



REGULATORY INFRASTRUCTURE FOR THE CONTROL OF RADIATION SOURCES IN THE AFRICA REGION: STATUS, NEEDS AND PROGRAMMES

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Abstract. In recent years, several African countries have taken steps towards creating or strengthening legal, administrative and technical mechanisms for the regulation and control of peaceful uses of nuclear technology, and towards improving the effectiveness and sustainability of radiation protection measures based on international standards. This stems from a growing awareness that a proper national infrastructure is a prerequisite for the implementation of safety standards to achieve and maintain the desired level of protection and safety, particularly in such sectors as public health and industry. Also, other issues of global and regional interest, such as the control of radiation sources, including the handling of hazardous waste, and response capabilities in the case of a radiological emergency, have contributed to a better perception of risks associated with deficiencies in or lack of adequate national radiation protection control mechanisms. Too often, however, this awareness has not been matched with adequate progress in the establishment of a regulatory framework for the control of radiation sources.

This paper presents a summary of the current status of radiation protection infrastructure in all African Member States. On a background of still existing weaknesses and challenges, an overview of the Agency's response to assistance needs and programmes in this field is discussed.

INTRODUCTION

In recent years, several African countries have taken steps towards creating or strengthening legal, administrative and technical mechanisms for the regulation and control of peaceful uses of nuclear technology, and towards improving the effectiveness and sustainability of radiation protection measures based on international standards. This stems from a growing awareness that a proper national infrastructure is a prerequisite for the implementation of safety standards which can help in achieving and maintaining the desired level of protection and safety, particularly in such sectors as public health and industry. Other issues of global and regional interest, such as the control of radiation sources, including the handling of hazardous waste, and response capabilities in the case of a radiological emergency, have also contributed to a better perception of risks associated with deficiencies in or lack of adequate national radiation protection control mechanisms.

Over the years, authorities in many African countries have demonstrated their increased awareness of the benefits that can be derived from international co-operation and harmonization in this field. The International Atomic Energy Agency has played a key role in this process, notably through its programmatic activities aimed at setting forth and developing international safety standards, and through its technical co-operation programme designed, among other things, to assist Member States in establishing and upgrading their radiation protection infrastructure in compliance with these standards.

EXTENT OF RADIATION PRACTICES

For over 20 years, many African countries have been implementing national programmes for peaceful uses of atomic energy in medicine, industry, agriculture, hydrology and research. Specifically, noticeable progress has been reported in the application of radiation producing machines, radiation processing and the use of radiation sources for everyday practices in the region. In spite of persistent economic problems and budgetary constraints, at times coupled with political instability and local hostilities in some countries, there has been steady development in the transfer of nuclear technology and the introduction of modern techniques based on the use of ionizing radiation. Even though an inventory of all radiation sources and radiation generating machines used in the African Member States is still too sketchy, and for many countries incomplete, the available data and information provide some indication on the trends and measures of development.

In the field of nuclear technology, today there are:

- nine multipurpose irradiation facilities for sterile insect technique (SIT), food irradiation and/or product sterilization;
- about 20 linear accelerators;
- about seven neutron generators;
- over 100 teletherapy units;
- several thousand X-ray units for diagnostic radiology;
- more than 200 brachytherapy units;
- several thousand industrial radiography projectors; and
- several thousand nuclear gauges and other instruments based on ionizing radiation.

Many of these facilities, installations and instruments have been provided through IAEA assisted technical co-operation projects. Although there is evidence that radiation protection, safety of installations and safety practices in managing radioactive waste have improved in many African states, there is still a need for an internationally harmonized and co-ordinated effort to assist in this process.

Table 1 presents a qualitative overview of peaceful uses of atomic energy and radiation sources in the region.

OVERVIEW OF ASSISTANCE PROGRAMMES

Past Assistance

The IAEA's assistance to African Member States in radiation and waste safety dates back to the seventies when several countries embarked on programmes for peaceful uses of atomic energy. The programmes were aimed at establishing the necessary infrastructure to enable the use of ionizing radiation and radiation sources for socioeconomic development. The IAEA's technical co-operation programme has been delivered through national, regional or interregional projects involving, in general, expert services and assistance in the provision of training and equipment.

TABLE 1

**MAJOR NUCLEAR FACILITIES, INSTALLATIONS
AND RADIATION SOURCES IN AFRICAN MEMBER STATES**

Member State	Type of Radiation Source													Sites	
	Power reactor	Research reactor	Mining and milling	Accelerator	Neutron generator	Neutron source (Am-Be...)	Large irradiation source	Teletherapy	Brachytherapy	Industrial radiography	Nuclear gauge	Large calibration source	Radwaste storage		Radwaste final deposition
ALGERIA	-	+	+	+	+	+	+	+	+	+	+	+	+	-	Phosphate mines
ANGOLA	-	-	+	-	-	-	-	+	-	+	-	-	-	-	Gold mines
BENIN	-	-	-	-	-	na	-	na	na	na	na	-	-	-	
BURKINA FASO	-	-	-	-	-	-	-	-	-	na	na	-	-	-	
CAMEROON	-	-	-	-	-	-	-	+	-	+	+	-	-	-	
CONGO, Rep. Dem. of	-	+	+	-	-	+	-	+	+	+	+	-	+	-	Cu/Au mines
COTE d'IVOIRE	-	-	-	-	-	-	-	+	+	+	+	-	+	-	
EGYPT	-	+	-	+	+	+	+	+	+	+	+	+	+	-	
ETHIOPIA	-	-	-	-	-	-	+	+	+	+	+	+	-	-	
GABON	-	-	+	-	-	+	-	+	-	+	+	-	-	-	Uranium mines
GHANA	-	+	+	+	+	+	+	+	+	+	+	+	+	-	Gold mines
KENYA	-	-	-	+	-	+	-	+	+	+	+	+	-	-	
LIBERIA	-	-	na	-	-	na	-	na	na	na	na	-	-	-	
LIBYAN A.J.	-	+	-	+	+	+	-	+	+	+	+	+	+	-	
MADAGASCAR	-	-	-	-	-	+	-	+	+	+	+	+	+	-	
MALI	-	-	-	-	-	-	-	-	-	+	+	-	-	-	
MAURITIUS	-	-	-	+	-	-	+	+	+	+	+	-	+	-	
MOROCCO	-	-	+	+	+	+	+	+	+	+	+	+	+	-	Phosphate mines
NAMIBIA	-	-	+	-	-	+	-	-	+	+	+	-	-	-	Uranium mine
NIGER	-	-	+	-	-	-	-	+	-	+	+	-	-	-	Uranium mines
NIGERIA	-	(+)	-	(+)	+	+	-	+	+	+	+	+	-	-	
SENEGAL	-	-	-	-	-	+	-	+	+	+	+	-	-	-	
SIERRA LEONE	-	-	-	-	-	na	-	-	-	na	na	-	-	-	
SOUTH AFRICA	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Gold mines
SUDAN	-	-	+	+	+	+	-	+	+	+	+	+	+	-	Phosphate mines
TUNISIA	-	-	-	+	-	+	+	+	+	+	+	+	-	-	Phosphate mines
UGANDA	-	-	+	-	-	-	-	+	+	+	+	-	-	-	Gold mines
U.R. TANZANIA	-	-	+	-	-	+	+	+	+	+	+	+	+	-	Phosphate mines
ZAMBIA	-	-	+	+	+	+	+	+	+	+	+	+	-	-	Cu/Co mines
ZIMBABWE	-	-	+	+	-	-	-	+	+	+	+	-	-	-	Gold mines

Significant assistance effort made by the IAEA in the past can be highlighted by such activities as:

- the RAPAT¹ programme (1984–1995) which included missions to 19 African countries;
- broadly based regional projects on radiation protection development in Africa (1988–1995), involving the participation of 24 Member States, and
- a number of national projects addressing specific priority needs in radiation protection infrastructure (e.g. training, setting up and/or upgrading radiation safety services)

Moreover, since 1990 assistance has also been provided under the African Regional Co-operative Agreement (AFRA) for research, development and training related to nuclear science and technology. The radiation protection and safety programme under AFRA initially addressed such issues as improving the capability of managing radioactive waste (1991–1996) and harmonizing environmental monitoring approaches and measuring methods (1993–1998). The current two AFRA five-year projects, which commenced in 1997, focus on the harmonization of radiation protection practices and the strengthening of waste management infrastructure in the region. AFRA, however, is not intended to create infrastructure or to establish facilities. The agreement rather aspires to build on achievements attained through national efforts and/or previous IAEA assistance.

Present Programme: Model Project

In 1994 an interregional Model Project on “Upgrading Radiation Protection Infrastructure” was included in the TC programme for that year and beyond. Seventeen African Member States² were invited to participate in the project which, in 1997, was transformed into five regional model projects for Africa (RAF/9/024), Europe, Latin America, East Asia and West Asia, respectively.

The establishment of the Model Project followed a review and evaluation of relevant infrastructures in the Member States concerned. It revealed that although joint effort by the governments and the IAEA contributed to an increased awareness of radiation and waste safety issues among many countries in the region, there was still considerable room for improvement in all aspects of radiation protection infrastructure, and, in general, the progress reported was not sufficient to meet the requirements of the international Basic Safety Standards (BSS). Major deficiencies included³:

- absence of a regulatory framework including the system for notification, authorization and the control of radiation sources;
- shortage of the necessary trained staff;
- lack of a system or severe weaknesses in the system for occupational radiation protection;
- insufficient funding; and
- inadequate level of protection and safety even in the countries with some infrastructure formally in place.

¹ RAPAT was the IAEA Radiation Protection Advisory Team, which provided — upon the request from a Member State — a comprehensive assessment of the country’s radiation protection status, including the identification of relevant needs and priorities.

² Cameroon, Côte d’Ivoire, Dem. Republic of the Congo, Ethiopia, Gabon, Ghana, Madagascar, Mali, Mauritius, Namibia, Niger, Nigeria, Senegal, Sierra Leone, Sudan, Uganda, Zimbabwe.

³ “Progress Report on the Implementation of the Model Project on Upgrading Radiation Protection Infrastructure (INT/9/143), GOV/1999/67, 16 November 1999.

The goals of the project have been determined by five milestones, as defined in GOV/1999/67⁴, and set to meet the requirements of the BSS. The project is based on comprehensive country-specific workplans with well-identified activities, the implementation of which is essential for the milestone to be attained. These activities are indicative of the high priority the Agency has assigned over the years to assistance in radiation protection under its technical co-operation programme. Since 1993, the overall expenditure for this assistance in Africa alone has amounted to over US \$8.7 million.

REGULATORY FRAMEWORK: STATUS AND TRENDS

An overall evaluation of the regulatory infrastructure in the region is based on the IAEA guidelines⁵, Model Project approach (*Milestone 1*) and factual information provided by:

- country Radiation and Waste Safety Profiles,
- questionnaires on *Radiation Protection Activities and Infrastructure*, submitted by most Member States, and
- expert reports from assignments under relevant TC projects, including the Model Project.

A distinction has been made at the following levels:

- (i) Relatively comprehensive updated information is available on the 17 Member States participating in the Model Project, whereas relevant data on other Member States is still in the process of compilation and verification. The adopted evaluation criteria, however, are analogous for both groups of countries.
- (ii) South Africa is the only country in the region with *Practice Group 3 uses*, as defined in the “Guidance” and is considered to have a well-developed infrastructure including the regulatory framework.
- (iii) Fifteen Member States (50%) already have, or are about acquire, facilities and installations categorized as *Practice Group 2 uses*. Therefore, due to the nature of relative hazards associated with this practice group, more requirements for appropriate radiation protection infrastructure apply to these countries. The criteria, however, for the evaluation of the regulatory framework of these countries are the same as for
- (iv) the remaining 15 Member States to which *Practice Group 1 uses* and associated relative hazards apply.

As stated before, in many Member States, an awareness of radiation and waste safety issues has been enhanced over the years. Too often, however, this awareness has not been matched with adequate progress in the regulatory control of radiation sources. Notwithstanding the reasons for such a situation, it should be noted that:

- infrastructure for radiation protection is largely inadequate in eight countries⁶, including three Member States which joined the Agency only recently, and

⁴ *Milestone 1: The establishment of a regulatory framework. Milestone 2: The establishment of occupational radiation protection comprising individual and workplace monitoring programmes. Milestone 3: The establishment of medical exposure control. Milestone 4: The establishment of public exposure control. Milestone 5: The establishment of emergency preparedness and response capabilities.*

⁵ “Guidance for the Assessment of Radiation and Safety Infrastructures in Developing Member States and Strategies for Enhancement of Infrastructure”, 1995.

⁶ Angola, Benin, Burkina Faso, Gabon, Liberia, Mali, Senegal, Sierra Leone.

- in eight other countries⁷, although some form of infrastructure is formally in place, the regulatory programme is still to be established or is inadequate for the types of practices used.

While 20 countries have a radiation protection law in force or are in the final stage of its promulgation, 15 of them have enacted regulations which follow the principal requirements of the international BSS. In seven other Member States the process is likely to be completed shortly. Twelve Member States have a system for notification, authorization and control of radiation sources (Milestone 1), although in most cases it has been reported, as for example in the results of project monitoring and Peer Review missions (1999–2000), that the systems have not been fully operational or are at their early stage. A positive development is that all countries in this group have progressed in the establishment of their national inventory of radiation sources using the Regulatory Authority Information System (RAIS) provided by the IAEA as software and related training, but here again, it appears that in several countries the system is not always complete or updated.

The shortage of qualified experts and trained staff required for radiation protection in general, and for the regulatory programme in particular, is still a major obstacle to attaining Milestone 1 for several countries. This is also largely due to:

- institutional instability;
- general infrastructural weaknesses;
- inadequate support at the decision-making level;
- changes in national development programme priorities;
- lack of or limited incentives for career development, resulting in a high turnover of staff already trained; and
- inability to solicit and allocate the necessary resources to recruit and retain specialists.

For many years now, the IAEA has provided a wide spectrum of education and training opportunities which has enabled African professionals to upgrade their academic background, gain expertise and develop practical skills in various areas of radiation protection. In 1999 and 2000 alone, 34 fellowships and scientific visits were awarded, and over 160 participants attended nine regional specialized training events and seminars organized under the Model Project⁸. The opening, in June 1999, of a Regional Centre for Radiation Protection Training in Johannesburg, South Africa, established with the IAEA assistance, marked a major milestone in addressing the problem of capacity building for radiation and waste safety in Africa. The two University-based regional postgraduate training courses in radiation protection held to date were successfully completed by 31 IAEA-supported students from 16 countries.

The situation in other elements of infrastructure, defined as Milestones 2, 3, 4 and 5 (ref. GOV/1999/67), is summarized below.

Occupational Radiation Protection

Significant progress can be reported in establishing a system for individual monitoring of occupationally exposed personnel, now in place in 24 countries. Thirteen of them have

⁷ Cameroon, Côte d'Ivoire, Dem. Rep of the Congo, Mauritius, Niger, Nigeria, Uganda, Zimbabwe.

⁸ One workshop was organized jointly with the AFRA programme.

benefited from assistance provided by the IAEA under the Model Project. There has been a steady expansion of the system, and in eight Member States the coverage of workers in this category is at about 80% or more. In seven countries, including the three new Member States, the system is still to be established⁹.

Even though information on workplace monitoring is not comprehensive enough, and its verification is more complex than it is in the case of individual monitoring, in recent years a national programme in this area has been initiated in five countries participating in the Model Project¹⁰. In the majority of countries, however, the programme is still very limited or non-existent.

Medical Exposure Control

The lack of or very limited use of quality assurance programmes for radiation protection in medical practice is common to most countries in the region. The problem is particularly acute in diagnostic radiology in the public medical sector, where serious difficulties with the operation and maintenance of generally obsolete equipment, are increased by the shortage of qualified medical physicists and radiographers. The trend causing much concern is that the availability of qualified personnel, even in principal medical institutions, has plummeted in many countries, largely due to the progressive privatization of that sector.

With a few exceptions, the status of radiation protection in radiotherapy and nuclear medicine is rather unsatisfactory. It appears that a programme in these areas is still to be set up in the majority of countries where such services are offered or due to be established.

The need to introduce and develop a quality-based approach to radiation protection in medical practice is prevalent in practically all countries in the region, and will remain one of the great challenges in the follow-up programme to the Model Project.

Public Exposure Control

The status evaluation in this component of radiation protection infrastructure is focused primarily on radioactive waste safety. The major problem, common to many countries, is a large number of spent radium sources awaiting conditioning and disposal. For many years, the IAEA has been giving advice on how that can be done. It is recognized, however, that there are countries where technical infrastructure is not developed enough to ensure that conditioning operations be managed properly. Some nuclear medicine departments in African Member States use significant quantities of radioisotopes or radioactive labelled compounds in their routine practice. This results in radioactive waste, in the form of diluted solutions, patient excreta, liquids used for cleaning equipment, etc. In most cases, it is necessary to establish a temporary storage facility at a work place, and arrange for controlled discharges of these solutions to sewage or similar liquid waste outflow systems. In certain cases, conditioning of liquid waste prior to discharge may be necessary.

So far, progress in improving the safety of spent sources, with few exceptions, has been too slow in the region. Assistance effort to address the needs of African countries in the area of

⁹ Angola, Benin, Burkina Faso, Gabon, Liberia, Senegal, Sierra Leone.

¹⁰ Ethiopia, Ghana, Madagascar, Namibia, Sudan.

waste safety has been initiated under the Model Project, and is due to intensify in the years to come (ref. next section). Assistance in the technical aspects of waste management will continue to be streamlined under the AFRA regional project on Strengthening Waste Management Infrastructure¹¹.

The safety of radioactive waste in the form of mine tailings is still more complex. The problem applies to several Member States, particularly those with uranium or phosphate mines (ref. Table 1). Mining companies in a few countries (D.R. of the Congo, Gabon, Niger) seem to be reluctant to take responsibility for the waste they generate. In the case of redundant mines there would appear to be no easy solution as the countries generally do not have the financial resources for remedial action at mining sites.

In this regard, activities carried out by the IAEA under the regional projects include:

- the identification and assessment, with expert assistance, of hazards from naturally-occurring radionuclides, including the identification of areas of particularly heavy contamination; and
- recommendations on appropriate precautions for those living or working in or near these areas.

Planning for and Response to Radiological Emergencies

With the exception of South Africa and some, but not all, countries with operational research reactors (Algeria, Egypt, Libya) where national and facility plans for response to a nuclear or radiological emergency are in place, the current status in this area is largely inadequate. The situation is characterized by the same general problems, referred to above, affecting radiation safety infrastructure and human resource development in many countries in the region. Additionally, in most African Member States there is still insufficient awareness amongst agencies and institutions in charge of dealing with emergency situations of the organizational and technical issues involved in setting up an effective national plan in case of a radiological accident or incident. There is justified concern that, in this area, principal requirements of the international BSS are not being met and, therefore, the need to improve preparedness and make use of assistance, including training, remains urgent.

Activities have been initiated under the Model Project to set up an emergency response plan in Ghana, operating a research reactor and an irradiation facility. A similar assistance programme is badly needed for the D.R. of the Congo. These activities are due to be completed by 2004.

High priority has also been assigned to assist other countries with relatively developed regulatory framework in attaining this milestone (ref. next section). Country-specific workplans will focus on designing overall national response plans for emergencies involving radiation sources or radioactive material. The plans will be commensurate with the extent of radiation practices in each country concerned.

A qualitative summary of radiation and waste safety infrastructure in the African Member States is presented in Tables 2 and 3.

¹¹ RAF/4/015 (AFRA I-14).

Table 2. Radiation Safety Legislation in the African Member States

MEMBER STATE	GENERAL LAW IN FORCE	REGULATIONS TO IMPLEMENT BSS	REMARKS
ALGERIA	yes	a set of regulations exists	update in progress
ANGOLA	no	no	joined IAEA in 1999; action initiated
BENIN	no	no	joined IAEA in 1998
BUKINA FASO	no	no	joined IAEA in 1998; action in progress
CAMEROON	no	no	final draft revised law and regulations in progress
COTE D'IVOIRE	yes (old)	no	draft in progress; action delayed
EGYPT	yes	a set of regulations exists	update in progress
ETHIOPIA	yes	yes	new regulations in progress
GABON	no	no	final draft law and regulations in progress
GHANA	yes	a set of five regulations exists	new regulations in progress
KENYA	yes (old)	a set of regulations exists (old)	revision of law and regulations in progress
LIBERIA	no	no	institutional instability in the country
LIBYAN A.J.	yes	a set of several regulations and codes of practice exists	update in progress to comply with BSS; to be enacted in 2001
MADAGASCAR	yes	yes (basic)	final draft new regulations in progress
MALI	no	no	draft legislation exists; action delayed
MAURITIUS	yes (old)	yes	final draft approved by Board and sent to State Law Office, action delayed
MOROCCO	yes	a set of regulations exists	update in progress
NAMIBIA	yes (old)	no	final draft law and regulation ready ; to be enacted in 2001.
NIGER	yes (Nov.99)	yes (Nov. 1999)	to be implemented
NIGERIA	yes	no	action delayed
SENEGAL	no	no	draft legislation exists; action delayed
SIERRA LEONE	no	no	draft legislation exists; action delayed by institutional instability in the country
SOUTH AFRICA	yes (new; 2000)	well established	
SUDAN	yes	yes	new regulations in progress
TUNISIA	yes (old)	a set of several regulations and codes of practice exists	revision of the law and regulation in progress
UGANDA	no	no	draft legislation being prepared; action delayed, but much progress made in 2000
TANZANIA	yes	yes	revision of regulations in progress to incorporate medical exposure, mining transport, waste safety
DEM. REP. OF CONGO	yes	yes	final draft legislation ready; to be enacted by Dec. 2000
ZAMBIA	yes	yes	being extended to include waste safety
ZIMBABWE	yes (to be amended)	no	draft in progress; action delayed

Table 3. Elements of Radiation Protection Infrastructure in the African Member States

Member State	System of notification, authorization, inspection and enforcement	Inventory of radiation sources	Occupational radiation protection		Medical exposure control QA/QC prog.			Public exposure control: waste safety programme	Emergency response plan
			Individual monitoring	Workplace monitoring	DR	RT	NM		
Algeria	established; operational	yes	yes	yes	ltd*	yes	yes	yes	in progress
Angola	to be established	in progress	no	no	no	no	no	no	no
Benin	to be established	no	no	no	no	no	no	no	no
Burkina Faso	to be established	in progress	no	no	no	no	no	no	no
Cameroon	to be established	in progress	yes	no	no	no	no	no	no
Cote d' Ivoire	to be established	yes	yes	yes	no	no	no	no	no
Egypt	established	yes	yes	yes	ltd	yes	yes	in progress	in progress
Ethiopia	established	yes	yes	yes	no	ltd	no	in progress	no
Gabon	to be established	incomplete	no	no	no	no	no	no	no
Ghana	established; operational	yes	yes	yes	no	ltd	no	in progress	in progress
Kenya	established	incomplete	limited	no	no	no	no	no	no
Liberia	not established	no	no	no	no	no	no	no	no
Libyan A.J.	not established	yes	yes	limited	ltd	ltd	ltd	in progress	in progress
Madagascar	established; initiated	yes	yes	yes	no	ltd	ltd	no	no
Mali	to be established	incomplete	limited	limited	no	no	no	no	no
Mauritius	to be established	yes	yes	yes	ltd	ltd	ltd	in progress	no
Morocco	established; operational	yes	yes	limited	ltd	ltd	ltd	in progress	in progress
Namibia	being established	yes	limited	limited	yes	yes	yes	no	no
Niger	being established	incomplete	U mines only	limited	no	no	no	no	no
Nigeria	not established	incomplete	very limited	limited	no	ltd	ltd	no	no
Senegal	not established	no	limited	limited	no	no	no	no	no
Sierra Leone	not established	no	no	no	no	no	no	no	no
South Africa	established; operational	yes	yes	yes	yes	yes	yes	established	established
Sudan	established; operational	incomplete	limited	limited	no	ltd	ltd	established	in progress
Tunisia	established; operational	yes	yes	limited	no	ltd	ltd	in progress	in progress
Uganda	to be established	incomplete	limited	limited	no	ltd	ltd	no	no
U.R. Tanzania	established	yes	yes	yes	no	ltd	ltd	in progress	in progress
D.R. Congo	to be established	incomplete	initiated	limited	no	no	no	in progress	no
Zambia	established	yes	limited	limited	no	no	no	in progress	no
Zimbabwe	to be established	yes	yes	yes	ltd	ltd	ltd	no	no

*ltd - limited.

THE AGENCY RESPONSE. REGIONAL OUTLOOK 2001–2004

The above overview shows that the needs of many countries in the region for assistance in attaining an adequate level of self-sustainable and effective regulatory mechanisms for the control of radiation sources and practices, in compliance with principal requirements of the international Basic Safety Standards, still remain persistent. As indicated in the contributed report on “Upgrading Radiation Protection Infrastructure in Developing Countries: A Successful Experience” (by Mr. Paulo M. C. Barretto), the IAEA’s effort in this statutory responsibility will continue on a regional basis in the years to come. The following projects for Africa have been included in the IAEA’s mid-term technical co-operation programme:

National Regulatory Control and Occupational Radiation Protection Programme

This Model Project is aimed at improving regulatory framework for radiation protection in participating countries, and at establishing adequate regulatory mechanisms for the control of radiation sources in new Member States (milestone 1). Focus will also be on setting up a national programme for occupational radiation protection (milestone 2). Fourteen African countries, including new Member States (Angola, Benin and Burkina Faso) have been invited to participate.

Development of Technical Capabilities for Sustainable Radiation and Waste Safety

The objectives of this new Model Project are to develop and consolidate adequate systems with technical capabilities for sustainable medical and public exposure control consistent with international standards (milestones 3 and 4), and to establish a national system for preparedness and response to radiological emergencies (milestone 5). The project is expected to involve 16 Member States, presumed to have attained milestones 1 and 2.

Postgraduate Training in Radiation and Waste Safety

This new project is designed to support all Member States in the region in their effort to attain a core number of managers, qualified experts and trainers in radiation protection, and to develop adequate expertise and skills required for self-sustainable national radiation protection infrastructure, with its major component: qualified human resources.