African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology

Fostering Nuclear Science and Technology for African Development

AFRA

AFRA

AFRICAN REGIONAL COOPERATIVE AGREEMENT FOR RESEARCH, DEVELOPMENT AND TRAINING RELATED TO NUCLEAR SCIENCE AND TECHNOLOGY

FOSTERING NUCLEAR SCIENCE AND TECHNOLOGY FOR AFRICAN DEVELOPMENT

September 2019

www.afra-web.org

AFRA

Contents

African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) – Fifth Extension

Pursuant to Article XIV.2 of the original Agreement, the fifth extension entered into force on 4 April 2015, upon expiration of the fourth extension, and will remain in force for an additional period of five years, i.e. through 3 April 2020.

State Parties to the Agreement: 41 (as of September 2019)

1. Algeria	22. Madagascar
2. Angola	23. Malawi
3. Benin	24. Mali
4. Botswana	25. Mauritania
5. Burkina Faso	26. Mauritius
6. Burundi	27. Morocco
7. Cameroon	28. Namibia
8. Central African Republic	29. Niger
9. Chad	30. Nigeria
10. Congo	31. Rwanda
11. Côte d'Ivoire	32. Senegal
12. Democratic Rep. of the Congo	33. Seychelles
13. Djibouti	34. Sierra Leone
14. Egypt	35. South Africa
15. Eswatini	36. Sudan
16. Ethiopia	37. Tunisia
17. Gabon	38. Uganda
18. Ghana	39. United Republic of Tanzania
19. Kenya	40. Zambia
20. Lesotho	41. Zimbabwe
21. Libya	

Introduction

The African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) is an inter-governmental Agreement, among countries in the Africa region which was established in February 1990 to promote cooperation among the International Atomic Energy Agency (IAEA) Member States in the region, as well as between these and the IAEA, in the peaceful applications of nuclear science and technology.

AFRA mission derives from the AFRA Agreement, which is to be the leading regional organization in Africa and vehicle of the States for the effective promotion and coordination of peaceful applications of nuclear science and technology for socioeconomic development on the African continent.

The international Atomic Energy Agency (IAEA) is not party to AFRA, but provides technical and scientific backstopping as well as financial and administrative support, in accordance applicable to the Agency's technical cooperation programme.

I. AFRA MANDATE

The AFRA Mandate is guided by the interests of AFRA Member States in terms of regional cooperation and based on their priority needs as described in the AFRA Agreement.

AFRA MANDATE

Through a regional approach to sustainable development, AFRA seeks to:

- Maximize the utilization of available infrastructure and expertise in Africa in the field of nuclear science and technology;
- Accelerate moves toward regional self-sufficiency in peaceful applications of nuclear techniques by establishing and strengthening necessary infrastructure, coordinating intellectual and physical resources and disseminating innovative methods and practices cost-efficiently; and
- Deepen the commitment of Member States to the application of nuclear science and technology for their socioeconomic development through sustained funding.

II. AFRA VISION AND MISSION

The AFRA mission derives from the AFRA Agreement, which states that "*…the Governments Parties to this Agreement […] recognize that, within their national atomic energy programmes, there exist areas of common interest wherein mutual cooperation can promote the more efficient utilization of available resources. […] The Government Parties undertake […] to promote and coordinate cooperative research, development and training projects in nuclear science and technology through their appropriate national institutions*".

AFRA VISION

To be the leading regional organization in Africa and vehicle of the Member States for the effective promotion and coordination of peaceful applications of nuclear science and technology for socioeconomic development on the African continent.

AFRA MISSION

"Based on the social context and the economic goals of its Member States, AFRA is to develop capacity, establish and facilitate, through regional cooperation, the use of infrastructure to exploit nuclear science and technology applications safely and cost effectively in order to meet the challenges of sustained communal socioeconomic development on the African continent"

III. STRATEGIC GOALS

The AFRA goals are:

Goal 1: To enhance the sustainable contribution of nuclear science and technology to meet the developmental needs and interests of Member States;

Goal 2: To entrench the culture of mutual assistance and regional cooperation in the effective utilization of available nuclear expertise and infrastructure;

Goal 3: To deepen the culture of nuclear safety and security at regional and national levels in the gainful exploitation of nuclear science and technology;

Goal 4: To continuously interact with and create awareness amongst decision makers, civil society, users and the general public on the benefits of peaceful application of nuclear science and technology;

Goal 5: To institute good governance and excellence in management of the activities in the region.

IV. AFRA STRATEGY

- Priority attention to the Least Developed Countries (LDCs), including practical strategies to address their specific needs and overcome their difficulties.
- Promotion of the participation of women and youth in nuclear science and technology, through the design and implementation of specific activities and initiatives in collaboration with women and youth associations, and networking and sensitization of decision makers in Member states.
- Particular attention to the efficient management and preservation of nuclear knowledge, skill acquisition and retention and networking
- Sustainable implementation of AFRA can only be achieved through ownership of the programme by Member States
- Enhancement of success of AFRA project implementation by building appropriate linkages with development plans of Member states with statutory funding
- Evolve an appropriate mechanism of adequate Member States participation in funding the activities of the AFRA programme
- Assumption of greater management responsibilities by AFRA Member States
- Particular attention to strengthen coordination and cooperation aimed at filling the relative gap in the nuclear science and technology infrastructure and knowledge between Member States.

V. AFRA CORE FUNCTION

AFRA will:

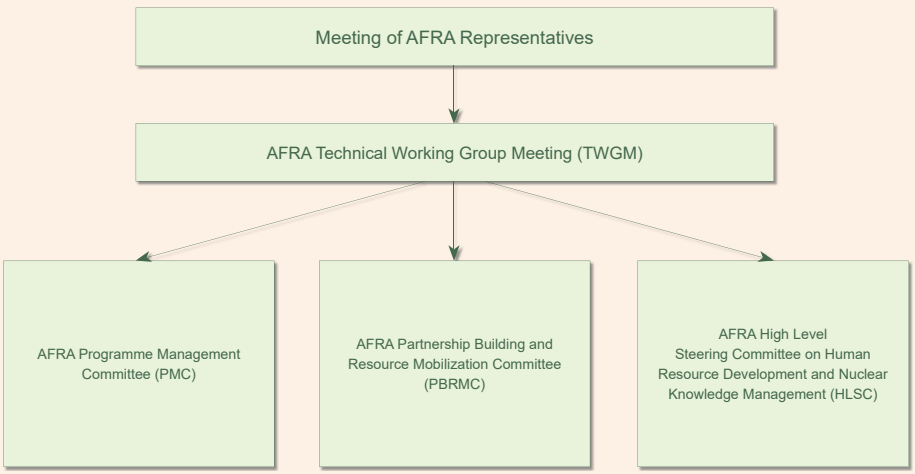
- Establish relevant institutional linkages and essential mechanisms for cooperation and coordination in the areas of training, nuclear science and technology, information and communication technologies (ICTs) and institutional sustainability, with a particular attention to the challenges facing the least developed countries (LDCs);
- Develop and implement appropriate systems for human resource development, nuclear knowledge management and preservation, and skills acquisition and retention;
- Harmonize regulations, practice and operational procedures, mechanisms for information management and exchange, and experience and best practice dissemination;
- Promote networking for the benefit of the African nuclear community and the involvement of youth and women in nuclear science and technology;
- Promote South-South cooperation among AFRA Member States, and between them and regional and international partners in fields of common interests and, where appropriate, to execute activities for regional partners such as the New Partnership for Africa's Development (NEPAD);
- Coordinate and streamline cooperation and assistance within the region for strengthening nuclear technology infrastructure in Member States with particular attention to the challenges facing the LDCs.

VI. AFRA MANAGEMENT

The decision making organ of AFRA is the Meeting of AFRA Representatives, composed of government officials who are authorized to commit their governments with respect to matters pertaining to the AFRA Agreement. The Meeting of AFRA Representatives convenes annually at the time of the General Conference of the IAEA.

The Technical Working Group, composed of AFRA National Coordinators meets at least once every year, normally in late July preceding the meeting of AFRA Representatives.

Following the decision made in November 2007 by the High Level Policy Review Seminar (HLPRS) to support the improvement of the managerial procedures of AFRA, to increase its effectiveness and efficiency and to promote full ownership of its programmes by AFRA Member States, the new management structure of AFRA includes three committees as described in the following organizational chart:



VII. AFRA REGIONAL STRATEGIC COOPERATIVE FRAMEWORK (2019–2023)

The AFRA Regional Strategic Cooperative Framework (RCF) is the principal planning tool for the establishment of regional cooperation priorities and the development of AFRA regional cooperative programmes. The new RCF will provide the frame of reference for the formulation of the AFRA regional programme in tandem with the Sustainable Development Goals. It will be the main modality for the planning and programming of AFRA regional projects focusing in the areas of human health; food and agriculture, radiation safety and human resource capacity building:

Human health

Most IAEA and AFRA African countries have no or limited radiation medicine facilities. Where radiotherapy facilities are available, patients in some of the countries must travel for days to reach urban areas, where often, the key pieces of equipment are not working optimally, causing more hardship and lowering the chances of survival. In addition, concerns about the quality of the delivery of radiotherapy services, even where QA/QC programmes exist, are frequently not implemented due to the excessive workload that creates service pressures, limiting the implementation of QA/QC programmes and hence compromising on the quality of services (e.g. patient protection, personnel exposure, equipment QC, etc.).

However, a quality radiotherapy service cannot be delivered, nor sustained if the one of the most important components, human resources, is not recognised professionally, nor trained at an internationally recognised level. On the latter, the IAEA/AFRA syllabus for training has been developed, but the adoption and accreditation of the developed training material has not yet been implemented in many African countries that have established teaching programmes in radiation medicine, principally in medical physics.

In this connection two new projects in the field of radiotherapy will be implemented to enhance the quality of the delivery of radiotherapy services in AFRA MS through harmonized clinical training schemes and sensitization of policy makers and to strengthen the treatment of cancer through the training and education of radiation medicine professionals in AFRA States.

In line with enhancing the quality of services to address cancer, another new project in the field of nuclear medicine will contribute towards enhancing the quality of the delivery of nuclear medicine in AFRA States through a well-established quality management system. One of the major key performance indicators will be the number of nuclear medicine centres that undergo a comprehensive audit.

Food and Agriculture

Crop production levels and the extent of genetic resource conservation in most agro-ecological zones in Africa are influenced by the multifaceted interaction of climate, soils, water and nutrient availability. Increasing agricultural productivity requires better crop varieties,

improved soil fertility and irrigation management. The introduction of varieties with tolerance to water scarcity contributes to improving crop production in terms of quantity and quality. To tackle one of these challenges, a first of its kind project will aim to enhance food security and income of cassava farmers through increased productivity, resource use efficiencies and climate resilience in cassava-based systems.

Recognizing that food safety is relevant for three of the Sustainable Development Goals (poverty reduction, food security and improved health), there will be a new project on Strengthening Food Contaminant Monitoring and Control Systems and Enhancing Competitiveness of Agricultural Exports using Nuclear/Isotopic Techniques.

In addition, livestock diseases such as transboundary zoonotic animal diseases (TADs) pose a serious threat to animal and human health with socioeconomic effects worldwide. In this context, regulations for biosafety and bio-security are of major importance. Drafting and implementing such regulations in Africa to protect the public from contamination and help in the design or renovation of veterinary laboratories will reduce risks and allow expansion of diagnostic techniques. For 2020-2021, a new project will aim for the first time to establish and implement biosafety and biosecurity regulations for and in veterinary diagnostic laboratories and to enhance capacities for bio-threat action.

Radiation Safety and Nuclear Security

The use of radiations sources has become wide spread in African Members States. However, an analysis of the radiation safety infrastructure in member states shows that more efforts are needed to improve the infrastructure for effective and efficient protection of patients, worker, public and the environment. Recognizing the challenges in the radiation safety infrastructure, AFRA prioritizes the development of radiation safety and nuclear security infrastructure in line with international standards for nuclear safety and security.

In view of the persisting challenges, the 2019-2023 RCF, identifies the issues that need further attention and strategies to help improve in the thematic safety areas of the AFRA member states. Therefore the priority areas that have been identified under the 2020-2021 programme and for which there will be regional projects will cover six thematic safety areas; Establishing Regulatory Infrastructure for Control of Radiation Sources in Some African Member States; Sustaining Occupational Exposure Monitoring Services in AFRA Member States; Improving capabilities of AFRA MS in Radiation Protection of Patients; Strengthening National Infrastructures for effective preparedness and response to radiological emergencies; Sustaining the establishment of education and training in radiation safety and human resource development in AFRA Member States Phase II and Strengthening Competent Authorities in transport of radioactive materials in AFRA Member States.

It is also judicious that enhancing the radiation safety infrastructure in Africa is accompanied by assistance that reviews and advises member states on their legal obligations and a new project will aim to assist Member States in the African region in establishing and maintaining adequate national legal frameworks for the safe, secure and peaceful use of nuclear energy and ionising radiation, in line with the relevant international legal instruments, IAEA safety standards and guidance documents, through legislative assistance and training in nuclear law.,

Human Resource Development

The essence of AFRA as the main vehicle for promoting regional cooperation for the peaceful uses of nuclear science and technology is to sustain a framework of active collaboration among AFRA Government Parties, which builds synergies between programmes at the regional and national levels. Technical Cooperation between Developing Countries (TCDC) is one of the key features of the AFRA Agreement. Expanding and strengthening further TCDC under the RCF will have a significant added value in terms of furthering the spirit of mutual assistance among Member States through the continuous transfer of knowledge and expertise, with limited involvement of the IAEA, and provides an opportunity for channelling programmatic synergies and optimising the utilisation of the resources of the relevant Regional Designated Centres (RDCs).

VIII. PROMOTING REGIONAL SELF-RELIANCE AND SUSTAINABILITY

AFRA Member States are committed to achieve regional self-reliance and sustainability in the peaceful, safe and secure application of nuclear science and technology through the principle of technical cooperation among developing countries (TCDCs). The following modalities are used:

AFRA Strategy on Human Resource Development and Nuclear Knowledge Management

AFRA Member States implement a regional strategy in human resource development (HRD) and nuclear knowledge management (NKM) through the AFRA Network for Education in Nuclear Science and Technology (AFRA-NEST). A High-Level Steering Committee on HRD and NKM, which oversees these important initiatives in the region, has been formed. A harmonized curriculum for the AFRA Master's Degree in Nuclear Science and Technology has been adopted as a minimum standard for awarding such a degree in the region. In addition, in 2019, a new project was approved and a project from 2020 has been initiated to cater for the needs of Member States that do not yet have the capacity to train medical physicist, an important specialist for the provision of quality radiotherapy services.

Specialized Teams

AFRA activities aim to strengthen human capabilities using new models such as the triangular initiative, hands on training, RDCs, and the involvement of regional experts and project scientific consultants (PSCs). In this connection, AFRA uses Specialized Teams composed of regional experts to perform a range of services, including conditioning and storage of sealed radioactive sources, auditing of radiotherapy and nuclear medicine facilities, and advising on steps to achieving self-reliance and sustainability of national nuclear institutions.

Project Scientific Consultants

When appropriate, AFRA Member States appoint Project Scientific Consultants (PSCs) to provide upon request technical backstopping to AFRA Member States and to the AFRA Committees. PSCs are African scientists recognized as experts and regional leaders in their respective fields. PSCs participate in AFRA activities in their individual capacity.

Promoting the Sustainability of National Nuclear Institutions and Other Facilities Using Nuclear Techniques

AFRA provides advice on the formulation and implementation of appropriate Strategic Action Plans (SAPs) to guide the efforts of national nuclear institutions to enhance their sustainability in order to enable them to remain relevant, to develop capabilities to adapt to changes in the external environment.

Regional Designated Centres (RDCs)

In the context of AFRA, the RDC is defined as an established African institution able to provide multinational services on the basis of the AFRA Agreement. AFRA Member States apply a rigorous process to recognize RDC.

Regional Designated Centres (RDCs)

(As of July 2019)

FIELD OF EXPERTISE	NAME OF INSTITUTION
RADIOACTIVE WASTE MANAGEMENT	South African Nuclear Energy Corporation (Necsa) Pretoria, South Africa
CLINICAL RADIOTHERAPY AND MEDICAL PHYSICS (ANGLOPHONE)	Tygerberg Hospital, Cape Town, South Africa
CLINICAL RADIOTHERAPY AND MEDICAL PHYSICS (FRANCOPHONE)	Institut National d'Oncologie Sidi Mohamed Ben Abdellah Rabat, Morocco
CLINICAL RADIOTHERAPY AND MEDICAL PHYSICS	National Cancer Institute (NCI) Cairo University, Cairo, Egypt
NON-DESTRUCTIVE TESTING TECHNIQUES (ANGLOPHONE)	Southern African Institute of Welding Johannesburg, South Africa
NON-DESTRUCTIVE TESTING TECHNIQUES (FRANOCPHONE)	Centre Technique des Industries Mécaniques et Electriques (CETIME) Tunis, Tunisia
	Centre National de l'Energie, des Sciences et des Techniques Nucléaires (CNESTEN) Rabat, Morocco
MUTATION BREEDING AND RELATED BIOTECHNOLOGY (ANGLOPHONE)	Agricultural Research Council (ARC) Pretoria, South Africa
REPAIR, PREVENTIVE MAINTENANCE AND QUALITY CONTROL OF MEDICAL AND SCIENTIFIC INSTRUMENTS (ANGLOPHONE)	Nuclear Research Centre, Egyptian Atomic Energy Authority Cairo, Egypt
IRRADIATION TECHNOLOGY	National Centre for Radiation Research and Technology (NCRRT), Egyptian Atomic Energy Authority Cairo, Egypt
SECONDARY STANDARDS DOSIMETRY LABORATORY (ANGLOPHONE)	National Metrology Institute of South Africa (NMISA) Pretoria, South Africa
SECONDARY STANDARDS DOSIMETRY LABORATORY (FRANOCPHONE)	Centre de Recherche Nucléaire d'Alger (CRN) Commissariat à l'Energie Atomique (COMENA), Algiers, Algeria
ENERGY PLANNING	General Directorate for Policies and Energy Planning (GDPEP), Ministry of Petroleum-Sudanese Petroleum Corporations Khartoum, Sudan
ENVIRONMENTAL ISOTOPE HYDROLOGY	National Centre for Nuclear Safety and Radiation Control (Central Lab. For Environmental Isotope Hydrology) Egyptian Atomic Energy Agency Cairo, Egypt
	Centre national de l'énergie, des sciences et des techniques nucléaires (CNESTEN) Rabat, Morocco
	Laboratory of Radio-Analyses and Environment of the National School of Engineers of Sfax (LRAE) University of Sfax Tunisia

FIELD OF EXPERTISE	NAME OF INSTITUTION
NUCLEAR MEDICINE AND RELATED MEDICAL PHYSICS	Service de medecine nucleaire CHU Bab El Oued Alger, Algeria
TRAINING AND EDUCATION IN RADIATION PROTECTION	Centre de Recherche Nucléaire d'Alger (CRNA) Commissariat à l'énergie atomique (COMENA) Algeria
	Radiation Protection Institute (RPI) Ghana Atomic Energy Commission (GAEC) Accra, Ghana
	Centre national de l'énergie, des sciences et des techniques nucléaires (CNESTEN) Rabat, Morocco
STABLE ISOTOPE IN HUMAN NUTRITION	National Food Technology Research Centre (NFTRC) Kanye, Botswana
	Unité Mixte de Recherche en Nutrition et Alimentation Universite Ibn Tofail de Kenitra Centre national de l'énergie, des sciences et des techniques nucléaires (CNESTEN) Kénitra, Morocco
COMMUNICABLE DISEASES	Centre de biotechnologie (Malaria) Universite of Yaoundé I Yaoundé, Cameroon
	Division of Molecular Biology and Human Genetics (Tuberculosis) Faculty of Health Sciences Stellenbosch University South Africa
FOOD SAFETY	Central Veterinary Laboratory Algiers, Algeria
	National Agency for Food and Drug Administration and Control (NAFDAC) Lagos, Nigeria
ACADEMIC AND CLINICAL TRAINING IN MEDICAL PHYSICS	Medical Physics Department School of Nuclear and Allied Sciences University of Ghana - Atomic Campus Accra, Ghana
ANIMAL HEALTH AND REPRODUCTION	National Medicine Veterinary School Sidi Thabet, Tunisia

IX. AFRA SUCCESSES

Notable examples of AFRA successes in thematic areas are presented below:

Human Health

Under AFRA, 40 radiotherapy centres in 18 African countries have been upgraded and more than 250 radiotherapists, medical physicists, nurses and radiographers have been trained on improved radiotherapy protocols, medical physics and management of radiotherapy departments.

AFRA projects in the field of radiotherapy and associated medical physics have been designed to tackle national and regional deficiencies in training/education by developing harmonized curricula to facilitate training in Africa and to promote recognition of the profession of medical physicists. AFRA RDCs have played a leading role in this effort. The curricula developed under AFRA have been utilized by at least six African countries with education programmes in the field. Emphasis has been placed on strengthening the response of Member States to the ever increasing incidence of cancer, particularly HIV related cancers, through the provision of dedicated training of key personnel. The AFRA programme has also focused on promoting more efficient management of the most common cancers in the region.

AFRA supported the organization of biennial Congresses of the African Radiation Oncology Group (AFROG), enabling African radiation oncologists and medical physicists to meet to debate issues of vital importance to their profession and to the region's strategy and plans to combat cancers holistically.

AFRA also supports efforts to strengthen regional capabilities in clinical nuclear medicine. The programme has enhanced Member State capabilities in the diagnosis and treatment of coronary artery disease, refractory arthritis, thyroid diseases, liver cancer, metastasis bone pain and lymphoma. Sound medical physics practices with regard to nuclear medicine have been promoted.

AFRA Specialized Teams have been used to audit nuclear medicine facilities in several Member States and are helping to identify major constraints. The recommendations made by the audits have proved to be an important tool in integrating nuclear medicine into the national health care systems.

Food and Agriculture

In the area of animal production, the AFRA programme is providing significant assistance to Member States to develop and facilitate the application of appropriate selection criteria for genetically improved livestock. An important contribution has been to focus on the interaction between nutrition and reproduction for improved productivity and to use modern reproductive techniques such as artificial insemination to improve the productivity and reproductive efficiency of livestock in the region.

Crop improvement is another area of focus for AFRA. A total of 17 AFRA Member States are working on the improvement of 'neglected crops', i.e. traditional crops which have not yet benefited from conventional breeding techniques. The development of drought tolerant lines has also been of great importance to the AFRA

Member States. As a result, six new crop varieties have been released in Egypt (sesame), Ghana (cassava), Kenya (wheat), Sudan (banana) and Zambia (finger millet and cotton). In addition, several countries have promising mutant materials and are at advanced stages of development: Tunisia (barley and lucerne), Egypt (safflower, lupin and wheat), United Republic of Tanzania (rice and barley) and Zambia (beans).

Other achievements are the development of fully established tissue culture laboratories in almost all the participating countries as well as molecular laboratories in three countries. In addition, new initiatives have been started in selected countries such as United Republic of Tanzania where the counterpart institute is working closely with the agriculture and food industry for the development of a new variety of barley. This has prompted other AFRA Member States to develop and disseminate staple and market oriented crops using mutation induction and biotechnology, supported by farmer participatory approaches.

Industrial Applications and Quality Management

AFRA focuses on the development of non-destructive techniques for industrial quality control. African Member States have opted for a regional approach to maximize the utilization of resources. Currently, most AFRA Member States rely on the training and certification of NDT personnel at RDCs: the Southern African Institute of Welding (SAIW) in South Africa and the Centre Technique des Industries Mécaniques et Electriques (CETIME) in Tunisia.

Until recently, no AFRA Member States had acquired the necessary capability to certify NDT personnel at level III. This level represents the expertise required to establish a sustainable NDT capacity for training and promoting NDT techniques at the national level. Since 2003, several regional training courses leading to certification at level III have been supported. NDT practitioners from 14 Member States have benefited from this initiative. In all, over 100 new level III certifications, in conformity with ISO 9712, have been achieved. The pass rate achieved is within the range of internationally observed limits, and it can therefore be concluded that the capability to train and certify NDT practitioners to level III has been firmly established within the region.

The AFRA programme on quality management has focused on strengthening the capacity and competence of nuclear and related institutions in participating Member States through the promotion of good managerial practices, especially quality management. The programme has provided training to managers and decision makers, facilitated regional networking and promoted the certification of nuclear laboratories in several countries. This network has already held its second regional conference on quality management in AFRA countries, aimed at improving recognition and implementation of ISO standards and their benefits for international trade and communication in Africa.

Information and Communication Technologies (ICTs)

AFRA Member States have established sustainable national and regional capabilities in the use of ICTs for training and education in the fields of nuclear science and technology relating to agriculture, human health, environmental monitoring, water resource management, nuclear instrumentation and other nuclear related fields.

Emphasis was placed on training nuclear engineers, computer scientists and technicians with the aim of building regional capabilities to train personnel using ICT based training materials and of further strengthening the use of ICT based training materials for national needs. ICT telecentres have been established in several countries.

Radioactive Waste Safety

Sealed radioactive sources have brought great benefits to human kind in almost all socioeconomic sectors. When these sources come to the end of their useful life, they are still radioactive enough to be hazardous to people and the environment and, therefore, should be carefully managed. AFRA developed, in collaboration with the South Africa Atomic Energy Corporation (Necsa), the Borehole Disposal for Sealed Radioactive Sources (BOSS) system, which was designed to provide safe and secure, disposal of disused sealed radioactive sources.

The AFRA Member States have also developed a mobile hot cell facility to manage Spent Highly Active Radioactive Sources (SHARS).

X. OPERATIONAL AFRA PROJECTS

The current AFRA Programme consists of the projects listed in the table below.

FIELD OF ACTIVITY		PROJECT NUMBER	PROJECT TITLE	PROJECT DURATION
Food and Agriculture (3)	1	RAF5079	Enhancing Crop Nutrition and Soil and Water Management and Technology Transfer through small-scale irrigation systems for increased Food Production and Income Generation (AFRA)	2018-2021
	2	RAF5076	Improving Crops by Using Mutation Induction and Biotechnology through a Farmer Participatory Approach	2016-2019
	3	RAF5078	Establishing a Food Safety Network through the Application of Nuclear and Related Technologies, Phase II	2016-2019
Human Health (5)	1	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	2016-2019
	2	RAF6053	Enhancing Capacity Building of Medical Physicists to Improve Safety and Effectiveness of Medical Imaging (AFRA)	2018-2021
	3	RAF6054	Strengthening and Improving Radio Pharmacy Services (AFRA)	2018-2021
	4	RAF6050	Improving Access to Quality Cancer Management through Sustainable Capacity Building	2017-2019
	5	RAF6051	Strengthening Education and Human Resources Development for Expansion and Sustainability of Nuclear Medicine Services in Africa	2016-2019
Radiation Safety and Nuclear Security (3)	1	RAF9061	Enhancing the capacities of National Regulatory Bodies for Safety in AFRA Member States	2018-2021
	2	RAF9062	Strengthening Radioactive Waste Management (AFRA)	2018-2021
	3	RAF9056	Strengthening Education and Training in Radiation Safety and Sustaining Human Resources Development and Nuclear Knowledge Management	2016-2019
Industrial Applications (2)	1	RAF1008	Supporting Radiation Technologies in Industrial Applications and Preventive Maintenance of Nuclear and Medical Equipment (AFRA)	2018-2021
	2	RAF1007	Strengthening the Capacities of Research Reactors for Safety and the Networking of Nuclear Accelerators	2018-2021
AFRA Management and TCDC (3)	1	RAF0050	Promoting Institutional Capacity Building Through Triangular Partnerships (AFRA)	2019-2020
	2	RAF0052	Supporting Human Resource Development in Nuclear Science and Technology	2018-2021
	3	RAF0046	Promoting Technical Cooperation among Developing Countries through Triangular Partnerships and Sustaining Regional Ownership of the AFRA Programme	2016-2019

AFRA

African Regional Cooperative Agreement for Research, Development
and Training related to Nuclear Science and Technology
http://www.afra-web.org

19-03796E