IAEA Technical Cooperation in Africa

International Atomic Energy Agency
Department of Technical Cooperation
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IAEA Technical Cooperation Programme

Foreword by the IAEA Director General

The IAEA's technical cooperation (TC) programme is the main mechanism for assisting Member States in the peaceful, safe and secure application of nuclear science and technology. The programme aims to strengthen technical and human resource capacities, with the long term goal of contributing to sustainable socioeconomic development. Special effort is devoted to supporting less developed countries, where assistance in addressing national development challenges is most needed.

Nuclear techniques can provide a viable, cost effective solution to many development problems. In addition, they generate reliable, timely data that help countries make informed decisions on major issues such as tackling pollution of the seas and oceans. Through the IAEA technical cooperation programme, we have the experience and capacity to contribute to Member States' efforts to achieve the Sustainable Development Goals.

The IAEA has been working with Member States in Africa for six decades. During this time, African countries have greatly increased their capacities in the peaceful application of nuclear science and technology. The impact of the IAEA's technical cooperation activities can be seen in hospitals, laboratories and universities, in the fields of farmers and in national industries. I look forward to our continuing successful collaboration.

Yukiya Amano
Director General

Foreword by the Head of Technical Cooperation

The IAEA's technical cooperation programme is active in 45 countries in the African region. The programme provides support in a wide range of fields that address crucial development issues: human health, non-communicable disease and infant nutrition; improved agriculture, better crops, healthier livestock and environmentally friendly pest management; environmental monitoring and water resource management, to name just a few areas. It draws on regionally available skills and facilities and strengthens networking and linkages between institutions, bringing countries together to resolve common development challenges, and providing not only technical capacity, but the tools to work together and to learn from each other.

This brochure provides an overview of our TC programme in Africa, highlighting successful projects in the region. It aims to raise awareness among legislators, political decision makers, stakeholders, donors and partners of the potential of nuclear techniques for helping to achieve sustainable development in Africa.

I look forward to our continued work with Member States in the African region in the peaceful application of nuclear science and technology, and to contributing to efforts in the region to address development priorities, including the Sustainable Development Goals.

Dazhu Yang
Deputy Director General and
Head of the Department of Technical Cooperation

Atoms for Peace and Development

In 1957, the IAEA was established as the world's "Atoms for Peace" organization. As a member of the United Nations (UN) family, the IAEA works with its Member States and multiple partners worldwide to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world."

The IAEA's technical cooperation programme

The IAEA's technical cooperation (TC) programme is the main mechanism through which the IAEA delivers technical assistance to its Member States. It aims "to increasingly promote tangible socio-economic impact by contributing directly in a cost-effective manner to the achievement of the major sustainable development priorities of each country". Through the programme, the IAEA helps Member States to build, strengthen and maintain their capacity to use nuclear science and technology in support of sustainable national development priorities. The TC programme is developed and managed jointly by the Member States and the IAEA Secretariat. Through technical cooperation, the IAEA also contributes to the attainment of the UN Sustainable Development Goals (SDGs). Some major areas of intervention are the following:

Health: IAEA interventions focus on health issues where nuclear techniques have proved to make a difference, such as cancer, malnutrition and non-communicable disease. They include the use of radiation medicine and the introduction of improved clinical and safety practices, as well as the provision of specialized training for radiotherapy specialists, medical physicists and radiographers.

Food and agriculture: IAEA projects focus on the use of nuclear techniques in the fields of animal health, crop improvement, soil fertility and water management, insect and pest control and food safety. This includes disease prevention through improved laboratories services and vaccine production and artificial insemination and progesterone measurement using radioimmunoassay.

Water resource management: IAEA interventions focus in projects that aim to use nuclear techniques to promote investigations related to integrated water resources assessment, groundwater dependent ecosystem protection and the management of shared aquifers.

Sustainable energy development: The IAEA promotes the dissemination and use of analytical models for energy planning including assistance for the feasibility of nuclear power as a source for electricity generation.

Radiation and waste safety, and nuclear security: TC assistance in this field promotes the development and promulgation of national legislative frameworks, the establishment of regulatory infrastructure and training on radiation protection services. Assistance is also provided to build national capacities for waste management in the safest and most secure manner.

IAEA technical cooperation in Africa

The IAEA provides assistance to African Member States in line with Africa's regional and national development priorities, in fields where nuclear techniques have a comparative advantage or can supplement conventional technologies. The TC programme has been working for 60 years to strengthen Africa's human and institutional capacity for the peaceful and safe utilization of nuclear techniques in the areas of human health, food and agriculture, water and the environment, energy, and industry. In addition to addressing national development priorities, the TC programme aims to support self-reliance and sustainable development in Africa.

The IAEA has 45 Member States in the Africa region which participate in the TC programme, of which 26 are least developed countries (LDCs). Membership for two additional countries (Cabo Verde and Comoros) has been approved by the General Conference, and will take effect once the two countries deposit the legal instruments with the IAEA.

IAEA Member States in Africa

Algeria	Eswatini	Namibia*
Angola*	Ethiopia*	Niger*
Benin*	Gabon	Nigeria
Botswana	Ghana	Rwanda*
Burkina Faso*	Kenya	Senegal*
Burundi*	Lesotho*	Seychelles
Cameroon	Liberia*	Sierra Leone*
Central African Republic*	Libya	South Africa
Chad*	Madagascar*	Sudan*
Congo	Malawi*	United Republic of Tanzania*
Côte d'Ivoire	Mali*	Togo*
Democratic Republic of the Congo*	Mauritania*	Tunisia
Djibouti*	Mauritius	Uganda*
Egypt	Morocco	Zambia*
Eritrea*	Mozambique*	Zimbabwe

** Least Developed Countries*

From 2000–2017, the TC programme for Africa has implemented a total of 1101 projects (including 139 regional projects) in the thematic areas of human health, food and agriculture, water resource management, energy, environment and safety. The IAEA is currently implementing 470 (new and ongoing) national and regional technical cooperation projects in Africa.

Funding the TC programme and resource mobilization

The TC programme is funded by the IAEA Technical Cooperation Fund (TCF), extrabudgetary resources including contributions from donor countries and international and bilateral organizations, government cost sharing and in-kind contributions. TCF support allocated to the Africa region in 2013 was €18.7 million, which had risen to €22.2 million by 2017. Extrabudgetary contributions provided to Member States in Africa since 2013 can also be seen in Figure 2.

In addition to project support, the IAEA helps Member States in Africa to develop bankable project documents and to establish platforms for cooperation with development banks and other financial institutions.

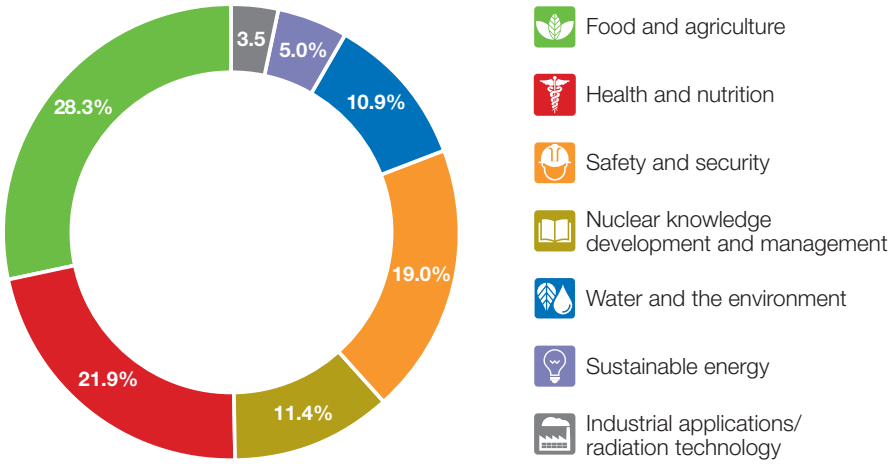

Figure 1: Disbursements in Africa by technical field, 2017

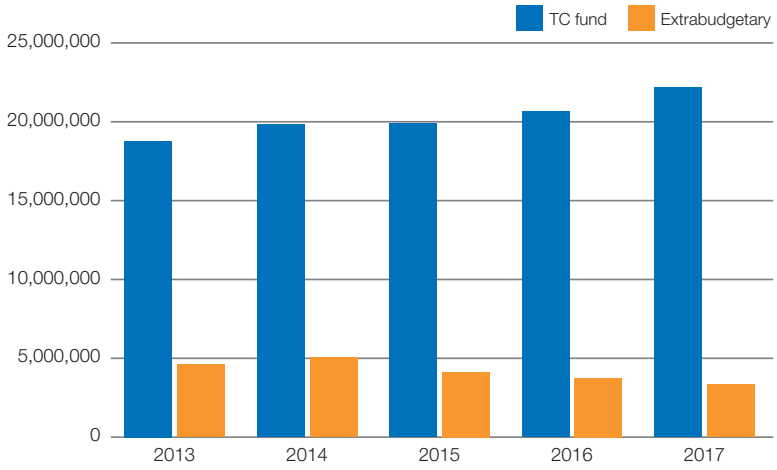

Figure 2: TC Fund and extrabudgetary contributions to Africa, 2013–2017 (in euros)

The TC programme in Africa and the Sustainable Development Goals (SDGs)

In order to provide effective support to Africa, the IAEA has aligned its TC programme with the national and regional development needs and priorities of its African Member States, as well as to nine of the SDGs in order to contribute to ending hunger and ensuring good health and well-being, the availability and sustainable management of water and access to reliable, sustainable energy, the promotion of industry and innovation, combatting climate change, the conservation and sustainable use of marine resources and the environment, and strengthened implementation and revitalized global partnerships for sustainable development.

The IAEA works closely in partnership with other United Nations agencies, research and civil society organizations at national and international levels to maximize the contribution of nuclear science and technology to the attainment of Member State SDG targets. Through its TC programme, the IAEA will contribute to the achievement of the SDGs, particularly in areas such as food and agriculture, human health, water resources management and the environment.

The Sustainable Development Goals directly addressed by the IAEA:

Partnerships and cooperation in development

Partnerships are at the heart of the IAEA's technical cooperation activities. Close collaboration between the IAEA, its Member States, United Nations organizations and other international and civil society organizations helps to maximize the impact of the IAEA's support towards the achievement of development priorities.

The IAEA's regional TC programme is an essential tool to promote technical cooperation among developing countries (TCDC), address common challenges efficiently and effectively, foster the exchange of best practices, and encourage networking. In Africa, much of this work is done through the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA). AFRA projects RAF0038, 'Promoting Technical Cooperation Among Developing Countries (TCDC) in Africa through Triangular Partnerships', and RAF0046, 'Promoting Technical Cooperation among Developing Countries through Triangular Partnerships and Sustaining Regional Ownership of the AFRA Programme', have supported TCDC initiatives in the area of triangular partnerships. For example, the effective use of radiotracers in industry was promoted through triangular partnerships between Morocco, as a more advanced country in the use of this technology, with Egypt, Kenya, Sudan and Zimbabwe. Côte d'Ivoire and Morocco are collaborating in using radioisotopes in conservation agriculture. Ghana and Tunisia are working together to establish digital radiography in non-destructive testing. Cooperation between Algeria and Burkina Faso has resulted in the calibration of several instruments used in occupational exposure control in Burkina Faso.

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

On 15 February 2018, the IAEA and the African Union Commission (AUC) concluded Practical Arrangements for the safe, secure and peaceful use of nuclear technologies for sustainable development in Africa. AUC Chairperson H.E. Moussa Faki Mahamat and IAEA Director General Yukiya Amano signed on behalf of their respective organizations. The Practical Arrangements are the first signed between the two parties, and cover a four-year period (2018–2022). They provide a framework for cooperation in the areas of: human health; food and agriculture; water and the environment; industrial application of nuclear technology; energy planning and nuclear power infrastructure building; and radiation and nuclear safety and security.

Food and Agriculture in Africa

Technical cooperation in the area of food and agriculture in Africa

Enhancing capacities and capabilities in the area of food and agriculture is one of the main development priorities for African Member States. Reducing food insecurity by increasing the output of staple crops, while reducing loses due to diseases or drought, are key areas of focus. Different nuclear techniques applied to plant breeding are helping increase yields by up to 30% in Central and Western Africa, and to develop varieties resistant to disease and adaptable to climate change. Improving the food safety of agricultural products for both domestic consumption and for export to lucrative markets in Europe or North America is another priority area benefiting from the application of nuclear techniques. The TC programme has focused on building capacities for the national management of food resources and the control of transboundary animal diseases, contaminants, and other pollutants that might affect food safety.

Project highlights

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

Handing the unmanned aerial vehicle to the Minister of Agriculture, Animal Industry and Fisheries, HE Vincent Bamulangaki Ssempijja. (Photo: Ministry of Agriculture, Animal Industry and Fisheries, Uganda)

Nuclear and isotopic techniques were used to analyse ethephon residues in pineapples from Benin. (Photo: M.Gaspar/IAEA)

Benin: Benin achieved important milestones in terms of food safety and food security. Pineapple farmers suffered under a voluntary export ban due to chemical residues found in Benin's pineapple exports. This led to a loss of income and also a reduction in farm employment in a sector that has been identified as one of three key growth areas in the country's development plan. Thanks to a comprehensive food safety programme supported under the project BEN5009, 'Monitoring Safe Food Supply through Total Diet Studies and the Application of Nuclear

and Complementary Analytical Techniques', Benin's farmers can again export pineapples to the European Union, their most lucrative market, following the set-up of a food safety surveillance system with the help of the IAEA and the Food and Agriculture Organization of the United Nations (FAO).

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

BKF5017: Genetic laboratory, Institute for the Environment and Agricultural Research (INERA), Burkina Faso. (Photo: M. Shamsuddin/IAEA)

Nuclear derived techniques have so far shown that Lesotho is free of foot-and-mouth disease, one of the most infectious diseases that kill livestock. (Photo: D. Calma/IAEA)

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

Human Health and Nutrition in Africa

Technical cooperation in the area of human health and nutrition in Africa

Human health and nutrition are key development priorities in many African countries. In Africa, the leading cause of years lost due to premature death comprises both communicable and non-communicable diseases. This includes ischemic heart disease, stroke, HIV/AIDS, malaria, lower respiratory infection and tuberculosis. Sub-Saharan Africa is particularly affected by this double burden of disease.

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

Inauguration of new cancer institute. (Photo: Uganda Cancer Institute)

Project highlights

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

Regional: In order to continue supporting AFRA State Parties' good operating standards and quality systems for hospital preparation of radiopharmaceuticals, the IAEA, together

with AFRA State Parties, developed the regional technical cooperation project RAF6049, 'Strengthening and Improving Radiopharmacy Services (AFRA)'. Under this project, the development and testing of an e-learning postgraduate programme in radiopharmacy has been finalized, and planning for implementation in Africa has been completed. This e-learning programme is a medium to long term sustainable solution, which aims at providing harmonized training curricula in radiopharmacy for competent qualified technicians and radiopharmacists in AFRA State Parties at Postgraduate Diploma and Master's Degree level. A network of universities has been established to develop, maintain and run the e-learning platform, prepare training materials, and evaluate and assess trainees. The network includes the Goce Delev University in Macedonia and the University at Ferrara, Italy. The installation of the e-learning modules in AFRA State Parties would allow the training and empowerment of qualified technicians and radiopharmacists, and contribute to improved patient safety in the practice of nuclear medicine.

Participants at the radiopharmacy training in Macedonia,16 January to 10 March 2017. (Photo: E. Janevik/Goce Delcev University in Stip)

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

Regional: A successful regional training course on Data Management took place in Jimma, Ethiopia, from 24–28 April 2017 within the framework of project RAF6052, 'Using Nuclear Techniques to Assess Body Composition in Children Previously Treated for Moderate and Severe Acute Malnutrition and Their Medium-Term Benefits and Risks in Six Countries'. Data analysts from eight African Member States were trained on how to design electronic data collection forms and how to ensure data quality, integrity and security in nutrition related initiatives. Data management remains a major gap and weakness in resource-poor settings in Africa. The training was among the first successful attempts in recent years for African nutrition projects within the IAEA to streamline data management and enable rich exchange between experts from developed countries and counterparts from resource-limited settings.

Water and the Environment in Africa

Technical cooperation in the area of water and the environment in Africa

In Africa, assistance to Member States in 2017 focused on supporting national efforts to characterize groundwater resources to enhance evidence-based decision-making on the judicious use of groundwater resources. In the Sahel region, the results of the regional project on characterizing shared groundwater resources in five basins were published. Countries ready to undergo the IAEA Water Availability Enhancement methodology were identified, and will play an important role in the follow-up Sahel project. With TC programme support, isotopic investigations are contributing to the efficient management of water resources, ensuring sustainable livelihoods and complementing efforts to enhance human health, food security and agriculture.

The TC programme also continues to provide support to African Member States in developing and implementing climate change mitigation and adaptation strategies, through projects to control soil erosion and land degradation, improve soil fertility, and manage and sustainably exploit water resources.

Project highlights

Tunisia: Two national projects, TUN7002, 'Using Isotopic and Hydrochemical Tools for Management and Development of Water Resources in Coastal Aquifers and Identifying the Origin of Groundwater Degradation', and TUN7003, 'Using Isotope Tracers Techniques for Integrated Sustainable Groundwater Management', have improved the understanding of the recharge process of Tunisia's Menzel Bouguiba and Ghar el Melah aquifer systems. A better insight into the consequences of overexploitation of groundwater resources due to urbanization and other human factors has been achieved. In addition, a thorough assessment of the consequences of climate change and related human activities on the degradation of groundwater quality, the interplay between marine intrusion and overutilization of groundwater resources, the vulnerability of groundwater to pollution and the extent to which such factors affect the sustainable use of available resources has been made, and useful data that can inform strategic and operational decisions have been derived. The various assessment exercises have been carried out in tandem with a range of human and institutional capacity building measures, contributing to the overall improvement of water resource management in the country.

Regional: Scientists from countries participating in the Sahel project RAF7019, 'Adding the Groundwater Dimension to the Understanding and Management of Shared Water Resources in the Sahel Region' – Algeria, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal and Togo – have been trained by the IAEA to carry out a detailed examination of groundwater using nuclear-based techniques. The project looked at the aquifers and basins that provide the main source of groundwater to the region's population: the Lullemeden Aquifer System, the Liptako-Gourma-Upper Volta System, and the Senegalo-Mauritanian, Lake Chad and Taoudeni basins. Spreading over a 7-million square kilometre area, the Sahel is home to 135 million people across West, Central and North Africa. The area has suffered from extreme drought in recent decades, affecting agriculture and causing widespread hunger. Without many rivers to draw water from, groundwater systems are the region's main source of fresh water. The data gathered has so far provided valuable information for the participating countries,

Isotope hydrologist takes water samples from a well in Bangui, Central African Republic. (Photo: L. Gil/IAEA)

Director General Amano visits the IThemba Laboratory for Accelerator-Based Sciences at Wits University in South Africa. (Photo: C. Brady/IAEA)

including origin and flow patterns between the different aquifers and contamination levels in the basins, and reports on groundwater resources in five basins were published in 2017.

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

Other areas of IAEA technical cooperation support in Africa

In addition to these thematic areas, the IAEA has been effectively applying nuclear techniques to support African Member States in achieving socioeconomic development goals that include meeting energy needs, strengthening industry, developing human resources, and building enhanced nuclear and radiation safety infrastructure.

Strengthening education and training infrastructure, and building competence in radiation safety in Africa

Nuclear and radiation safety is still an area of high priority in Africa. Progress has been made in implementing the International Basic Safety Standards throughout the continent, giving due attention to the different Thematic Safety Areas. The IAEA is continuing to provide support at both regional and national levels in order to develop national capacities in radiation protection and nuclear and radiological safety, provide education and training and to strengthen the national radiation safety infrastructure.

In 2017, the Algiers Nuclear Research Centre hosted the Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radiation Sources for French-speaking countries while the Graduate School of Nuclear and Allied Sciences in Accra, Ghana hosted the same training course for English-speaking candidates. These courses, conducted under project RAF9056, 'Strengthening Education and Training in Radiation Safety and Sustaining', brought together 44 participants from 27 English and French-speaking Member States in the African region. The participants were holders of a university degree in physical, chemical or life sciences and engineering, and were working as radiation protection officers in national regulatory bodies or earmarked to work in the field of radiation protection and the safe use of radiation sources in their countries. The aim of the PGEC in Radiation Protection and the Safety of Radiation Sources is to meet Member States' needs for initial training for professionals at graduate level (or equivalent) that will enable them to acquire a sound basis in radiation protection and the safety of radiation sources. This course also serves as foundation knowledge for personnel who may be appointed as regulators or radiation protection officers and qualified experts in their respective countries.

Fellows of the PGEC in Ghana (2017).

Until 2017, Africa was the only region without an ALARA network. With the objective of improving occupational radiation protection, twenty-five Member States from Africa joined together to create the African ALARA Network (AFAN) in 2017. Following the ALARA principle, AFAN will facilitate the exchange of information, contribute to the harmonisation of radiation protection policies and practices, and promote the implementation of the ALARA principle. AFAN was created under the framework of project RAF9057, 'Strengthening National Capabilities on Occupational Radiation Protection in Compliance With Requirements of the New International Basic Safety Standards'.

Strategic planning and regional cooperation

Strategical framework for technical cooperation in Africa

The Division for Africa is finalizing its first strategical framework for technical cooperation in Africa for the next six years (2018–2023), aligned with the IAEA Mid-Term Strategy, African Development Bank 'High-Five', African Union Agenda 2063 and the Sustainable Development Goals. This Strategy will describe the strategic objectives for technical cooperation in Africa and will serve as a guiding tool in the provision of assistance to Member States.

Dr Eng. Joseph K. Njoroge, Principal Secretary, Ministry of Energy and Petroleum, and Mr Dazhu Yang, IAEA Deputy Director General and Head of the Department of Technical Cooperation at the signing of Kenya's CPF for 2017–2022, May 2017. (Photo: J.Krickl/IAEA)

Country Programme Frameworks (CPFs)

The formulation and delivery of the national TC programme is guided by the Country Programme Framework (CPF) process. A mid-term strategic planning document of between five to six years, CPFs reflect an agreement between national stakeholders and the IAEA that nuclear science and technology can contribute directly and cost effectively to national development in a range of specified topic areas. The development of the CPF document is a highly interactive process, which includes intensive consultations with national counterpart institutions and sometimes donors, taking into account linkages to the United Nations Development Assistance Framework (UNDAF), in order to prioritize development needs where nuclear technology can be applied for sustainable socioeconomic development. CPFs also aim to identify key partners and potential donors and in the future are expected to be aligned with the SDGs. As of June 2018, 40 African countries have signed CPFs with the IAEA.

United Nations Development Assistance Framework (UNDAF)

The IAEA participates in the UNDAF process where possible, to identify areas where nuclear techniques could be usefully deployed in partnership with other UN organizations, and to ensure that their application is integrated with existing development initiatives. In 2017, the IAEA co-signed new UNDAFs with Botswana, Gabon and Morocco.

Regional cooperation – AFRA

The countries of Africa face many common development challenges which have a regional dimension. The African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA), which came in to force in April 1990, is a regional cooperative framework that encourages nuclear research and the peaceful application of nuclear science and technology for development in Africa. Forty-two African Member States participating in the TC programme are now AFRA State

Parties. Using a cooperative approach, AFRA seeks to enlarge the contribution of nuclear science and technology to social welfare, health and education throughout Africa, using TCDC. AFRA is currently in the process of finalizing the Regional Cooperative Framework document to extend its commitment to the continent for 2019–2023.

The AFRA Fund

The AFRA fund was established in 2009 to mobilize financial resources to sustain and enhance nuclear science and technology activities in Africa. Between 2017 and 2018, the total contribution of AFRA States Parties to the AFRA Fund was approximately €1 million. The Fund supports the implementation of the unfunded portion of the AFRA programme. The Fund is a vehicle for collecting the voluntary contributions of AFRA States Parties, the main contributors to the Fund, as well as other donors.

Regional Designated Centres

A regional designated centre (RDC) is an established African institution able to provide regional services on the basis of the AFRA agreement and for which IAEA and donor support may be requested within the context of approved programmes. RDC designations are agreed upon by the AFRA States Parties.

As of 2018, 32 RDCs have been designated in fields including human health, food and agriculture, industry, safety and security, energy and the environment. RDCs play a major role in providing training and expert services for the development of the region. AFRA is currently in the process of expanding its RDC network.

RDC support to postgraduate training

Under the AFRA Masters Fellowship Programme in Nuclear Science and Technology, which is now in its sixth cycle, 10 candidates from African Member States were awarded fellowships to undertake a two-year Masters Programme in Nuclear Science and Technology at two AFRA RDCs: the Department of Nuclear Engineering, University of Alexandria, Egypt, and the Graduate School of Nuclear and Allied Sciences, University of Ghana. The programme has now selected and awarded 61 fellows since its beginning.

AFRA Regional Designated Centres (RDCs)

Field of expertise	Country
Radioactive Waste Management	South Africa
Clinical Radiotherapy and Medical Physics	South Africa Morocco Egypt
Non-Destructive Testing Techniques	South Africa Tunisia Morocco
Mutation Breeding and Related Biotechnology	South Africa
Repair, Preventive Maintenance & Quality Control of Medical and Scientific Instruments	Egypt
Irradiation Technology	Egypt
Secondary Standards Dosimetry Laboratory	South Africa Algeria
Energy Planning	South Africa Sudan
Higher and Professional Education	Egypt Ghana
Environmental Isotope Hydrology	Egypt Morocco Tunisia
Nuclear Medicine and Related Medical Physics	Algeria
Training and Education in Radiation Protection	Algeria Ghana Morocco
Stable Isotope in Human Nutrition	Botswana Morocco
Communicable diseases	Cameroon Kenya South Africa
Food safety	Algeria Nigeria
Academic and Clinical Training in Medical Physics	Ghana
Animal Health and Reproduction	Tunisia

Human and institutional capacity building

The IAEA's TC programme supports human and institutional capacity building activities, networking, knowledge sharing and partnership facilitation, as well as the procurement of equipment. It is committed to helping developing Member States achieve self-reliance in the nuclear science and technology field. Human resource capacity building is provided through expert missions and meetings, fellowship training and special national, regional and interregional training courses focusing on the safe, effective and peaceful application of nuclear science and technology.

To complement IAEA efforts to develop Africa's next generation of nuclear scientists, approximately €11.1 million of equipment was procured in 2017 to ensure that laboratories are able to use the latest technology to address the challenges faced by the continent.

Several African Member States have successfully established nuclear institutions, including universities, training centres, laboratories and research facilities, and the IAEA continues to support these institutions. Many of these institutions have been recognized as AFRA-RDCs.

Training courses

Between 2013 and 2017, the IAEA conducted 228 regional training courses in the areas of human health, food and agriculture, water resource management, industry, energy, environment, and safety and security. In 2017, 50 training courses were held and 1139 candidates trained. These efforts support the development and sustainability of a new generation of scientists in Africa.

Participants at the Regional Training Course on Individual Monitoring for Internal Radiation Sources, July 2017. (Photo: IAEA)

IAEA fellowships and scientific visits

The successful implementation of nuclear techniques for socioeconomic development requires skilled personnel, technicians, and engineers. IAEA fellowships and scientific visits provide important support in this area. Between 2013 and 2017, the IAEA awarded 3518 fellowships and scientific visits to individuals from African Member States in various thematic fields. IAEA fellowships and scientific visits contribute to the successful transfer of knowledge and technology to fellows' home institutions, their home countries, and the TC projects in which they are involved.

Gender in the TC programme

Women are encouraged to participate in every aspect of the TC programme, which aims to mainstream gender and enhance gender equality. Female participation as a fellow, scientific visitor or in other training activities increases women's access to professional opportunities and education in science and technology, and supports gender equality in nuclear related fields.

Programme of Action for Cancer Therapy (PACT) and imPACT Reviews

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

Burundi: Most cancer patients in Burundi are diagnosed at a late stage. Services are further constrained by a shortage of qualified medical staff. Diagnosis and treatment capacities are not adequate to meet the population's needs. Recommendations emphasized the need to strengthen national efforts for cancer control, establish a population-based cancer registry to determine the actual cancer burden, improve access to cancer diagnosis and treatment including using nuclear technology in the short and long term, and establish an adequate radiation safety infrastructure.

Congo: Health services are concentrated in the two biggest cities, and radiotherapy services have not been available since 2015. Recommendations included reinforcing national efforts for cancer control, re-establishing and improving cancer registration structures, restoring and enhancing accessibility to radiotherapy services, and establishing an adequate radiation safety infrastructure.

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

Eswatini: Eswatini faces major cancer control challenges, with limited capacity for diagnosis and treatment, and a lack of radiotherapy facilities. Eswatini concluded the draft of its first national cancer control plan, and established a dedicated cancer control unit within the Ministry of Health and a population-based cancer registry. Recommendations highlighted the urgent need for specialist radiologists and an adequate legal and regulatory framework.

Togo: Togo is committed to strengthening access to cancer care services. Recommendations focused on the need to strengthen cancer control planning and to establish and implement the legal and regulatory framework for radiation safety to ensure the radiation protection of workers and patients. It was also recommended to improve access to cancer diagnosis and treatment services at the national level.

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