In 2015, the four year TC regional project on radioactive waste safety, RER/9/107, 'Strengthening Radioactive Waste Management Capabilities', was completed. Over the course of the project's lifetime, the Agency conducted two training courses and 16 workshops, which were attended by 389 participants from 30 Member States. By the close of the project, most participating Member States had established national radioactive waste management policies and several had a national action plan in place, which is a combination of policy, strategy and implementation requirements. Finally, the project had contributed to improving existing technologies, due to sharing of knowledge, experience and good practice among participating countries. However, it was also recognized that there was a need for continuation, and as a result, related activities have been included in the follow up project RER/9/143, 'Enhancing Radioactive Waste Management Capabilities', initiated in 2016.

In the Europe region, an additional 30 project managers received training in 2015 under RER/7/006, 'Building Capacity for Developing and Implementing Integrated Programmes for Remediation of the Areas Affected by Uranium Mining', adding to the 30 trained in 2014. In cooperation with the IAEA, training courses were developed and conducted at the Rosatom Central Institute for Continuing Education and Training, and extrabudgetary support for the project was also provided by Russia. The managers trained came from remedial action organizations, technical support institutions and regulatory authorities. As a result of the project's support, Kyrgyzstan now has some 20 additional remediation managers, and Tajikistan has 12 newly trained managers. Remediation activities have increased in participating countries in following the intake of trained managers, resulting in the establishment of new workplaces.

The same project has been providing an essential link to the International Target Programme 'Remediation of the Uranium Mining Areas of the Eurasian Economic Community (EurAsEC) Member States', with the overall aim of contributing to an evolving broad international cooperation to eliminate the issue of residues of uranium mining and milling activities.

National radioactive waste management capabilities in Latin America and the Caribbean were strengthened through regional project RLA/9/078, 'Enhancing the National Regulatory Framework and Technological Capabilities for Radioactive Waste Management'. Over 450 DSRs were recovered and conditioned in Chile, Peru, and Uruguay in 2015. With Agency support for the preparation of documentation and assessments for licensing its storage

facility, characterization and conditioning of DSRS, upgrading the national inventory and registries, and the provision of technical advice on the management of category 3-5 DSRS, Uruguay received the license for its centralized radioactive waste storage facility in December 2015. In Paraguay, the regulatory framework for the control of public and environmental exposure and radioactive waste management was updated and is pending final approval.

Argentina runs three NPPs and is planning the installation of a fourth, and has research reactors and nuclear medicine centres. Radioactive waste has been accumulated since the beginning of nuclear activities in the country, and its safe disposal is of paramount importance. To ensure the safe disposal of radioactive wastes, the IAEA has provided continuous support to the national authorities through ARG/9/013, 'Treating Radioactive Waste by Thermal Processes', and ARG/9/014, 'Developing National Capacities in Vitrification of Nuclear Waste', to build capacities for radioactive waste management using thermal processes. Extensive training and equipment support have been provided on the implementation of vitrification processes for treatment and conditioning of low-level and intermediate-level solid wastes, obtaining a mechanically stable and chemically corrosion resistant waste form, and on the plasma treatment of radioactive waste. The national universities have been actively engaged, and significant financial investment have been made by the Argentinian National Atomic Energy Commission (CNEA) for an extensive set of process tests.

Through national project CUB/9/018, 'Strengthening Technological Capabilities for Conditioning and Long-Term Storage of Radioactive Waste and Disused Radioactive Sources', Cuba's technological capabilities for characterizing, conditioning, and long term storage of radioactive waste and disused radioactive sources have been strengthened. This entailed extending the useful lifespan of the existing storage facility through a series of reconstruction activities. In addition, support was provided for applying the appropriate radiation safety standards for the management of radioactive waste and disused sealed sources. The project contributed to assuring the safety of radioactive waste management, reducing the general risk to the public as the possibility of non controlled waste or orphan sources has been minimized. Moreover, the project has supported continuing and increased application of ionizing radiation in medicine and industry for the benefit of society. This will have a positive impact on the quality of life of the population. The characterization methodology, developed through this project, facilitated the measuring of over 100 packages of waste. This method allows decision-makers to select follow-up management options, from clearance and release to conditioning and long term storage.



ARG/9/013: Melting glass in an electrical furnace as part of research into safe radioactive waste disposal, Nuclear Materials Laboratory, Bariloche Atomic Centre. Photo: CNEA.

Nuclear Knowledge Development and Management



In Africa, assistance was provided to enhance the sustainability of national nuclear institutions and other end users of nuclear techniques in African Member States through RAF/0/042, 'Promoting the Sustainability and Networking of National Nuclear Institutions for Development'. Senior managers of business development units, marketing units, atomic energy commissions and nuclear research centres vested with responsibility to manage the promotion and development of peaceful applications of nuclear techniques at national level were trained in sustainability strategy, business development, quality management strategy, marketing strategy and on the formulation and implementation of intellectual property policy and licensing to protect innovations. During the coordination meeting in December 2015, Egypt, Ethiopia, Ghana, Madagascar, Morocco, Nigeria and South Africa reported to their peers the achievements and good managerial practices which contributed to sustain their national nuclear infrastructures. This project has enabled a better understanding of the integration of applied research and development (R&D) activities into national development programmes, improved managerial practices, and increased income generation. It has also provided participating Member States with an opportunity to acquaint themselves with the general principles and approaches for income generation from R&D activities, including pricing and costing of nuclear goods and services. The project has also contributed to the training of managers of nuclear institutions in the use of the most important indicators of sustainability, including business development services and related quality requirements, efficient management of revenues, and the development and implementation of quality management systems.

In addition, within the framework of IRA/2/011, 'Strengthening and Upgrading Capabilities for Safe and Reliable Operation and Maintenance of a Pressurized Light Water Reactor', the Agency provided support to Iran on the establishment of a corporate knowledge management system. The Nuclear Power Production and Development Company (NPPD) operating organization subsequently established a Nuclear Knowledge Management (NKM) team and initiated a NKM Programme of NPPD as part of the Integrated Management System (IMS) to support plant safety whenever required.

The Agency is assisting Saudi Arabia in facilitating the establishment of a baseline for nuclear education and training using the IAEA's Education Capability Assessment and Planning (ECAP) methodology, under the projects SAU/2/006, 'Developing Infrastructure for the Introduction of a Nuclear Power Programme (Phase I)', and SAU/9/008, 'Strengthening the Safety Infrastructure for the Introduction of Nuclear Power'. The first ECAP workshop has provided a forum for exchanging experiences and information on the current status of nuclear education and training in the country, and has led to the establishment of a National Steering Committee on Nuclear Education and Training to identify objectives, goals and benchmarks, along with a National Network on Nuclear Education & Training to widen academic and industrial collaboration, knowledge transfer and outreach.

In Europe, the IAEA provided assistance to Romania to strengthen its human resources capacity for reactor physics through ROM/0/007, 'Supporting a Refuelling Simulator and Nuclear Knowledge Management Tool'. Support focused on: (i) knowledge about the Canada deuterium-uranium (CANDU) reactor core behaviour, and (ii) development of educational simulators for refuelling management and some other important aspects of the CANDU reactor physics. This topic is a high priority for Romania, which already has two CANDU units (and prospects for purchasing another two units). Fuel management in CANDU reactors is a continuous online operational function (i.e. online fuelling) and requires advanced training in physics and extensive on-the-job training in the use of advanced codes. Through the project, two Romanian experts received training on the educational CANDU refuelling simulator in the form of fellowships.

"In Europe, the IAEA provided assistance to Romania to strengthen its human resources capacity for reactor physics."

Also in Europe, project SLR/0/009, ‘Strengthening Human Resource Capacity and Nuclear Knowledge Preservation’, supported the development of qualified human resources in Slovakia in all major areas of nuclear applications and nuclear power development. Several activities were related to follow up on IRRS mission recommendations and suggestions for the regulatory authority. Through the project, a number of experts received additional training in the form of fellowships for topics related to their new assignments. In addition, the participation of several experts in international events was supported, including in symposiums, conferences and expert meetings. Staff increased their level of competence and expertise through continuous education and training, keeping up to date with the latest developments in relevant fields.

In Belarus, a concept for knowledge management has been developed as part of National Workforce Plan 2020 within the framework BYE/2/005, ‘Supporting Human Resources and Infrastructure Development for the Nuclear Power Programme’. Several activities were implemented for the national education programme in 2015, including the development of a regional network for nuclear education and training. Three universities joined this initiative and cooperation has been established with counterparts in Armenia, Azerbaijan, Kazakhstan, the Russian Federation and Ukraine. Training materials for managers were also developed and delivered.

In the Czech Republic, several fellowships have been implemented under CZR/0/007, ‘Strengthening Human Resource Capacity and Nuclear Knowledge Preservation for the Further Improvement of Knowledge and Expertise in Relevant Fields’, mainly in support of capacity building for the regulatory authority and technical support organization, and in cooperation with Oak Ridge National Laboratory (USA).

In 2015, eight professionals from the Latin America and the Caribbean region attended the School of Nuclear Knowledge Management in Trieste, Italy, supported by RLA/0/048, ‘Networking for Nuclear Education, Training, Outreach and Knowledge Sharing’. This project enabled the training of 30 professionals in total. Also supported by RLA/0/048, *The First International Symposium on Education, Training and Knowledge Management in Nuclear Energy and Applications* took place in Cusco, Peru, in November 2015, welcoming 102 participants from 15 countries. The symposium, part of a programme of activities by the LANENT, was organized by the Peruvian Society of Radiation Protection with the support of the National University of Saint Anthony the Abbot in Cuzco as well as LANENT member institutions and personnel from the Peruvian Institute of Nuclear Energy.

Ion beam accelerators provide important analytical techniques and applications in a diverse range of fields including materials science, environmental science, cultural heritage and biosciences. Through TC projects, the Agency supports the planning, establishment, maintenance and upgrade of accelerator facilities and related nuclear instrumentation, as well as their effective utilization. Under GHA/0/013, ‘Installing an Accelerator Facility and Subsystems for Human Capacity Building, Training, Research and Development in Nuclear Science, Phase II’, and GHA/0/014, ‘Human Resource Capability to Support Education, Research and Training at the Graduate School of Nuclear and Allied Sciences’, a new ion beam accelerator facility is being established in the premises of the Ghana Atomic Energy Commission in Accra, Ghana. The TC project provides a framework for establishing new research areas and collaboration in topic areas including clean environment, cultural heritage, minerals analysis for the mining industry, and food safety.

In Thailand, enhancements to the scientific capacities of the Ion Beam Accelerator Laboratory as a result of THA/0/014, ‘Developing Applications of Ion Beam and Plasma Technology for the Induction of Crop Mutation, Gene Transfection and Biomedical/Biochemical Material Modification’, have led to an increased recognition of the laboratory’s work at an international level. In November 2015, the laboratory organized the 19th International Conference on Surface Modification of Materials by Ion Beams (SMMIB-19), in Chiang Mai, with about 350 participants from around the world.

“The First International Symposium on Education, Training and Knowledge Management in Nuclear Energy and Applications took place in Cusco, Peru, in November 2015.”

Annex 2. TC Programme Fields of Activity²⁹

Nuclear Knowledge Development and Management
Capacity building, human resource development and knowledge management (01)
Building national nuclear legal infrastructures (03)
Industrial Applications/Radiation Technology
Reference products for science and trade (02)
Research reactors (08)
Radioisotopes and radiation technology for industrial applications (18)
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, radiopharmaceuticals and radiation technology for health care applications (28)
Dosimetry and medical physics (29)
Nutrition for improved health (30)
Water and the Environment
Water resources management (15)
Marine, terrestrial and coastal environments (17)
Safety and Security
Governmental regulatory infrastructure for radiation safety (09)
Safety of nuclear installations, including siting and hazard characterization (10)
Governmental regulatory infrastructure for nuclear installations safety (11)
Radiation protection of workers, patients and the public (12)
Transport safety (13)
Nuclear security (14)
Emergency preparedness and response (16)
Radioactive waste management, decommissioning and environmental remediation (19)

²⁹ The field of activity number is shown in parentheses.



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