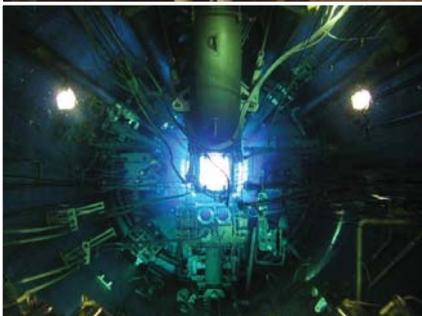


Technical Cooperation Report for 2012

Report by the Director General



IAEA
International Atomic Energy Agency

Technical Cooperation Report for 2012

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PREFACE

The Board of Governors has requested the transmission to the General Conference of the attached Technical Cooperation Report for 2012, the draft of which was considered by the Board at its June 2013 session.

The Director General is also hereby reporting in fulfilment of the request contained in resolution GC(56)/RES/11 on “Strengthening of the Agency’s technical cooperation activities”.

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Summary

This year's Technical Cooperation (TC) Report 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 2012: Regional Overview. Annex 1 provides examples of project activities and achievements in specific thematic areas.

Part A is divided into two sections. The first presents an overview of the Agency's technical cooperation activities in 2012 in the context of global development, reports on how the programme is tailored to the specific needs of Member States in each region (with a focus on human resource development), and highlights TC activities in the field of food production, food protection and food safety, the topics covered by the 2012 Scientific Forum.

The Director General's emphasis in 2012 on food security reflects the importance of this topic in each region that the TC programme serves. Throughout 2012, TC projects in the Africa region contributed to agricultural productivity and food security using nuclear technology. Projects built Member State capacity to tackle tsetse and trypanosomiasis using the sterile insect technique (SIT), and to improve rice varieties through mutation breeding and biotechnology. Other projects focused on improving the use of agricultural resources, combating soil erosion by optimizing conservation agriculture and supporting innovative practices to combat land degradation and enhance soil productivity for improved food security. Assistance was provided to improve cattle productivity through genetic improvement, including artificial insemination.

In Asia and the Pacific, assistance to Member States in this field built competencies in soil-water management and crop nutrition, as well as in mutation breeding, with the aim of enhancing agricultural productivity and developing suitable crop varieties that are adaptable to climate change. Additional projects focused on artificial insemination and control of transboundary animal diseases.

In Europe, TC activities in food and agriculture focused on the transfer of technologies that allow early and rapid diagnosis of transboundary animal diseases, improve crop adaptability and quality, and facilitate the eradication of fruit pests.

In Latin America, projects created capabilities to better manage crop production and improve soil fertility and crop yields, thus increasing income, particularly for smallholders. At the interregional level, progress is being made in developing crops resistant to Ug99, the fungus that causes the black stem rust disease that destroys wheat crops.

The second section of Part A focuses on ongoing efforts to build a more efficient, more effective TC programme, covering mid-term planning tools such as the Country Programme Framework, efforts to create and strengthen partnerships with other United Nations organizations (with a focus on participation in United Nations Development Assistance Framework processes), and closing with an overview of activities undertaken to prepare for the 2014–2015 TC programme cycle.

Part B of this document presents a summary of indicators, reviewing mobilization of resources for the TC programme through the Technical Cooperation Fund (TCF), and presenting extrabudgetary and in-kind contributions. Programme delivery is expressed through both financial and non-financial indicators. Pledges to the TCF in 2012 totalled €55.6 million (not including national participation costs (NPCs), assessed programme costs (APCs) or miscellaneous income), or 89.3% of the €62 302 500 TCF target set for the year. New extrabudgetary resources for 2012 came to €11.4 million and in-kind contributions were €1.2 million. Overall, implementation for the TCF reached 76.5%, higher than the 73.9% attained in 2011.

Part C of this document responds to the operative paragraphs of resolution GC(56)/RES/11, covering assistance to Member States in the peaceful, safe, secure and regulated application of atomic energy and nuclear

techniques in specific fields. It highlights regional activities and achievements in technical cooperation in 2012. When considering programme distribution at the global level, health and nutrition accounted for the highest proportion of TC programme actuals, at 26.2%. This was followed by safety and security at 22.6%, then by food and agriculture at 14.8%. Distribution varied somewhat according to priorities at the regional level – for example, the Europe region had higher actuals in safety and security, at 40.3%. In the three other regions, however, health and nutrition held the lead.

Project examples are presented in Annex 1 according to thematic areas, covering human health and nutrition, agricultural productivity and food security, monitoring and managing water resources and the environment, industrial applications, energy planning and nuclear power, and radiation protection, nuclear safety and nuclear security

¹ Terminology has changed with the implementation of the Agency-wide Information System for Programme Support (AIPS). Actuals are the equivalent of disbursements.

The Agency's Technical Cooperation Programme in Figures

(as at 31 December 2012)

2012 target for voluntary contributions to the Technical Cooperation Fund:

€62 302 500

Rate of Attainment (on pledges) at the end of 2012:

89.3%

New resources for the technical cooperation (TC) programme: **€70.7 million**

Technical Cooperation Fund²: **€58.1 million**

Extrabudgetary resources³: **€11.4 million**

In-kind contributions: **€1.2 million**

TCF implementation rate:

76.5%

TC 2012 year-end budget⁴ (TCF, extrabudgetary resources and in-kind contributions):

€118.8 million

125 countries/territories receiving support

18 Country Programme Frameworks (CPF) signed in 2012

4880 meeting participants and other project personnel assignments

3117 participants in training courses

121 Revised Supplementary Agreements (as at 26 February 2013)

78 currently valid CPFs (as at 26 February 2013)

1675 fellowships and scientific visits

3250 expert and lecturer assignments

191 training courses

² Including TCF payments, national participation costs (NPCs), assessed programme costs (APCs) and miscellaneous income.

³ Includes donor contributions, government cost-sharing and UNDP resources. 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.

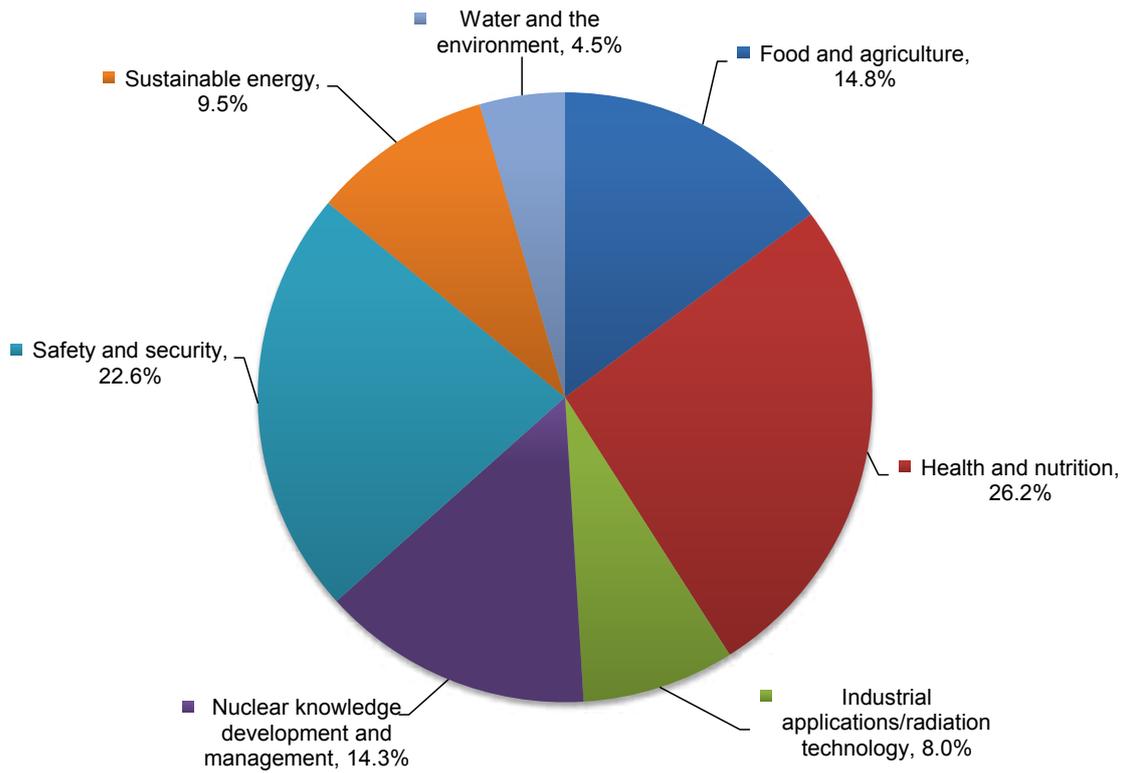


Figure 1: Actuals⁵ by grouped⁶ Fields of Activity for 2012⁷.

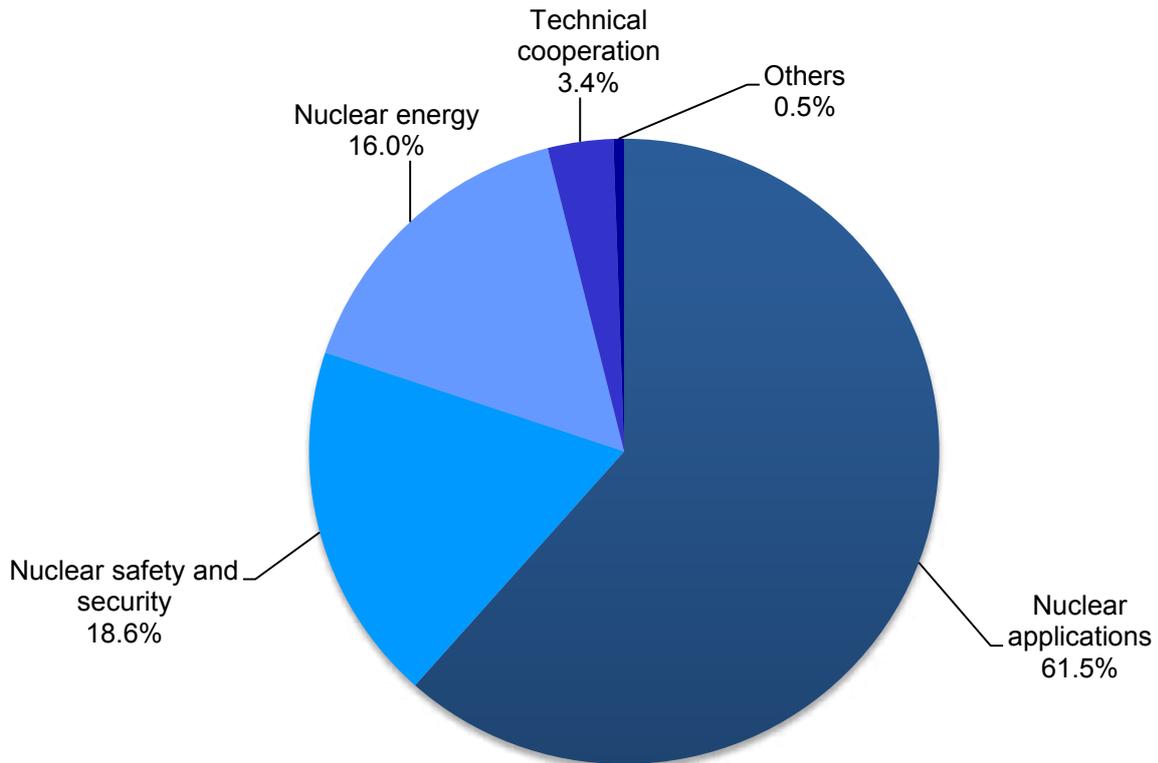


Figure 2: Support to the technical cooperation programme according to the Department of the primary Technical Officer for each project (shown as percentage of total number of projects).

⁵ Terminology has changed with the implementation of the Agency-wide Information System for Programme Support (AIPS). Actuals are the equivalent of disbursements.

⁶ Field of Activity groupings are given in Annex 2 to this report.

⁷ Throughout this report, percentages in charts may not add up to 100% exactly due to rounding.

Technical Cooperation Report for 2012

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(56)/RES/11.

Part A of the document provides an overview of technical cooperation (TC) activities from 1 April 2012 to 31 March 2013, presents the context for the TC programme in 2012, focuses on capacity building in Member States, and offers a snapshot of efforts to improve programme effectiveness and quality. Reflecting the topic of the 2012 Scientific Forum, Part A also highlights TC activities in food production, food protection and food safety.

Part B presents a summary of financial indicators and reviews the mobilization of resources for technical cooperation through the Technical Cooperation Fund, extrabudgetary resources and in-kind contributions.

Part B also offers an overview of programme delivery, with both financial and non-financial indicators.

Part C responds to the operative paragraphs of resolution GC(56)/RES/11 by reporting on assistance to Member States in the peaceful, safe, secure and regulated application of atomic energy and nuclear techniques in specific fields. It presents regional activities and achievements in technical cooperation in 2012.

Annex 1 offers examples of project activities in the thematic areas of human health and nutrition, agricultural productivity and food security, monitoring and managing water resources and the environment, industrial applications, energy planning and nuclear power, and radiation protection, nuclear safety and nuclear security.



Strengthening the Agency's Technical Cooperation Activities⁸

Technical cooperation in 2012: An overview⁹

Global developments in 2012: The context for the TC programme

In 2012, the Agency's technical cooperation (TC) programme took place against a global development backdrop that included the Millennium Development Goals (MDGs), discussions on the post-2015 UN development agenda, and the outcomes of the United Nations Conference on Sustainable Development (Rio+20). The MDGs have provided a global framework for development since 2000. Although there has been significant progress in several MDG target areas, work remains to be done in others. As 2015 – the target year for attainment of the MDGs – approaches, it is clear that the framework remains relevant and necessary. Science, technology and innovation – significant Agency strengths – are expected to play a larger role in post-2015 development initiatives.

The contributions of science, technology and innovation to development were also recognized by Heads of State attending the UN Conference on Sustainable Development (Rio+20) in June 2012, who highlighted their importance in the achievement of sustainable development in areas such as human health and nutrition, food and agriculture, climate change, water and marine environments, desertification, energy, land degradation and drought. The Heads of State called for the strengthening of technical and scientific cooperation

in human resource development, training, sharing of expertise, knowledge transfer and technical assistance to enhance sustainable development capacities.

To ensure that the TC programme can play its full role, and to ensure that the world benefits effectively from the peaceful application of nuclear technology, the Agency participated actively in discussions on the post-2015 development agenda throughout 2012. As part of this effort, the Agency Secretariat reached out to the international development community through participation in several global conferences, including Rio+20 and the World Water Forum, and through contributions to global development reports. Efforts focused on emphasizing the contribution of science, technology and innovation to development, and on raising awareness of the TC programme among potential partners.

Responding by region: How the TC programme is tailored to Member State needs¹⁰

The TC programme helps Member States in four geographical regions (Africa, Asia and the Pacific, Europe and Latin America) to develop their capacities to use nuclear technology to address development needs in areas where nuclear techniques offer advantages over others, or where nuclear techniques can usefully supplement conventional means. Each region has specific needs, which are identified and defined through mid-term national planning mechanisms such as Country Programme Frameworks (CPFs), regional

⁸ This section responds to section 2, operative paragraph 2 of resolution GC(56)/RES/11 on strengthening TC activities through the development of effective programmes and well defined outcomes.

⁹ This section responds to section 2, operative paragraph 4 of resolution GC(56)/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 the MDGs; 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 MSs, and enhancing regional and interregional cooperation.

¹⁰ This section responds to section 3, operative paragraph 1 of resolution GC(56)/RES/11 on strengthening TC activities, including the provision of sufficient resources, based on Member State's needs and priorities, and ensuring that the components of TC projects are readily available.

profiles and strategic frameworks, and various other programme planning modalities. In 2012, at the global level, health and nutrition accounted for the highest proportion of TC programme actuals, at 26.2%. This was followed by safety and security at 22.6%, then by food and agriculture at 14.8%. Distribution varies according to priorities at the regional level – for example, the Europe region has higher actuals in safety and security, at 40.3%.

In Africa, meeting basic human needs remains the focus of the TC programme. Programme assistance was enhanced through partnership building and resource mobilisation in order to achieve more effective implementation and to realise potential synergies with other UN specialised agencies. Considerable support was provided in the area of food and agriculture to help Member States to increase agricultural productivity and achieve food security. Availability of water remains a challenge in the region, and the Agency responded to this most pressing need by launching several regional and national projects, including a four-year regional project on water resource management for the Sahel region. Institutional capacity building for human health is another key area for the TC programme in Africa, with the focus on developing human resources through education, training and the provision of expert services. African Member States are making efforts to promote regional expertise and self-reliance and enhance synergy and sustainability by using African institutions and African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) Regional Designated Centres for education and training. Where necessary and appropriate, the region also relies on educational institutions and training opportunities in other regions. Finally, an overarching part of the TC programme in Africa consists of safety projects to strengthen radiation safety and regulatory infrastructure across the region.

In Asia and the Pacific, one increasing area of support responds to the region's growing need for energy and Member States' interest in nuclear power. As the development of nuclear power infrastructure is a complex undertaking and requires the active involvement of several national institutions, emphasis

has been placed on developing Integrated Work Plans (IWPs) in newcomer countries. Such work plans outline the sequence of activities that must be carried out in the medium term through coordinated regional and national TC projects. IWPs also identify the contribution expected of the various role players and indicate the levels of achievement required. An IWP provides a solid foundation that supports strategic national road maps that will lead to the achievement of the necessary infrastructure requirements for a viable nuclear power programme. IWPs have emerged as an effective modality for ensuring efficient delivery of Agency assistance. Draft IWPs have been developed, in close consultation with the potential stakeholder institutions, for Bangladesh, Jordan, Malaysia, Vietnam and the United Arab Emirates.

In the Europe region, as in all TC regions, the TC programme is driven and guided by the priority needs of Member States as defined in CPFs and in the Regional Profile. Further needs in specific areas are defined through various mechanisms. For example, operational safety issues have been identified by Agency operational safety review services and other internal or external reviews/audits. In the area of health, specific needs have been identified through Quality Assurance Team for Radiation Oncology (QUATRO) and Quality Assurance in Nuclear Medicine (QUANUM) missions, as well as through integrated missions of the Programme of Action for Cancer Therapy (imPACT). Capacities for introducing nuclear power have been assessed through Integrated Nuclear Infrastructure Review (INIR) and Emergency Preparedness Review (EPREV) missions. The main outputs from such peer reviews are recommendations for Member States and the Agency, many of which have led to targeted actions through TC projects.

In Latin America, the 2007–2013 Regional Strategic Profile for Latin America and the Caribbean (RSP) guides regional programme activities. The RSP is currently under review, and a planning and coordination working group and six thematic working groups have been established to assess future regional priorities in the areas of human health, environment, food security, energy, industry and radiation safety. With many Member States in the region facing adverse

consequences from climate change, the need for technical and scientific support to national institutions responsible for measuring and monitoring these consequences is particularly important for enabling the policies and regulations necessary for effective mitigation and adaptation. Another area of importance is the provision of support to agricultural trade to overcome phytosanitary trade barriers.

Developing human resources and building capacities¹¹

The successful implementation of nuclear technology programmes requires skilled personnel as well as technicians and engineers. The Agency places significant emphasis on the development of human resources for the peaceful use and application of nuclear science and technology in all regions. Short and long-term fellowships, scientific visits and training courses are offered to qualified scientists, and capacity building mechanisms such as e-learning, network creation and development, curriculum development and the recognition of regional centres for nuclear technology are widely used. Emphasis is also placed on educational programmes in radiation protection and waste safety, nuclear engineering and human health.

Several workshops were organized in the Africa region under RAF/0/033, ‘Increasing Awareness at Decision Making Level Related to the Feasibility of a Nuclear Power Programme’. The workshops aimed to strengthen awareness of the importance of stakeholder involvement and of the availability of human resources when making decisions related to starting a nuclear power programme. Issues such as education and training and the creation of communication programmes were also considered. One workshop examined how existing educational and training models and approaches can be applied in the Africa region to enhance the sustainability of human resource development in an integrated manner.

Outreach was also identified as a way to promote sustainable human resource (HR) development in the Asia and the Pacific region. Under TC project

RAS/0/065, ‘Supporting Sustainability and Networking of National Nuclear Institutions in Asia and the Pacific Region’, a workshop on ‘Innovative Approaches to a Model for Sustainable Human Resources Development and Outreach’ was held in Vienna, Austria, in December 2012. The workshop examined how existing HR development models and approaches can be applied in countries to enhance HR development sustainability, and also looked at outreach programmes in the region, drawing on the experiences of the USA’s Nuclear Power Institute and the Korea Atomic Energy Research Institute (KAERI). The workshop discussed the experiences of newcomer countries in HR development and outreach, and highlighted the growing use of social media (e.g. Facebook, Twitter) as an effective means to provide information on nuclear matters to the general public. The workshop identified early science and technology education for youngsters as a priority.

Using e-learning to support training

A pilot workshop for Asia and the Pacific took place in December 2012 under TC project RAS/0/064, ‘Supporting Nuclear Education and Training through e-Learning and Other Means of Advanced Information Communication Technology (ICT)’. The workshop focused on the use of e-learning platforms as a cost-effective training tool in the field of nuclear science and its applications, and demonstrated a number of Agency-developed e-training packages in the area of TC project design, energy planning and nuclear security. An e-training module on the logical framework approach (LFA) has been developed to improve project design skills, targeting national liaison officers, project counterparts and Agency staff. The module complements other training opportunities, such as face-to-face workshops on project design, planning and evaluation events. It presents the main LFA steps, including situation and stakeholder analysis, problem analysis, objective analysis and the logical framework matrix, and is available on the Agency’s Cyber Learning Platform for Nuclear Education and Training (CLP4NET).

¹¹ This section responds to section 2, operative paragraph 1 of resolution GC(56)/RES/11 on facilitating and enhancing the transfer of nuclear technology and know-how among Member States.

Under ARM/0/006, ‘Developing and Implementing an Integrated Human Resource Management Improvement System in the Armenian Nuclear Power Sector’, the Agency installed a computer-based educational laboratory at the State Engineering University of Armenia (SEUA) on ‘Reactor Physics, Control and Safe Operation of NPP’, to train young specialists in nuclear engineering and reactor physics. WWER-1000 nuclear power plant modelling software was included. The educational laboratory complex significantly enhances Armenia’s nuclear engineering education and training system. This is critically important if a new nuclear power plant (NPP) is to be built in Armenia, as it provides a valuable contribution to enhanced NPP safety and operation. Based on the positive results of the project, TC projects to establish similar educational laboratories have been initiated in Belarus and Ukraine.

‘Supporting Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power’. Several scientific visits and training activities were conducted under the project in 2012. These focused on leadership and management of nuclear power programmes, including management systems, safety of nuclear energy systems and advanced fuel cycle initiatives, feasibility, contracting and construction of a nuclear power plant, and safeguards and security.

Under KEN/2/005, ‘Building Capacity for the Implementation of a Nuclear Power Programme by Developing Human Resources, Institutional Capacity and the Legal and Regulatory Framework’, 29 fellows received a comprehensive introduction to nuclear power in 2012 at the Nuclear Power Institute of



ARM/0/006: Presentation of the water cooled water moderated power reactor (WWER) simulator at the State Polytechnic University.

Under project RLA/0/049, ‘Building Capacity and Training Technical Staff for Maintenance of Nuclear Instruments Used in Medical Applications, for Laboratories and for Quality Control for Health Services’, an e-learning course was developed to provide theoretical background on gamma cameras and to serve as an introductory training course on the topic.

Fellowships, scientific visits and specialized training

The Agency supports newcomer countries that wish to launch nuclear power programmes or expand existing programmes through interregional project INT/2/013,

Texas A&M University (TAMU). The training was tailored to the needs of each participant, and helped to prepare participants to undertake a nuclear energy pre-feasibility study under the umbrella of Kenya’s Nuclear Electricity Project. The inclusion of all the key sector organizations within the capacity building programme was important to define the level of coordination required for nuclear power development from the outset. This training was fully financed by Kenya through an extrabudgetary government contribution.

Medical physicists play very important roles in nuclear medicine, safeguarding quality assurance of equipment

and ensuring that the patient receives the minimum dose possible while achieving images of diagnostic quality. However, there is little awareness of the role of medical physicists in nuclear medicine in many developing countries. In 2009, project RAF/6/038, 'Promoting Regional and National Quality Assurance Programmes for Medical Physics in Nuclear Medicine', was initiated to promote human resource development and recognition of the medical physics profession in Africa. With the support of this project and several national projects, medical physics is now recognized as a profession in Burkina Faso, Egypt, Ghana, Kenya, Madagascar, Mauritius, Nigeria, South Africa, Sudan, United Republic of Tanzania, Uganda and Zimbabwe. Furthermore, academic training programmes now exist in Algeria, Egypt, Ghana, Libya, Morocco, Nigeria, South Africa, Sudan and Tunisia. Current efforts focus on harmonizing the academic and clinical training programme in these countries. A draft harmonized curriculum was developed and finalized in 2012.

Under RAS/6/054, 'Upgrading Medical Physics Services in ARASIA State Parties Through Education and Training (Phase II)', nine fellows from Iraq, Jordan, Saudi Arabia, Syria and Yemen successfully completed training of at least two years in the field of Radiation Metrology and Dosimetry at the University of Jordan.

Five Afghan fellows also completed two-year training programmes in 2012 in radioisotope and radiation treatment under AFG/6/012, 'Establishment of a Radiation Oncology Centre in the Medical University of Kabul'. The training was provided in the Islamic Republic of Iran, Turkey and the United Kingdom. In addition, three fellows from Yemen successfully completed oncology radiation training in the field of radioisotope and radiation treatment at Tata Memorial Hospital in India and Ain Shams University in Egypt under YEM/6/006, 'Support for the Establishment of a Radiation Oncology Centre in the City of Aden'.

Thirteen participants from Asia and the Pacific undertook a group scientific visit in Italy in November 2012 to study medical exposure control. The visit covered topics such as International Basic Safety Standards in diagnostic radiology and radiological procedures, and took place under RAS/9/065, 'Strengthening Radiation

Protection of Patients in Medical Exposure'.

As part of on-going efforts to support Member States to protect radiation workers and the public from hazards that may arise due to exposure to ionising radiation, the Agency organized a Post-graduate Educational Course (PGEC) in Radiation Protection and the Safety of Radioactive Sources in Kuala Lumpur, Malaysia, from 17 September 2012 to 9 March 2013. The six-month course enabled 23 young professionals to acquire a sound basic knowledge of relevant safety fundamentals. The participants are expected, in due course, to play lead roles in the field of radiation protection and safety of radiation sources in their countries. Similar courses were offered or are ongoing in Algeria and Ghana for African Member States, and in Greece and Belarus for European Member States.

In the Europe region, the high demand for trained radiation oncologists, radiation therapy technologist (RTTs) and medical physicists is being addressed through training courses provided under regional projects RER/6/022, 'Strengthening Knowledge of Radiation Oncologists and Radiation Therapists', and RER/6/023, 'Strengthening Medical Physics in Radiation Medicine'. Five courses were organized in cooperation with the European Society for Radiotherapy and Oncology (ESTRO) in 2012, covering different areas of radiation oncology, technology and medical physics. In addition to supporting attendance at ESTRO courses, an Agency training course in medical physics and expert missions to support transfer of the ESTRO curricula for RTTs to the national level were also implemented.

Supporting the sharing of experiences through networking among countries

Within the Asia and Pacific region, regional project RAS/2/016, 'Supporting Decision Making for Nuclear Power Planning and Development' has assisted in building Member State capabilities for the introduction of nuclear power through regional training courses and workshops on several topics related to the IAEA milestones approach. The areas covered in 2012 included human resource development, financial models, regulatory and legal infrastructure, education and training programmes, public information and

stakeholder involvement. A successful mentoring programme – including countries operating nuclear power plants such as Japan, Republic of Korea and China – has been established, providing newcomer countries with the opportunity to benefit from sharing of experience in the launch of successful nuclear power programmes.

Many TC projects in the Europe Region focus on developing or strengthening the human resource base for safe, secure and peaceful use of nuclear technology including through knowledge sharing and networking. For example, under RER/1/007, ‘Enhancing Use and Safety of Research Reactors through Networking, Coalitions and Shared Best Practices’, the safety and utilization of research reactors (RRs) was further supported at the regional level on the topics Code of

Conduct on the safety of RRs, education and training with RRs, neutron activation analysis and comparative performance testing. At the same time sub-regional cooperation was supported through the coalition meetings of Eastern Europe, EuroAsia, Baltic, Mediterranean and newly established Commonwealth of Independent States (CIS) research reactor networks.

Supporting gender equality: women in the TC programme¹²

The Agency encourages the participation of women in every area of the TC programme. In line with the Agency’s gender policy, TC activities work to mainstream gender and to enhance gender equality. In 2012, 4,286 women from all regions participated in the TC programme.

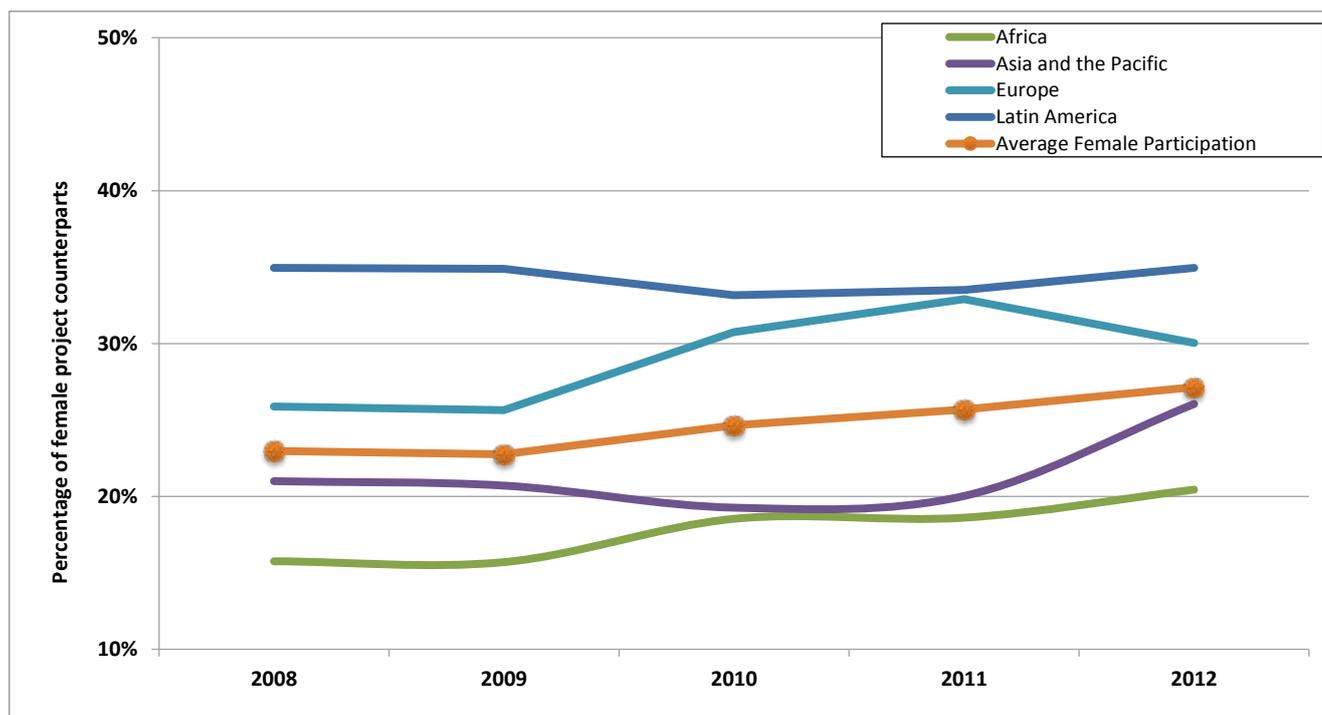


Figure 3: Female project counterparts by region, 2008–2012.

¹² This section responds to section 2, operative paragraph 3 of resolution GC(56)/RES/11 on promoting gender equality and advancing gender balance in the TC programme.

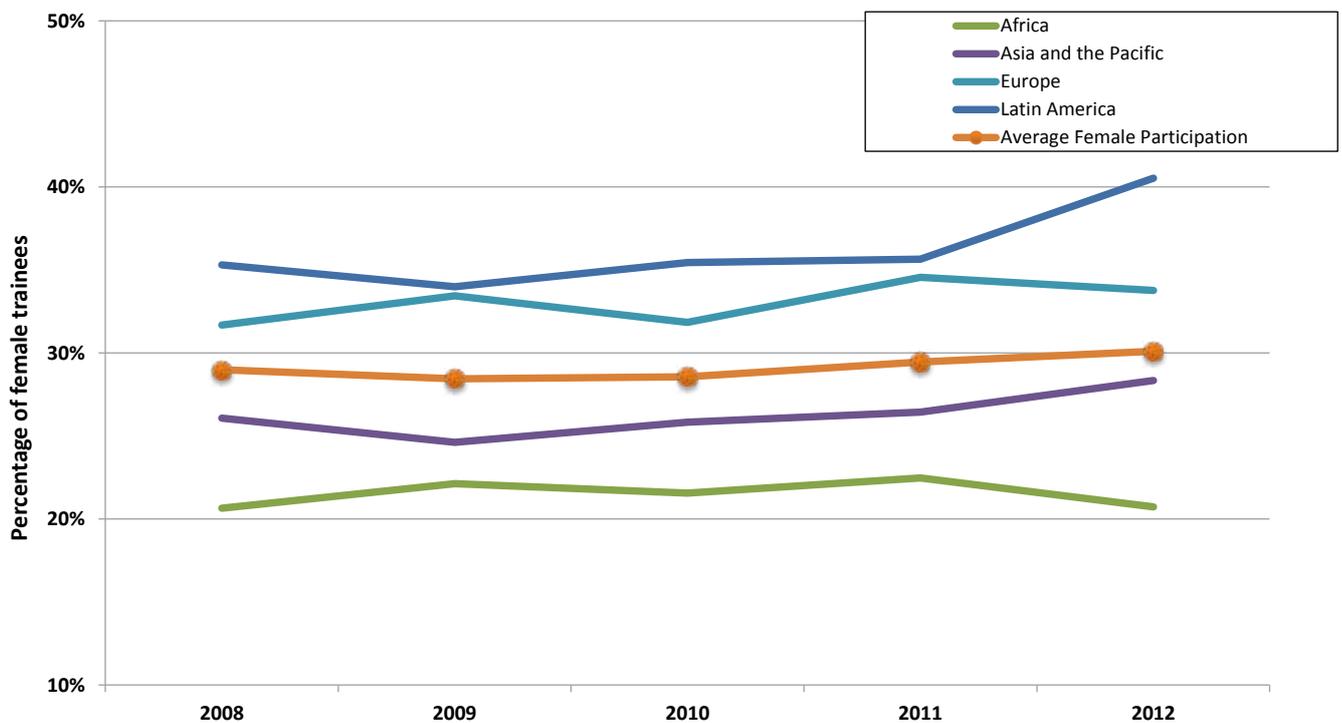


Figure 4: Female participation in training as fellows, scientific visitors, training course participants, meeting participants and other project personnel, 2008–2012.

Food for the Future: Meeting the Challenges with Nuclear Applications

The 2012 Scientific Forum focused on improving food production, food protection and food safety through the use of nuclear applications. By 2050, the global population is expected to exceed nine billion people. To meet the world's food needs, it will be necessary to produce 70% more food. Sustainable agricultural intensification and diversification, as well as the production of higher quality crops that can resist climate change, will be critical to meeting this target. Global food insecurity is exacerbated by pests and diseases that harm livestock and crops – it has been estimated that the losses caused by diseases and pests at both the pre- and post-harvest levels average 30–40% of agricultural outputs. Food safety issues, such as contamination, adulteration and traceability, are also of global concern. In each area, nuclear technology plays an important role.

In Africa, a four-year project, RAF/5/063, 'Supporting Innovative Conservation Agriculture Practices to Combat Land Degradation and Enhance Soil Productivity for Improved Food Security', was initiated in 2012 to

introduce the use of fallout radionuclides (FRN) for estimating soil erosion and assessing the effectiveness of soil conservation measures in the region. A total of 21 scientists and technicians from universities and governmental organizations have already been trained to use FRN. Six expert missions, four in the frame of the regional project, and two related to national TC projects in Mali and Madagascar, were carried out to assist counterparts in the selection of study sites and the development of sampling strategies. South–South cooperation is being promoted, and a regional network for strengthening conservation agriculture practices in Africa to combat land degradation and enhance soil quality and productivity will be strengthened. It is expected that good quality FRN analytical capacity will soon be available in five of the 10 participating countries, which will enable pilot investigations in the study areas in those and neighbouring Member States.

Rice (*Oryza sativa*) is a staple food in the United Republic of Tanzania, and is grown both for food and as a cash-crop by small and large-scale farmers. Rice production in the United Republic of Tanzania is adversely affected by climatic conditions and crop diseases. Through project URT/5/026, 'Improving

Rice Varieties through Mutation Breeding and Biotechnology in Zanzibar', the Agency has helped the Kizimbani Research & Training Station in Zanzibar to apply biotechnological methods to develop new rice varieties. Necessary core infrastructure has been built, and technical knowledge has been developed to support further research into developing disease resistant and high yield rice varieties. The project utilized information from local farmers in the selection of superior genotypes, in a process called participatory variety selection, to help isolate disease resistant and high yielding strains of rice, such as the strain resistant to Rice Yellow Mottle Disease and another strain that could potentially yield five to six times more per hectare compared to local varieties. The rice varieties developed through the project are expected to be of great economic benefit to small-scale farmers, particularly women farmers, and the general public.

A total of 10 regional food security and safety projects were initiated in 2012 in the Asia and the Pacific region, three conducted under the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA), and two projects under the Cooperative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA). Three of the projects are inter-disciplinary, integrating mutation breeding and crop and soil management techniques to enhance agricultural productivity and develop suitable crop varieties that can adapt to climate change. A further two focus on food safety, in particular food traceability and control systems using nuclear techniques, as well as the application food irradiation for sanitary and phytosanitary purposes. The remaining projects deal with soil degradation, mutation breeding, the sterile insect and related pest control techniques, warning, response and control of transboundary animal diseases, and artificial insemination.

The Agency has also been assisting ARASIA States Parties in the area of mutation breeding for the last five years through TC project RAS/5/048, 'Mutation Induction and Supportive Breeding and Biotechnologies for Improving Crop Productivity'. This support is continuing under TC project RAS/5/058, 'Supporting

Mutation Induction and Supportive Breeding and Biotechnologies for Improved Wheat and Barley - Phase II'. The projects promote regional partnerships to support the breeding of strategic crops. To date new germplasm for promising and advanced mutant lines and cultivars of durum wheat, bread wheat and barley have been developed.

In Europe, 320 million sterile Mediterranean fruit fly pupae were released in the mandarine-producing Neretva Valley pilot area in Croatia under regional project RER/5/018, 'Supporting Fruit Fly Pest Prevention and Management in the Balkans and the Eastern Mediterranean', on the control of fruit flies to reduce losses and insecticide use in this valley, which includes important wetlands. As a result, the percentage of fruit export shipments with infested fruit was reduced from over 90% in 2011 to less than 40% in 2012, and infested fruits in the shipment were reduced from an average of 4.1 % in 2011 to 0.9 % in 2012. Foundations have been laid for the establishment of a 'regional fruit fly network', possibly extending sterile insect technique (SIT) activities beyond the pilot area. Specialists from the region were trained on quarantine and pest risk analysis.

Projects in support of food security and safety in Latin America covered a wide range of topics in 2012. Seafood safety, the focus of project RLA/5/054 'Ensuring Seafood Safety in Latin America and the Caribbean Through a Regional Programme for the Bio Monitoring of Contaminants in Molluscs and Fish (ARCAL CIII)', was initiated in 2009 to determine levels of chemical elements and persistent organic compounds in molluscs and fish in the region. Counterparts have been trained in sample collection, processing and analysis of organic elements and detection of heavy metals. Regional capabilities for aquatic biomonitoring have increased. Another ARCAL project, RLA/5/057, 'Establishing and Maintaining Fruit Fly Free and Low Prevalence Areas in Central America, Panama and Belize, Using the Sterile Insect Technique (SIT) (ARCAL CVI)', was also initiated in 2009 to set up fruit-fly-free areas through the appropriate area-wide integration of SIT. The project aimed to generate opportunities to export fruits and vegetables to high value markets that require strong phytosanitary measures to prevent the entrance

of exotic fruit fly species. This objective has been achieved, contributing significantly to job creation and development in rural areas. SIT capacities have been developed in all participating countries.

Project RLA/9/072, ‘Supporting a Database of Values of Radioactivity in Typical Latin American Food (ARCAL CXXIX)’, aimed to carry out a radiological characterisation of typical food cultivated in Latin America and to create a georeferenced database. Laboratories in the region extended the scope of their

ISO 17025 accreditation for food control, implementing and validating analytical techniques for residues monitoring, and the project results were presented at an international workshop. A national project in Bolivia, BOL/5/018, ‘Enhancing Food Security Using Conventional and Nuclear Techniques for the Acquisition of Climate-Change Tolerant Commercial Potato Seed’, was set up to generate sustainable induced mutation-related technologies to obtain seeds of economic importance to the country.



RER/5/018: Wild fruit flies from the pilot SIT area in Neretva Valley, Croatia.

Spotlight on crop protection: Developing wheat that is resistant to Black Stem Rust

The interregional project INT/5/150, 'Responding to the Transboundary Threat of Wheat Black Stem Rust (Ug99)', is accelerating research into new varieties of wheat to identify those resistant to an aggressive fungus. The fungus (race Ug99) causes the black stem rust disease that is destroying harvests in African and Middle Eastern countries. Countries participating in the project have been breeding for stem rust resistant wheat and barley at Chepkoilel University College, Kenya, over the past four years. Ten wheat mutant germplasm have so far been selected and advanced and four were submitted for national performance trials (NPTs) in the 2011–2012 and 2012–2013 seasons. Currently over 25 wheat mutant germplasm materials from participating countries have been planted at various agroecological zones and are being re-examined for their response to stem rust infection. Participants from different Member States came for screening and viewing of the material in Eldoret, Kenya, and shared the results among themselves during harvests in March and November 2012.



INT/5/150: Performance of selection (green uninfected by stem rust) compared to other selections (highly infected) in NPT in Kenya.

The success of the project is clear in the photograph below. On the left and right, different competing lines are dying from stem rust. In the middle, four green lines are resistant and withstanding the three most virulent strains of Ug99. Two of these lines have been scored as high yielding and are currently sown on three acres for seed multiplication (target 6 tonnes), to be released to farmers for commercial production in August 2013. On average, it takes around ten years to release a new variety, so the official release of two new varieties within a four year period is a significant achievement.



INT/5/150: Four green lines that are resistant and withstanding the three most virulent strains of Ug99.

Building a more efficient, more effective technical cooperation programme¹³

Country Programme Frameworks and Revised Supplementary Agreements

Country Programme Frameworks define mutually agreed priority development needs and interests that can be supported through TC activities. CPFs reflect national development plans, country specific analyses and lessons learned from past cooperation, and seek linkages with United Nations Development Assistance Frameworks (UNDAFs). This ensures that the application of nuclear science and technology is integrated with a Member State's existing development initiatives and plans. Eighteen CPFs were signed in 2012¹⁴.

CPFs signed in 2012

Albania	Latvia	Mali
Brazil	Lesotho	Malta
Costa Rica	Libya	Moldova
El Salvador	Lithuania	Morocco
Ethiopia	Iraq	Peru
Indonesia	Israel	South Africa

Revised Supplementary Agreements (RSAs) govern the provision of technical assistance by the Agency, and are required under the Statute and the Revised Guiding Principles and General Operating Rules to Govern the Provision of Technical Assistance by the Agency (ref. INFCIRC/267). They must be concluded by Member States participating in the TC programme. Four RSAs were signed in 2012, by Bahrain, Burundi, Palau and Nepal. As at 26 February 2013, 121 Member States had signed an RSA¹⁵.

Maximizing programme impact: improving interaction with the United Nations system and building partnerships¹⁶

More than half of the TC programme activities implemented in Member States address sectors where the Agency does not possess the lead UN mandate, such as human health, food and agriculture, and water and the environment. Effective partnerships with lead UN organizations are essential for achieving tangible socioeconomic impact of the Agency's support to Member States. Coordination and cooperation with UN Coordinators and individual UN organizations at country level as part of the One UN initiative and the UNDAF process has clearly advanced and will continue to be an essential element of the Agency's outreach and partnership efforts in support of development.

In this regard, the Agency has made progress in its efforts to participate to a greater extent in UNDAF processes and to build on complementarities with other international and regional development organizations. By the end of 2012, 29 UNDAFs in total had been signed by the Agency. In cases where there is no national UNDAF, the Agency collaborates with or reaches out to UN organizations working in the country in areas where nuclear technologies can add value.

The Agency signed a Practical Arrangement with the United Nations Industrial Development Organization (UNIDO) in 2012, to enhance cooperation in selected pilot countries hosting National Cleaner Production Centres supported by UNIDO. The cooperation seeks to develop the role of nuclear technologies that can contribute to cleaner industrial production processes in support of green economies for industry.

Outreach was initiated to better align the TC programme with the United Nations Children's Fund (UNICEF)

¹³ This section responds to section 3, operative paragraph 1 of resolution GC(56)/RES/11 on strengthening TC activities, including the provision of sufficient resources, based on Member State's needs and priorities, and ensuring that the components of TC projects are readily available.

¹⁴ Total CPF signatures are calculated according to the year in which the Member State signs the document.

¹⁵ This paragraph responds to section 1, operative paragraph 1 of resolution GC(56)/RES/11 on adhering to the Statute and document INFCIRC/267; and to operative paragraph 2 on the importance of Revised Supplementary Agreements (RSAs).

¹⁶ This section responds to section 5, operative paragraph 1 of resolution GC(56)/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.

and the World Health Organization (WHO) at the global level in the field of nutrition. At the regional level, the Agency has signed a Practical Arrangement with WHO and the Pan American Health Organization (PAHO) for Latin America and the Caribbean, geared toward intensifying combined efforts in areas such as cancer, medical physics, non-communicable diseases, nutrition, environmental health, radiological emergencies, and safety and quality assurance in radiation uses in medicine.

The Agency is collaborating closely with the Agriculture and Consumer Protection Department of the Food and Agriculture Organization of the United Nations (FAO), including through the Joint FAO/IAEA Division, to identify joint TC activities. Progress has been made in establishing a partnership under the FAO-supported Global Soil Partnership (GSP), whereby the Agency aims to link existing TC soil and water management projects to the GSP's objectives at regional, national and global level. To this end, TC participated in the 'Global Soil Week' in Berlin which was organized in support of the GSP by the German Government, FAO and the EU. A dedicated sub-site was established on the TC website in support of the GSP.

The programme of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (NAFA) addresses the challenge of land degradation and desertification through projects in soil and water management, and crop nutrition improvement. During 2012, contacts were established with the Secretariat of the United Nations Convention to Combat Desertification (UNCCD), in an effort to expand the reach and impact of Agency work by linking IAEA projects in soil and water management with the national and regional efforts of the UNCCD.

During 2012, particular efforts were made to deepen engagement with various European Union (EU) institutions, and, while so doing, to enhance the visibility of the Agency's work in development. While cooperation between the EU and the Agency

is already well-established in the fields of nuclear and radiation safety, security and safeguards, potential exists for cooperation in the Agency's work in science, technology and innovation. Various high-level visits were conducted throughout 2012, and close cooperation was established with the UN Brussels Team to bring the Agency's message on the essential contribution of science, technology and innovation to development to the various EU institutions.

Looking back and moving forward: finalizing the 2014–2015 TC programme¹⁷

Preparations for the 2014–2015 TC programme cycle started in 2012, incorporating the findings of quality reviews and lessons learned from previous cycles. A note verbale and guidelines on preparing the new programme cycle were issued to Member States in January 2012.

To continuously improve the TC programme, the Secretariat continued to implement a two-step quality review mechanism to systematically assess the quality of projects being prepared for the 2014–2015 TC cycle. The first step consisted of a review of around 50% of the project concepts submitted by Member States by May 2012. Detailed feedback was provided to the submitting States. A further step took place in January 2013, when the quality of the preliminary project designs submitted by the end of 2012 was reviewed. Lessons from the 2009–2011 and 2012–2013 programme cycles were used to develop the review methodology, and projects were assessed for compliance with TC project criteria and the LFA. An e-training module on the LFA is available on the Agency's Cyber Learning Platform for Nuclear Education and Training (CLP4NET).

Internal coordination between the Office of Internal Oversight Services (OIOS) and the Department of Technical Cooperation continued in 2012, and systematic follow up and implementation of accepted recommendations was conducted.

¹⁷ This section responds to section 3, operative paragraph 3 of resolution GC(56)/RES/11 on providing Member States with information on project development according to the logical framework approach; to section 3, operative paragraph 5 on the two-step mechanism in monitoring the quality of TC projects; and to section 3, operative paragraph 6 on enhancing adherence with the central criterion and all the TC requirements.



TC Programme Resources and Delivery

Financial overview

Resources for the technical cooperation programme¹⁹

At the end of 2012, €55.6 million²⁰ or 89.3% of the €62 302 500 target had been pledged for the 2012 Technical Cooperation Fund (TCF), and €55.0 million in payments had been received. Total TCF resources including national participation costs (NPCs), assessed programme cost (APC) arrears and miscellaneous income amounted to €58.1 million (€55.0 million TCF, €2.8 million NPCs, €0.2 million APCs, €0.1 million miscellaneous income), lower than the 2011 figure of €63.0 million. New extrabudgetary resources for 2012 came to €11.4 million and in-kind contributions were €1.2 million.

The rate of attainment on pledges, as at 31 December 2012, was 89.3% for 2012, the same percentage as in 2011. The rate of attainment on payments for 2012 as at 31 December 2012 was 88.3% (reflecting unpaid pledges of €0.6 million), higher than the 86.0% rate for 2011 as at 31 December 2011.

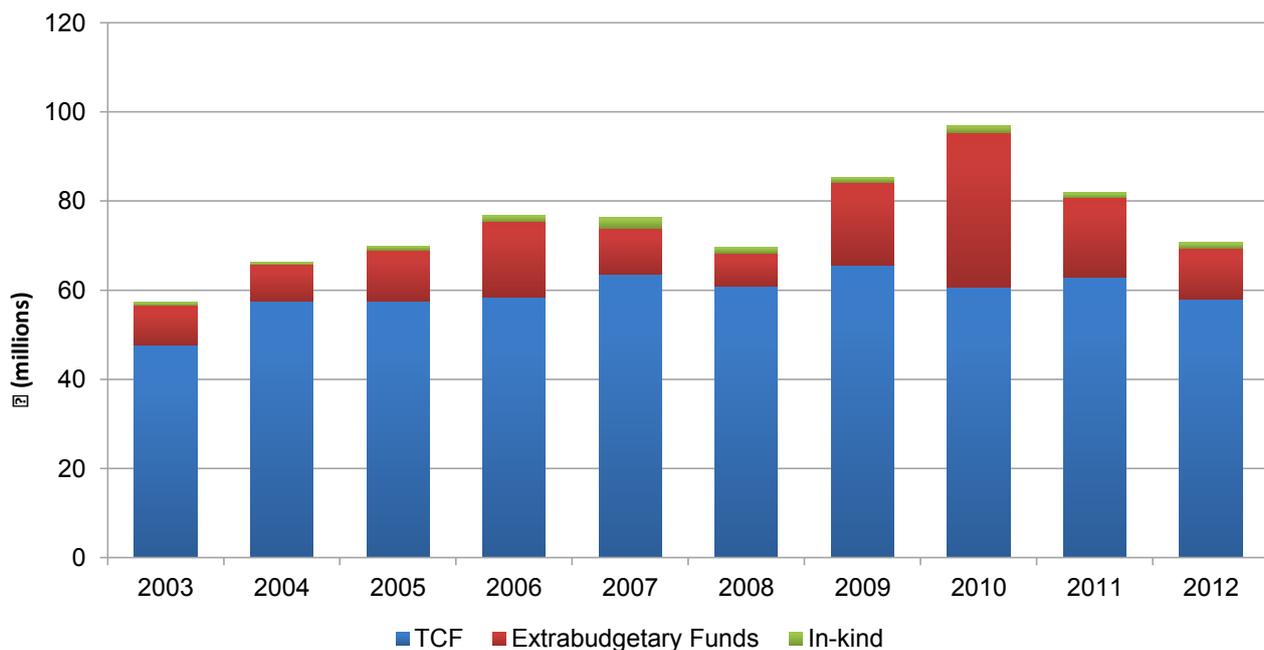


Figure 5: Trends in technical cooperation programme resources, 2003–2012.

¹⁹ This section responds to section 4, operative paragraph 1 of resolution GC(56)/RES/11 on payment of TCF contributions and NPCs, and payment of APC arrears; and to section 4, operative paragraph 5 on timely payments to the TCF.

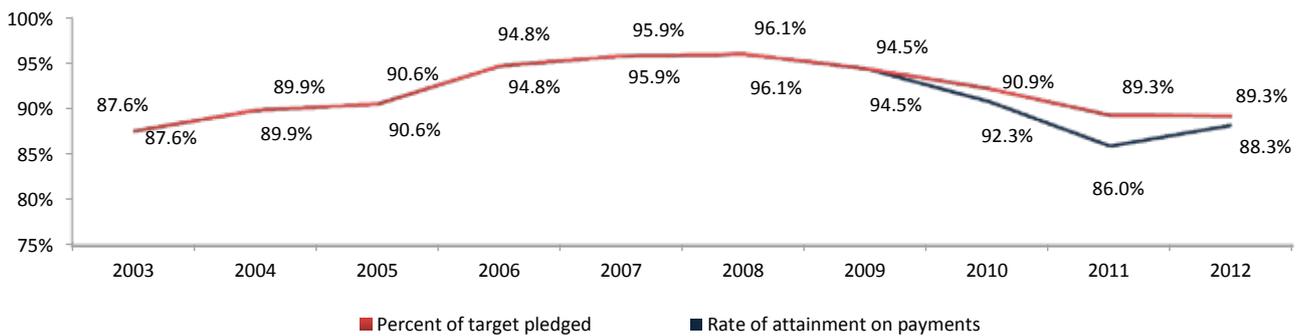
²⁰ Not including national participation costs (NPCs), assessed programme costs (APCs) or miscellaneous income.

Table 1: TC Programme resources in 2012

2012 target for voluntary contributions to the Technical Cooperation Fund	€62.3 million
Technical Cooperation Fund (TCF), NPC, APC, miscellaneous income	€58.1 million
Extrabudgetary resources ²¹	€11.4 million
In-kind contributions	€1.2 million
Total new resources for the TC programme	€70.7 million

Table 2: Payment of national participation costs (NPCs) and assessed programme cost (APC) arrears

	Received in 2012	Outstanding payments
NPCs	€2.8 million	€0.2 million
APCs	€0.17 million (\$0.23 million)	€1.2 million (\$1.6 million)

*Figure 6: Rate of attainment trends, 2003–2013.*

Extrabudgetary and in-kind contributions²²

Extrabudgetary contributions from all sources in 2012 (donor countries, international and bilateral organizations, government cost sharing) accounted for €11.4 million, including €4.4 million from the USA, of which €3.4 million was designated for the Peaceful Uses Initiative. In-kind contributions accounted for €1.2 million in 2012.

²¹ Please refer to Table A.5 of the Supplement to this report for details (Table A.5 does not include €0.2 million from UNDP).

²² This section responds to section 4, operative paragraph 6 of resolution GC(56)/RES/11 on seeking resources to implement footnote-a/ projects; to section 4, operative paragraph 7 on voluntary contributions and the implementation of footnote-a/ projects; and to section 4, operative paragraph 8 on extrabudgetary contributions, including the Peaceful Uses Initiative.

Table 3: Extrabudgetary contributions to TC programme by donors, 2012 (in Euros)

Chile	8 040	Spain	155 000
China	146 318	Sri Lanka	3 870
Czech Republic	122 675	United States of America	4 374 725
Hungary	60 000	AFRA Fund	316 708
Indonesia	88 000	European Commission	681 259
Japan	554 960	One UN Coherence Fund	41 799
Korea, Republic of	408 052		

Table 4: Government cost sharing, 2012 (in Euros)

Albania	50 000	Kenya	236 852
Azerbaijan	40 000	Mauritius	75 000
Cameroon	25 000	Nigeria	1 367 817
Chile	204 000	Pakistan	290 430
Costa Rica	159 400	South Africa	143 541
Cuba	483 867	Sudan	53 803
Czech Republic	5 206	Tajikistan	30 037
El Salvador	49 490	Turkey	470 217
Indonesia	32 589	Uruguay	147 000
Israel	250 000	Uzbekistan	69 527
Jordan	54 719		

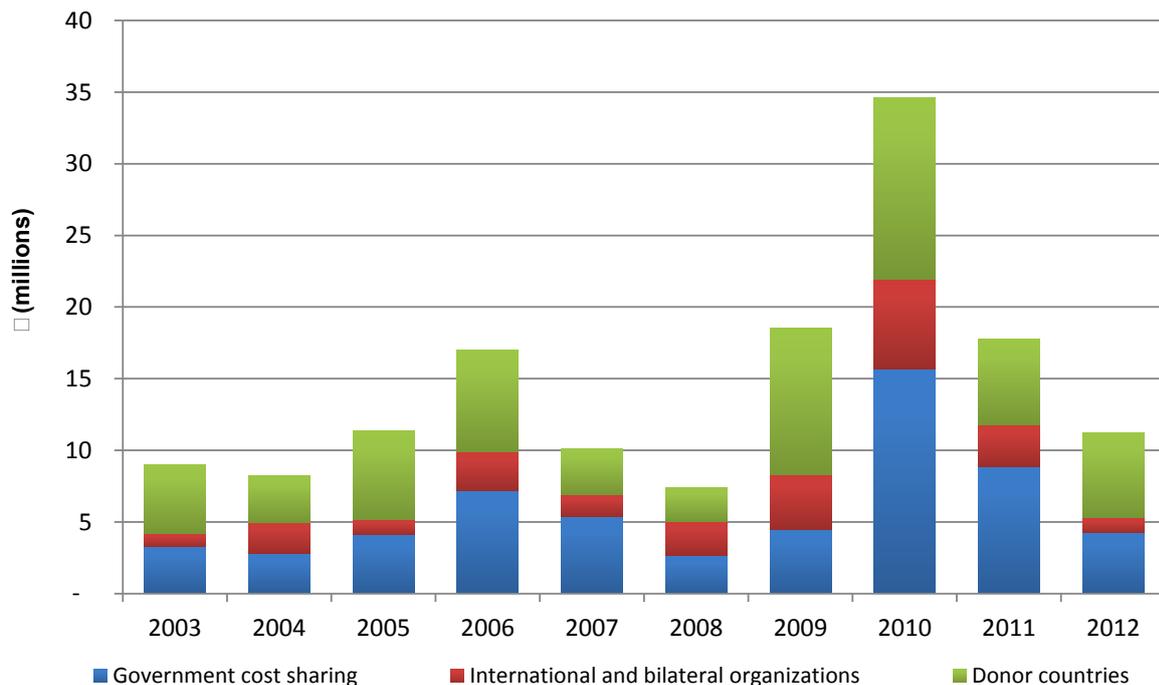


Figure 7: Trends in extrabudgetary contributions by donor type, 2003–2012.

Delivering the technical cooperation programme

Financial implementation

TC programme delivery is expressed in both financial and non-financial terms. Financial delivery is articulated in terms of actuals and encumbrances²³. 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 2012 as on 31 December 2012, reached 76.5%, higher than the 73.9% attained in 2011 for the TCF (Table 5).

Indicator	2011	2012
Budget allotment at year end ²⁴	€86 526 047	€79 514 463
Encumbrances + actuals	€63 914 291	€60 867 056
Implementation rate	73.9%	76.5%

Unallocated balance

At the end of 2012, the unallocated balance²⁵ was €9.9 million. Of this total, some €0.7 million were unpaid TCF pledges, of which €0.6 million were for 2012. In 2012, €3.5 million were received as advance payments for the 2013 TCF. Some €1.3 million of cash is held in currencies which are difficult to use in the implementation of the TC programme.

Description	2011	2012
Total unallocated balance	4 166 749	9 924 799
Pledges not yet paid	(3 939 638)	(681 578)
Advance payment in 2011 and 2012 for TCF for following year	1 314 084	3 482 041
Non-convertible currencies that cannot be utilized	(12 579)	(12 257)
Currencies that are difficult to convert and can only be used slowly	(1 421 069)	(1 311 516)
Adjusted unallocated balance	107 547	11 401 489

²³ Terminology has changed with the implementation of the Agency-wide Information System for Programme Support (AIPS). Encumbrances are the equivalent of obligations, and actuals are the equivalent of disbursements.

²⁴ Includes carryover from the previous year.

²⁵ Total funds not allocated to TC projects.

Human resources²⁶

Human resource indicators show the non-financial delivery of the TC programme. Indicators for 2012 show an increase in meeting participation, fellowships and scientific visits and training course participants.

Indicator	2011	2012	Increase/ (decrease)
Expert and lecturer assignments	3319	3250	(69)
Meeting participants and other project personnel	4634	4880	246
Fellowships and scientific visitors in the field	1397	1675	278
Training course participants	3051	3117	66
Training courses	205	191	(14)

At the end of 2012, there were 894 active projects with an additional 145 in the process of being closed. During 2012, 417 projects were closed, seven of which were cancellations.

Programme Reserve projects²⁷

Three Programme Reserve projects were implemented in 2012 at the request of Palau, Pakistan and Thailand.

Project	Actuals end 2012	Encumbrances end 2012	Total
PAK/5/049 - Support for Capacity Building in Baseline Data Collection for Mosquito Dengue Vector Management in Pakistan	€21 815.72	€3 050.25	€24 865.97
PLW/9/001 - Establishment of a National Radiation Safety Infrastructure	€4 931.92	€7 960.26	€12 892.18
THA/5/050 - Emergency support to Thailand's flood relief and rehabilitation efforts in the fields of crop, soil and water resources management	€17 677.76	€0.00	€17 677.76

²⁶ This section responds to section 3, operative paragraph 1 of resolution GC(56)/RES/11 on strengthening TC activities, including the provision of sufficient resources, based on Member State's needs and priorities, and ensuring that the components of TC projects are readily available.

²⁷ Programme Reserve projects are funded by the Programme Reserve, an amount set aside within the TCF by the Board each year for financing assistance of an urgent nature requested after the Board has approved the TC programme.



Programme Activities and Achievements in 2012: Regional Overview²⁸

Africa

Emcumbrances and actuals:

€17.7 million

TCF Implementation rate:

74.5%

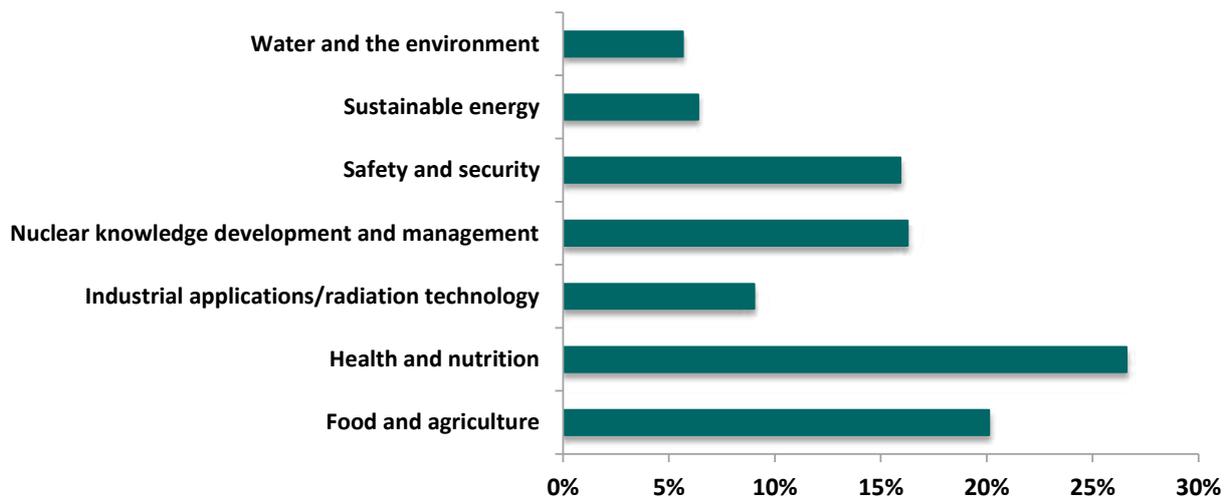


Figure 8: Actuals in the Africa region in 2012 by technical field.

³² This section responds to section 2, operative paragraph 1 of resolution GC(56)/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 2012

The Agency is providing continued support through the TC programme to its African Member States, including 23 least developed countries (LDCs), in the utilization of nuclear technology for development in the priority areas of human health, food and agriculture, water resource management, environmental protection, energy planning and radiation safety. The 2012 TC programme in the Africa region achieved an implementation rate of 74.5%.

Six CPFs were signed in Africa in 2012. 87% of the Member States in Africa participating in the TC programme now have valid CPFs. The Agency had signed a total of 16 UNDAFs in the region by the end of 2012, and is involved in the drafting or updating process for others in the region.

CPFs signed in Africa in 2012

Ethiopia	Mali
Lesotho	Morocco
Libya	South Africa

Cooperation Agency (JICA) and the Sahara and Sahel Observatory. Initial implementation activities have been supported financially by Japan, Sweden and the United States of America through the Peaceful Uses Initiative.

The Agency participated in the Second Conference of State Parties of the African Nuclear-Weapon-Free Zone Treaty (the Pelindaba Treaty) in November 2012 at the Headquarters of the African Union Commission. The Agency distributed a document



Signature of Morocco's CPF at the IAEA Headquarters.

A new off-cycle TC regional project, RAF/7/011, 'Integrated and Sustainable Management of Shared Aquifer Systems and Basins of the Sahel Region', was approved by the IAEA Board of Governors in June 2012. The project aims to improve the capacity of the countries in the Sahel region to assess water resources. The project is being undertaken with partners including the United Nations Educational, Scientific and Cultural Organization (UNESCO), Japan International

titled 'Factual Information on the Status of Nuclear Science and Technology in Africa' that provided an up to date overview of the peaceful applications of nuclear science and technology and of IAEA TC activities in the region.

Nuclear safety and security remain major priorities in the Africa region. The Agency continued to provide an extensive programme of assistance in this area



Sahel joint reception (September 2012) hosted by the Permanent Missions of Japan and Sweden to raise awareness of the large scale regional TC project to improve water management in the Sahel region. Left: Mr Toshiro Ozawa, Ambassador of Japan, Mr Yukiya Amano, Director General of the IAEA, and Mr Nils Daag, Ambassador of Sweden. Right: Mr Adani Illo, Ambassador of Niger, Mr Kwaku Aning, Deputy Director General of the IAEA, and Mr Soumana Sanda, Minister for Public Health, Niger.

throughout 2012, launching seven new regional radiation safety projects. The projects address identified gaps and overlaps in the organization of national authorities for the regulatory control for radiation sources, as well as deficiencies in the national infrastructure to protect workers, patients and the public from the harmful effects of ionizing radiation. The projects will help to strengthen the effectiveness and sustainability of national radiation safety infrastructure, and will contribute to the continuous improvement of the safety performance of regulatory bodies and end-users in the participating countries.

A high level seminar was organized by the Agency, the Islamic Development Bank (IDB) and the Organisation of Islamic Cooperation (OIC) in Jeddah, Saudi Arabia, in September 2012, with the participation of the African Member States of the IDB and the IAEA. The seminar aimed to enhance cooperation between the IDB, the OIC and the Agency, together with the

common Member States of the IAEA and IDB in the Africa Region, in order to strengthen Agency support for cancer control efforts in the region and to develop partnerships with potential donors. The seminar adopted a roadmap to facilitate and guide follow-up actions, including the submission of bankable project documents by participating Member States for funding consideration by the IDB or other donors.

Regional cooperation and partnerships

The African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA) continues to be the primary mechanism for technical cooperation among developing countries (TCDC) in Africa, and for enhanced regional cooperation. The final assessment of the 2008–2013 AFRA Regional Strategic Cooperative Framework was completed and a new regional Strategic Framework for 2014–2018 was endorsed



Participants at the high level seminar on building partnerships for cancer control, held in Jeddah, September 2012.

by AFRA States Parties during the 23rd Meeting of AFRA Representatives in September 2012. The new Strategic Framework defines and prioritizes areas of regional cooperation in the peaceful application of nuclear science and technology, and defines a strategy for resource mobilization and partnership building with relevant bi- and multilateral organizations.

In 2012, under the AFRA Masters Fellowship Programme in Nuclear Science and Technology, nine candidates from seven African Member States (Benin, Democratic Republic of Congo, Mali, Nigeria, South Africa, Sierra Leone and Uganda) were awarded fellowships to undertake a two-year Masters Programme in Nuclear Science and Technology in the Alexandria University, Egypt, and the University of Ghana. This programme contributes significantly to the training of a new generation of African scientists who will foster education and training in nuclear science and technology for Africa's development. Both the Department of Nuclear Engineering at the University of Alexandria and the Graduate School of Nuclear and Allied Sciences of the University of Ghana are recognized AFRA Regional Designated Centres for Higher and Professional Education. Both have the capacity to implement the harmonized curriculum for a Master's Degree in Nuclear Science and Technology, which is required for the award of such a degree in the region.

In 2012, 40 candidates from AFRA States Parties were selected for a six-month Group Fellowship Training

of the Postgraduate Education Course in Radiation Protection, starting in November 2012. This training is hosted by the Algiers Nuclear Research Centre (CRNA) and the School of Nuclear and Allied Sciences (SNAS) of the University of Ghana. Both centres were appointed in 2011 as AFRA Regional Designated Centres for Education and Training in Radiation Protection.

Preparing for the next TC cycle²⁹

In preparation for the 2014–2015 TC programme cycle, intensive interactions and consultations continued throughout 2012. Member States were encouraged to develop and submit fewer but improved project concepts, in line with the priorities identified in individual Member State CPFs. While further capacity building in programme development is still required, the project design training and support provided to Member States has improved the quality of project proposals submitted for the new TC cycle.

A meeting of National Liaison Officers (NLOs) and AFRA National Coordinators took place in April 2012 at IAEA headquarters. The meeting supported interactions among Member States in the region, and led to the formulation of an action plan on key issues related to technical cooperation, including effective programme implementation, formulation of a prioritized programme for the new TC cycle, partnership building and radiation safety infrastructure.

NLOs and AFRA national coordinators meeting at IAEA headquarters, April 2012.



²⁹ This section responds to section 3, operative paragraph 2 of resolution GC(56)/RES/11 on rationalizing the number of TC projects in order to increase programme efficiency and create synergies among projects.

Asia and the Pacific

Emcumbrances and actuals:

€14.5 million

TCF Implementation rate:

74.7%

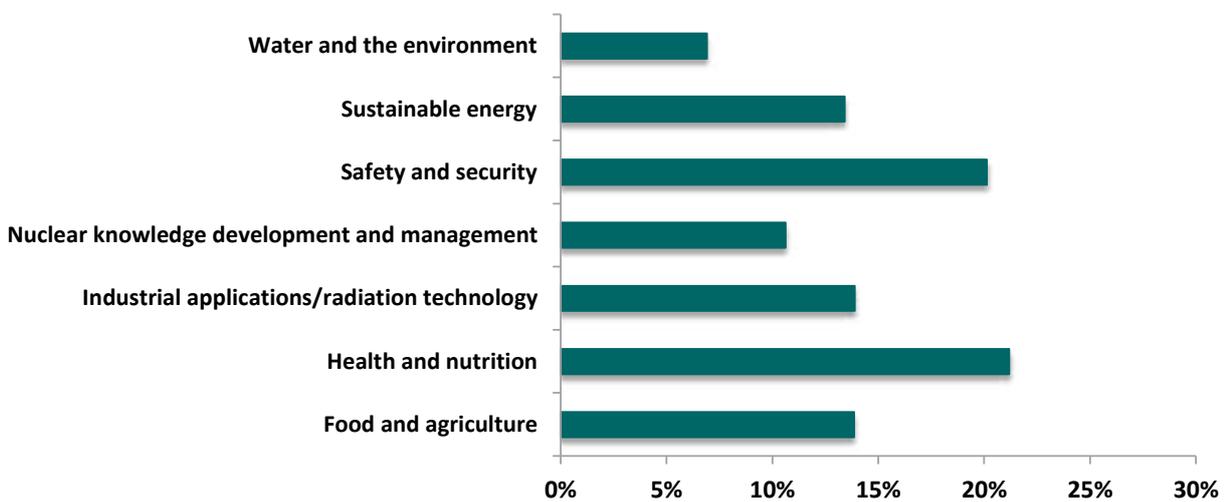


Figure 9: Actuals in the Asia and the Pacific region in 2012 by technical field.

Regional highlights in 2012

Special efforts were made in 2012 to streamline programme and project management in the Asia and the Pacific region to support greater efficiency

in programme delivery. The region achieved high programme delivery, with an overall implementation rate for TCF of 74.7%.

Three CPFs were signed in Asia and the Pacific in 2012. Furthermore, continued policy dialogue and technical consultations were held throughout the year with several Member States with advanced CPF drafts, including Bangladesh, Qatar, Saudi Arabia and Yemen, with the aim of finalising agreement.

CPF signed in Asia and the Pacific in 2012

Indonesia

Israel

Iraq



Signature of Iraq's Country Programme Framework, 18 September 2012. Iraq's CPF was signed by Dr. Abdulkerim Ali Yaseen Al-Samerrai, Minister of Science and Technology, and Mr. Kwaku Aning, IAEA Deputy Director General and Head of the Department of Technical Cooperation.

In Vietnam, the Agency has participated in the development of the One UN Plan for 2012–2016, which outlines three focus areas to be jointly addressed by the United Nations and the Government of Vietnam. These areas include inclusive, equitable and sustainable growth; access to quality essential services and social protection; and enhanced governance and participation. The One UN Plan document was signed between UN Agencies and Vietnam on 27 March 2012; related IAEA activities are indicated as an annex to the main document.

A three-day meeting of the NLOs from 28 Member States in Asia and the Pacific took place in February 2012, in Vienna, Austria. The meeting aimed to strengthen policy dialogue among participating

Member States and between the Member States and the Agency, to strengthen understanding of stakeholder roles, (in particular that of the NLO) and to improve the quality, efficiency and effectiveness of the TC programme in the region. The meeting produced an agreed Plan of Action which will provide a frame of reference for all programme stakeholders. It supports the common goal of achieving higher efficiency in ongoing TC projects, and increasing the effectiveness of IAEA-supported activities at the national and regional levels. The meeting contributed to establishing a solid base for upstream work for the 2014–2015 TC programme cycle.



RAS/0/062: Asia and the Pacific National Liaison Officers Meeting, Vienna, Austria. NLOs from the Asia and Pacific region met at IAEA Headquarters from 21 to 24 February 2012. The meeting assisted with the establishment of a sound basis for upstream work and succeeded in developing a common understanding for regional cooperation.

An induction workshop for new NLOs/NLAs was held in August 2012 in Vienna, Austria. New NLOs and National Liaison Assistants (NLAs) from Bangladesh, China, Indonesia, Iraq, Laos, Mongolia, Myanmar, Nepal, Pakistan, Qatar, Vietnam and Yemen participated in the workshop.

Regional cooperation and partnerships

To enhance cooperation within the Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA), the States party to the

Agreement have formed a working group to identify criteria for the identification and recognition of ARASIA Regional Resource Centres in connection with specific areas of human health, food and agriculture, as well as radiation protection and protection of the environment. The ARASIA TC programme has contributed to strong cooperation and networking among various institutions in the ARASIA States Parties in the areas of human health, food and agriculture and marine environment.

The Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science



RCA 40th Anniversary Exhibition, held during the IAEA General Conference in September 2012.

and Technology (RCA) celebrated the 40th anniversary of its effective cooperation in 2012. Various celebratory events were organized at the regional and national levels, including RCA exhibitions and a panel discussion that took place during the 56th General Conference of the IAEA. The Fifth RCA Extension Agreement entered into force on 12 June 2012 for a further five years.

Efforts have continued to improve the quality and effectiveness of the RCA programme, with the establishment of a Project Monitoring Committee for RCA Programme Development. The RCA Regional Office has continued its endeavours to enhance publicity and promote partnerships. Moreover, RCA project design mechanisms have been proposed as IAEA 'Best Practices' for replication in other regions.

The proposed regional programme for the 2014–2015 TC programme cycle takes account of a stronger interest in safety in the region, which is closely linked to the rise in countries embarking on, or expanding, nuclear power programmes. This includes a greater focus on emergency preparedness and response. A growing interest in nuclear medicine and diagnostic imaging is also reflected in a higher number of project concepts submitted in this area. The region is also prioritising agriculture, water and soil management, as well as radioisotopes and radiation technology for industrial applications.



Representatives from all Governments party to the RCA attended the 34th RCA National Representatives Meeting and the RCA 40th Anniversary Exhibition in April 2012 in Beijing, China.

Preparing for the next TC cycle³⁰

In preparation for the 2014–2015 TC cycle, considerable efforts were devoted to supporting strategic upstream planning in Member States in the region. Over 200 national project concepts were submitted. The proposed regional programme encompasses some 30 regional projects. Seven of these projects have been submitted under the RCA Programme, addressing topics such as more effective cancer treatment, food irradiation and mutation breeding of bio-energy crops, and the application of advanced nuclear techniques for enhancing industrial productivity.

Finally, a project design workshop was held in Vienna in December 2012 involving 18 countries in the region that will be potentially involved in projects on child obesity and on infant and young child nutrition. The workshop sought to optimize available resources by bringing all stakeholders together for the project design process.

³⁰ This section responds to section 3, operative paragraph 2 of resolution GC(56)/RES/11 on rationalizing the number of TC projects in order to increase programme efficiency and create synergies among projects.



RAS/0/063: NLO/NLA Induction Workshop, Vienna, Austria. NLOs and NLAs from countries in the Asia and Pacific region met in August at the IAEA headquarters, with the objective of enhancing their common understanding of the Agency's TC programme.

Europe

Emcumbrances and actuals:

€12.6 million

TCF Implementation rate:

80.2%

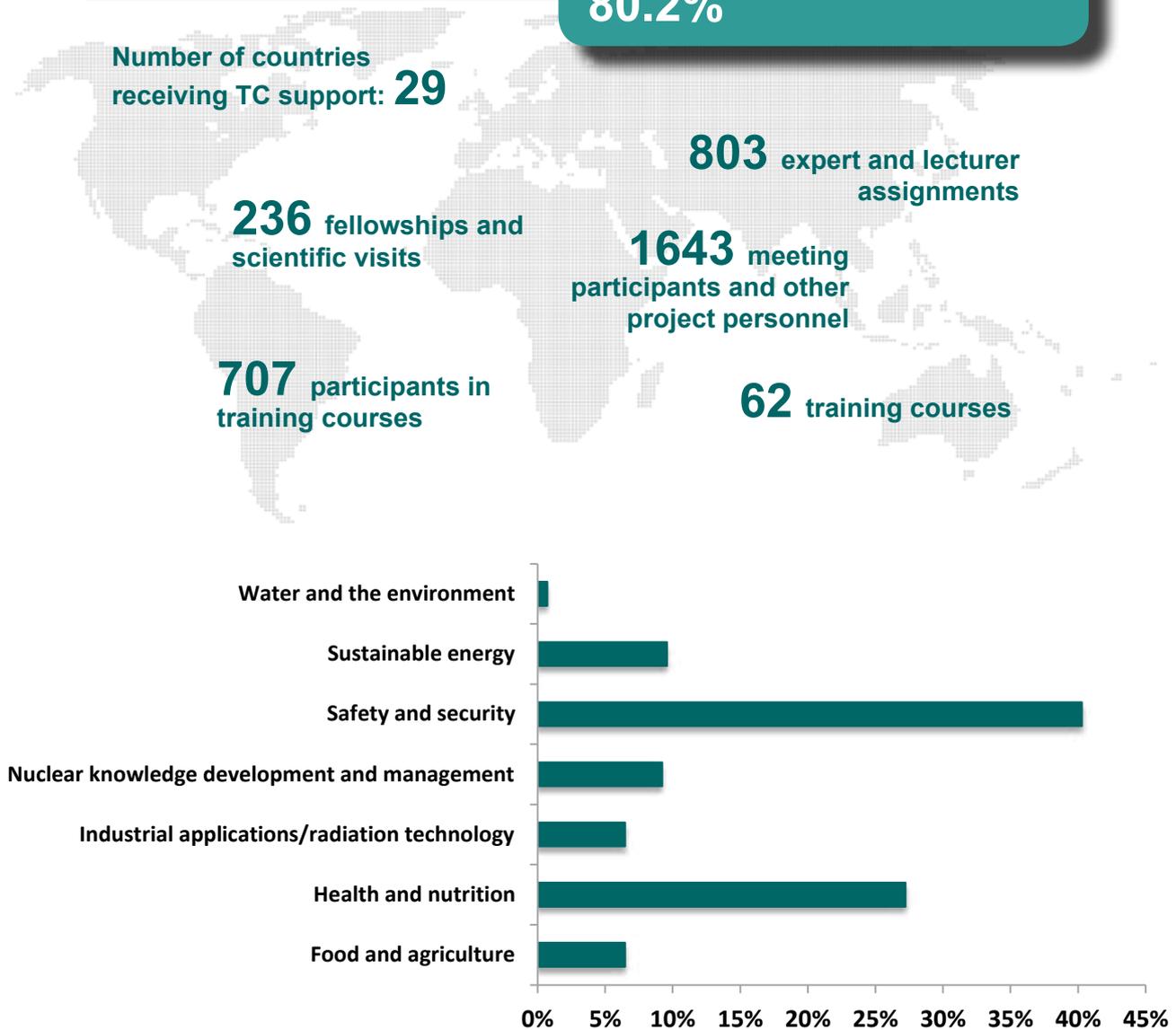


Figure 9: Actuals in the Europe region in 2012 by technical field.

Regional highlights in 2012

In Europe, technical cooperation activities over the last 12 months have covered the development of nuclear power, applications in health care and industry, and environment protection and remediation. A major

emphasis continues to be placed on maintaining appropriate levels of safety and security in all aspects of the peaceful use of nuclear technology. Financial implementation of the TCF component of the TC programme in the Europe region was 80.2%.

The CPF process in Europe continued throughout 2012. CPFs for Albania, Latvia, Lithuania, Malta and Moldova covering the period 2012–2017 were updated and signed. Significant progress was made in updating the CPFs of Azerbaijan, Tajikistan, Turkey and Ukraine, which are expected to be signed in 2013.

CPF signed in Europe in 2012

Albania	Lithuania	Moldova
Latvia	Malta	

Efforts also continued to promote cooperation with other UN Agencies through involvement in the UNDAF and One UN processes, and through interaction with the UN Country Teams (UNCTs) in relevant Member States. In 2012, the Agency signed the UNDAF for the Republic of Moldova.

An 18-week, English-language Postgraduate Educational Course on Radiation Protection and the Safety of Radiation Sources took place in Aghia Paraskevi, Greece, with Agency support under the regional TC project RER/9/101, ‘Building Competence through Education and Training in Support of Radiation Protection Infrastructure’. The course, which concluded in March 2012, offered 14 young professionals from the Europe region the unique opportunity of receiving high-quality, hands-on training in the field of radiation protection and safety of radiation sources. A similar course in Russian for 18 young professionals started in October 2012 in Minsk, Belarus, under regional project RER/9/109, ‘Strengthening Education and Training Infrastructures and Building Competence in Radiation Safety’.

The Agency continues to offer Member States intensive, specialised support through schools for drafting nuclear and radiation safety regulations, aiming to ensure that all such regulations rigorously address all necessary safety aspects of nuclear activities and radiation uses and are consistent with IAEA and other international safety standards. In collaboration with the European Commission, the Agency brought together regulatory staff from 13 Member States in the Europe region (Albania, Armenia, Azerbaijan, Croatia,

Cyprus, Kazakhstan, Lithuania, Republic of Moldova, Romania, Serbia, Tajikistan, Turkey, and Ukraine) to help them to develop or revise their safety regulations. Participants compared and examined each other’s regulations and used the knowledge they acquired for the development of their own. Participants spent a full month working with international experts and Agency specialists who provided input on technical, legal and regulatory issues.

Regional cooperation and partnerships

Regional cooperation, guided by the Europe Regional Profile and Strategy for technical cooperation in the Europe region, remained a key focus for the TC programme. Activities under the regional projects were a key vehicle for triangular cooperation, facilitating sharing of experience and expertise, as well as networking. Regional cooperation was also promoted with regional organizations and institutions sharing common interests. For example, the Agency signed a Memorandum of Understanding for TC project training courses with the European Society for Radiotherapy and Oncology (ESTRO), and the European Association of Nuclear Medicine (EANM). Cooperation with the European Commission continued in the areas of safety and emergency preparedness, and in addressing the environment problem of uranium production sites, especially in Central Asia.

Preparing for the next TC cycle³¹

In 2012, assistance was provided to Member States in the planning of the national and regional programme for 2014–2015. This included training in the use of the logical framework approach for project design and adherence to TC quality criteria. Care was taken to ensure that potential national programmes are aligned to priorities identified in CPFs, and that the regional programme focuses on the priority areas identified in the Europe Regional Profile: safety and security, waste management and environment protection, health, nuclear power and industry. A total of 105 national and 38 regional project concepts were submitted by Member States.

³¹ This section responds to section 3, operative paragraph 2 of resolution GC(56)/RES/11 on rationalizing the number of TC projects in order to increase programme efficiency and create synergies among projects.

Latin America

Emcumbrances and actuals:

€12.7 million

TCF Implementation rate:

81.3%

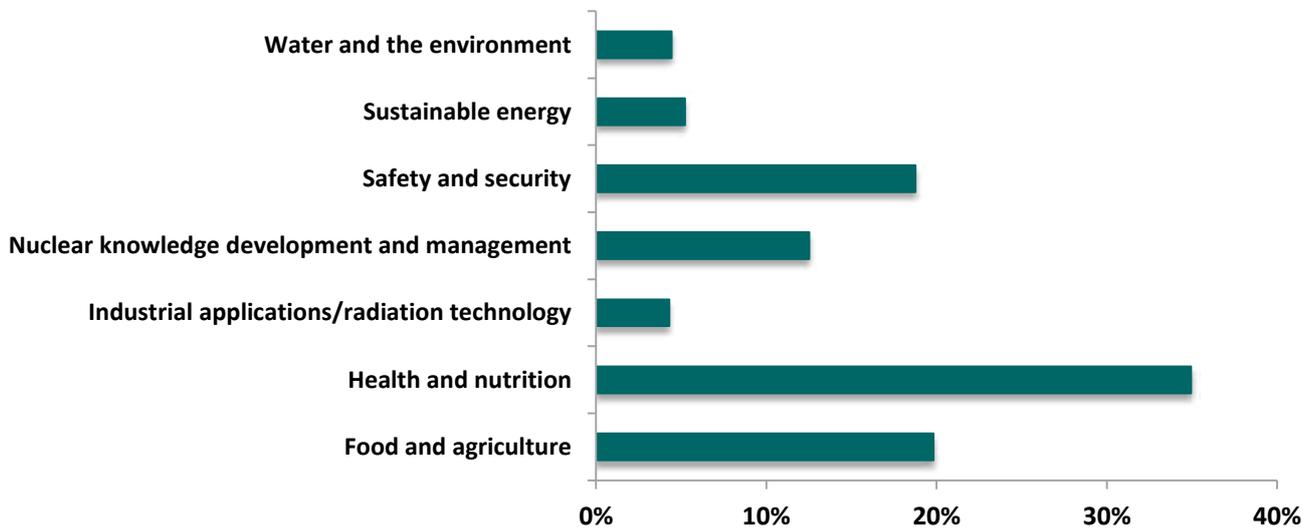


Figure 9: Actuals in the Latin America region in 2012 by technical field.

Regional highlights in 2012

Member States in Latin America face mounting challenges from the impact of climate change, environmental pollution, scarcity of water resources and the need to ensure food security and safety for

growing populations. The programme strategy for the region seeks to improve recognition and support for the scientific, technical and regulatory counterpart institutions that potentially hold solutions to these problems, but that must be funded, resourced, interlinked and mutually supportive if they are to be effective.

The March 2012 meeting with NLOs on programme management issues contributed significantly to the financial implementation of the TCF component of the TC programme in the Latin America region at 81.3%, the highest recorded for the region. Issues discussed included larger scale procurement, on-time project delivery and workload management.

The CPF remains the principal mechanism for planning and designing country programmes in the region. The coming generation of CPFs will include an additional focus on the two or three key national counterpart institutions expected to make significant contributions to national development goals, including through the human resource plans and strategies necessary to ensure that essential knowledge and experience are retained. In 2012, two CPFs were concluded in El Salvador and Brazil. Work is in progress to update CPFs for Argentina, Cuba, Chile, Honduras, Panama, Paraguay, Venezuela and Uruguay.

CPF signed in Latin America in 2012

Brazil

El Salvador

The Agency is working closely with other UN agencies operating in the Member States of the Latin American region. In 2012 the Agency signed the UNDAF for Belize, covering cooperation in the fields of human health, water supply management, maternal child care and occupational safety and health. The Agency also signed the UNDAF for Bolivia in 2012, covering ongoing cooperation in the environment, rural development (animal health and agriculture), and human health (non-communicable diseases).

The Agency communicated closely with the UN Country Team (UNCT) in Cuba on preparations for its UNDAF, together with 12 UN agencies. The parallel preparation of Cuba's UNDAF and CPF will help integrate the work of the IAEA with that of the other UN agencies to address the main development needs of the country. Finally, initial discussions with the UNCTs of Venezuela, Paraguay and Uruguay have taken place regarding the preparation or updating of UNDAFs for these countries.

Regional cooperation and partnerships

The regional programme continues to be guided by the 2007–2013 Regional Strategic Profile (RSP). A revision of the current RSP was initiated in 2012, with the aim of preparing a new iteration for 2016–2023. The review will assess progress made through regional projects and will define lessons learned. The new document will place special attention on the definition of strategic objectives and SMART performance indicators to monitor the progress and impact of regional projects.

Cooperation with strategic partners in the region was enlarged and enhanced throughout 2012. On-going joint programmes with the European Commission regarding safety culture in nuclear power plants and in occupational radiation protection have already achieved important results. Valuable cooperation through effective partnerships maintained with PAHO, the Research Centre for Energy, Environment and Technology (CIEMAT), the Latin American Association for Radiation Oncology (ALATRO), the ESTRO, the Latin American Association of Societies of Nuclear Medicine and Biology (ALASBIMN) and the Latin American Medical Physics Association (ALFIM) has supported audits, training courses, dissemination of nuclear medicine learning materials, and activities in diagnostic radiology and radiation oncology. In radiation safety, cooperation with the US Nuclear Regulatory Commission and with the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies is increasing. Cooperation has also been initiated with the French Institute for Radiological Protection and Nuclear Safety.

A project to strengthen communication and partnership in ARCAL countries to enhance the sustainability of nuclear applications was initiated in 2012. Strategies for communication and partnership will be prepared, and an integrated information management system will be set up to establish procedures to record and manage all ARCAL project generated information, and to share information between ARCAL agreement stakeholders and project counterparts.

Argentina's experience in preparing a Strategic Plan for its nuclear sector was shared with other countries

in the region through a regional meeting within the framework of project RLA/0/050, ‘Strengthening the Regional Nuclear Sector and the Application of Nuclear Science and Technology for Development through Training and Facilitating Strategic Activities’. Other countries also presented their experience in planning nuclear technology development at the national scale. The meeting offered participants a good opportunity to share best practices and to learn from others’ experience, and will help to improve the content of CPFs by considering priorities and goals in national plans.

Preparing for the next TC cycle³²

2012 was the first year of preparations for the 2014–2015 TC cycle, and dialogue with Member States was intensified to ensure that national and regional TC programmes match the priority needs of the region. The ARCAL regional agreement plays a major role in establishing a robust regional programme to tackle cross-regional issues and challenges using nuclear technology. The regional programme under preparation for 2014–2015 places greater emphasis on regional leadership and self-reliance, benefiting from south-south cooperation and TCDC.

On average, four national project concepts per country have been submitted for consideration, as well as 39 regional project concepts, including ARCAL and non-ARCAL proposals. Compared to previous cycles, these numbers represent a big step forward in streamlining the content of the region’s TC programme towards fewer but larger, better and more relevant projects.

Thirty-seven participants from 14 countries, primarily counterparts for national projects, attended a regional training event on the LFA in Panama. The training event led to better designed national projects as each counterpart was able to work on his or her own project design. Sub-regional and country-specific LFA training events to assist Member States that had expressed a need for support in the design of national projects were

held in Paraguay and Jamaica, and a workshop was organized in Brazil attended by more than 30 institutes that will participate in the national TC programme.

An innovative workshop was organized in October 2012 to review the first round of regional project designs. The workshop was attended by the Designated Team Members of the projects, a set of experts from the region, and Agency staff. Experts on project design, quality and training and strategic partners also participated. The workshop was organized as combined hands-on training in LFA and project design review – participants attended lectures and received expert advice on project management while they were revising the project from a technical standpoint. This is the first time that strategic partners have been involved at such an early stage of preparations for regional projects.

³² This section responds to section 3, operative paragraph 2 of resolution GC(56)/RES/11 on rationalizing the number of TC projects in order to increase programme efficiency and create synergies among projects.

Interregional projects

Interregional projects address the common needs of Member States in different regions. They are categorized as trans-regional, global, capacity building or joint activities. In 2012, encumbrances and actuals under interregional projects totalled €2.3 million. Currently, there are 20 active interregional projects in areas that include human capacity building, sharing of best practices, the utilization and operation of the Synchrotron-light for Experimental Science and

Applications in the Middle East (SESAME) research centre, preservation of world cultural heritage, assessing the impact of mutation breeding, capacity building on the sterile insect technique, nuclear reactor technology evaluation, wheat stem rust (Ug99), uranium exploration, quality in nuclear medicine, and protecting the marine environment.

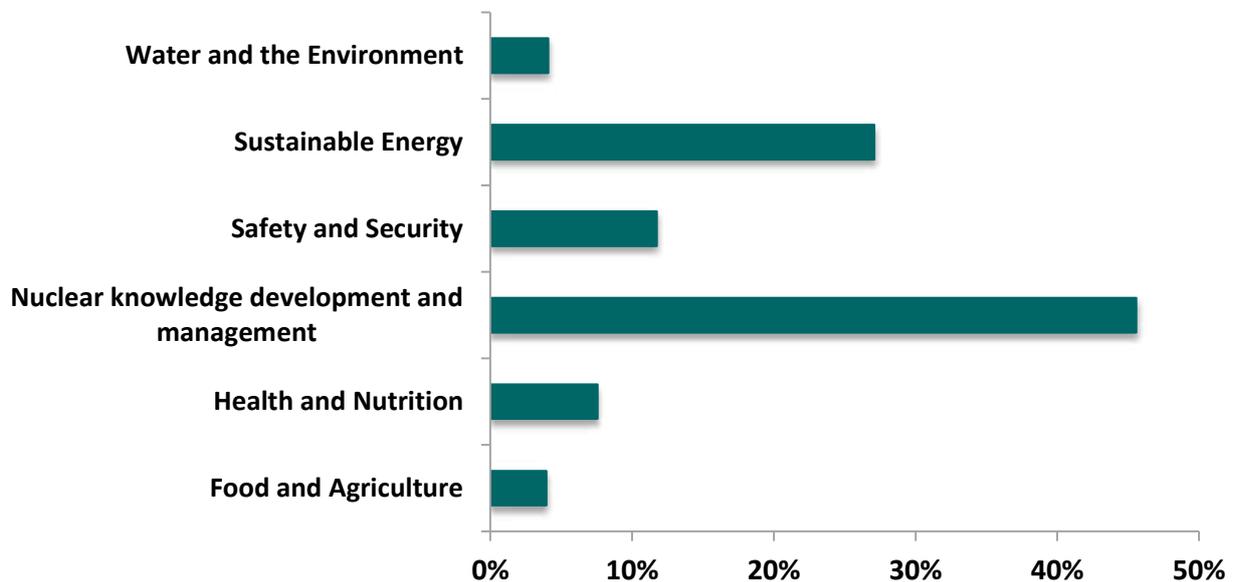


Figure 12: Interregional actuals in 2012 by technical field.

Table 9: Active interregional projects

Project Number	Project Title	1st Year of Approval
INT0083	Support for Human Capacity Building in Developing Member States	2009
INT5150	Responding to the Transboundary Threat of Wheat Black Stem Rust (Ug99)	2009
INT6054	Strengthening Medical Physics in Radiation Medicine	2009
INT7017	Providing Coordinated Support in the Use of Receptor Binding Assay to Address Impacts of Harmful Algal Toxins in Seafood	2009
INT7018	Supporting Capacity Building in Marine Environmental Protection	2009
INT0085	Sharing best practices for the design and management of technical cooperation projects	2010
INT0086	Building Human Capacity for the Construction, Operation and Use of SESAME	2012
INT0087	Supporting Human Capacity Building in Developing Member States (Phase II)	2012
INT1056	Supporting Non-Highly Enriched Uranium (HEU) Molybdenum-99 Production Capacity for Nuclear Medicine Applications)	2012
INT2013	Supporting nuclear power infrastructure capacity building in Member States introducing and expanding nuclear power	2012
INT2014	Supporting Member States to Evaluate Nuclear Reactor Technology for Near-Term Deployment	2012
INT2015	Supporting Uranium Exploration, Resource Augmentation and Production Using Advanced Techniques	2012
INT2016	Supporting Climate Change Mitigation Strategies and Energy Options	2012
INT2017	Capacity building in long-range strategic nuclear energy planning for global sustainability.	2012
INT5151	Sharing Knowledge on the Use of the Sterile Insect and Related Techniques for Integrated Area-Wide Management of Insect Pests	2012
INT5152	Supporting Mutation Breeding Impact Assessment	2012
INT6056	Supporting Quality Management Audits in Nuclear Medicine Practices (QUANUM)	2012
INT9174	Connecting Networks for Enhanced Communication and Training	2012
INT9175	Promoting safe and efficient clean-up of radioactively contaminated facilities and sites	2012
INT9176	Strengthening Cradle-to-Grave Control of Radioactive Sources in the Mediterranean Region	2012

List of frequently used abbreviations

AFRA	African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology	MDG	United Nations Millennium Development Goal
Agency	International Atomic Energy Agency	NLO	National Liaison Officer
APCs	assessed programme costs	NPCs	national participation costs
ARASIA	Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology	NPP	nuclear power plant
ARCAL	Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean	RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology
CPF	Country Programme Framework	RSA	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the International Atomic Energy Agency
FAO	Food and Agriculture Organization of the United Nations	SIT	sterile insect technique
IAEA	International Atomic Energy Agency	TC	technical cooperation
		TCF	Technical Cooperation Fund
		UNDAF	United Nations Development Assistance Framework



Annex 1. Achievements in 2012: Project Examples by Thematic Area

Human health

Through the technical cooperation programme, the Agency helps Member States use nuclear techniques to address important health problems. Agency services support the work of health care professionals and technologists, policy makers, regulators, universities and patients, providing Member States with specialized skills and infrastructure to prevent, detect and cure major illnesses. Within this sector, the Agency helps Member States to address the challenges posed by cancer, malaria and tuberculosis, malnutrition and obesity, and chronic disease. It also supports quality management in nuclear medicine, radiation oncology and diagnostic radiology.

Regional highlights

In the Africa region, human and institutional capacity building to strengthen health care facilities remained a priority for TC activities. In 2012, several national and regional projects aimed to improve health services and make them more accessible, including through the establishment and strengthening of radiotherapy and nuclear medicine centres. Activities supported long-term training of radiation oncologists, medical physicists, nuclear medicine physicians and related professionals, as well as the procurement of essential equipment and expert services. Counterpart institutions received support to adopt and implement national cancer control strategies and to develop self-reliance in human capacity building for cancer management. National capacity to study the effects of breastfeeding on the nutritional status of HIV/AIDS infected lactating women and the potential for mother to child transmission of HIV/AIDS was strengthened.

Special efforts were made to build partnerships for resource mobilization to strengthen national healthcare facilities, especially in light of the increasing incidence of cancer in the region. TC project NIR/6/022, 'Expanding Nuclear Medicine Services', offers an example of successful resource mobilization by a Member State. The project was approved in 2009, with TCF and footnote-a/ funding. It received government

cost sharing of US\$ 1 million in 2010 and over US\$ 1.7 million in 2012. US\$ 2.2 million of this was dedicated to the long term training of 16 nuclear medicine physicians from 10 referral hospitals, with the remainder for the procurement of medical equipment. Most of the fellows trained, in addition to their clinical duties, will serve as lecturers in a national graduate programme of training that will start in 2016. The project's lead institution, the Nuclear Medicine Department of the University College Hospital of Ibadan, has been supported by a private philanthropist, Mr Afe Babalola, who has provided some US\$5 million for the construction of the building that houses the Nuclear Medicine Centre.

In Asia and the Pacific, human health activities also focused on improving both the quality and accessibility of health care services in the region. Member States prioritised upgrading the use of nuclear technologies for the diagnosis of diseases and treatment, ensuring the safe use of ionizing sources, and adopting the quality assurance practices required. Capacities in cancer management, advanced medical diagnostics and nutrition were strengthened.

In Europe, the human health programme focused on expanding and upgrading nuclear medicine and radiotherapy facilities through the introduction of high capacity and high efficiency equipment. Quality of services has been emphasized, and specific needs have

been identified through QUATRO and QUANUM missions. The production of radiopharmaceuticals related to disease diagnosis is also important for the region.

The focus of the Latin America programme in human health was to create essential capabilities underrepresented in the national institutions responsible for health care and services. Throughout 2012, the TC programme in the region focused on improving the quality and accessibility of health care services by providing equipment (usually with government cost-sharing support), training for radiation oncology and nuclear medicine professionals, including medical physicists and technicians, and expert guidance for safe and effective diagnosis, treatment and palliation. In Argentina, for example, advanced nuclear techniques and instruments for nuclear medicine were introduced, with a special focus on quality issues. The project led to the establishment of advanced diagnostic and therapeutic techniques in Argentina that strengthened the public health system and improved the quality of the treatment received by patients.

Addressing cancer and other non-communicable diseases

In the United Republic of Tanzania, national projects focused on developing cancer control services.

Radiotherapy and nuclear medicine services were established at Bugando Health Centre in northern United Republic of Tanzania and nuclear medicine services were expanded and the quality of clinical services upgraded in the Ocean Road Cancer Institute. This institute is a regional designated centre for the IAEA's Programme of Action on Cancer Therapy (PACT), which is providing support to the United Republic of Tanzania to revive and strengthen the established national steering committee in order to spearhead the adoption of a comprehensive national cancer control strategy, and to develop self-reliance in human capacity building for cancer management. Notable achievements have been made in building this capacity, establishing facilities for cancer management and in training medical personnel in radiography in cooperation with Muhimbili University.

Agency support under projects ETH/6/013 and ETH/6/014, phases I and II of 'Strengthening the Nuclear Medicine and Radiotherapy Services', and 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', has strengthened nuclear medicine and radiotherapy services at the Black Lion Hospital in Addis Ababa,



ETH/6/013, ETH/6/014 and ETH/6/015: SPECT Gamma Camera, dose calibrators and Gamma Counter at the Black Lion Radiotherapy and Nuclear Medicine Centre at the Black Lion Hospital procured by the IAEA.

Ethiopia. Support to the hospital includes long-term training of radiation oncologists and medical physicists, and the procurement of two Cobalt 60 machines, a new teletherapy machine and other necessary items with government cost-sharing.

A regional workshop on cancer control was held under RAS/6/060, 'Supporting Comprehensive National Cancer Control'. Twenty-seven participants from 16 Member States in the Asia and Pacific region met for three days to define and agree on strategic directions, and priorities to be addressed.

ImPACT missions were implemented in Jordan and Malaysia in 2012 under regional TC projects. In each country, the mission teams carried out a comprehensive assessment of national cancer control capacity and needs in the areas of cancer control planning, cancer information/registration, prevention, early detection, diagnosis and treatment, palliative care and civil society activities.

In Asia, coronary artery disease (CAD) is becoming an acute health problem, due in part to the increased prevalence of diabetes, hypertension and smoking habits. CAD has a higher mortality in developing countries, and affects younger people and women disproportionately. Nuclear cardiology with single photon emission computed tomography (SPECT) is a powerful tool to depict coronary artery disease in both asymptomatic and symptomatic patients. RAS/6/063, 'Strengthening the Application of Nuclear Medicine

in the Management of Cardiovascular Diseases', addresses the need for nuclear cardiology training in the region, particularly in developing countries. Early diagnosis of CAD will lead to early treatment, better prognosis and fewer complications.

In Albania in 2012, national capacity to provide specialized care for the prevention, diagnosis and treatment of cancer was enhanced through support provided under project ALB/6/013, 'Supporting the Safe Implementation of Advanced Techniques in Radiotherapy and Nuclear Medicine'. Hands-on training of key professionals and the procurement of specialized equipment increased the capacity of the Mother Teresa University Hospital Centre to provide safe and enhanced diagnostic and therapeutic services. The project contributes to the successful implementation of the One UN Programme of Cooperation in Albania.

The highly specialized and expensive therapeutic procedure of bone marrow transplantation with total body irradiation and blood irradiation is now available in Bulgaria, thanks to BUL/6/008, 'Routine Application of Highly Specialized Total Body Irradiation Prior to Bone Marrow Transplantation'. Services started in 2012 in the Queen Giovanna University Hospital and the Specialized Hospital for Active Treatment of Children with Onco-Haematological Diseases. The procedures are of especially high value for children.

In Belarus, the Agency provided a new linear medical accelerator to the Gomel Regional Oncological Centre



BYE/6/009: Treatment of patient using linear accelerator at the Gomel Regional Oncology Centre, Belarus.



BUL/6/008: Young patient at the Paediatrics Clinic of the Queen Giovanna University Hospital, Sofia, Bulgaria.

under project BYE/6/009, 'Improving Radiotherapy Services in the Chernobyl Affected Territories with the Introduction of a Single Mode Linear Accelerator'. This complements existing facilities and has significantly improved cancer treatment capacity in this region of Belarus, which was heavily affected by Chernobyl. The project will be completed with an IAEA QUATRO audit mission on the quality of radiotherapy services³³.

A total of 163 professionals were trained in Latin America under projects RLA/0/039, 'Creating a Latin America Network for Collaboration and Education in Nuclear Medicine (ARCAL CXX)', RLA/6/061, 'Training and Updating Knowledge in Medical Physics (ARCAL CVII)', RLA/6/065, 'Strengthening Quality Assurance in Nuclear Medicine (ARCAL CXI)', RLA/6/067, 'Establishing a Sub regional Plan for Cancer Prevention and Integral Cancer Care in Central America and the Dominican Republic (ARCAL XCIII)', and RLA/6/068, 'Improving Quality Assurance in Radiotherapy in the Latin America Region (ARCAL CXIV)'. The expanded capabilities that resulted from this training demonstrate the long-term commitment of the Agency to strengthening institutional knowledge in key areas of health care such as nuclear medicine.

In Honduras, the Agency is supporting the strengthening of radiotherapy services in Hospital San Felipe under HON/6/003, 'Strengthening the External Radiotherapy Service at the San Felipe General Hospital'. Hospital San Felipe is the main public health institution offering radiotherapy treatment in the country. With the purchase of a radiotherapy treatment planning system and the training of medical staff in the use of 3D dosimetry, the hospital will be able to increase the number of patients treated in the radiotherapy unit by 50%.

A new linear accelerator (Linac) has been installed to offer oncology treatment to low income patients in Guatemala under GUA/6/017, 'Strengthening Radiotherapy in Guatemala by Improving the Radiotherapy Department at the Dr. Bernardo del Valle S. Cancer Institute'. This is the first time treatment of

this nature has been made available in a public hospital in the country.

Nuclear medicine services in Paraguay are only available in private centres. Through PAR/6/014, 'Strengthening Nuclear Medicine for Diagnosis and Therapy', care of patients with cancer and cardiac diseases has been enhanced through improvements in the quality of diagnostic services and radiopharmaceuticals products provided by the public sector. With the acquisition of a gamma camera in 2013 and the training of the relevant staff, the Health Science Research Institute will become the first public health institution to provide such services in Paraguay.

The Agency is helping Venezuela to strengthen its human health sector through two national projects. Under VEN/6/015, 'Supporting Clinical Quality Assurance of Treatment in Radiation Oncology', quality assurance for the radiotherapy services provided in the University Hospital in Caracas has been improved. Medical staff have received training in the application of various modern radiotherapy techniques. Advances in radiotherapy such as dose fractionation and conformal radiation techniques mean that normal cells and tissues are spared. Nuclear medicine services have been strengthened through VEN/6/016, 'Developing Nuclear Cardiology Techniques'. One in five deaths in Venezuela is due to cardiovascular disease, which mainly affects people between 44 and 64 years of age. The project aims to disseminate myocardial perfusion imaging as a tool for diagnosis, monitoring and guidance in the therapeutic management of patients. Five different health institutions are taking part in the project. Multi-disciplinary and specific training for staff is being provided in order to establish capacities for the implementation and interpretation of myocardial perfusion imaging.

In 2012, several training courses were organized for medical doctors, physicians, technologists and surgeons under regional project RLA/6/063, 'Improving Management of Cardiac Diseases and

³³ This paragraph responds to section 2, operative paragraph 5 of resolution GC(56)/RES/11 on assistance and radiological support to the most affected countries in mitigating the consequences of the Chernobyl disaster.

Cancer Patients by Strengthening Nuclear Medicine Techniques in Latin America and Caribbean Region’. Nuclear medicine techniques were strengthened and treatment quality improved.

Imaging

In the Asia and the Pacific region, project RAS/6/061, ‘Improving Cancer Management with Hybrid Nuclear Medicine Imaging’, was initiated under the RCA to improve the management of cancer in patients through better and more comprehensive reporting of positron emission tomography–computed tomography (PET/CT) and SPECT/CT scans. Nuclear medicine practitioners and service users (medical, surgical and radiation oncologists; neurologists; cardiologists; orthopaedic surgeons; rheumatologists) will benefit from a better understanding of the disease process, which will enhance clinical care.

Eight regional training courses were implemented in 2012 under RER/6/026, ‘Strengthening Single Photon Emission Computed Tomography/Computed Tomography (SPECT/CT) and Positron Emission Tomography (PET)/CT Hybrid Imaging Applications for Chronic Disease Diagnosis’. These included a training course on hybrid imaging using SPECT/

CT held in Vilnius, Lithuania. Course participants strengthened their knowledge and skills in implementing the technology in clinical practice; identified clinical scenarios where SPECT/CT could be applied; carried out a cost-benefit analysis; and established radiation safety procedures to make applications safer. Under the same project, a theoretical and practical training course was held in Italy to introduce state-of-the-art hybrid imaging using SPECT/CT and PET/CT technology in head and neck cancers. The course focused strongly on the practical aspects of clinical practice, using a format where participants were exposed to ‘live’ cases with patients undergoing both nuclear imaging and CT angiography.

Training and support for medical physicists

The Agency has been supporting the development of human resource capacity in ARASIA States Parties since 2007 to address the shortage of clinical medical physicists in the region. The TC projects RAS/6/052 and RAS/6/054, phases I and II of ‘Upgrading Medical Physics Services in the ARASIA Member States through Education and Training’, together with the on-going project RAS/6/068, ‘Supporting a Pilot Regional Clinical Training Programme in Medical



RAS/6/052 and RAS/6/054: Upgrading Medical Physics Services in the ARASIA Member States through Education and Training’, Phases I and II.

Physics for Radiation Oncology in Saudi Arabia', have focused on many aspects of medical physics. This included academic education, clinical training, and the establishment of supervised, structured clinical training programmes in radiation oncology medical physics, as well as the development of essential documents and training material to support these efforts. During this period 15 physicists were fully supported by the TC programme and received their Master of Science degrees.

The shortage of qualified medical physicists is also a challenge in several RCA countries, and sound clinical training in the profession is urgently required. Under RCA project RAS/6/038, 'Strengthening Medical Physics through Education and Training', the Agency has provided technical assistance to establish regional approaches to the education and training of medical physicists. The project also sought to improve and upgrade safe operating practices and technical standards, through the establishment of a common quality assurance/quality control (QA/QC) programme. Competency-based clinical training guides in Radiation Oncology Medical Physics (ROMP), Diagnostic Radiology Medical Physics (DRMP), and Nuclear Medicine Medical Physics (NMMP) were developed

and pilot tested. Institutions using ionising radiation for medical purposes in the region benefited greatly from the project activities. The training programmes developed through the project have been well reviewed, pilot tested and refined, and demonstrate considerable potential for use in other countries.

The Jamaican University of the West Indies (UWI), with the support of the Agency, launched an official education programme in Medical Physics at the BSc level some years ago. In 2012, the TC project JAM/6/011, 'Building Human Capacity for Medical Physics', was the first attempt to develop local capacity for sustainable postgraduate training in Medical Physics. Six persons have been selected for enrolment in the first Master's degree programme in medical physics, following a 'train-the-trainers' concept.

Radiotherapy use in Bosnia and Herzegovina has expanded significantly over the past three years, from four teletherapy machines in Sarajevo in 2009 to 11 teletherapy machines in five centres in 2012. As a result, the country faced a growing demand for experienced medical physicists and had a pressing need for continuous education and clinical training. TC project BOH/6/012, 'Establishing a Medical Radiation Physics Centre', aimed to set up a centre, in compliance with



BOH/6/012: Establishing a Medical Radiation Physics Centre.



ALG/7/004: A varispeed multi-rotor, staff at work in the radiobiology laboratory at the Nuclear Research Centre of Algiers.

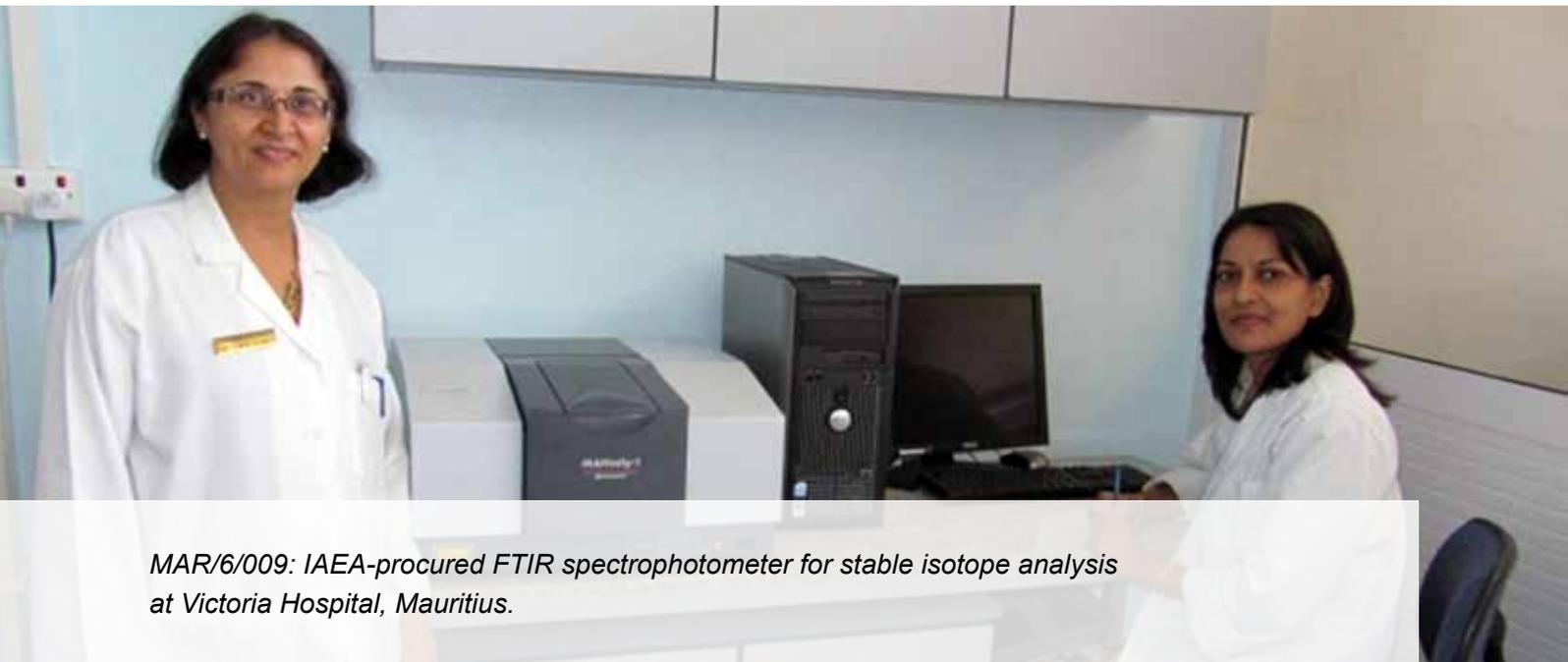
international standards, for the sustainable training of medical physicists and for continuing professional development. A Master's programme in Medical Physics was started in 2009, organized by the Faculty of Science of Sarajevo University and the Department of Medical Physics and Radiation Safety of the Clinical Centre. To support the Master's programme a postgraduate course in medical physics was organized in the scope of the project. As a result of the project, a medical radiation physics centre was established at the Clinical Centre of Sarajevo University that can provide education and clinical training in medical physics and radiation protection. Bosnia and Herzegovina now has a larger professional body of medical physicists, and its infrastructure meets internationally accepted standards for training in all major areas of application of medical radiation physics: radiotherapy, diagnostic radiology and nuclear medicine.

In 2012, project MAK/0/005, 'Upgrading the Training Laboratory for Nuclear Science (Phase II)' was completed in the former Yugoslav Republic of Macedonia. The project has helped establish an infrastructure for nuclear and medical physics training, including appropriate laboratory exercises for physics and non-physics students. Through these exercises, students learn the laws of nuclear physics and are trained in the application of nuclear physics methods and techniques, in particular for medical purposes and environmental research and preservation. An experimental facility was established to provide training in the use of nuclear/radiology medical physics for students and future hospital staff.

In Algeria, assistance was provided to establish a radiobiology laboratory at the Algiers Nuclear Research Centre (CRNA) under ALG/7/004, 'Developing National Capacities in Radiation Biology'. Support was delivered through advisory services and training on basic cytology and histology techniques. Equipment and consumables were provided, including a laminar flow, ultra-low freezer with storage rack, a variable speed refrigerated multiple rotor centrifuge complete with tubes, adapters, a coulter counter Model Z1 Dual Threshold Particle Counter, and an autoclave. With the support of the Government of Algeria, the radiobiology laboratory became operational in 2012.

Nutrition

In Mauritius, the increasing prevalence of non-communicable diseases (NCDs) and risk factors such as obesity and overweight have been documented. Since obesity leads to insulin resistance and diabetes, it is crucial that the problem be addressed at a young age, so that a preventive national control and awareness programme can be launched. Through MAR/6/009, 'Assessing Health Risk Factors Associated with Diabetes in Mauritius', the Agency supported the development of capacity at Victoria Hospital in the use of stable isotopes to assess body composition, using the deuterium dilution method. Data were collected and analysed, leading to better understanding of the management and prevention of diabetes at early age. The hospital's potential as a training centre for the sub-region is being considered.



MAR/6/009: IAEA-procured FTIR spectrophotometer for stable isotope analysis at Victoria Hospital, Mauritius.

In the Dominican Republic, project DOM/6/007, ‘Assessing Obesity and Obesity-Related Risk Factors in Women’, is supporting the assessment of women of child-bearing age working in public institutions such as the Ministries of Education, Agriculture, and the Autonomous University of Santo Domingo. Through the project, analytical capacities have been established at the Nutritional Research Institution of the Ministry of Public Health, and 300 women are currently participating in the evaluation of their nutritional status. Based on the results so far, the women have been provided with nutritional information and recommendations, with those found to be at high risk receiving specific guidance. The final stage of the assessment will involve the evaluation of body composition using isotopic techniques. The results will provide a basis for an advocacy campaign to incorporate good practices into the working environment in order to reduce obesity-related risk factors.

Nutrition and HIV/AIDS

In Botswana, HIV/AIDS has become a major challenge, threatening public health and economic development. TC project BOT/6/003, ‘Assessing Nutritional Interventions Related to HIV/AIDS’, has strengthened national capacity to study the effects of breastfeeding on the nutritional status of HIV/AIDS infected lactating women. The project counterpart, the

National Food Technology Research Centre, Kanye, has been selected as an AFRA Designated Centre and is now a training centre for the region.

In South Africa, SAF/6/015, ‘Determining the Influence of Probiotics to Reduce Morbidity and Improve the Immune Status of People Living with HIV/AIDS’, is building national capacity to determine anthropometric status as a crucial aspect of monitoring nutritional status and morbidity. Using the deuterium dilution technique allows an accurate determination of small but important changes in fat free mass that cannot be identified using available non-nuclear techniques. Equipment and training for the study of probiotics and HIV status has been provided under the project.

Quality

A Quality Assurance in Nuclear Medicine (QUANUM) mission was conducted in Israel under ISR/6/019, ‘Improving Quality Management and Clinical Practice of Nuclear Medicine’. The QUANUM audit team focused on three areas: management and human resources development; risk management; and general clinical services. A first national QUANUM workshop was held in October 2012 to help improve the quality of nuclear medicine services.

In Thailand, a workshop held under INT/6/056, ‘Supporting Quality Management Audits in Nuclear

Medicine Practices', was attended by 20 participants from the Asia and Pacific region. The workshop supported the alignment of views on audit methodology in the region. The design and implementation of a Quality Management System in Nuclear Medicine Audit in accordance with IAEA guidelines was discussed.

Two training courses on QUATRO were provided under RAS/6/070, 'Supporting Quality Assurance Team for Radiation Oncology (QUATRO) Training', in Jakarta, Indonesia, and Bangkok, Thailand. The course in

Jakarta (attended by 26 participants) trained teams of national auditors on the QUATRO audit methodology. The course in Bangkok (attended by 24 participants) presented the QUATRO auditing methodology to professionals working in radiotherapy departments which receive an audit. The courses were based on the IAEA 'Comprehensive Audits of Radiotherapy Practices: A Tool for Quality Improvement – Quality Assurance Team for Radiation Oncology' and helped to harmonize audit methodology and strengthen the quality of radiotherapy practices in the region.

Agricultural productivity and food security

The Agency, in partnership with the FAO, helps Member States improve food security. Efforts focus on improving yield and quality by enhancing the diversification and adaptability of crops. Technical cooperation projects also help Member States to reduce pesticide use and to decrease the crop losses caused by pests and diseases, as well as to overcome phytosanitary barriers to trade.

The Agency also helps Member States to improve livestock productivity. Projects concentrate on the efficient use of locally available feed resources, on improved reproductive techniques and breeding programmes for indigenous and advanced animal breeds, as well as on improving diagnostic capacities and prophylactic strategies for the control of important transboundary animal diseases, including zoonoses.

Regional highlights

Throughout 2012, more than 75 national and 10 regional ongoing TC projects in the Africa region contributed to agricultural productivity and food security using nuclear technology. Projects were implemented to build Member State capacity to tackle tsetse and trypanosomosis using the sterile insect technique (SIT), and to improve rice varieties through mutation breeding and biotechnology. Other projects focused on improving the use of agricultural resources, combating soil erosion by optimizing conservation agriculture and supporting innovative practices to combat land degradation and enhance soil productivity for improved food security. Assistance was provided to improve cattle productivity through genetic improvement, including artificial insemination.

In Asia and the Pacific, assistance to Member States built competencies in soil-water management and crop nutrition, as well as in mutation breeding, with the aim of enhancing agricultural productivity and developing suitable crop varieties that are adaptable to climate change. In regard to animal production and health, projects focused on artificial insemination and control of transboundary animal diseases.

In Europe, TC activities in 2012 focused on the transfer of technologies that allow early and rapid diagnosis of transboundary animal diseases, improve crop adaptability and quality, and facilitate the eradication of fruit pests.

In Latin America, activities focused on creating capabilities to better manage crop production and improve soil fertility and crop yields, thus increasing income, particularly for smallholders.

Food safety

An operational and self-sustainable network of Latin American laboratories and Centres of Excellence has been established under RLA/5/055, 'Establishing a South American Regional Network of National and Reference Laboratories for Pharmacologically Active Substances and Contaminants in Food of Animal Origin Through Implementation of Approved Nuclear & Conventional Analytical Techniques (ARCAL CIV)'. The network is working to enhance food safety and security for regional consumers through harmonized, improved procedures for the analysis of pharmacologically active substances and contaminants in food of animal origin. The network will contribute to better management of veterinary drug residues, thus increasing opportunities for international trade in animal-derived food products.

Animal production and health

In Chad, CHD/5/004, 'Improving Cattle Productivity through Genetic Improvement, Including Artificial Insemination, to Contribute to Reducing Poverty and Combating Food Insecurity', focuses on creating a national centre for animal reproduction in the N'djamena area. The project aims to improve the productivity of local cattle breeds through artificial insemination, developing local breeds, and creating four regional centres for the promotion of semi-industrial farms. It

also aims to extend research products to producers and to support the creation of dairies in large towns. Under the project, participating laboratories have received equipment and training to enable data collection and undertake artificial insemination.

In Zambia, ZAM/5/028, 'Improving Productivity of Dairy Animals Maintained on Smallholder Farms through Selected Breeding and Effective Disease Diagnosis and Control Using Isotopic and Nuclear Techniques' supports cattle farmers in four dairy centres in the Lusaka area and the Southern province. Farmers have received seeds for improved fodder

necessary equipment, consumables and tools, and a solar power system was set up to ensure the continuous running of fridges and freezers, operation of laboratory equipment for ND vaccine production, and molecular diagnostics. Due to the project, national capacity has been established in epidemiological surveys and laboratory techniques for the diagnosis of PPR and ND in small ruminants and local chicken. Thermostable ND vaccine for application in the field can now be produced locally, and vaccines are available beyond Njala and surrounding areas.



CHD/5/004: Local breeds selected for insemination.

grass and legumes, including fodder trees, as well as guidance on preparing silage and hay for use during the dry season. Extension officers are being trained through national training courses on artificial insemination and disease control monitoring. The National Artificial Insemination Services provides frozen semen from local and exotic breeds and the Central Veterinary Research Institute monitors brucellosis, tuberculosis and tick-borne diseases as well as heavy metals in milk and water. The Agency has supplied equipment for feed analysis and artificial insemination plus training on laboratory techniques and semen processing.

The lives of rural subsistence farmers in Sierra Leone can be directly improved by increasing the productivity of small ruminants and chicken. TC project SIL/5/011, 'Controlling Economically Important Livestock Diseases', has supported the design of epidemiological surveys and the adoption of appropriate rapid laboratory techniques for the diagnosis of peste des petits ruminants (PPR) and Newcastle disease (ND) in small ruminants and chickens. Human resource development was supported through overseas fellowships and a national training course. The Agency also supplied

In addition, the project led to the installation of a poultry production facility that provides the vaccine lab with eggs and supports the vaccine testing. The installation of the solar system has allowed the safe cold storage of reagents and frozen samples for analysis for the first time. The laboratory is the only veterinary laboratory in the country performing quality assured diagnostic test in serology and disease detection using molecular means.

In Europe, experts from 13 Member States agreed on a common set of standard operational procedures and methods for the early diagnosis of West Nile Fever, African and Classical Swine Fever, Hepatitis E and Equine Infectious Anaemia, supported by project RER/5/016, 'Supporting Coordinated Control of Transboundary Animal Diseases with Socioeconomic Impact and that Affect Human Health'. This, with hands-on training offered in 2012 for all target diseases, marked an important step towards data comparability and harmonization at the regional level.

RER/5/016: Hands-on training session in the laboratory on early and rapid nuclear and nuclear-related diagnostic and tracing technologies for West Nile Fever, Hepatitis E and Equine Infectious Anaemia (Izmir, Turkey).



In Belize, BZE/5/005, ‘Providing Technical Assistance and Training for Upgrading National Laboratory Capacity’, is enhancing current practice in the use of stable isotopes techniques for quality control of analytical processes and tests. Stable isotopes are being applied to measure isotopic ratios in agrochemicals and to perform analytical quality management, traceability and integrated monitoring of Good Agriculture Practices.

Mutation induction in crops

Technical and human capacity to apply radiation induced mutagenesis techniques to increase the genetic variability of rice has been established in Colombia under COL/5/023, ‘Enhancing Mutagenesis and Biotechnology Used in the Improvement of Rice’, which also supported the creation of the National Programme for the Genetic Improvement of Rice. In Bolivia, BOL/5/018, ‘Enhancing Food Security Using Conventional and Nuclear Techniques for the Acquisition of Climate-Change Tolerant Commercial Potato Seed’, is supporting the use of mutation induction technologies to generate characteristics resilient to climate change in potato seeds. Capacities to conduct

independent research in the area of mutation induction in support of the National Seed Programme have been enhanced, supporting food security in the country. The newly produced potato strains are expected to improve the livelihoods of Bolivian farmers, because their crops will be more tolerant to abiotic and resistant to biotic stresses. Trade and export of potatoes should increase.

Under RAF/5/056, ‘Field Evaluation and Dissemination of Improved Crop Varieties Using Mutation Breeding and Biotechnology Techniques (AFRA II-5)’, participating African countries have developed improved food crops that are both more productive and of higher nutritional quality. Underutilized and neglected crops such as Bambara groundnut, colocasia, African yam bean, lupins, noug and cocoyam have been improved through mutation and in vitro techniques. These crops have been integrated in new cropping systems, providing additional components for a balanced diet.

The project has enhanced regional capacity for field evaluation and dissemination of improved crop varieties using mutation breeding and efficiency-enhancing biotechnologies, and has helped AFRA States Parties

to develop and disseminate improved staple and market crops. Major project achievements include enhanced research capability, basic infrastructure and trained staff in most participating countries, and well-functioning tissue culture laboratories in 14 countries. In addition, early generations and advanced mutant lines are available in most participating countries, and officials and the public are now more aware of the benefits of mutation induction in crop improvement in most countries. Partnerships with private sector companies have been initiated in the United Republic of Tanzania and Zambia.

In Sudan, support has been provided under SUD/5/030, 'Increasing Productivity of Selected Crops Using Nuclear Related Techniques', to address capacity gaps and to improve the adoption of new crop varieties. Young researchers received training, and two tomato varieties resistant to tomato yellow leaf curl virus (TYLCV) were released (Sinar-4 and Sinar-8). Both have higher fruit yields (above 35 t/ha) and better fruit quality (double the fruit size and increased firmness), and are ready for harvesting earlier. The new varieties have a higher tolerance to TYLCV and powdery mildew in comparison not only to their parent variety but also to the most commonly grown commercial tomato cultivars.

Under MAK/5/006, 'Improving Wheat, Barley and Triticale for Food and Feed in Drought-Prone Areas, Using Nuclear Techniques', initial breeding material was selected and sent to the IAEA laboratory for irradiation with gamma rays to induce mutations. Three M2 mutant populations were developed from wheat, barley and triticale. In 2012, screening and phenotyping of the M3 generation were carried out, and the best mutant lines will be selected for further breeding process and genetic studies. The project aims to create drought tolerant varieties with a higher yield. A laboratory for molecular genetics and quality control for cereals has been established under the project at the Faculty of Agricultural Sciences and Food in the former Yugoslav Republic of Macedonia, providing crop research opportunities for faculty staff, as well as excellent facilities for students.

The Agency has been providing support to Member States in the Europe region through RER/5/013, 'Evaluation of Natural and Mutant Genetic Diversity in Cereals Using Nuclear and Molecular Techniques', since 2009 to develop new mutant germplasm in cereals and in Solanaceae species such as potatoes, peppers, tomatoes, and eggplants. An increased number of pre-breeding and breeding lines with desirable characters are now available.

Sterile insect technique (SIT) for crop production and rural development

In Mauritius, under MAR/5/016, 'Feasibility Study for the Suppression of the Melon Fly (*Bactrocera Cucurbitae*) in Selected Areas of Mauritius', an integrated pest management approach has been developed to reduce crop losses and insecticide use in an environmentally friendly way and to produce better quality fruits and vegetables. Educational and public information activities and on-site staff SIT training have been carried out, and a melon fly surveillance system has been established. As a result of the project, cucurbit infestation, which was above 30% before project implementation, was reduced to 5% by the end of the project. A decrease in the frequency of pesticide application was recorded, along with an increase in cucurbit production. The project successfully transferred this environmentally friendly pest control technology, and enhanced national capabilities in Mauritius.

In Honduras the Agency has been supporting capacity building in SIT through HON/5/006, 'Using Sterile Insect Technique (SIT) to Obtain Recognition as a Mediterranean Fruit Fly Free Area in the Aguan River Valley'. Once the area is recognized as free of fruit flies, the export of fruits and vegetables will benefit farmers and the population in the region.

Agency support through Ethiopia's Southern Rift Valley Tsetse Eradication Project (STEP) under projects ETH/5/014, 'Monitoring and Control of Major Animal Diseases', and ETH/5/015, 'Creating a Tsetse-Free Zone in the Southern Rift Valley', is helping to tackle tsetse flies, the vectors responsible for trypanosomiasis in animals, which is at the root of



MAR/5/016: Melon flies larvae at the rearing facility, Adult melon flies in a cage at the rearing facility, Mauritius.

much rural poverty in Ethiopia. The support, delivered through a comprehensive, multisectoral approach, has resulted in the establishment of the most effective area-wide integrated pest management campaign against insect pests in Ethiopia and the largest tsetse mass rearing facility in Africa. The development of human resource capacity through external fellowships and local training has allowed increased livestock production by the rural communities in parts of the 25,000 square kilometer project area. STEP has also attracted support from several external partners, including the African Development Bank, FAO, United Nations Trust Fund for Human Security and the USA.

Agency support is not directed only at the transfer of SIT for tsetse fly eradication, but, in collaboration with other partners, is contributing to addressing wider socioeconomic issues related to sustainable agricultural and livestock development. Accordingly, improvements to livestock productivity and agricultural development activities have been implemented alongside the suppression of tsetse and trypanosomosis, which are proving crucial in stimulating rural development in previously underutilized areas.

The Niayes area in Senegal is particularly favourable for market gardening, arboriculture and stockbreeding.



ETH/5/014 and ETH/5/015: Tsetse SIT aerial releases in Ethiopia.

Unfortunately, conditions are also favourable for tsetse flies. Senegal has been working with the Agency for a decade to address the problem, and is currently receiving support under SEN/5/03, 'Supporting the Operational Phase of Eliminating *Glossina palpalis gambiensis* from the Niayes Area by Promoting the Development of Integrated Stockbreeding'. The project focuses on the preparation and implementation of the release of sterile male, provides technical and financial support through expert missions to supplement local expertise in defining needs, analysing the data collected, running the insectarium and training.

Pakistan requested urgently needed Agency support following a severe outbreak of dengue fever in the country in 2012. A national project, PAK/5/049, 'Support for Capacity Building in Baseline Data Collection for Mosquito Dengue Vector Management in Pakistan', was established as an IAEA Programme Reserve project to provide immediate assistance in two main areas: basic surveillance and control for dengue vectors focussing on vector control to reduce disease and dengue pathogenesis; and diagnosis and case management addressing clinical issues around managing epidemics. Two workshops were conducted in Islamabad, in May and October 2012, each of which was attended by approximately 80 national participants.

In Sri Lanka, an IAEA expert mission was conducted under TC project SRL/5/044, 'Supporting a Feasibility Study Using the Sterile Insect Technique (SIT) for Integrated Control of Mosquitoes', within the context of the Anti-Malaria Campaign, to advise on colony establishment and mosquito rearing. A second mission focused on pilot site selection and population surveillance. Laboratory equipment and consumables were provided to facilitate colony establishment, and a scientific visit to the Insect Pest Control Laboratory in Seibersdorf supported project planning.

Although the incidence of malaria in South Africa has been considerably reduced, it is still one of the potentially most threatening public health problems in the country. The malaria distribution in South Africa is in the southernmost tip of the continent and in northern KwaZulu-Natal, eastern Mpumalanga and north-eastern Limpopo provinces. South Africa aims to ascertain

the feasibility of using mosquitoes reared under laboratory conditions in prospective SIT suppression programmes against malaria transmitting mosquitoes with the support of project SAF/5/013, 'Assessing the Sterile Insect Technique for Malaria Mosquitoes'. The project is part of the Nuclear Technologies in Medicine and the Biosciences Initiative (NTeMBI), a national collaborative platform managed by the South African Nuclear Energy Corporation (Necsa). In 2012 a genetic sexing strain of *Anopheles arabiensis*, together with the protocols for the maintenance and purification of the strain, were transferred to the counterpart, and staff were trained to treat and manage it. The status of the insectary and mosquito rearing was also reviewed.

Soil fertility and nutrient management

Maize (*Zea mays*) is one of the major crops in Zambia, but high maize productivity is limited by the cost of inorganic fertilizer that the crop needs. With the support of project ZAM/5/027, 'Developing Maize Genotypes for Drought and Low Soil Fertility Tolerance', a study was carried out to evaluate how the use of nitrogen (N) and phosphorous (P) could determine the optimal application rates of coated fertilizers, using N-15 labelled fertilizer to see how this could improve N use efficiency, plant N uptake and increase maize yields

The study showed that coated fertilizer technology can be highly effective in increasing maize grain yield at lower rates of N in medium to high pH soils. High grain yields (5 tonnes/ha) could be obtained at half of the recommended rate of nitrogen (100 kg N/ha) which translated to a significant saving in terms of N fertilizer inputs and hence expenditure for an area of 500 000 ha of maize. The results of this study are likely to shape policy on the type of fertilizer used and fertilizer imports in Zambia.



ZAM/5/027 (left): Urea coated with Agrotain. ZAM/5/027 (right): Dr Munyinda (Project CP) explaining the study to a visitor.

Soil and water conservation

Conservation agriculture systems, specific mulch-based cropping approaches that protect the soil through retention of crop residues, minimum tillage and crop rotation, are being adapted to the agro-ecological conditions of the humid highlands of Madagascar to enhance productivity and ensure its sustainability under MAG/5/019, ‘Improving the Use of Agricultural Resources and Combating Soil Erosion by Optimizing Conservation Agriculture and Developing Strategies for Its Dissemination’. Isotope and nuclear techniques are used to optimize the combined use of crop residues, legumes and fertilizer application in conservation agriculture for Malagasy highland soils, as well as the role of conservation agriculture in combating soil erosion and improving soil water availability in the Malagasy highland soils. The project also helps national organizations to develop strategies for the dissemination of the adapted conservation agriculture systems. Through strong linkages with the regional TC project RAF/5/063, ‘Supporting Innovative Conservation Agriculture Practices to Combat Land Degradation and Enhance Soil Productivity for Improved Food Security’, this important project has been extended beyond the national level.

Malagasy staff involved in the TC project are also collaborating in a coordinated research project (CRP),

‘Soil Quality and Nutrient Management for Sustainable Food Production in Mulch-based Cropping Systems in Sub-Saharan Africa (D1.50.12)’, coordinated by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. This CRP focuses on the development and validation of innovative, robust and more cost-effective isotope techniques of the next generation for improving soil management in the tropics. The synergy between national and regional TC projects and CRPs significantly increases the speed of dissemination of innovative and well-adapted isotope and nuclear techniques to Member States.

In Zimbabwe, climate change has aggravated the country’s problems of decreased soil moisture and fertility with erratic rainfall and mid-season droughts. Project ZIM/5/018, ‘Optimising Water Use and Soil Productivity for Increased Food Security in Drylands through Farmer Participation in Sustainable Technologies’, promotes climate change adaptation technologies that include soil surface management, water harvesting, soil amendment and cropping strategies. The Agency is supporting expert missions to build local human capacity and providing fellowships and scientific visits. The Agency is also providing equipment for research and to upgrade laboratory facilities. By the end of the project, Zimbabwe counterpart institutions and land use planners will be better positioned to disseminate the validated

techniques among smallholder farmers in selected geographic areas.

The first group fellowship facilitated by the IAEA on the use of isotopic and nuclear techniques for soil and water management, supported through RAS/5/064, ‘Enhancing Productivity of Locally-underused Crops through Dissemination of Mutated Germplasm and Evaluation of Soil, Nutrient and Water Management Practices’, successfully concluded on 17 August 2012. The four-week fellowship programme included participation in a one week international symposium on ‘Managing Soils for Food Security and Climate Change Adaptation and Mitigation’, followed by three weeks of intensive training on the use of isotopes to understand soil-water-crop processes and to identify strategies for enhancing crop productivity. During the three-week group training, participants improved their skills, knowledge and technical capacity in the management of soil, water, crops and nutrients in agriculture.

The group fellowship training, supported by a Japanese extrabudgetary contribution through the Peaceful

Uses Initiative, brought together 20 scientists and technical personnel from 16 countries in the Asia and the Pacific region. It is the first time that the IAEA has offered fellowship training in a group setting. Participating countries included Afghanistan, China, Indonesia, Islamic Republic of Iran, Cambodia, Lao People’s Democratic Republic, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Palau, Sri Lanka, Vietnam and Yemen.

A regional training course for 28 participants was delivered in Mexico using internet-based geospatial information visualization tools, under the framework of RLA/5/051, ‘Using Environmental Radionuclides as Indicators of Land Degradation in Latin American, Caribbean and Antarctic Ecosystems’. The training aimed to disseminate and promote work carried out in soil erosion monitoring and land conservation. This five-year project is generating very valuable data on soil erosion which will be used to support recommendations for land conservation.



AFG/5/004: Enhancing Crop Productivity through Mutation Breeding and Pest Control. Fellows meet with IAEA staff upon completion of the training programme in August 2012.

Monitoring and managing water resources and the environment

The Agency's technical cooperation programme helps Member States to achieve their development priorities while monitoring and protecting the air, earth and oceans. Through the TC programme, the Agency provides Member States with information and skills in the peaceful application of nuclear technologies to better understand and manage environmental resources in a sustainable way.

TC projects promote the use of isotopic techniques to understand the source, extent and behaviour of water resources, and to support the development of comprehensive national and transboundary water resource plans for sustainable water management.

TC projects also help Member States to establish or improve analytical laboratories that can measure environmental radioactivity and pollutants in air, land and oceans, and support the ability of Member States to manage and protect marine resources.

Regional highlights

For many African Member States, sustainable utilization and management of water resources is a very high priority in their national development plans. Agency assistance strengthens national and regional capacity in the utilization of nuclear techniques for the optimum utilization of water resources. Isotopic techniques have been used to study the rainwater infiltration rate for artificial recharge of groundwater tables in selected aquifers.

In the Asia and the Pacific region, TC activities in 2012 have focused on marine environmental studies and on pollution monitoring. This includes activities under the RCA Marine Benchmark Study related to the Fukushima radioactive releases in the region. Further attention was also dedicated to strengthening the strategic and sustainable management of groundwater resources, including the development of necessary hydrogeological and climatic data.

In Europe, activities focused on addressing environment pollution from industry and the monitoring of both water and atmospheric pollution.

In Latin America, Member States face continuing and mounting challenges from the impact of climate change, increasing levels of environmental pollution and harmful algal bloom (HAB) outbreaks, increasing scarcity of water resources, as well as the need to

preserve and protect the environment and its resources for future generations. TC activities seek to improve scientific and technical capabilities and thereby to gain recognition and support for the scientific, technical and regulatory counterpart institutions that potentially hold solutions to these problems.

Managing groundwater

Agency support to the development of the Ethiopian National Groundwater Database (ENGDA) under projects ETH/8/007, 'Groundwater and Geothermal Resource Exploration in the Ethiopian Rift Valley and Adjacent Areas', ETH/8/008, 'Environmental Isotopes for Groundwater Management in the Afar Region', and ETH/8/010, 'Assessment of Groundwater Resources in Selected River Basins', has resulted in significant achievements in the analysis of factors underlying the severe drought conditions experienced in large areas of Ethiopia. A comprehensive plan to integrate isotope hydrology into the Ethiopian Groundwater Resource Assessment Programme (EGRAP) in several areas has also been elaborated, and an isotope hydrology laboratory has been established at Addis Ababa University and is now fully operational. A national plan to make the hydrology laboratory economically viable and generate local funds to cover running costs and maintenance of equipment acquired through the TC projects is being implemented.

Artificial recharge is considered to help restore the natural equilibrium of the water tables and raise their piezometric levels, slowing the advance of saline infiltration. In Morocco, project MOR/7/004, 'Using Nuclear and Isotopic Techniques to Study the Rainwater Infiltration Rate for Artificial Recharge of Groundwater Tables in Selected Aquifers', has been assessing the impact of artificial recharge on groundwater at a pilot study site, applying isotope and other techniques for the sustainable development of water resources.

river waters and precipitation, comprising isotope and chemical constituents, was established for use by the wider water resources management community. Information and recommendations, including advice on preventive measures and mitigation, drawn from the use of environmental isotope and chemical techniques, are being provided to different end users including water supply managers, water authorities and other Government departments responsible for water resources management policies.



MOR/7/004: Left: water sample collection in the area of the limestone ridge, Rif, in the northern Morocco. Right: the artificial recharge zone in the Charf Laakab aquifer.

In the Asia and the Pacific region, a new RCA project, RAS/7/022, 'Applying Isotope Techniques to Investigate Groundwater Dynamics and Recharge Rate for Sustainable Groundwater Resource Management', started implementation in 2012. The project seeks to establish a regional hydrochemical and isotope database, which will be useful for sustainable groundwater resource management. Field studies are conducted at the national level, and the participating countries have initiated mechanisms for data analysis and information exchange.

Project RER/8/016, 'Using Environmental Isotopes for Evaluation of Streamwater/Groundwater Interactions in Selected Aquifers in the Danube Basin', was completed in 2012. Managers of the local Water Directorate, Environmental Authority and Water Supply Companies took part in the sampling, analysis and interpretation of isotope data. All participating Member States received software tools for data analysis and modelling. A regional database of water quality parameters for groundwater,

The monitoring and evaluation of the groundwater flow dynamics in dam sites using isotopic techniques is being supported in Paraguay under PAR/7/001, 'Establishing Groundwater Interaction with the Local Aquifer and Surface Water at the Itaipu and Yacyreta Dams'. In Venezuela, project VEN/7/004, 'Use of Agro-environmental Radioactive Soil Tracers for Assessing and Managing Sedimentation Processes Impacting Reservoirs', focuses on assessing and managing sedimentation processes that affect reservoirs. Training and equipment is being provided, with the intention that capacity to investigate sedimentation processes is established at the University Simon Bolivar.

In Mexico, MEX/8/026, 'Supporting Isotope and Hydrogeochemical Characterization of Drinking Water Wells Supplying the León Valley, Guanajuato (Phase II)', is having an important social and economic impact in the Valle de Leon región. The project contributes to an important national water programme financed by Mexico.

Aquifer mapping

In June 2012, thirteen African countries and the Agency, in collaboration with international and regional stakeholders and development partners, initiated a regional long term project, RAF/7/011, 'The Integrated and Sustainable Management of Shared Aquifer Systems and Basins of the Sahel Region'. The project aims to enhance knowledge of the five large transboundary aquifer systems in the region, in order to enable the rational, sustainable management of shared groundwater resources in support of sustainable socioeconomic development. The aquifer systems, shared by thirteen African Member States and two non-Member States of the IAEA, are the Illumedden Aquifer System, the Liptako-Gourma-Upper Volta System, the Senegalo-Mauritanian Basin, the Chad Basin and the Taoudeni Basin.

The project takes a comprehensive approach to sustainable groundwater management, drawing on a range of actors across the UN, national governments and local authorities in the Sahel. It will involve local and governmental authorities in the Sahel across several sectors and at different levels including the transnational/transboundary level, the national level with government institutions, local level with local governments, and the community and consumer level, with water users associations, the informal sector (independent providers of water services) and end-users.

Capacity for evaluating stream-aquifer interactions using environmental isotopes was introduced in El Salvador under ELS/8/010, 'Determining the Interaction Between Ground and Surface Waters in Order to Establish the Behaviour of the Flow of Pollutants in the Basin of the River Acelhuate towards the San Salvador, Guazapa and Aguilares Aquifers'. Projects results have provided information for the sustainable management of the Acelhuate river basin and other watersheds. The country is now able to provide reliable information to decision makers to establish management plans and strategies, using the operational methods and techniques acquired through the project.

The technical and human capacities of the Dominican Republic's National Institute of Hydraulic Resources were developed through DOM/7/003, 'Obtaining Water Balance Estimates of the Los Haitises Catchment Area as Key Information for the Establishment of a Water Management Programme Ensuring the Supply of Safe Freshwater', and the estimation and interpretation of the water balance and vulnerability of Los Haitises aquifer, as well as the development of hydrochemical and flow conceptual models, has been carried out. With this climatic, hydraulic geophysical, chemical and isotopic information, it was possible to determine that the protected area used for drinking water was in fact polluted with animal manure and other contaminants. The origin of the main river feeding the spring had been wrongly estimated and protective measures did not cover the real source of contamination. Such a finding was only possible through the application of stable isotope techniques. Other project findings are supporting the quantification of water storage capacity. Information generated by the project will improve the management of this important aquifer to ensure the supply of safe freshwater to the villages in the central coastal part of the country.

Monitoring pollution and remediating environmentally damaged sites

Under CHI/1/019, 'Establishing the Origin of Heavy Metal Contamination in Water and Soil', seven Chilean professionals have been trained on inductively coupled plasma mass spectrometry (ICP-MS) methods for analysis of toxic elements at trace concentration levels in environmental samples, including sample preparation procedures, calibration and quantification, uncertainty estimation and identification of potential sources of pollution.

Member States in the Asia and the Pacific region are building on the success of a previous RCA project on air pollution to implement a new project, RAS/7/023, 'Supporting Sustainable Air Pollution Monitoring Using Nuclear Analytical Technology', which aims to assist Member States in source apportionment and fingerprinting of air particulate matter pollution. The project data, generated through national samplings

and studies, will serve as an additional element in the existing air monitoring database for planning and intervention.

Good progress was made in Europe in 2012 in the implementation of RER/1/008, ‘Supporting Air Quality Management’. Participating Member States collected and analysed airborne particulate matter (APM) according to agreed protocols, to better understand the status of atmospheric pollution in the Europe region. Specialists were trained in relevant nuclear analytical techniques, while cooperation between nuclear research institutions and environmental authorities was strengthened.

In Azerbaijan, radioactive contamination of former iodine production sites was regarded as a serious impediment to local development. The legacy of the former operations posed potential health concerns to the population because the contaminated sites were located approximately 15 km east of central Baku, close to Baku International Airport and the National Exposition Centre. Under TC project AZB/9/005, ‘Establishing Technology for the Management of Disused Sealed Radioactive Sources’, expert assistance was provided to develop recommendations for the cleaning up of the land around the iodine plants, which was contaminated by charcoal containing natural radionuclides at the Absheron Peninsula. Two IAEA expert missions were arranged to provide recommendations on decontamination technology, waste transportation and disposal before and during the clean-up process. As a result of the clean-up activities, over 150,000 cubic

meters of soil contaminated with naturally occurring radioactive material (NORM) were disposed of in dedicated disposal cells constructed near the national waste storage facility. The IAEA Mobile Unit for Site Characterization confirmed the high quality of the clean-up activities and the effective removal of contaminated material.

Addressing marine and coastal pollution

Regional project RAS/7/021, ‘Marine Benchmark Study on the Possible Impact of the Fukushima Radioactive Releases in the Asia-Pacific Region’, was launched in July 2011. The project received extrabudgetary funding from Australia, Japan, New Zealand, the Republic of Korea and the USA. Project participants comprise 24 countries in the region, including six Pacific Island States (Cook Islands, Fiji, Kiribati, Marshall Islands, Palau and Solomon Islands) that are participating in a TC project for the first time. Project implementation is progressing according to plan. A number of regional training courses have been conducted, including courses on marine sampling and the assessment of radiological risks and quality management systems in laboratories. The first annual project review meeting, held in Vietnam in August 2012, concluded that the project has helped to enhance technical capacities of the participating countries in the area of radioactivity monitoring in marine environments. These include techniques for sampling collection and analysis, quality assurance and data management. The data generated will be compiled in the regional Asia and Pacific Marine Radioactivity Database (ASPAMARD),



AZB/9/005: Cleaning up at the Absheron Peninsula, Azerbaijan – before (left) and after (right) clean up.

and submitted to the IAEA Marine Information System (MARIS). The Philippines has been designated as a repository to coordinate and manage the database. ASPAMARD will be a live database that contains useful data and information. It provides a platform for data compilation as well as exchange of information related to marine monitoring among the countries in the region.

In Cuba, CUB/7/008, 'Strengthening the National System for Analysis of the Risks and Vulnerability of Cuba's Coastal Zone Through the Application of Nuclear and Isotopic Techniques' has contributed

to establishing analytical capabilities needed for assessing environmental quality of coastal ecosystems. Various assessments have been carried out, involving over 4000 laboratory assays in environmental matrices of heavy metals, radioactive substances and organic compounds in key coastal ecosystems in the country as well as in areas of industrial discharge to the marine ecosystem from power plants, refineries, aquacultures, etc. These evaluations have allowed policy makers and environmental authorities to design and implement management actions that minimize environmental risks.

Industrial Applications

Nuclear science and technology can be used in a wide range of industrial applications. A range of safe, tested nuclear techniques can be used to measure pollution levels, identify and measure material properties, sterilize and disinfect, and change chemical, physical and biological properties. The Agency builds Member State capacities in radiation technologies through training and the establishment or upgrading of nuclear centres, and ensures strong quality assurance and quality controls.

Regional highlights

African Member States are showing an increased interest in the industrial applications of nuclear and radiation technology. In 2012, Agency assistance focused on strengthening capacities for the application of radioisotopes and radiation technology to improve and enhance industrial efficiency across the region. Demand for tracer techniques is increasing and several specific radioisotope techniques (sealed sources and tracers) are being applied to assist industries to increase their production efficiency.

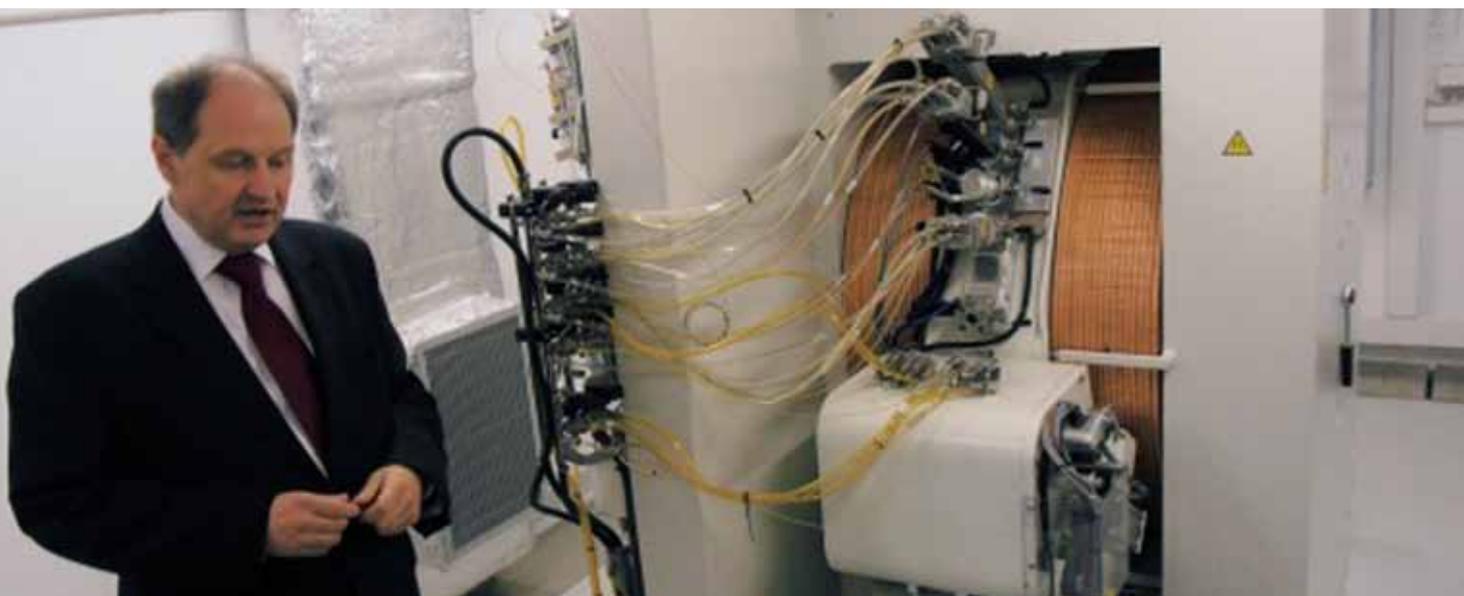
In the Asia and the Pacific region, efforts in the area of industrial applications in 2012 have focused on building the infrastructure and human resource base needed for key industrial applications employing nuclear techniques.

In Europe, the focus has been on establishing infrastructure for human resource capacity building for nuclear sciences and for industrial applications.

In Latin America, maintaining or expanding public investment in capabilities and capacities for the industrial application of radiation technology is a priority for many Member States.

Radiopharmaceutical production

In 2012, after several difficult years in implementing turn-key contracts to establish a cyclotron facility for radiopharmaceutical production at Poland's Warsaw University under projects POL/4/016, 'Cyclotron Facility for Positron Emission Tomography Radiopharmaceutical Production', and POL/4/018, 'Establishing a Cyclotron Facility for Positron Emission Tomography Radiopharmaceutical Production, Phase II', building was finally completed, the cyclotron



POL/4/016: The Radiopharmaceuticals Production and Research Centre at the Warsaw University was opened in May 2012.



ROM/6/017: IAEA experts monitor the installation of a cyclotron and PET radiopharmaceuticals production facility in the National Institute of Physics and Nuclear Engineering 'Horia Hulubei', Romania.

installed and made operational, and Warsaw University staff trained at the contractor's training centre.

In Romania, significant progress was made in 2012 in implementing ROM/6/017, 'Establishing a Cyclotron and PET Radiopharmaceutical Manufacturing Facility and Implementing GMP and ISO Management Systems for Quality Assurance'. The Agency fielded two expert missions, through which the counterpart obtained the knowledge and skills necessary to undertake a qualification and validation programme of their equipment, as well as valuable inputs related to quality in cyclotron facility operation and radiopharmaceutical production.

Agency assistance to Turkey through TUR/6/011, 'Improving Expertise on the Management of the TAEK Proton Accelerator Facility (TAEK-PAF) and Radiopharmaceutical Production', contributed to the production of quality isotopes at the Turkish Atomic Energy Authority's (TAEK) Proton Accelerator Facility (PAF). Two expert missions assisted PAF staff in setting up good management and improved the operation of the PAF cyclotron for quality isotopes.

Other industrial applications

Project RAF/1/004, 'Supporting Radioisotope Technology as a Diagnostic Tool for Plant Process Performance, Optimization and Troubleshooting (AFRA)', promotes the utilisation of radioisotope technology, improves and enhances industrial processes which can lead to better optimization of plant process problems, and ensures long term sustainability

of radioisotope technology utilization. A radiotracer laboratory was set up under 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', at the Kenya Bureau of Standards with the basic capability and facilities to apply radiotracer applications in industry and environment, in particular to measure the flow rate of water in pipes to calibrate the flow meters that are installed in many industrial processes. Software training in radiotracer applications was provided. The current regional project is helping build capacities, and is supporting the upgrade of hardware and software. A regional training course on radiotracers was implemented in November 2012. Several Member States have now established radiotracer and sealed source laboratories with basic hardware and software.

The Agency has been assisting Lebanon to enhance the capabilities of the Lebanese Atomic Energy Commission for surface chemical and structural analysis of biological and organic materials, through LEB/2/007. The project has enhanced capability in the performance of broad-spectrum chemical and structural analyses in the fields of biomedical, biomaterial, and polymer analysis using time-of-flight secondary ion mass spectrometry (TOF-SIMS). New applications of nuclear techniques were introduced in the field of forensic sciences and quality control for different solid state materials, with considerable scientific and economic impact.

In the Philippines, fellowships and scientific visits have been completed in the fields of nuclear instrumentation, electronics and reactor control, as well as general atomic energy development, under PHI/1/017, 'Using E-beam Technology for Industrial, Environmental and Agricultural Applications'. The project, approved in 2012, supports research and development activities using E-beam technology.

Project RER/0/034, 'Enhancing the Characterization, Preservation and Protection of Cultural Heritage Artefacts', supports continued networking and training opportunities for specialists from nuclear science and conservation institutions from the 28 participating Europe region Member States. Regional knowledge and technical skills in the application and integration of different nuclear techniques for characterization and preservation of cultural heritage artefacts have been greatly enhanced.

Project URU/1/006, 'Establishing an Industrial Gamma Irradiation Facility for Multipurpose Use', is preparing Uruguay for the introduction of irradiation techniques. A semi-commercial scale demonstration irradiation facility has been constructed and is being operated by the Technological Laboratory of Uruguay. The laboratory is working with national industry to transfer the technology to the commercial sector, particularly the food industry which is important to the national economy.

Through SAF/0/004, 'Completing the High-Energy Analysis System for Accelerator Mass Spectrometry at iThemba LABS (Gauteng)', the High-Energy Analysis System for accelerator mass spectrometry (AMS) at the iThemba Laboratory for Accelerator-Based Sciences (iThemba LABS) in South Africa is being upgraded jointly with the counterpart. With the AMS system fully complete, iThemba LABS will provide a vital link in the nuclear innovation value chain as South Africa seeks to fulfil its desire to become a technologically self-sufficient nation as articulated by the government. Presently there are about 46 AMS facilities worldwide, with only five in the Southern hemisphere (three in Australia, one in New Zealand and one in Brazil). An AMS facility must be developed in the African continent to support frontier level research across the broadest range of disciplines by fulfilling the new specific needs of science and technology for ultra-rare isotope detection and to ensure both the preservation and development of scientific infrastructure and therefore the enhancement of excellent research that has its main themes and origins in the African continent. The Agency has delivered accessory equipment including a rare isotope detector system and a gas handling system.



KEN/1/004: Participants working on a diotracer application for flow meter calibration in Kenya.



LEB/2/007: TOF-SIMS used for surface elemental, chemical and structural analysis of biological and organic materials.

Energy planning and nuclear power

Although the MDGs do not include sustainable energy development as a stand-alone goal, without increased investment in the energy sector, and major improvements in energy services in developing countries, it will not be possible to meet the MDGs. The Agency helps developing countries to build energy planning capabilities, and supports countries that are exploring the establishment of, or already have, a nuclear power programme.

A number of developing countries are looking seriously at introducing nuclear power as part of their energy mix or expanding its use. The main factors driving interest in nuclear power include concerns about climate change, increases in global electricity demand, high and volatile fossil fuel prices, and the desire of governments to increase national levels of energy security. When a country is considering the introduction of nuclear power into its national energy mix, the Agency advises that it take a comprehensive step-by-step approach (the IAEA Milestones approach), integrating the relevant work of its governmental, industrial and educational institutions.

Through the TC programme, the Agency supports Member States in building the necessary nuclear power infrastructure in an integrated manner through relevant services developed using an 'Assistance Package' mechanism and an appropriate evaluation methodology that includes the Integrated Nuclear Infrastructure Review (INIR) mission. Several INIR missions (for example, in Belarus and Vietnam) have later been used as the backbone for comprehensive planning and finalization of Integrated Work Plans (IWP) in the relevant countries, incorporating all relevant actions and activities required for the sustainable introduction of a nuclear power programme.

Regional highlights

Energy needs in Africa are enormous, but the potential of available natural resources remains unharnessed – or not even properly appraised. Agency assistance in energy planning helps Member States in the region to plan how to meet their energy needs. National and regional projects supplement each other to build national capacity that supports understanding and assessment of how future national energy demand may be met with available energy resources, as well as analysing regional energy supply potentials and opportunities to evaluate pooling and sharing of regional energy resources. Special attention is also given to environmental considerations and the financial viability of various options. Activities in 2012 focused on preparation of national energy plans, improving energy access and affordability, enhancing energy security and sustainable energy development planning.

A number of Member States in Asia and the Pacific continue to show interest in nuclear power and several have taken concrete steps towards constructing their

first nuclear power plants. The assistance provided through national and regional projects focused on strengthening national capabilities for developing national nuclear power infrastructures in embarking countries as well as supporting countries operating nuclear power plants. Developing human resources for nuclear power programmes in some Member States presents specific challenges that require innovative approaches. In this context, mentorship programmes have been established in the region in collaboration with experienced countries such as China, Japan and the Republic of Korea. The programmes enable senior managers and decision makers from countries embarking on nuclear power to acquire the sound knowledge and information needed for decision-making purposes. Given the large number of Member States contemplating nuclear power in the region, particular efforts were also made to help countries to develop and implement national strategies for human resource development, including education in the field of nuclear power engineering.

For advanced embarking countries in the Asia and the Pacific region, the Agency supported self-assessment and the implementation of INIRs. The self-assessment process has been completed by Vietnam and initiated by Malaysia. A Phase II³⁵ INIR mission was conducted in Vietnam in December 2012. It reviewed the status of the national nuclear power infrastructure under 19 issue areas, based on the standard IAEA Milestones Approach. Following intensive consultation with the Agency, the IWP for the development of Vietnam's national nuclear power infrastructure has been further updated. An IWP for 2012–2016 has also been developed and adopted by Malaysia, and initiated by the United Arab Emirates. After the initiation of an IWP for Bangladesh, an IWP 2012–2015 was adopted and is being implemented to achieve Milestone 2.

In Europe, the TC programme continued to support targeted capacity building for effective energy planning and infrastructure establishment for introducing nuclear power. The exchange of knowledge and experiences among Member States was fostered and emphasis was placed on ensuring that any Member State planning the introduction and expansion of nuclear power has a complete understanding of the range of issues and activities to be addressed before implementation of a nuclear power project.

In Latin America the programme goal for energy planning and nuclear power is to ensure that national decisions and policies for sustainable energy production and use are based on the best available methodology and techniques. TC activities also focus on enabling the sharing and exchange of experience and knowledge about energy systems, particularly nuclear power, among Member States.

Energy planning

The TC regional project RAF/2/009, 'Planning for Sustainable Energy Development', provides comprehensive training to facilitate the development of sub-regional energy plans compatible with the national development goals. Planning is extended beyond the

modellers to the government departments that are responsible for the implementation of energy plans. To address the lack of expertise in the region, the project prioritizes 'train-the-trainers' activities, through which training on the Model for Energy Supply Strategy Alternatives and their General Environmental Impacts (MESSAGE) has been provided.

In Seychelles, project SEY/2/001, 'Building Capacity on Energy Planning for the Energy Commission and the Preparation of an Energy Master Plan for the period 2014–2030 to Improve Energy Security' was launched in 2012 to improve energy security and control dependency on petroleum imports while promoting sustainable development. The first stage of the project, which involves the preparation of energy demand projections using the IAEA's Model for Analysis of Energy Demand (MAED), was successfully completed in 2012. The Agency provided a national training course and trained two fellows in Vienna to use their national energy data to develop long-term energy demand scenarios. Upon their return, the fellows presented a draft report to senior officials responsible for energy. The report highlighted the need to expand the national electricity system to meet estimated future demand. The presentation was well received and it was decided that the team would prepare a position paper for consideration by the Cabinet of Ministers.

In the Islamic Republic of Mauritania, MAU/0/003, 'Sustainable Energy Development – Strengthening Capacity in Energy Planning', supported the establishment of national capabilities for sustainable energy development planning with a view to diversifying energy production sources. The project contributed to the development of a national report on energy planning, using the IAEA's MAED to forecast future demand. The energy demand analysis for the country covers the period 2002 to 2025, and the results of the study were presented to national senior officials to serve as a tool to support energy decision-making in the country.

³⁵ Phase II: Preparatory work for the construction of a nuclear power plant after a policy decision has been taken.

In Honduras, under HON/2/001, ‘Identifying Potential Sites for the Generation of Electricity Using Geothermal Energy’, training and equipment has been provided in order to create capacity for the identification of potential geothermal sites that will be used for electricity generation. In 2012, specific training on geothermal energy development and techniques for sampling and analysis of geothermal water was organized for the team at the National Electricity Company.

National training activities in the use of IAEA energy planning tools have been organized in Uruguay through project URU/2/015, ‘Using Long-Term Energy Planning to Assess the Impact of Policies that Manage Energy Dependence on External Supplies’, to ensure that national decisions on energy demand and supply infrastructures take into consideration all possible energy supply and demand options, and are in line with national energy and development policies.

RLA/0/040, ‘Building Capacity for the Development of Sustainable Energy (Phase II)’, has been very important for the Latin America region, providing participating counterparts with the information and knowledge necessary to advise policy and decision-makers on diversifying supply and rationalizing energy use. The project has strengthened different national capabilities in the energy sector for energy analysis and planning. The results will contribute to improving the efficient use of energy resources, and will reduce uncertainty in regard to international market supply. It is expected that a higher level of energy independence, in accordance with national development plans, will be achieved. The project benefited from collaboration with regional organizations such as the Latin American Energy Organization (OLADE).

Introduction of nuclear power

The Agency is supporting capacity building in several Member States around the world on nuclear power infrastructure, for the introduction and expansion of nuclear power programmes, through interregional project INT/2/013, ‘Supporting Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power’. The project also aims to support the establishment of a

global network for the exchange of information, sharing of experiences and transfer of knowledge required to strengthen the Milestones approach. Member States participating in the project have received tools and mechanisms to support the establishment of a sustainable infrastructure.

Two national workshops were carried out in the United Arab Emirates under UAE/2/003, ‘Supporting the Development of National Nuclear Power Infrastructure for Electricity Generation’. The first workshop, on the International Nuclear and Radiological Event Scale (INES), introduced the participants to INES, while the second, on ‘Implementation of the Comprehensive Safeguards Agreement and Additional Protocol’, was designed to provide participants with a basic knowledge of the implementation of safeguards obligations in the United Arab Emirates, including some practical experience and good practices in other IAEA Member States.

JOR/2/007, ‘Developing Nuclear Infrastructure for the Construction and Operation of a Nuclear Power Plant’, aims to build capacity in key national organizations to support the development of the nuclear infrastructure that is needed for the implementation of Jordan’s first nuclear power programme. A mission was conducted under this project in 2012 to review the current status of Jordan’s nuclear power programme and update the Integrated Work Plan.

The Europe region receives assistance on certain aspects of nuclear power infrastructure building through regional project RER/2/007, ‘Enhancing Nuclear Power Infrastructures for Countries Considering Developing or Expanding Nuclear Power Programmes’. Experience is shared through regional workshops on common infrastructure issues. In three regional workshops in 2012, the topics of integrated safety, security and safeguards, feasibility and pre-feasibility studies and how to become a knowledgeable customer of nuclear power were covered.

Belarus’ national nuclear power infrastructure building is supported by the Agency under project BYE/2/004, ‘Developing Nuclear Power Infrastructure and a Staff Training System for a Nuclear Power Programme’. In



BYE/2/004: INIR team visiting Osrovet's NPP construction site.

2012, new computer-based training system modules and a reactor physics laboratory at the Belarusian National Technical University were delivered through the project. In June 2012, an INIR mission showed significant progress in Belarus' nuclear power infrastructure development.

Nuclear power reactors

Project ARG/2/013, 'Supporting a Plant Life Management Programme for Long Term Operation of Atucha-Type Nuclear Power Plants', is contributing to the preparation of the plant life management (PLiM) Programme for the long term operation of Atucha I and Atucha II Nuclear Power Plants by training staff in charge of monitoring concrete degradation and stability and the long-term performance of barriers and reinforced concrete.

In Mexico, MEX/2/016, 'Evaluating the Effects of Extended Power Uprate for Applied License Renewal of Laguna Verde Nuclear Power Plant (LVNPP)', aims to evaluate the effects of Extended Power Uprate (EPU) in the ageing mechanisms of the structures, systems and components of LVNPP. The project will have a major economic impact, and contributes to Mexico's national energy programme.

Radiation protection, nuclear safety and nuclear security

Assistance in radiation protection and radiation safety is provided to Member States through dedicated regional projects covering strengthening regulatory infrastructure, occupational exposure control, medical exposure control, protection of the public and the environment from radiation practices, nuclear and radiological emergencies, education and training, and transport safety.

Agency assistance provided through TC projects is also instrumental in strengthening the capacities of Member States for the prevention and detection of incidents involving nuclear and other radioactive material, as well as for the response to such incidents. These projects aim to support the implementation of relevant legal instruments with the ultimate goal of establishing sustainable security infrastructures and of strengthening aspects of nuclear security such as prevention capabilities at facilities housing nuclear and other radioactive material, and detection and response capabilities at borders and other checkpoints.

Training assists national authorities in developing and implementing physical protection principles and requirements covering systems engineering, facility analysis and coordination between the authorities in charge of nuclear security.

Regional highlights

Supporting the establishment of nuclear safety and regulatory infrastructure is a major TC activity in the Africa region. The growing demand for cancer control services and other applications using nuclear technology, as well as uranium mining and exploration, requires competent, functioning regulatory bodies in Member States. The Agency has developed and implemented an extensive assistance programme in the region, structured around seven thematic safety areas, which aims to establish and strengthen national radiation safety infrastructure with a sound legal framework and competent human resources, in compliance with IAEA safety standards.

In Asia and the Pacific, the Agency provides comprehensive assistance in the areas of radiation and nuclear safety and nuclear security. This has contributed to improving the safety and security infrastructure in Member States in the region. For example, focused regional and national training courses have been implemented on 'Effective and Sustainable Regulatory Control of Radiation Sources' under regional project RAS/9/062, 'Promoting and Maintaining Regulatory Infrastructures for the Control of Radiation Sources'. These courses aim to enhance the knowledge and practical skills of regulatory staff, and to improve the

effectiveness of the regulatory process. A first school of drafting safety regulations in the Asia and the Pacific Region will be implemented in early 2013.

Comprehensive support has been provided to Indonesia, Jordan, Malaysia and Vietnam through dedicated national projects, focusing on strengthening their regulatory infrastructures, and on developing the regulatory instruments and working systems needed to regulate the siting, construction and operational phases of nuclear power programmes in each country.

In Europe, nuclear and radiation safety as well as nuclear security remain top priorities for the region. TC projects covered various areas, including radiation protection of patients and workers, operational safety of research and power reactors, decommissioning and waste management, and regulatory aspects.

In Latin America, radiological and waste safety and nuclear security are increasingly a programmatic priority, as countries in the region increase their capacity to utilize nuclear technology.

Strengthening regulatory infrastructure

In 2012, substantial work was carried out in the Africa region in the area of radiation safety and security. The Agency delivered a comprehensive assistance

programme, structured to support the thematic safety areas of radiation safety infrastructure, occupational protection, patient protection, waste management and emergency preparedness and response that contributed to strengthening the effectiveness and sustainability of national regulatory infrastructures, and to continuous improvements in the performance of Regulatory Bodies in the participating countries. In 2012, seven new radiation safety regional projects were initiated, which address gaps and overlaps in the organization of national authorities for the regulatory control for radiation sources, as well as deficiencies in the national infrastructure to protect workers, patients and the public from the harmful effects of ionizing radiation.

To reach compliance with International Safety Standards and achieve a sound radiation safety infrastructure across the region requires government commitment and ownership. The implementation of the Self-Assessment Tool (SAT) within national regulatory bodies may determine the most appropriate support needed for continuous improvements to national regulatory frameworks for radiation safety, within a results based national action plan.

Under UGA/9/005, ‘Developing a National Regulatory Infrastructure and Occupational Exposure Control Programme’, and UGA/9/006, ‘Strengthening the National Regulatory Infrastructure and Developing a National Nuclear Security System to Control Radiation Sources and Occupational Exposure’, Uganda has made good progress in the first three thematic safety areas (TSAs) in just three years. The Agency first organized a workshop to train staff of the newly established Atomic Energy Council (AEC), and to discuss TC activities and projects related to regulation and safety. This resulted in an action plan, through which quick progress in TSA1 and TSA2 was made. Uganda has now enhanced its radiation and nuclear safety regulatory infrastructure through constant communication and a good implementation structure for UGA/9/006.

The establishment of the Radiation Protection Authority (RPA) in Mauritius serves as a good model for small countries. Through project MAR/9/003, ‘Developing a National Regulatory Infrastructure and

an Occupational Exposure Control Programme’, the Agency helped the country to establish a regulatory authority which did not need to be particularly large. A total of six technical staff members were recruited by the RPA between 2010 and 2012. The Agency assisted in providing adequate training for these staff, and also procured several pieces of radiation detection and monitoring equipment. As a result, Mauritius was able to attain the minimum requirements for thematic safety areas 1 and 2 within three years.

Indonesia’s Nuclear Energy Regulatory Agency (BAPETEN) is making efforts to strengthen the national regulatory infrastructure relevant to the construction and operation of a NPP. The Agency is providing support through a national project INS/9/023, ‘Strengthening Nuclear Safety Regulatory Capacity’. A mission to review national regulations concerning the licensing of NPPs, and to assess the management systems of the Regulatory Body for Safety, was successfully accomplished in July 2012.

A site safety review advisory mission was conducted under VIE/9/011, ‘Improving the Capability for Site Characterization and Evaluation of New Nuclear Installations’, and assistance has been provided to the Vietnam Agency for Radiation and Nuclear Safety (VARANS) on finalizing the draft circular on nuclear safety requirements for siting nuclear power plants. This legal document is the most important national regulation relating to the safety aspects of Vietnam’s first NPP.

The Agency is providing support to Lebanon under LEB/9/005, ‘Establishing a Radiation Early Warning Network System’. The system includes 20 remote monitoring stations, in addition to a central station. This system will allow the Lebanese authorities to strengthen their radiation safety infrastructure and to increase their capacity in emergency response and preparedness.

The first NPP Unit-1 at Bushehr site in the Islamic Republic of Iran reached full power in August 2012. Agency assistance through the TC programme has focused on safety, and has contributed to strengthening the capabilities of the owner and operation organization

of BNPP-1 to properly discharge their functions and responsibilities in the successful start-up of the unit.

In Latin America, specialized assistance was provided to the countries with greater needs to enhance their current radiation safety regulatory infrastructure within the framework of project RLA/9/071, 'Establishing Sustainable National Regulatory Infrastructures for the Control of Radiation Sources in Haiti, Belize, Jamaica and Honduras'. In 2012 these countries were provided with basic equipment to monitor radiation and exercise inspection functions, together with expert advice and other general assistance. In addition, under RLA/9/064, 'Strengthening National Regulatory Infrastructures for the Control of Radiation Sources', a set of guides was produced with practical advice for undertaking the licensing process of a number of industrial and medical practices, and the exercise of regulatory inspection while in operation. Awareness raising field missions will be organized in 2013 to inform national authorities about the status of the radiation safety infrastructure and the upgrades necessary to reach the level requested by the IAEA Safety Standards.

A workshop of heads of nuclear and radiation safety regulatory authorities in the Latin America region was held in Havana, Cuba, under the same project. The workshop was organized on the occasion of the 15th anniversary of the creation of the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies and provided an excellent opportunity to create synergies between the Agency's TC programme and the Forum. The workshop participants identified regional priorities in the field of radiation safety in preparation for the 2014–2015 TC cycle. Two training courses were delivered on the regulatory control of PET/CT cyclotrons, which have a growing use in the region, and on the IAEA-designed Regulatory Authority Information System (RAIS) 3.2 Web version. In December, a widely attended meeting was organized in Rio de Janeiro, Brazil, to discuss radioactive material transport safety and to address the denials of shipment in the region

In Latin America, with the support of the European Commission, a set of workshops were organized to share experiences in safety culture related to occupational

radiation protection under the project RLA/9/066, 'Strengthening and Updating Technical Capabilities for the Protection of Health and Safety of Workers Occupationally Exposed to Ionizing Radiation'. The workshop also covered optimization of occupational radiation protection programmes in facilities related to the production of radionuclides, quality assurance in technical and scientific support organizations for occupational radiation protection, and optimization of occupational exposure in NORM industries.

Health professionals in Latin America and the Caribbean were trained and basic equipment was provided or upgraded in some of the participating countries through RLA/9/067, 'Ensuring Radiological Protection of Patients during Medical Exposures'. Guidelines have also been designed to support the preparation of high quality procedures to monitor the release of patients undertaking nuclear medicine therapy. Software for quality control in mammography was developed in the framework of the project and several activities were organized to improve measures to prevent accidents and injuries in radiotherapy and enhance interventional procedures.

Waste management

The Agency has been assisting Iraq through various programmes to deal with the radioactive waste that resulted from the destruction of the former nuclear sites. The Agency is helping Iraqi authorities to safely decommission the former nuclear facilities and to manage the radioactive waste generated. This includes safe predisposal and disposal of radioactive waste as well as suitable environmental assessment and remediation strategies for the former nuclear sites. The TC projects IRQ/9/007, 'Decommissioning and Remediation of Former Nuclear Facilities and Sites', and IRQ/9/009, 'Strengthening the National Radioactive Waste Management Programme', have been approved by the Agency for four years in order to support Iraq's efforts to address these issues, building on ongoing national and international efforts in this area.



IRQ/9/007 and IRQ/9/009: Radiological characterization for the hot cells and waste tank.

ARG/9/012, ‘Consolidating National Technical Capacity for the Management of Radioactive Wastes’, has contributed to national efforts in Argentina to improve human resources and consolidate existing infrastructure to address nuclear waste management requirements, particularly predisposal of radioactive wastes and the development of methods and processes to characterize, treat and condition nuclear wastes. A low background high purity coaxial germanium detector was also delivered within the framework of the project.

In Latvia, under LAT/9/009, ‘Upgrading the Radiation Monitoring System for the “Radons” Repository at the Baldone Site’, an assessment of the need to upgrade the radiation monitoring system for the repository has been completed by a team of international experts, allowing the procurement of appropriate equipment.

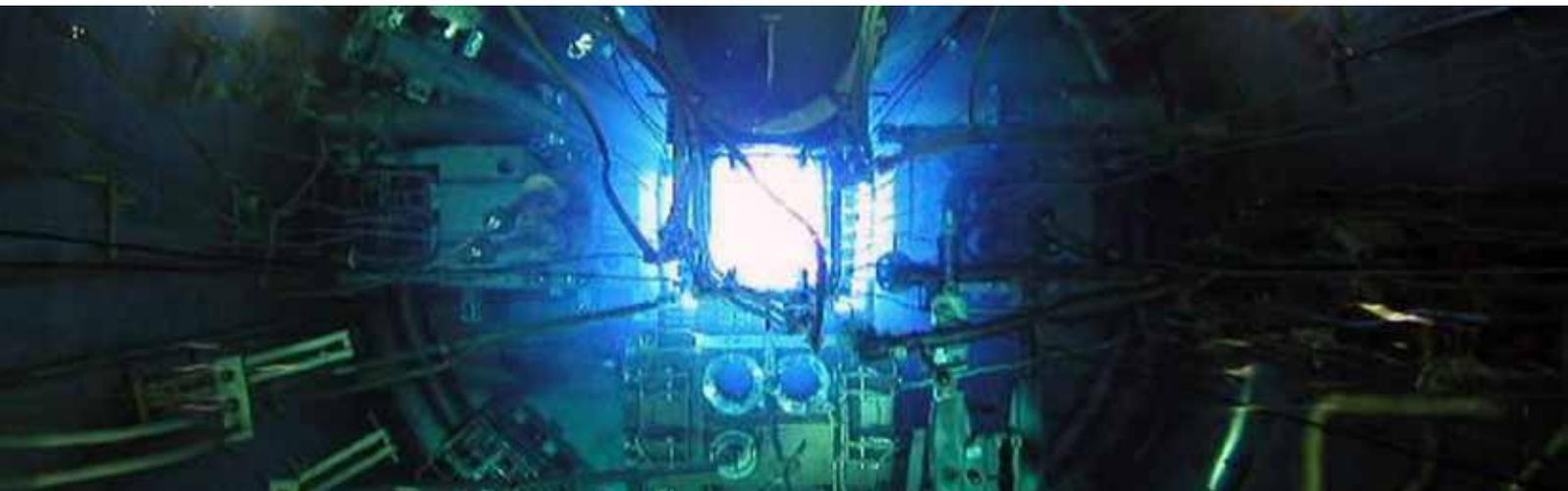
Project SLO/3/005, ‘Developing a New Iteration of Decommissioning, Spent Fuel and Low and Intermediate Level Waste Management Programmes for the Krško Nuclear Power Plant’ was completed in 2012. Through the project, recommendations were provided on boundary conditions, predisposal management of radioactive waste, including decommissioning waste, and options for spent fuel storage for the new iteration of decommissioning programmes. Slovenian experts

were also introduced to decommissioning and waste management approaches applied in different countries.

Project ROM/3/007, ‘Improving Spent Nuclear Fuel and Radioactive Waste Management at ANDRAD’, supported capacity development and strengthened nuclear fuel and radioactive waste management by helping to develop proper and safe administration for low and intermediate level radioactive waste in Romania. Expert advice and personnel training were provided through the project.

Supporting safety in nuclear power plants and research reactors

Africa has ten research reactors in eight countries. These reactors play a significant role in the peaceful applications of nuclear energy in the region, contributing to the education and training of nuclear engineers and scientists, and producing radioisotopes for medical and industrial applications. They play a crucial role in providing data on nuclear fuel for power generation, and on material and system viability, and play a positive role in the socioeconomic development in the region.



ETRR-2 Egypt.

AFRA project RAF/4/022, 'Enhancing Research Reactor Utilization and Safety', emphasizes the training of human resources, and is particularly oriented to making improvements in identified safety areas. These include regulatory supervision of the safety of research reactors, management of ageing, maintenance programmes, radiation protection programmes, safety analysis reports, operational limits and conditions, and emergency preparedness. The project offers an excellent framework for sharing operational information among the participants, and supports strong regional cooperation.

The creation of a Regional Advisory Safety Committee for Research Reactors in Africa (RASCA) is a very important milestone in improving the safety of the African research reactors through regional cooperation and networking. This strategic approach adopted by the AFRA and the IAEA in facilitating effective networking through the establishment of RASCA will lead to significant further steps towards the strengthening of nuclear reactor safety and utilization in Africa with increased ownership of the AFRA States Parties involved. The first Regional Meeting of RASCA was held in January 2012 in the Democratic Republic of the Congo under the regional project 'Enhancing Research Reactors Utilization and Safety' with EU funding in order to enhance the role and responsibilities of research reactor national safety committees.

The current membership of RASCA includes the following AFRA States Parties: Democratic Republic of the Congo, Egypt, Ghana, Morocco, Nigeria and Sudan. Other AFRA States Parties invited to join RASCA include Algeria, Libya, South Africa and Tunisia.

The main purpose of the RASCA is to ensure a high safety level of research reactors in the Africa region. The objectives of the RASCA are to: (i) Provide a platform for fostering regional cooperation, exchange of expertise in various safety areas through peer reviews for research reactors; (ii) Exchange information and share knowledge, operating experience feedback, and good safety practices; (iii) Facilitate the development and maximization of use of resources; and (iv) Promote networking with other similar structures.

In Europe, various projects are underway to support the introduction of nuclear power programmes. In Belarus, a priority need related to the new nuclear power programme is to strengthen the regulatory authority. In 2012, several activities to review national legislation and develop a new national strategy for radioactive waste management were implemented through meetings and expert assistance. In 2012, through project POL/9/021, 'Strengthening Nuclear Regulatory Authority Capabilities to Prepare the Introduction of Nuclear Power', fellowship training and expert meetings on nuclear safety regulations concerning

prospective bidding and licensing processes, as well as on the management systems in the regulatory body, were organized in Poland. Turkey has also decided to embark on a nuclear power programme. Through extensive expert missions under project TUR/9/017, 'Enhancing the Turkish Atomic Energy Authority's capabilities for regulatory oversight of construction, commissioning and operation of new nuclear power plants', the country made significant progress on the seismic assessment of the Akkuyu NPP site and on improving the safety assessment skills of TAEK staff.

Project RER/3/009, 'Supporting Planning for the Decommissioning of Nuclear Power Plants and Research Reactors (Phase II)', supported field experiences and exercises organized in cooperation with the International Decommissioning Network (IDN), which provided both regulators and operators with a realistic understanding of the technical challenges posed and the appropriate safety measures to address them. All reactors in the participating countries have now at least a Preliminary Decommissioning Plan in place, and a true network of confident and self-reliant professionals willing and able to assist each other in solving the most difficult technical problems matured through the project.

In 2012, project RER/9/117, 'Upgrading National Capabilities for Controlling Public Exposure', supported improvements in Europe's regional capabilities to assess radiological impacts, and the consolidation or setup of environmental monitoring networks to share technical knowledge and experiences on the regulatory control of public exposure. Protection of the environment, with emphasis on IAEA Safety Standards, also received attention.

Research reactor safety and utilization was further supported at the regional level in Europe under RER/1/007, 'Enhancing Use and Safety of Research Reactors through Networking, Coalitions and Shared Best Practices'. The topics Code of Conduct on the Safety of Research Reactors, education and training with research reactors, neutron activation analysis and comparative performance testing were supported, following the proposed shift from sub-regional cooperation to a thematic approach. At the same

time, sub-regional cooperation was supported through the coalition meetings of Eastern Europe, Euroasia, Baltic, Mediterranean and the newly established Commonwealth of Independent States Research Reactors Coalition (CISRRC).

TC project ROM/9/030, 'Providing Technical Assistance to the Nuclear Regulatory Body of Romania for Improving Regulatory Skills (Phase II)', aims to enhance the counterpart's capability in the field of nuclear safety, quality management and radiological safety. In 2012, the Agency supported the participation of national experts in relevant meetings, including the CANDU Senior Regulators Meeting and a meeting on Maintenance Optimization and Outage Management in NPPs. Fellowship training and scientific visits were awarded in the areas of safety assessment for radioactive waste disposal, and regulatory infrastructure for nuclear safety. In addition, a national training course for 50 participants was conducted in the field of regulatory infrastructure for radiation and waste safety.

Specific areas where operational safety problems exist in Europe's Member States have been identified by IAEA operational safety review services (Operational Safety Review Team, Peer Review of Operational Safety Performance Experience, long term operation and Safety Culture Assessment Review Team), other internal or external reviews/audits (World Association of Nuclear Operators), events that occurred in nuclear power plants, and internal self-assessment programmes in operating organizations (nuclear power plants and nuclear utilities). Under RER/9/124, 'Improving Operational Safety of Nuclear Power Plants', Member States were assisted in strengthening the operational safety of nuclear power plants through information sharing and mutual support to resolve deficiencies and implement improvement programmes. Four workshops involving over 60 participants from the countries operating NPP reactors took place in 2012.

Many Member States in the Europe region have given high priority to the long term operation (LTO) of nuclear power plants beyond the timeframe originally anticipated (e.g. 30 or 40 years). In 2012, training courses and workshops under project RER/2/009, 'Strengthening Capabilities for Nuclear Power Plant



RER/2/009: Regional Workshop on plant life management approach and ageing management for long term operation in Bulgaria, April 2012.

Lifetime Management for Long Term Operation’, involving over 120 participants from the countries operating nuclear power reactors were held. These events helped Member States to collect and share information on good practices in plant life management for LTO, by comparing the various approaches to the periodic safety review reference and by drawing lessons learned from relevant applications and experiences.

In 2012, under regional projects RER/9/125, ‘Strengthening Nuclear Safety Assessment Capabilities Through the use of the Safety Assessment, Education and Training (SAET) Programme’, and RER/9/126, ‘Advancing Safety Assessment Capabilities, Harmonizing Safety Assessments and Creating Synergy between Deterministic and Probabilistic Safety Analyses’, ten workshops on the safety of nuclear installations were held to help Member States to implement certain aspects of the IAEA Action Plan on Nuclear Safety.

Site and External Events Design (SEED) missions and workshops were delivered through the TC programme in 2012 in Algeria, Islamic Republic of Iran, Jordan, Lebanon, Nigeria, Turkey and Vietnam. Support to siting decisions was also provided under INT/2/013, ‘Supporting Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power’.

Providing legislative assistance

Under projects RAS/0/056, ‘Providing Legislative Assistance’, RAF/0/034, ‘Establishing a Legal Framework for the Safe, Secure and Peaceful Uses of Nuclear Energy’, RLA/0/044, ‘Providing Legislative Assistance’ and RER/9/105, ‘Establishing National Legal Frameworks’, the Agency continues to assist Member States in reviewing and drafting national legislation governing the safe and peaceful uses of nuclear energy. Apart from reviewing draft national nuclear laws as requested by Member States, participants from all regions were supported in attending the second session of the Nuclear Law Institute held in Baden, Austria, from 23 September to 5 October 2012. The session was attended by 60 representatives from 51 Member States.

Emergency preparedness and response

Although significant progress has been made by Member States in the Europe region in establishing national capabilities for emergency preparedness and response, many are interested in further strengthening and harmonizing national arrangements for response to radiological and nuclear emergencies, and in improving compliance with international standards (GS-R-2). In 2012, considerable assistance was provided to individual Member States under RER/9/118, ‘Strengthening and Harmonizing National

Capabilities for Response to Nuclear and Radiological Emergencies’, through regional workshops, training courses and expert services. For example, support was provided to Lithuania to assess its national emergency preparedness and response infrastructure, arrangements and capabilities in accordance with the Guidelines for Emergency Preparedness Review (EPREV) services. In Bulgaria, an IAEA expert mission was fielded to provide advice on plans for the development of a new Accident Management Centre outside the perimeters of the Kozloduy NPP.

In Bulgaria and Lithuania, projects BUL/6/010, ‘Creating a Medical Center for the Treatment of Radiation-Exposed People by Bone-Marrow Transplantation’, and LIT/6/005, ‘Establishing the National Biological Dosimetry Laboratory for Cytogenetic Analysis of Ionising Radiation Exposure and Biological Dose Assessment’, supported targeted capacity building, provision of expert guidance, and procurement of specialized machinery, which contributed significantly in 2012 to enhancing the national emergency preparedness and response infrastructures of both countries.

Under project RER/9/100, ‘Developing National Arrangements and Capabilities for Preparedness and Response to a Nuclear and Radiological Emergency’, which is implemented in cooperation with the European Commission, national systems for emergency preparedness and response to nuclear and radiological

emergencies are being established or strengthened using an integrated all-hazards approach in Armenia, Belarus, Egypt, Georgia, Jordan and Ukraine. Emergency Preparedness Review missions have been carried out in four Member States, and a further two missions are being prepared.

Monitoring NORMs

At the request of Qatar, two expert missions were carried out under QAT/9/006, ‘Monitoring and Assessing Naturally Occurring Radioactive Materials (NORM) from the Oil and Gas Industry’. The first expert mission in July assessed national issues of NORMs from oil and gas industry, identified priority needs and conducted a two-day workshop on IAEA guidance on NORMs. The second expert mission in December reviewed, along with the national regulatory authority, the current and proposed legislation and legal framework related to NORM management, and carried out a national NORM assessment in accordance with the IAEA Safety Standards.



RER/9/118: The EPREV mission to Lithuania in October 2012.

Annex 2. TC programme Fields of Activity, grouped for reporting purposes

Nuclear knowledge development and management

- Capacity building, human resource development and knowledge management
- Building national nuclear legal infrastructures

Industrial Applications/Radiation Technology

- Reference products for science and trade
- Research reactors
- Radioisotopes and radiation technology for industrial applications

Sustainable Energy

- Energy planning
- Introduction of nuclear power
- Nuclear power reactors
- Nuclear fuel cycle

Food and Agriculture

- Crop production
- Agricultural water and soil management
- Livestock production
- Insect pest control
- Food safety

Health and Nutrition

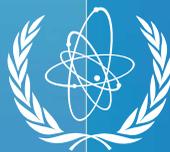
- Prevention and control of cancer
- Radiation oncology in cancer management
- Nuclear medicine and diagnostic imaging
- Radioisotopes, radiopharmaceuticals and radiation technology for health care applications
- Dosimetry and medical physics
- Nutrition for improved health

Water and the Environment

- Water resources management
- Marine, terrestrial and coastal environments

Safety and Security

- Governmental regulatory infrastructure for radiation safety
- Safety of nuclear installations, including siting and hazard characterization
- Governmental regulatory infrastructure for nuclear installation safety
- Radiation protection of workers, patients and the public
- Transport safety
- Nuclear security
- Emergency preparedness and response
- Radioactive waste management, decommissioning and environmental remediation



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