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## **PROJECT DESK EVALUATION**

**A DESK EVALUATION REVIEW OF PROJECT  
RAF/9/005  
RADIATION PROTECTION DEVELOPMENT**

**DEPARTMENT OF TECHNICAL CO-OPERATION**

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EVALUATION SECTION

**DEPARTMENT OF TECHNICAL CO-OPERATION**

## **PROJECT DESK EVALUATIONS**

A Project Desk Evaluation (PDE) is an intensive review process, using agreed guidelines, of the design, implementation, and the outputs of a project. Its purpose is to convey concisely as comprehensive a picture of a project's performance as can be obtained without a special evaluation mission to the project site. It also seeks, where possible, to draw generalizable lessons that go beyond the specific project under review. Frequently, Project Desk Evaluations are conducted on a set of similar projects, e.g. radiation protection projects or projects in nuclear medicine, in various countries and reported on together. In this way a wide range of approaches, strategies, problems and trends relating to a common type of undertaking can be examined and conclusions confidentially drawn.

Project Desk Evaluations are carried out by the staff of the Evaluation Section, Department of Technical Co-operation, with the assistance of the relevant staff in the Agency concerned with the specific projects. Upon completion, each Project Desk Evaluation is submitted to the Deputy Director General of the Department of Technical Co-operation.

DESK EVALUATION REVIEW OF PROJECT  
RAF/9/005  
RADIATION PROTECTION DEVELOPMENT

**Table of Contents**

	Page
Executive Summary	i-vi
I. Introduction	1
II. Project under Review	5
Financial Summary	6
Approved Project Objectives and Activities	7
Project Summary	8
Implementation	10
Accomplishments	23
III. Findings	27
IV. Recommendations	30
<b>Annex I</b> Counterpart Institutions of Project RAF/9/005 - Radiation Protection Development	33
<b>Annex II</b> Experts Assignments under Project RAF/9/005 (1988 - April 1994)	35
<b>Annex III</b> Country and other Regional Projects in Radiation Protection and Related Areas in Africa (Operational as of April 1994)	37
<b>Annex IV</b> Country Projects in Radiation Protection and Related Areas in Africa (Completed since 1984)	43

## **EXECUTIVE SUMMARY**

Protection of workers, the public and the environment from the hazards of exposure to ionizing radiation that may result from the use of radioactive materials and/or radiation producing devices, is a prerequisite for the peaceful utilization of atomic energy and its applications in various fields of agriculture, health, industry, raw materials prospection and research. Many countries in Africa had been using radioactive materials and ionizing radiation sources for these purposes for many years without practically any radiation protection measures being taken. By the early 1980s, only very few countries in Africa had appropriate radiation protection infrastructure (act, regulations, codes of practice and national competent authority) in existence and practically none had the necessary facilities for personnel and environmental monitoring, both in terms of service personnel and laboratory set up. It was therefore essential that concerted efforts be made to control and minimize the harmful effects of ionizing radiation for the radiation workers, the general public and the environment, including the flora and fauna and the aquatic lives.

The Agency has been assisting these efforts through a number of national TC projects in radiation protection and related areas over the years. In addition, a regional project RAF/9/005 - Radiation Protection Development (which is under this review) was approved in 1988, with the aim of assessing existing radiation protection practices in the African Member States in relation to the Agency's new basic safety standards for radiation protection, and to advise Governments on improvements. The project was subsequently extended up to 1994 as an umbrella project to assist all African Member States in the development of appropriate radiation protection services; to co-ordinate the implementation of the relevant national TC projects; and to develop co-operation amongst groups of Member States on a regional and sub-regional basis. Particular emphasis was to be given to manpower development through workshops, seminars and training courses in radiation protection and safety.

In parallel thereto, the Agency's Radiation Protection Advisory Teams (RAPATs) visited nineteen African Member States during the period 1986 through 1993, to review and assess their radiation protection activities, identify priorities, and design long-term radiation protection programmes. RAPAT findings and recommendations were considered in drawing up programmes for implementation under project RAF/9/005.

The total budget of project RAF/9/005 for the years 1988 through 1994 includes 87.7 months of expert services, \$134 900 for equipment as well as \$299 865 for group training.

This desk evaluation review was undertaken at the request of the Africa Section, TCPM, to assess project achievements and to provide a basis for determining its future direction.

### **Accomplishments**

As of April 1994, project RAF/9/005 has provided a total of 73.5 months of expert services, equipment and supplies worth \$115 824 and group training at a cost of \$224 328. In line with the project's objectives, the following has been achieved:

A total of 231 African scientists and technicians have received training in radiation protection and related areas through 14 regional and national training courses, seminars and workshops. Intra-regional co-operation and communication was promoted through three meetings of national radiation protection officers and project counterparts.

Assistance was provided to five countries in drafting legislation and regulations and reviewing final drafts, with the result that these countries now have a radiation protection act in force or at least in draft form.

A number of laboratories were upgraded through the supply of microcomputers and of expendable supplies not locally available. TLD equipment provided under four national projects was installed and the staff trained. Temporary dosimetry services were provided to four countries. Intercomparison studies for the quality control of Agency-supplied TLD systems were arranged for six countries; calibration services were provided to three.

Technical backstopping and co-ordination of some 20 national TC projects in 18 Member States was provided by the project co-ordinator. Four scientists from developing countries were used as project experts, thus promoting co-operation among developing countries (TCDC). Pre-project missions carried out under the project resulted in four new national radiation protection projects.

Considerable improvement in radiation protection has now been achieved in many of the African Member States. Based on the reports presented by the country representatives at the meetings on "Regional Co-operation in Radiation Protection in Africa" organized under the project RAF/9/005, on experts reports, as well as RAPAT mission reports and other sources of information available to the Agency, an attempt has been made to compare the status of radiation protection infrastructure and services as existing in early 1989 and in late 1993, in the 26 African Member States (see Table 8 on page 25).

This comparative study shows that 15 countries have now a radiation protection act in force and six have it in draft form, as compared to nine and seven, respectively, in 1989. Similarly, nine countries now have effective radiation protection regulations and four have drafts, as compared to three and five, respectively, in 1989. Codes of practice are now available in eight countries, as compared to four (one in draft) in 1989. Thirteen countries have a national competent authority, as compared to seven in 1989.

Similar improvements are also noticeable in the area of radiation protection services. Thirteen countries have adequate service staff, as compared to eight in 1989; 17 countries have some personnel monitoring facilities, as compared to 14 in 1989; and 14 countries have some facilities for radiometry, as compared to 13 in 1989.

## **Findings**

Radioisotopes and/or ionizing radiation were used in some form or another in medicine, agriculture, industry and research in most of the Agency Member States in Africa for a long time practically without any infrastructure and services for radiation protection and safety of the workers, the general public and the environment. Intensified Agency efforts through national technical co-operation programmes, regional and interregional training courses combined with the establishment of the regional TC project RAF/9/005 - "Radiation Protection Development" have significantly addressed this problem.

An analysis of the achievements, however, reveals that deficiencies still exist. Based on this analysis, and considering the availability of other services relevant to radiation protection and safety, such as safety assessment, inspection of radiation sources and installations for quality control, national calibration laboratory, radiological emergency preparedness, and the management of radioactive wastes, the 26 Member States in Africa can be broadly divided into the following four categories as far as radiation protection is concerned:

Category A = Adequate (10 countries)

Algeria, Egypt, Ghana, Kenya, Libya, Madagascar, Morocco, Tanzania, Tunisia and Zambia.

Category B = Deficient/not up to the mark (5 countries)

Côte d'Ivoire, Ethiopia, Mauritius, Nigeria and Sudan.

Category C = Poor (3 countries)

Namibia, Senegal and Zimbabwe.

Category D = Very Poor (8 countries)

Cameroon, Gabon, Liberia, Mali, Niger, Sierra Leone, Uganda and Zaire.

There is still a long way to go in establishing radiation protection infrastructure and services in all the African Member States. The process is slow, and mainly depends upon the Member State's desire and resolution to act upon it. There are obstacles through political and economic situations over which the Agency has little control. It is only through communication and direct dialogue at the appropriate level that the Agency can influence Governments to intensify their own efforts, assisted by the Agency with expert advice, personnel training and equipment supplied under national TC projects.

Radiation Protection Advisory Team (RAPAT) missions have already been carried out in 19 of the African Member States, with follow-up missions to six of them. Considering the current level of infrastructure and services for radiation protection in many of the African Member States, this review is of the opinion that continuous surveillance of the situation is needed, if necessary substantiated by expert missions, so that appropriate corrective measures could be taken as required. It is expected that the forthcoming Policy Review Seminar during the IAEA General Conference in September 1994 will discuss future methodologies for assuring continuous surveillance of radiation protection practices in Member States.



An interregional model project on "Upgrading Radiation Protection Infrastructure" (INT/9/143) has been approved for a five-year period from 1994-1998 with the objective "to assist a number of selected Member States with an inadequate radiation safety infrastructure to enhance and strengthen this so that it complies with standards established by the Agency for protection against ionizing radiation and for the safety of radiation sources". In consideration of the prevailing conditions of radiation protection infrastructures in African Member States, three countries (Cameroon, Ghana and Uganda) have already been included in the project on first priority, and six more (Gabon, Mali, Senegal, Sierra Leone, Zaire and Zimbabwe) will be included at a later date.

Although substantial progress has been made in radiation protection manpower development through the national and regional training courses organized under project RAF/9/005, as well as through fellowship training and other regional and interregional training courses, more qualified manpower is still needed, particularly for countries with smaller programmes in nuclear fields.

The organization under the project of regional training courses for francophone countries has not been too successful. One course had to be postponed from 1993 (and is likely to be cancelled) owing to lack of qualified candidates. A regional training course (RAF/9/012) was delayed from May 1994 to October 1994 for the same reason. Fellowship training would seem to be more appropriate for these countries.

Although many of the Member States do not have national programmes for manpower training in radiation protection and safety, and rely entirely on Agency-organized training programmes, it is heartening to note that the majority of the national training courses held under the project were organized and managed mainly by local experts, some of whom had received Agency training earlier, with only minimal input by the Agency. This should be encouraged.

This review recognizes the commendable work that has been done by the project co-ordinator in providing technical expertise for a large number of national TC projects as well as in co-ordinating their activities under the regional project RAF/9/005. However, since the main thrust of the new model project is likely to be on Africa, the co-ordinating functions of RAF/9/005 could be taken over by project INT/9/143. This will on the one hand save duplication of efforts for the same purpose, and on the other hand, promote harmonization of activities under the two projects, as has been recommended by the Meeting on Regional Co-operation for Radiation Protection in Africa, held recently in Madagascar.

## **Recommendations**

1. Continuous surveillance should be maintained of the status of radiation protection in African Member States under both the new model project, INT/9/143, and RAF/9/005, so as to allow corrective action to be taken, as required.
2. Expert services should be provided to assist Member States in the formulation of legislation and regulations, where these do not exist, or where further advice may be needed. Regional experts should be used as available.
3. For countries with inadequate trained manpower in radiation protection, training should be provided through individual fellowships (minimum six months). In selecting the host countries, preference should be given to the countries in the region so as to develop closer regional co-operation. For this purpose, funds from the regional "Manpower Development" project (RAF/0/009) should be used.
4. Regional training courses/workshops should be organized in a timely manner to ensure full participation.
5. Wherever sufficient service personnel are available, the project counterparts should be encouraged to organize regular national training courses on basic radiation protection and safety. National experts who have already received Agency training should be encouraged to share their experience with their colleagues in such training courses. The Agency may provide some expert assistance, as needed.
6. Recognizing the significant improvements that have already been achieved in establishing radiation protection regimes in some African Member States, but mindful of the continuing need in others, it is recommended that project RAF/9/005 be extended for another two years under the 1995-96 programme, so as to assist these countries in establishing the national radiation safety infrastructure commensurate with the scope of their nuclear-related activities.

## INTRODUCTION

The importance of radiation protection at the national level for the peaceful utilization of atomic energy and ionizing radiation for the benefit of the general public, along with Government awareness to that effect, and the role of the IAEA in propagating a radiation protection and safety culture, have been continuously stressed over the past 35 years.

Article III A.6 of the IAEA's Statute states that the Agency is authorized:

"To establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operations as well as to the operations making use of materials, services, equipment, facilities and information made available by the Agency or at its request or under its control or supervision."

Article XI E.3 of the Agency Statute further specifies that:

"Before approving a project [under the Agency's Technical Co-operation Programme], the Board of Governors shall give due consideration to the adequacy of proposed health and safety standards for handling and storing materials and for operating facilities."

In support of these statutory obligations, a document in the name of "Basic Safety Standards for Radiation Protection" was first approved by the IAEA Board of Governors and published by the IAEA as Safety Series No. 9 in 1962 and revised in 1967 and 1982. A recent revision was approved by the Board in June 1994.

Twenty-seven countries in Africa are currently Members of the IAEA, of which 26 are recipients of Agency technical assistance. By the early 1980s, many had embarked on research and development work involving radioactive materials and ionizing radiation sources, although none of them had sufficient infrastructure for radiation protection. Most of the uses of ionizing radiation and radioactive materials were in medical (diagnostic, sometimes even therapeutic) practices, in agriculture and industry. In these 26 African countries, there are today six operational research reactors, with a few more being planned; seven large-scale multi-purpose irradiation facilities for food irradiation and/or product

sterilization; three operational linear accelerators and two more planned; about a dozen neutron generators; several uranium processing plants; and three plants for the recovery of uranium from phosphoric acid are under study. In addition, it is estimated that there are around one hundred teletherapy units and more than twice as many brachytherapy sources, several thousands of industrial radiography sources, nuclear gauges and other radiation-based devices and instruments.

The above shows the extent of the utilization of radioactive materials and radiation sources for peaceful purposes in Africa, vis-a-vis the need for effective measures for their control and the protection of the workers, the general public and the environment from their harmful effects.

The Agency had been addressing this need through a number of national TC projects in radiation protection and related areas, including environmental monitoring, safety standards, regulations and procedures, dosimetry and radiological emergencies. To further strengthen this support, the Agency since 1984 has been assisting its developing Member States through Radiation Protection Advisory Teams (RAPATs), in reviewing and assessing their radiation protection activities, identifying priorities, and designing long-term radiation protection programmes.

Starting from 1986, RAPAT missions were carried out in 19 African Member States, with follow-up missions to six of them (**Table 1**). Reference to RAPAT is made in this report only to draw a comprehensive picture of the status of radiation protection in African Member States. The recommendations made by RAPAT missions are not normally implemented through the project RAF/9/005 - it has neither the scope nor the financial resources for that purpose. Funds permitting, RAPAT recommendations are implemented through appropriate national TC projects and only the co-ordination of these activities is carried out under RAF/9/005. However, while formulating activities under the regional project, due consideration is always given to the RAPAT recommendations. In fact, most of the regional and national activities undertaken under the project were also recommended by RAPAT.

**Table 1**  
**RAPAT Missions to Africa during 1986 - 1993**

<b>Country</b>	<b>RAPAT Mission In Year</b>	<b>Follow-up Mission In Year</b>
Algeria	-	-
Cameroon	1989	-
Côte d'Ivoire	1988	1992 <sup>1/</sup>
Egypt	1986	-
Ethiopia	1988	-
Gabon	-	-
Ghana	1989	1992
Kenya	1986	-
Liberia	-	-
Libyan A.J.	1990	-
Madagascar	1988	-
Mali	-	-
Mauritius	1993	-
Morocco	1989	-
Namibia	-	-
Niger	1991	1992
Nigeria	1988	-
Senegal	1988	-
Sierra Leone	1991	-
Sudan	1987	1992
Tunisia	-	-
Uganda	-	-
U.R. Tanzania	1987	1993
Zaire	1986	-
Zambia	1986	1991
Zimbabwe	1989	-
<b>Total</b>	<b>19</b>	<b>6</b>

<sup>1/</sup> Funded by UNDP Sectoral Support Programme.

The regional project RAF/9/005 - Radiation Protection Development (under this review) was approved in 1988, to assist all African Member States in developing appropriate radiation protection services; to co-ordinate the implementation of the relevant national TC projects; and to develop co-operation among groups of Member States on a regional and sub-regional basis. Particular emphasis was to be given to manpower development through workshops, seminars and training courses in radiation protection and safety.

This desk evaluation review of the project was requested by the Africa Section, TCPM, to assess project achievements as a basis for determining what direction the project should take in the near future, and how the experience gained during the implementation of this project might be utilized in the management and implementation of similar projects in Africa or in other regions.

## II

### **PROJECT UNDER REVIEW**

The following section contains a Project Desk Evaluation (PDE) of the Agency's multi-year regional project RAF/9/005, "Radiation Protection Development", approved for the Africa region in 1988.

The review was undertaken to assess the project's viability and achievements after six years of operation and to determine future needs and possible Agency assistance required. It must be borne in mind, however, that a project desk evaluation is but one element of a critical examination and therefore there must be a tentativeness to and continual testing of its conclusions. As the Joint Inspection Unit concluded:

"One of the most difficult problems which internal evaluation systems face is the tendency to regard them as a self-contained management technique which merely needs to be introduced into an organization to swiftly improve operations. In fact, evaluation is only one phase -- although an important one -- in the basic management cycle. It cannot have its full impact until it becomes part of a continuing commitment to development and improvement of the overall management system." (Second Report on Evaluation in the United Nations System, para. 28, Joint Inspection Unit, JIU rep.6)

Findings and recommendations are in Sections III and IV of this report.

**FINANCIAL SUMMARY**

**RAF/9/005 - Radiation Protection Development**

**Recipients:** All 26 Member States in Africa recipient of Agency technical assistance.

**Counterparts:** National Co-ordinators of participating countries (**Annex - I**).

**Financial Data:**

Current Budget	1988	1989	1990	1991	1992	1993	1994	Total
Experts (m/m)	8/00	15/00	16/20	15/00	11/07	6/25	15/00	87/20
Equipment (\$)	15 000	15 000	24 900	25 000	25 000	15 000	15 000	134 900
Training (\$)	28 800	40 000	60 000	80 000	21 440	9 625	60 000	299 865
<hr/>								
Disbursements	1988	1989	1990	1991	1992	1993	1994	Total
Experts (m/m)	7/10	12/06	13/27	11/08	12/19	15/01	1/03	73/14
Equipment (\$)	12 926	10 696	26 810	12 764	22 116	20 268	3 886	109 470
Training (\$)	623	23 714	63 666	94 920	12 857	27 046	-	222 828

**Current Financial Status (as of 14 April 1994):**

Total Disbursements (Experts, Equipment, Training): \$1 102 986

Unliquidated Obligations:

Experts -  
 Equipment \$6 354  
 Training \$1 500

Sub-total \$7 854

Earmarkings:

Experts (14/06 m/m) \$153 360  
 Equipment \$19 075  
 Training \$75 536

Sub-total \$247 971



## **APPROVED PROJECT OBJECTIVES AND ACTIVITIES**

The objectives of this regional multi-year project are to strengthen the regional capabilities and infrastructure in radiation protection; to establish more effective national radiation protection services; to co-ordinate technical assistance efforts in radiation protection in African Member States; to assess their radiation protection practices; and to advise Governments on improvements. The following activities were foreseen:

- Identification of national competent authorities/institutes in the 26 African Member States, who could take over co-ordination and guarantee sustainable follow-up activities.
- Organization of meetings of national co-ordinators to further regional co-operation, and formulation of policies to that effect, including long-term strategies and programmes in the area of radiation protection.
- Organization of regional and national training courses, workshops and seminars to strengthen manpower development in radiation protection.
- Provision of expert services
  - (a) for pre-project assessment and formulation of TC projects in radiation protection, as may be necessary, and
  - (b) in specific areas relevant to the development of national infrastructure in radiation protection and safety.
- Provision of specialized equipment and expendable supplies which are not locally available.
- Provision of temporary personnel monitoring services by the Agency for Member States not having such services available locally, or who may need temporary assistance because of equipment failure in an established national service.
- Assisting Member States in intercomparison studies, calibration services, etc. with a view to quality control of monitoring equipment.
- Co-ordination of project activities, as well as technical backstopping for Agency-assisted national TC projects in radiation protection, so as to ensure that they are properly planned and regularly evaluated.

The Agency is assisting these activities by organizing regional and national training courses, workshops and meetings; providing some equipment and supplies; providing the services of experts to assist in training activities, pre-project assessments and other project related tasks; as well as co-ordination of national TC projects.

The intended target groups and beneficiaries are the participating institutes/organizations in Member States engaged in research and development of nuclear science and technology, as well as the general public and the environment.

## **PROJECT SUMMARY**

Taking into consideration the differences in culture, language and the level of development as existing in 1988, the 26 Member States in Africa could be roughly divided into the following three groups on sub-regional basis:-

Region 1: Includes the countries in the North-of-the-Sahara region (Algeria, Egypt, Libyan Arab Jamahiriya, Morocco and Tunisia). In this region the status of radiation protection was rather satisfactory.

Region 2: Includes the anglophone Member States in the South-of-the-Sahara region (Ethiopia, Ghana, Kenya, Liberia, Mauritius, Namibia, Nigeria, Sierra Leone, Sudan, United Republic of Tanzania, Uganda, Zambia and Zimbabwe). In this region there was a vast difference in the level of development of the radiation protection infrastructure and services, and special technical assistance programmes were to be directed to groups of countries within this region. A potential existed here for establishing regional radiation protection co-operation.

Region 3: Includes the francophone Member States in the South-of-the-Sahara region (Cameroon, Côte d'Ivoire, Gabon, Madagascar, Mali, Niger, Senegal and Zaire). This region was the least developed, and priority had to be given to manpower training in basic radiation protection, as well as to the development of basic radiation protection infrastructure and services.

Initially, 20 countries were selected for participation in the regional project. The countries that were not included were: Algeria, Egypt and Libya - having rather adequate infrastructures and services for radiation protection - and Gabon, Liberia and Zaire - having very little TC activities at that time. Since early 1993, these six countries have also been included as project participants.

To provide a firm basis for project implementation, the following steps were taken:-

- (i) The Agency appointed an ex-staff member Mr. W. Hasling (DEN), as project co-ordinator and technical officer with effect from 9 June 1988. His duties also included the functions of a technical officer for national TC projects on radiation protection in about 18 African Member States, so as to be able to co-

ordinate their activities in relation to the regional project RAF/9/005. (With short breaks, Mr. Hasling continued in this post until 3 February 1994, with a total period of assignment of 60 months and 11 days).

- (ii) National competent authorities/institutes were identified in each Member State, which were expected to co-ordinate the project activities in their respective home countries. A list of the counterpart institutes along with the names of the national co-ordinators is given in **Annex - I**.

Between March 1988 and December 1993, 14 programme changes were made to respond to project developments. The total current budget amounts to \$1 223 120, including \$788 355 (87/20 man-months) for expert services, \$134 900 for equipment and \$299 865 for group training. No provision for individual fellowships and scientific visits was made under the project since global and regional fellowship funds as well as funds under national TC projects were available for these purposes.

As of 14 April 1994, total disbursements under the project amount to \$1 102 986, unliquidated obligations to \$7 854 and funds earmarked for implementation to \$247 971 (see Financial Summary, page 6). Including unliquidated obligations, the project has already provided 73.5 months of expert services, \$115 824 worth of equipment and supplies and \$224 328 for group training.

## **IMPLEMENTATION**

### **A. Project Activities**

#### **Experts**

A total of 73.5 months of expert services were utilized during the period January 1988 to April 1994 (**Annex II**), including 60.4 months for the project co-ordinator. The remaining 13.1 months of expert services can be broadly divided into the following four categories:-

- (i) Pre-project missions to Ghana, Nigeria, Senegal and Sierra Leone (24 days).
- (ii) Missions related to Legislation and Regulations carried out in Cameroon, Madagascar, Sierra Leone, Sudan and Tunisia (2 months and 20 days).
- (iii) National Workshops/Seminars held in Libya, Nigeria, Sierra Leone, Tanzania, Zambia and Zimbabwe (6 months and 1 day).
- (iv) Regional Training Courses/Workshops and Meetings (3 months and 18 days).

The distribution of these services is given in **Table 2** and **Table 3**.

Most of the national workshops/seminars were organized locally, involving a number of local experts/demonstrators. For a regional workshop held in Vienna in May 1991, Agency staff members were involved as lecturers; and for two others held in March and April 1991 (also in Vienna), five instructors from commercial companies were invited and were paid from the equipment component of the project. Similarly, four local lecturers recruited for a regional workshop in Ghana, were paid from the training funds of the project.

As project co-ordinator, Mr. Hasling also carried out short missions to Kenya in 1988 (three days), Côte d'Ivoire in 1990 and 1992 (13 days), Zambia in 1990 (four days), Zimbabwe in 1990 (five days), Tanzania in 1992 (ten days) and to Ghana in 1992 (six days) and participated in the Meetings on Regional Co-operation in Radiation Protection in Africa, held in Tanzania in 1989 and 1992.

**Table 2**  
**Country-wise Breakup of Expert Services**

Country	Task No.	Expert & Origin	Time	Duration (m/m)	Remarks
Cameroon	9	Risselin (FRA)	April 1990	0/18	Drafted legislation and regulations.
	23	Phoung (VIE)	Dec. 1993	0/12	Drafted legislation and regulations.
Ghana	5	Buchtela (AUS)	May 1989	0/07	Pre-project mission.
Libyan A.J.	20	Barakat (EGY)	May 1993	0/14	National Workshop.
		Othman (SYR)		0/15	
		Skornik (IAEA)		0/08	
Madagascar	23	Phoung (VIE)	Dec. 1993	0/11	Drafted legislation and regulations.
Nigeria	10	Skornik (IAEA)	June 1990	0/04	National Workshop.
	12	Palfalvi (HUN)	July 1990	0/04	Pre-project mission.
	19	Bergman (IAEA)	Mar. 1993	0/02	National Workshop (postponed due to strike).
Senegal	3	Ouvrard (IAEA)	Feb. 1989	0/08	Pre-project mission.
Sierra Leone	4	Hasting (IAEA)	April 1989	0/05	Pre-project mission.
	11	Skornik (IAEA)	June 1990	0/04	National seminar.
	17	Westerlund (NOR)	Sept. 1992	0/09	Drafted legislation and regulations.
Sudan	21	Othman (SYR)	Dec. 1993	0/15	Translated draft laws and regulations from English to Arabic.
Tunisia	14	De Nercy (FRA)	Jan/Feb 1992	0/15	Final review of draft legislation.
U.R. Tanzania	15	Ortiz-Lopez (IAEA)	Jan. 1992	0/10	National Seminar.
	26	Ortiz-Lopez (IAEA)	Jan. 1993	0/06	National Seminar.
Zambia	24	Tole (KEN)	Dec. 1993	0/11	National Workshop.
Zimbabwe	16	Benini (IAEA)	June 1992	0/18	National Workshop.
		Griffiths (UK)		0/17	
		8 National Consultants (ZIM)		2/12	
<b>Total</b>				<b>9/15</b>	

**Table 3**  
**Expert Services for Regional Training Courses/Workshops and Meetings**

Task No.	Place & Date	Expert & Origin	Duration (m/m)	Remarks
2	Kenya August 1988	Hasling (IAEA) Ouvrard (IAEA)	0/27 0/17	Regional Training Course.
6	Kenya June 1989	Hasling (IAEA)	0/02	Preparatory meeting.
7	U.R. Tanzania September 1989	Hasling (IAEA)	0/07	Meeting on Regional Co-operation.
8	Tunisia January 1990	Ouvrard (IAEA)	0/05	Preparatory meeting.
13	Nigeria December 1990	Skornik (IAEA) Westerlund (NOR)	0/15 0/17	Regional Workshop.
18	Ghana March 1993	Bergman (IAEA) Skornik (IAEA)	0/04 0/09	Regional Training Course.
27	Egypt December 1993	Strohal (IAEA)	0/05	Meeting of the Organization of African Unity.
<b>Total</b>			<b>3/18</b>	

### **Equipment**

Total disbursements plus unliquidated obligations for equipment as of mid-April 1994 amount to \$ 115 824, or some 10% of total disbursements under the project. Roughly one-third of this amount (about \$36 000) was spent for direct supplies to Member States which also included the repair of a Ge(Li) detector for Ghana, installation of TLD systems in Madagascar, Tanzania, Uganda and Zambia, microcomputers for Kenya and Zaire, computer software for Nigeria, and some expendable supplies for Mali and Tanzania. The remaining funds of about \$80 000 were spent for equipment and supplies (including their transportation) needed for the organization of regional training courses/workshops, and for the supply of expendable items such as TLD badges, plastic bags, light-tight dosimeter labels, etc., not locally available. These were purchased by the Agency and shipped as required to individual laboratories. It also includes the cost of five instructors from commercial companies hired for two regional workshops held in Vienna.

### **Training**

Four regional training courses, three regional workshops, four national workshops and three national seminars have already been organized under the project. One regional training course for radiation protection officers scheduled in November 1993 (Côte d'Ivoire)

for the francophone countries did not take place, owing to lack of qualified candidates; and one national workshop on radiation safety in the Nigerian petroleum industry scheduled in March 1993 was postponed due to a local strike. The details of the group training events are given below:-

(a) Regional Training Courses (RTC)/Workshops (RWS) Organized:

- I. RTC for Radiation Protection Officers  
Nairobi, Kenya, 8 August - 2 September 1988  
Lecturers: Hasling (IAEA), Ouvrard (IAEA)  
Participants: Regular 8: Uganda (2), Tanzania (5), Zimbabwe (1)  
Local 5
- II. RTC for Radiation Protection Officers (francophone countries)  
Tunis, Tunisia, 5 May - 1 June 1990  
Lecturers: Ouvrard (IAEA), Rebiffé (FRA)\*, Bodineau (FRA)\*  
Participants: Regular 16: Cameroon (2), Côte d'Ivoire (2), Gabon (1), Madagascar (2), Morocco (2), Niger (2), Senegal (3), Zaire (2)  
Local 7
- III. RWS on Basic Radiation Protection and Development of National Infrastructure for Radiation Safety (anglophone countries)  
Ibadan, Nigeria, 3 - 14 December 1990  
Lecturers: Westerlund (NOR), Skornik (IAEA), Belugun (NIR), Farari (NIR), Olomo (NIR), Oresegun (NIR)  
Participants: Regular 18: Ethiopia (1), Ghana (2), Kenya (2), Mauritius (2), Sierra Leone (2), Sudan (2), Uganda (2), Tanzania (2), Zambia (2), Zimbabwe (1)  
Local 5
- IV. RWS on Trouble Shooting and Maintenance of Harshaw TLD Equipment  
Vienna, Austria, 18 - 22 March 1991  
Lecturers: Three instructors from Bicron Technologies (formerly Harshaw), Germany  
Participants: Regular 9: Ghana (1), Madagascar (1), Morocco (1), Sudan (1), Tunisia (2), Uganda (1), Tanzania (1), Zambia (1)
- V. RWS on Trouble Shooting and Maintenance of Vinten TLD Equipment  
Vienna, Austria, 8 - 12 April 1991  
Lecturers: Two instructors from NE Technology Ltd. (formerly Nuclear Enterprises Ltd.), U.K.  
Participants: Regular 6: Côte d'Ivoire (1), Ethiopia (1), Kenya (1), Nigeria (2), Zimbabwe (1)
- VI. RWS on Emergency Planning and Preparedness and International Co-operation (anglophone countries)  
Vienna, Austria, 27 - 31 May 1991  
Lecturer: Weiss (IAEA)  
Participants: Regular 10: Ethiopia (1), Ghana (1), Kenya (1), Nigeria (1), Sierra Leone (1), Sudan (1), Uganda (1), Tanzania (1), Zambia (1), Zimbabwe (1)

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\* Not charged to project.

- VII. RTC for Radiation Protection Officers (anglophone countries)  
Legon-Accra, Ghana, 8 - 31 March 1993  
Lecturers: Bergman (IAEA), Skornik (IAEA)  
Participants: Regular 12: Ethiopia (1), Kenya (2), Namibia (1), Sierra Leone (2), Sudan (2), Tanzania (1), Zambia (1), Zimbabwe (2)  
Local 1

(b) National Workshops (NWS)/Seminars (NS) Organized:

- (i) NWS on Radiation Protection for Medical Doctors  
Ibadan, Nigeria, 4 - 9 June 1990  
Lecturer: Skornik (IAEA)  
Participants: 6 (local)
- (ii) NS on Radiation Protection, Monitoring and Radioisotope Uses  
Freetown, Sierra Leone, 4 - 9 June 1990  
Lecturer: Skornik (IAEA)  
Participants: 28 (local)
- (iii) NS for Radiation Safety Officers  
Arusha, Tanzania, 11 - 20 January 1992  
Lecturer: Ortiz-Lopez (IAEA)  
Participants: 21 (local)
- (iv) NWS on Radiation Protection and Quality Assurance in Diagnostic Radiology  
Harare, Zimbabwe, 17 - 24 June 1992  
Lecturers: Griffiths (UK), Benini (IAEA) and eight local experts recruited by IAEA  
Participants: 22 (local)
- (v) NS on Radiation Protection for Medical Radiographers  
Arusha, Tanzania, 11 - 15 January 1993  
Lecturer: Ortiz-Lopez (IAEA)  
Participants: 16 (local)
- (vi) NWS for Radiation Safety Officers  
Tajoura, Libya, 9 - 20 May 1993  
Lecturers: Barakat (EGY), Othman (SYR), Skornik (IAEA)  
Participants: 19 (local)
- (vii) NWS on Radiation Protection and Quality Control in Diagnostic Radiology  
Lusaka, Zambia, 20 November - 11 December 1993  
Lecturer: Tole (KEN)  
Participants: 22 (local)

(c) Planned for 1994:

1. Regional Workshop on Standardization of Dose Measurements at National Calibration Laboratories,  
Seibersdorf, Austria, 7 - 18 November 1994



A summary of the 231 participants in regional and national group training events, as organized under the project, is given in **Table 4**.

**Table 4**  
**Participants in Group Training Events under RAF/9/005**  
**by Nominating Country**  
**(1988 - 1993)**

Country	Regional Training Courses/Workshops								National Workshops/Seminars	Grand Total
	I	II	III	IV	V	VI	VII	Total		
Algeria	-	-	-	-	-	-	-	-	-	-
Cameroon	-	2	-	-	-	-	-	2	-	2
Côte d'Ivoire	-	2	-	-	1	-	-	3	-	3
Egypt	-	-	-	-	-	-	-	-	-	-
Ethiopia	-	-	1	-	1	1	1	4	-	4
Gabon	-	1	-	-	-	-	-	1	-	1
Ghana	-	-	2	1	-	1	1 <sup>+</sup>	5	-	5
Kenya	5 <sup>+</sup>	-	2	-	1	1	2	11	-	11
Liberia	-	-	-	-	-	-	-	-	-	-
Libyan A.J.	-	-	-	-	-	-	-	-	19	19
Madagascar	-	2	-	1	-	-	-	3	-	3
Mali	-	-	-	-	-	-	-	-	-	-
Mauritius	-	-	2	-	-	-	-	2	-	2
Morocco	-	2	-	1	-	-	-	3	-	3
Namibia	-	-	-	-	-	-	1	1	-	1
Niger	-	2	-	-	-	-	-	2	-	2
Nigeria	-	-	5 <sup>+</sup>	-	2	1	-	8	6	14
Senegal	-	3	-	-	-	-	-	3	-	3
Sierra Leone	-	-	2	-	-	1	2	5	28	33
Sudan	-	-	2	1	-	1	2	6	-	6
Tunisia	-	7 <sup>+</sup>	-	2	-	-	-	9	-	9
Uganda	2	-	2	1	-	1	-	6	-	6
U.R. Tanzania	5	-	2	1	-	1	1	10	37	47
Zaire	-	2	-	-	-	-	-	2	-	2
Zambia	-	-	2	1	-	1	1	5	22	27
Zimbabwe	1	-	1	-	1	1	2	6	22	28
<b>Total</b>	<b>43</b>	<b>23</b>	<b>23</b>	<b>9</b>	<b>6</b>	<b>10</b>	<b>13</b>	<b>97</b>	<b>134</b>	<b>231</b>

<sup>+</sup> Local Participants.

Attention was also given to providing training in radiation protection through individual fellowships and scientific visits outside of this project. During the ten years period 1984-1993, 202 such awards of fellowships and scientific visits for a total of 1138 months of training went to 22 countries participating in the project RAF/9/005, as shown in **Table 5**.

**Table 5**  
**Fellowships and Scientific Visits Awarded in Radiation Protection**  
**and Related Areas**  
**(not funded from Project RAF/9/005)**  
**(1984 - 1993)**

Country	Number of Awards	Man-Months/Man-Days
Algeria	10	26/29
Cameroon	4	27/18
Côte d'Ivoire	7	7/26
Egypt	43	254/13
Ethiopia	11	61/00
Gabon	1	6/00
Ghana	5	25/06
Kenya	6	36/09
Liberia	-	-
Libyan Arab Jamahiriya	27	245/28
Madagascar	3	3/12
Mali	1	1/05
Mauritius	-	-
Morocco	11	30/23
Namibia	-	-
Niger	6	32/18
Nigeria	16	128/11
Senegal	2	7/00
Sierra Leone	-	-
Sudan	7	42/12
Tunisia	8	27/04
Uganda	2	14/20
United Republic of Tanzania	14	65/16
Zaire	11	81/07
Zambia	4	6/03
Zimbabwe	3	6/07
<b>Total</b>	<b>202</b>	<b>1137/27</b>

Additional training was provided through regional training courses (94 participants) and interregional training courses (106 participants) organized by the Agency outside of the project RAF/9/005. Altogether, a total of 633 candidates from African Member States were offered training in radiation protection and related areas through fellowships and training courses during the ten-year period 1984 through 1993 (**Table 6**).

**Table 6**  
**Total Training Awards in**  
**Radiation Protection and Related Areas**  
**(1984 - 1993)**

Country	RAF/9/005 (Table 4)	Other Regional Training Courses	Interregional Training Courses	Fellowships and Scientific Visits (Table 5)	Total
Algeria	-	3	12	10	25
Cameroon	2	3	3	4	12
Côte d'Ivoire	3	1	3	7	14
Egypt	-	11	13	43	67
Ethiopia	4	4	4	11	23
Gabon	1	1	2	1	5
Ghana	5	3	10	5	23
Kenya	11	7	5	6	29
Liberia	-	-	-	-	-
Libyan A.J.	19	1	6	27	53
Madagascar	3	2	2	3	10
Mali	-	1	3	1	5
Mauritius	2	3	1	-	6
Morocco	3	18	5	11	37
Namibia	1	2	-	-	3
Niger	2	2	2	6	12
Nigeria	14	6	7	16	43
Senegal	3	1	3	2	9
Sierra Leone	33	-	-	-	33
Sudan	6	3	5	7	21
Tunisia	9	5	1	8	23
Uganda	6	3	-	2	11
U.R. Tanzania	47	5	8	14	74
Zaire	2	5	7	11	25
Zambia	27	2	3	4	36
Zimbabwe	28	2	1	3	34
<b>Total</b>	<b>231</b>	<b>94</b>	<b>106</b>	<b>202</b>	<b>633</b>

Taking into account that a number of trainees have received multiple training, it is estimated that the total number of individuals from African Member States trained by the Agency in radiation protection would be over 300.

### **Meetings**

Three meetings on "Regional Co-operation in Radiation Protection in Africa" have so far been organized under the project:

1. Tanzania, 12 to 14 September 1989.  
Participating countries: Ethiopia, Ghana, Kenya, Mauritius, Nigeria, Sierra Leone, Sudan, Tanzania, Uganda and Zambia.
2. Tanzania, 10 to 13 March 1992.  
Participating countries: Ethiopia, Ghana, Madagascar, Namibia, Nigeria, Sierra Leone, Uganda and Tanzania.
3. Madagascar, 9 to 12 May 1994.  
Participating countries: Algeria, Côte d'Ivoire, Ghana, Kenya, Madagascar, Mali, Mauritius, Morocco, Namibia, Nigeria, Senegal, Sierra Leone, Tanzania, Tunisia, Zaire, Zambia and Zimbabwe.

The purpose of these meetings was to discuss and agree upon the framework for project activities, to assess the progress made, and to recommend future activities to be carried out under the project. The areas discussed included personnel monitoring, calibration, intercomparison, equipment maintenance, emergency preparedness, waste management, environmental monitoring, legislation and, on the administrative side, manpower development, the recruitment of regional experts, communication and future operational procedures. At each of these meetings, the participants presented a report on the current status of the national radiation protection services within their countries.

The recommendations of the most recent (May 1994) meeting are summarized as follows:

#### A. General

- (1) The meeting acknowledged with appreciation the establishment of an interregional Model Project on Radiation Protection Infrastructure in Selected Member States (INT/9/143), and recommended that the activities under RAF/9/005 be harmonized with those under the model project.
- (2) The meeting recommended that the Republic of South Africa be invited to participate in the project RAF/9/005.

- (3) The meeting noted that some countries still lacked the appropriate law, regulations and codes of practice to govern and ensure the safe use of radioisotopes and nuclear techniques. The participants were urged to stimulate the initiation and development of such legislation in their countries, if still non-existent. In developing the legislative process, infrastructure and organizational structures of national competent authorities, care must be taken to enhance adequate radiation protection, commensurate with the degree of utilization of nuclear techniques in a Member State.
- (4) It was noted that some competent authorities still lacked trained manpower to manage radiation protection and enforce the approved legislation. Exchange of expertise through the fellowship programme and scientific visits was seen to be one of the modalities to facilitate manpower development and to promote information exchange, common level of understanding and radiation protection development. The IAEA was requested to continue these efforts.
- (5) Communication problems within the recipient Member States should be resolved at the national level. This required urgent action as it had led to an insufficient number of applications for some of the training events.
- (6) The need to develop radiation protection in mining, particularly in uranium and phosphate mining, was reported to be of urgent importance for some Member States. Algeria offered to provide assistance in this respect, if requested by Member States.
- (7) Some Member States reported defective radiation measuring equipment. Since this was a problem of maintenance and repair capability, it was recommended that it should be dealt with under the relevant regional project RAF/4/004 - Nuclear Instruments Maintenance.
- (8) It was reported that nearly all Member States within the region had problems with the management of radioactive wastes, particularly with spent sources. It was recommended that all activities related to this area be carried out under the regional project RAF/9/007 - Waste Management.

B. Recommended Activities to be Carried Out under RAF/9/005 (in order of priority)

(1) Education and Training

The following specialized training courses (RTC) and workshops (RWS) were recommended:-

- (a) RTC on Standardization of Dose Measurement at National Calibration Laboratories, scheduled to be held in Seibersdorf in November 1994.
- (b) RWS on Emergency Response and Preparedness in the Event of a Radiological Emergency, Vienna, 1995.
- (c) RTC for Radiation Protection Officers, Algeria, 1995.
- (d) RWS on Trouble Shooting and Equipment Maintenance, Ghana, 1996.
- (e) RWS on Computer-aided Management of Radiation Protection for Regulatory Purposes, Kenya, 1996.

The meeting also noted that radiation protection and quality control in the area of medical applications, and in particular in diagnostic radiology, were insufficient in some countries. Noting further the various training events on this subject involving African Member States that had already been included in the Agency's regular training programme for 1995-96, a Workshop on Radiation Protection and Quality Control in Diagnostic Radiology was proposed to be held in Morocco in 1997.

The meeting adopted that the language of all training events will be English. Efforts should be made to organize the training events and other activities jointly, both involving anglophone and francophone countries, in order to facilitate greater understanding between the two groups of countries, a very desirable spin-off result.

(2) Calibration and Intercomparison

It was noted that three countries (Algeria, Ghana and Tanzania) had calibration facilities in operation and two (Madagascar and Morocco) had them under construction, while the rest had no such facilities. Considering the high investment cost in establishing calibration facilities, countries with operational facilities were invited to extend services to others. It was agreed that the IAEA be requested to facilitate such co-operation within the region - starting from the 1995-96 programme cycle.

(3) Information Exchange

The meeting underscored the importance of information exchange through a Newsletter and noted the big delay already incurred (four years). However, it was agreed that Kenya be given another chance to work on it. The meeting urged all participating Member States to follow up their commitments to contribute papers/articles for this purpose.

(4) Next Meeting Schedule

It was agreed that the next Meeting on Regional Co-operation in Radiation Protection in Africa be held in Rabat, Morocco in 1996.

**B. Related Activities**

• Country and other regional projects in Radiation Protection and Related Areas

Thirty-one national TC projects are currently under implementation in 20 countries, covering the areas of environmental monitoring, safety standards, regulations and procedures, dosimetry and radiological emergency; as well as one regional project on environmental radiation measurement and harmonization (**Annex - III**). Another 25 national TC projects have been completed since 1984 in 16 countries, covering the areas of environmental monitoring, radiological safety and personnel dosimetry (**Annex - IV**). A financial summary of both completed and operational national TC projects, by country, is given in **Table 7**.

**Table 7**

**National TC Projects in Radiation Protection and Related Areas in Africa**

Country	Closed since 1984		Operational as of April 1994		Total	
	No.	Total disbursements (\$)	No.	Current total budget (\$)	No.	Value (\$)
Algeria	3	144 623	1	118 705	4	263 328
Cameroon	1	114 161	-	-	1	114 161
Côte d'Ivoire	-	-	1	376 520	1	376 520
Egypt	6	772 671	4	422 325	10	1 194 996
Ethiopia	1	122 523	1	420 000	2	542 523
Gabon	1	6 464	-	-	1	6 464
Ghana	-	-	1	87 300	1	87 300
Kenya	2	354 332	-	-	2	354 332
Liberia	-	-	-	-	-	-
Libyan A.J.	2	176 680	3	184 165	5	360 845
Madagascar	-	-	1	337 656	1	337 656
Mali	1	105 211	-	-	1	105 211
Mauritius	-	-	1	181 850	1	181 850
Morocco	-	-	3	559 740	3	559 740
Namibia	-	-	1	322 500	1	322 500
Niger	1	118 475	2	391 250	3	509 725
Nigeria	1	235 145	3	396 799	4	631 944
Senegal	-	-	1	134 282	1	134 282
Sierra Leone	-	-	1	188 840	1	188 840
Sudan	1	123 719	1	163 350	2	287 069
Tunisia	-	-	2	502 044	2	502 044
Uganda	1	112 003	1	144 600	2	256 603
U.R. Tanzania	1	488 736	1	177 306	2	666 042
Zaire	1	193 965	-	-	1	193 965
Zambia	1	164 109	1	86 135	2	250 244
Zimbabwe	1	17 980	1	156 596	2	174 576
<b>Total</b>	<b>25</b>	<b>In 16 Countries</b>	<b>31</b>	<b>In 20 Countries</b>	<b>56</b>	<b>8 602 760</b>

- Regional and Interregional Training Courses

Two hundred African trainees participated in the regional and interregional training courses in radiation protection and related areas organized by the Agency during the last ten years (see table 6, page 17). One of these courses entitled "Nuclear Law and Safety Regulations" (RAF/O/004), held in Nairobi, Kenya, from 4 to 15 March 1991, was particularly designed for lawyers. It was attended by 20 participants, from 18 Member States comprising anglophone and francophone countries, namely, Algeria, Cameroon, Egypt, Ethiopia, Gabon, Ghana, Libya, Mali, Mauritius, Morocco, Namibia, Nigeria, Senegal, Tanzania, Tunisia, Uganda, Zaire and Zimbabwe.

An interregional training course on Radiation Protection (INT/9/142) is at present under way in France with ten participants from Africa: Algeria (2), Cameroon (1), Egypt (1), Morocco (2), Niger (2), Nigeria (1) and Senegal (1).

In addition, two regional training courses (with priority for francophone African Member States) are planned for 1994:-

- |           |  |
|-----------|--|
| RAF/9/012 | Regional Training Course on Radiation Protection in Medical Practice (in French)<br>Tunis, Tunisia, 17 October - 4 November 1994<br>(Postponed from May 1994 due to lack of sufficient applicants) |
| RAF/9/013 | Regional Training Course on System of Notification, Registration, Licensing and Control of Radiation Sources and Installations<br>Dar es Salaam, Tanzania, 10 October - 4 November 1994            |

- Meeting

An Agency-organized regional seminar (IAEA-SR-149) on "Radiation Protection Services for Developing Countries in Africa" was held in Nairobi from 5 to 9 September 1988. The seminar was attended by 32 participants from 14 countries (Cameroon, Egypt, Ethiopia, Ghana, Kenya, Madagascar, Mali, Nigeria, Sierra Leone, Sudan, Uganda, Tanzania, Zambia and Zimbabwe), and was the first of its kind organized in Africa, providing a forum for exchange of information and experience in radiation protection among the participating Member States. The seminar gave a good overview of the status of radiation protection services in Africa and illustrated the growing awareness of radiation protection issues in African Member States. The meeting unanimously adopted to co-operate in this field on a regional basis.



## **ACCOMPLISHMENTS**

As of April 1994, project RAF/9/005 has provided a total of 73.5 months of expert services, equipment and supplies worth \$115 824 and group training at a cost of \$224 328. The following has been achieved:-

- (i) Four regional training courses and three regional workshops were organized, four of them held in the region (Ghana, Kenya, Nigeria and Tunisia) and three in Vienna, providing training to 97 African scientists and technicians in radiation protection and related fields. Another 134 were trained through four national workshops and three national seminars organized under the project in Libya, Nigeria, Sierra Leone, Tanzania, Zambia and Zimbabwe.
- (ii) Three meetings of chief radiation protection officers from Member States were organized, which highlighted the needs for regional co-operation in radiation protection in Africa and focussed on the current status of radiation protection infrastructure and services and on future needs and priorities in the participating countries.
- (iii) Expert assistance was provided to Cameroon, Madagascar, Sierra Leone, Sudan and Tunisia for the drafting of legislation and regulations as well as for review of final drafts. As a result, these countries now have a radiation protection act either in force or at least in draft form.
- (iv) Pre-project missions carried out under the project resulted in four new TC projects in radiation protection (Ghana, Nigeria, Senegal and Sierra Leone).
- (v) Some laboratories were upgraded through the supply of microcomputers and the provision of expendable supplies, such as TLD badges, light-tight dosimeter labels, plastic containers for food contamination monitoring, etc. which are not locally available but are mandatory for the operation of an established radiation protection service.
- (vi) The project has also assisted with the installation of TLD equipment in Madagascar, Tanzania, Uganda and Zambia, along with training of local staff for its operation and maintenance, as well as with the repair of a Ge(Li) detector for Ghana, provided under national TC projects.

- (vii) Temporary dosimetry services were provided to Côte d'Ivoire, Sierra Leone and Nigeria, where no such services were available. Tanzania also received such services from May to July 1989 during a break down of their TLD system.
- (viii) Intercomparison studies for the quality control of Agency-supplied TLD systems were arranged for Ethiopia, Ghana, Kenya, Nigeria, Sudan and Uganda. Calibration services were provided to Kenya, Tunisia and Zimbabwe.
- (ix) Technical backstopping and co-ordination of some 20 national TC projects in 18 Member States was provided by the project co-ordinator of RAF/9/005.
- (x) Four experts from developing countries, two from Africa, one from the Middle East and one from the Asia and Pacific Region, were used for expert missions as well as for training courses organized under the project; thus promoting co-operation among developing countries (TCDC).

Considerable improvement in radiation protection has now been achieved in many of the African Member States. Based on the reports presented by the country representatives at the meetings on "Regional Co-operation in Radiation Protection in Africa" organized under the project RAF/9/005, on experts reports, as well as on RAPAT mission reports and other sources of information available to the Agency, an attempt has been made to compare the status of radiation protection infrastructure and services as existing in early 1989 and in late 1993, in the 26 African Member States recipient of Agency technical assistance. This is shown in **Table 8**.

As can be seen from the table, 15 countries have now a radiation protection act in force and six have it in draft form, as compared to nine and seven, respectively, in 1989. Similarly, nine countries now have effective radiation protection regulations and four have drafts, as compared to three and five, respectively, in 1989. Codes of practice are now available in eight countries, as compared to four (one in draft) in 1989. Thirteen countries have a national competent authority, as compared to seven in 1989.

**Table 8**  
**Status of Radiation Protection Infrastructure and Services**  
**In African Member States**  
**(as existing in early 1989 and late 1993)**

Item	1989	1993
Radiation Protection Act	Algeria <sup>1</sup> , Côte d'Ivoire <sup>1</sup> , Egypt, Ethiopia <sup>1</sup> , Ghana <sup>1</sup> , Kenya, Libya, Mauritius <sup>1</sup> , Morocco, Nigeria <sup>1</sup> , Sudan, Tanzania, Tunisia, Zaire <sup>1</sup> , Zambia and Zimbabwe	Algeria, Cameroon <sup>1,2</sup> , Egypt, Ethiopia, Ghana, Kenya, Libya, Madagascar <sup>2</sup> , Mauritius, Morocco, Namibia <sup>1,2</sup> , Niger <sup>2</sup> , Nigeria <sup>1</sup> , Senegal <sup>1,2</sup> , Sierra Leone <sup>1,2</sup> , Sudan <sup>1</sup> , Tanzania, Tunisia, Uganda <sup>2</sup> , Zambia and Zimbabwe
	16 countries (7 drafts)	21 countries (6 drafts)
Radiation Protection Regulations	Algeria <sup>1</sup> , Côte d'Ivoire <sup>1</sup> , Egypt, Gabon <sup>1</sup> , Kenya, Morocco <sup>1</sup> , Tunisia and Zaire <sup>1</sup>	Algeria, Cameroon <sup>1,2</sup> , Egypt, Gabon <sup>1</sup> , Ghana <sup>2</sup> , Kenya, Libya <sup>2</sup> , Madagascar <sup>1,2</sup> , Morocco, Senegal <sup>1,2</sup> , Tanzania <sup>2</sup> , Tunisia and Zambia <sup>2</sup>
	8 countries (5 drafts)	13 countries (4 drafts)
Codes of Practices	Algeria, Egypt, Kenya and Tanzania <sup>1</sup>	Algeria, Egypt, Kenya, Libya <sup>2</sup> , Morocco <sup>2</sup> , Tanzania, Tunisia <sup>2</sup> and Zambia <sup>2</sup>
	4 countries (1 draft)	8 countries
National Competent Authority	Algeria, Egypt, Kenya, Morocco, Tanzania, Tunisia and Zambia	Algeria, Côte d'Ivoire <sup>2</sup> , Egypt, Ghana <sup>2</sup> , Kenya, Libya <sup>2</sup> , Madagascar <sup>2</sup> , Mauritius <sup>2</sup> , Morocco, Sudan <sup>2</sup> , Tanzania, Tunisia and Zambia
	7 countries	13 countries
Radiation Protection Service Staff	Algeria, Egypt, Ethiopia, Ghana, Kenya, Libya, Tanzania and Tunisia	Algeria, Egypt, Ethiopia, Ghana, Kenya, Libya, Madagascar <sup>2</sup> , Morocco <sup>2</sup> , Nigeria <sup>2</sup> , Sudan <sup>2</sup> , Tanzania, Tunisia and Zambia <sup>2</sup>
	8 countries	13 countries
Personnel Monitoring Laboratory Facilities	Algeria, Egypt, Ethiopia, Ghana, Kenya, Libya, Madagascar, Morocco, Nigeria, Sudan, Tanzania, Tunisia, Zambia and Zimbabwe	Algeria, Côte d'Ivoire <sup>2</sup> , Egypt, Ethiopia, Ghana, Kenya, Libya, Madagascar, Mali <sup>2</sup> , Morocco, Nigeria, Senegal <sup>2</sup> , Sudan, Tanzania, Tunisia, Zambia and Zimbabwe
	14 countries	17 countries
Radiometric Laboratory, including Food and Environmental Monitoring	Algeria, Egypt, Ethiopia, Ghana, Kenya, Libya, Morocco, Nigeria, Sudan, Tanzania, Tunisia, Zambia and Zimbabwe	Algeria, Côte d'Ivoire <sup>2</sup> , Egypt, Ethiopia, Ghana, Kenya, Libya, Morocco, Nigeria, Sudan, Tanzania, Tunisia, Zambia and Zimbabwe
	13 countries	14 countries

<sup>1</sup> In draft.

<sup>2</sup> New in 1993.

Similar improvements are also noticeable in the area of radiation protection services. Thirteen countries have adequate service staff, as compared to eight in 1989; 17 countries have some personnel monitoring facilities, as compared to 14 in 1989; and 14 countries have some facilities for radiometry, as compared to 13 in 1989.

This progress does not mean that all is well in radiation protection in Africa. Many countries still lack in one or more of the sectors on the list, and very few countries have them all in force. It should also be noted that in some countries the facilities listed may be less adequate than in others or deficient in one respect or another. Some countries have even fallen from the 1989 status mainly for socio-economic and political reasons.

### III

#### **FINDINGS**

Radioisotopes and/or ionizing radiation were used in some form or another in medicine, agriculture, industry and research in most of the Agency Member States in Africa for a long time practically without any infrastructure and services for radiation protection and safety of the workers, the general public and the environment. Intensified Agency efforts through national technical co-operation programmes, regional and interregional training courses combined with the establishment of the regional TC project RAF/9/005 - "Radiation Protection Development" have significantly addressed this problem.

An analysis of the achievements, however, reveals that deficiencies still exist. Based on this analysis, and considering the availability of other services relevant to radiation protection and safety, such as safety assessment, inspection of radiation sources and installations for quality control, national calibration laboratory, radiological emergency preparedness, and the management of radioactive wastes, the 26 Member States in Africa can be broadly divided into the following four categories as far as radiation protection is concerned:

Category A = Adequate (10 countries)

Algeria, Egypt, Ghana, Kenya, Libya, Madagascar, Morocco, Tanzania, Tunisia and Zambia.

Category B = Deficient/not up to the mark (5 countries)

Côte d'Ivoire, Ethiopia, Mauritius, Nigeria and Sudan.

Category C = Poor (3 countries)

Namibia, Senegal and Zimbabwe.

Category D = Very Poor (8 countries)

Cameroon, Gabon, Liberia, Mali, Niger, Sierra Leone, Uganda and Zaire.

There is still a long way to go in establishing radiation protection infrastructure and services in all the African Member States. The process is slow, and mainly depends upon the Member State's desire and resolution to act upon it. There are obstacles through political and economic situations over which the Agency has little control. It is only through communication and direct dialogue at the appropriate level that the Agency can influence Governments to intensify their own efforts, assisted by the Agency with expert advice, personnel training and equipment supplied under national TC projects.

Radiation Protection Advisory Team (RAPAT) missions have already been carried out in 19 of the African Member States, with follow-up missions to six of them. Considering the current level of infrastructure and services for radiation protection in many of the African Member States, this review is of the opinion that continuous surveillance of the situation is needed, if necessary substantiated by expert missions, so that appropriate corrective measures could be taken as required. It is expected that the forthcoming Policy Review Seminar during the IAEA General Conference in September 1994 will discuss future methodologies for assuring continuous surveillance of radiation protection practices in Member States.

An interregional model project on "Upgrading Radiation Protection Infrastructure" (INT/9/143) has been approved for a five-year period from 1994-1998 with the objective "to assist a number of selected Member States with an inadequate radiation safety infrastructure to enhance and strengthen this so that it complies with standards established by the Agency for protection against ionizing radiation and for the safety of radiation sources". In consideration of the prevailing conditions of radiation protection infrastructures in African Member States, three countries (Cameroon, Ghana and Uganda) have already been included in the project on first priority, and six more (Gabon, Mali, Senegal, Sierra Leone, Zaire and Zimbabwe) will be included at a later date.

Although substantial progress has been made in radiation protection manpower development through the national and regional training courses organized under project RAF/9/005, as well as through fellowship training and other regional and interregional training courses, more qualified manpower is still needed, particularly for countries with smaller programmes in nuclear fields.

The organization under the project of regional training courses for francophone countries has not been too successful. One course had to be postponed from 1993 (and is likely to be cancelled) owing to lack of qualified candidates. A regional training course (RAF/9/012) was delayed from May 1994 to October 1994 for the same reason. Fellowship training would seem to be more appropriate for these countries.

Although many of the Member States do not have national programmes for manpower training in radiation protection and safety, and rely entirely on Agency-organized training programmes, it is heartening to note that the majority of the national training courses held under the project were organized and managed mainly by local experts, some of whom had received Agency training earlier, with only minimal input by the Agency. This should be encouraged.

This review recognizes the commendable work that has been done by the project co-ordinator in providing technical expertise for a large number of national TC projects as well as in co-ordinating their activities under the regional project RAF/9/005. However, since the main thrust of the new model project is likely to be on Africa, the co-ordinating functions of RAF/9/005 could be taken over by project INT/9/143. This will on the one hand save duplication of efforts for the same purpose, and on the other hand, promote harmonization of activities under the two projects, as has been recommended by the Meeting on Regional Co-operation for Radiation Protection in Africa, held recently in Madagascar.

#### IV

### RECOMMENDATIONS

1. Continuous surveillance should be maintained of the status of radiation protection in African Member States under both the new model project, INT/9/143, and RAF/9/005, so as to allow corrective action to be taken, as required.
2. Expert services should be provided to assist Member States in the formulation of legislation and regulations, where these do not exist, or where further advice may be needed. Regional experts should be used as available.
3. For countries with inadequate trained manpower in radiation protection, training should be provided through individual fellowships (minimum six months). In selecting the host countries, preference should be given to the countries in the region so as to develop closer regional co-operation. For this purpose, funds from the regional "Manpower Development" project (RAF/0/009) should be used.
4. Regional training courses/workshops should be organized in a timely manner to ensure full participation.
5. Wherever sufficient service personnel are available, the project counterparts should be encouraged to organize regular national training courses on basic radiation protection and safety. National experts who have already received Agency training should be encouraged to share their experience with their colleagues in such training courses. The Agency may provide some expert assistance, as needed.
6. Recognizing the significant improvements that have already been achieved in establishing radiation protection regimes in some African Member States, but mindful of the continuing need in others, it is recommended that project RAF/9/005 be extended for another two years under the 1995-96 programme, so as to assist these countries in establishing the national radiation safety infrastructure commensurate with the scope of their nuclear-related activities.



## **Annexes**

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**ANNEX I**

**COUNTERPART INSTITUTIONS OF  
PROJECT RAF/9/005 - RADIATION PROTECTION DEVELOPMENT**

1. Centre de Radioprotection et de Sûreté, Alger, ALGERIA.  
Project co-ordinator: Dr. Salah Djeflal
2. Secrétaire du Comité National de Développement des Technologies Mesures, Yaounde, CAMEROON.  
Project co-ordinator: Mr. Efa Fouda
3. Laboratoire National de la Santé Publique, Abidjan, COTE D'IVOIRE.  
Project co-ordinator: Mr. A. Kodja
4. Chairman, Nuclear Regulatory and Safety Centre, Atomic Energy Authority, Cairo, EGYPT.  
Project co-ordinator: Prof. F.M. Hammad
5. Institute of Pathology, Addis Ababa University, Addis Ababa, ETHIOPIA.  
Project co-ordinator: Mr. W. Mengesha
6. Directeur Général de l'Energie, Ministère des Mines, des Hydrocarbures, de l'Energie et des Ressources Hydrauliques, Libreville, GABON.  
Project co-ordinator: Mr. Philippe Ossoucah
7. Radiation Protection Board, Ghana Atomic Energy Commission, Legon-Accra, GHANA.  
Project co-ordinator: Mr. C. Schandorf
8. Radiation Protection Board, Ministry of Health, Nairobi, KENYA.  
Project co-ordinator: Mr. S. Wanguru
9. Ministry of Health and Social Welfare, Monrovia, LIBERIA.  
Project co-ordinator: Mr. Eric D. Johnson
10. Department of Radioprotection and Health Physics, Tajoura Nuclear Research Centre, Tripoli, LIBYAN ARAB JAMAHIRIYA.  
Project co-ordinator: Mr. Abdulaziz T. El Kiklu
11. Institut National des Sciences et Techniques Nucléaires, Antananarivo, MADAGASCAR.  
Project co-ordinator: Prof. R. Andriambololona
12. Département de Radiologie et de Médecine Nucléaire, Hôpital du 'Point G', Bamako, MALI.  
Project co-ordinator: Dr. S. Bakary
13. Physics Department, Victoria Hospital, Ministry of Health, Quatre Bornes, MAURITIUS.  
Project co-ordinator: Mr. J.C. Baguant
14. Service National de Radioprotection, Direction de l'Epidémiologie et des Programmes Sanitaires, Ministère de la Santé Publique, Rabat-Chellah, MOROCCO.  
Project co-ordinator: Dr. Charif Yousfi

15. Occupational Health Services and National Radiation Protection Services, Ministry of Health and Social Affairs, Windhoek, NAMIBIA.  
Project co-ordinator: Ms. Josephine Ndinelao Nathingé
16. Chef de Service, Inspection Médical du Travail, Ministère de la Santé Publique, Niamey, NIGER.  
Project co-ordinator: Dr. (Ms.) A. Niandou
17. Federal Radiation Protection Service, Department of Physics, University of Ibadan, Ibadan, NIGERIA.  
Project co-ordinator: Ms. M. Oresegun
18. Institut de Technologie Nucléaire Appliquée, Université Cheikh Antadiop de Dakar, Dakar, SENEGAL.  
Project co-ordinator: Prof. C.S. Diatta
19. Radioisotope Unit, Cannought Hospital, Freetown, SIERRA LEONE.  
Project co-ordinator: Dr. Gordon Harris
20. Sudan Atomic Energy Commission, Khartoum, SUDAN.  
Project co-ordinator: Dr. Omer I. El Amin
21. Directeur du Centre National de Radioprotection, Hôpital d'Enfants, Tunis Jabbari, TUNISIA.  
Project co-ordinator: Dr. S. M'Timet
22. Department of Physics, Makerere University, Kampala, UGANDA.  
Project co-ordinator: Prof. J.O. Ilukor
23. National Radiation Commission, Arusha, UNITED REPUBLIC OF TANZANIA.  
Project co-ordinator: Mr. A.M. Nyanda
24. Commissaire Général à l'Energie Atomique, Kinshasa, ZAIRE.  
Project co-ordinator: Prof. Malu wa Kalenga
25. Radiation Protection Board, Ministry of Health, University Teaching Hospital, Lusaka, ZAMBIA.  
Project co-ordinator: Mr. Kennedy Mwale
26. Hazardous Substances and Articles Department, Ministry of Health, Causeway, Harare, ZIMBABWE.  
Project co-ordinator: Mr. Gurejena.

**ANNEX II**

**EXPERTS ASSIGNMENTS UNDER PROJECT RAF/9/005  
(1988 - APRIL 1994)**

		<b>mm/dd</b>
1.	Project Co-ordinator (co-ordination at IAEA Headquarters, including short missions to Kenya in 1988, to Côte d'Ivoire in 1990 and 1992, to Zambia and Zimbabwe in 1990, to Tanzania and Ghana in 1992) Hasling (DEN) June 1988 - February 1994	60/11
2.	Regional Training Course for Radiation Protection Officers (Kenya) Hasling (IAEA) Ouvrard (IAEA) 1988	1/14
3.	Training in Radiation Protection - a pre-project mission (Senegal) Ouvrard (IAEA) 1989	0/08
4.	Planning a National Radiation Protection Service - a pre-project mission (Sierra Leone) Hasling (IAEA) 1989	0/05
5.	Pre-project Assessment for Environmental Monitoring (Ghana) Buchtela (AUS) 1989	0/07
6.	Preparation of Meeting on Regional Co-operation (Kenya) Hasling (IAEA) 1989	0/02
7.	Meeting on Regional Co-operation in Radiation Protection in Africa (Tanzania) Hasling (IAEA) 1989	0/07
8.	Preparation of Regional Training Course (Tunisia) Ouvrard (IAEA) 1990	0/05
9.	Legislation and Regulations (Cameroon) Risselin (FRA) 1990	0/18
10.	National Workshop on Radiation Protection for Medical Doctors (Nigeria) Skornik (IAEA) 1990	0/04
11.	National Seminar on Radiation Protection, Monitoring and Radioisotope Uses (Sierra Leone) Skornik (IAEA) 1990	0/04
12.	Pre-project Assessment for a TLD System (Nigeria) Palfalvi (HUN) 1990	0/04
13.	Regional Workshop on the Development of National Infrastructure for Radiation Protection (Nigeria) Westørlund (NOR) Skornik (IAEA) 1990	1/02

14.	Final Review of Draft Legislation (Tunisia) De Nercy (FRA)	1992	0/15
15.	National Seminar for Radiation Safety Officers (Tanzania) Ortiz-Lopez (IAEA)	1992	0/10
16.	National Workshop on Radiation Protection and Quality Assurance in Diagnostic Radiology (Zimbabwe) Griffiths (UK) Benini (IAEA) Eight National Consultants (ZIM)	1992	3/17
17.	Legislation and Regulations (Sierra Leone) Westerlund (NOR)	1992	0/09
18.	Regional Training Course for Radiation Protection Officers (Ghana) Bergman (IAEA) Skornik (IAEA)	1993	0/13
19.	National Workshop on Radiation Safety in the Nigerian Petroleum Industry (Nigeria) Bergman (IAEA) (Workshop was postponed due to strike)	1993	0/02
20.	National Workshop for Radiation Safety Officers (Libya) Othman (SYR) Barakat (EGY) Skornik (IAEA)	1993	1/07
21.	Radiation Protection Legislation (Sudan) Othman (SYR)	1993	0/15
22.	Installation and Testing of Radiation Equipment (Sudan) Haider (AUS) (The mission due in November 1993 was postponed to 1994)		-
23.	Legislation and Regulations (Cameroon and Madagascar) Phoung (VIE)	1993	0/23
24.	National Workshop on Radiation Protection and Quality Control in Diagnostic Radiology (Zambia) Tole (KEN)	1993	0/11
25.	Radiation Safety Assessment (Liberia) Novotny (CZR) (Pending security clearance from UN since November 1993)		-
26.	National Seminar on Radiation Protection (Tanzania) Ortiz-Lopez (IAEA)	1993	0/06
27.	Consultant, OAU Meeting (Egypt) Strohal (IAEA)	1993	0/05

**Total: 73/14**

**ANNEX III**

**COUNTRY AND OTHER REGIONAL PROJECTS IN  
RADIATION PROTECTION AND RELATED AREAS IN AFRICA**

**(Operational as of April 1994)**

- 1. ALG/9/007 Environmental Monitoring**  
To strengthen the capability of the existing Radiation Protection Centre to undertake regular monitoring of the air, soil and food chain, and to train researchers and technicians.  
RP 1991-1993  
Total current budget: Experts: 0.83 man-months  
Equipment: \$110,675
- 2. EGY/9/022 Radiological Emergency Mobile Laboratory**  
To establish a mobile laboratory for handling radiological emergencies on location.  
RP 1989-1991  
Total current budget: Experts: 1 man-month  
Equipment: \$118,425
- 3. EGY/9/026 Personnel Dosimetry**  
To upgrade and automate the dosimetry services, thereby improving the radiation protection infrastructure.  
Extrabudgetary (USA) 1992-1993  
Total current budget: Experts: 6 man-months  
Equipment: \$100,000
- 4. EGY/9/028 Radiological Emergency Preparedness**  
To enhance the capability of the Nuclear Regulatory and Safety Centre to deal with a radiological emergency.  
Extrabudgetary (USA) 1991-1992  
Total current budget: Experts: 5 man-months  
Equipment: \$40,000
- 5. EGY/9/030 Occupational Radiation Protection (Phase III)**  
To establish an infrastructure for radiation monitoring as related to the mining and milling of, and exploration for, radioactive ores.  
RP 1994  
Total current budget: Experts: 1 man-month  
Equipment: \$40,000
- 6. ETH/9/005 Radiation Protection and Environmental Monitoring**  
To upgrade the existing radiation protection services and the national calibration laboratory.  
RP 1988-1994  
Total current budget: Experts: 3 man-months  
Equipment: \$353,300  
Fellowships: \$37,450

- 7. GHA/9/004 Radiation Protection Services**  
To develop an effective radiation protection and environmental monitoring service.  
RP 1991-1992  
Total current budget: Experts: 0.7 man-months  
Equipment: \$81,000
- 8. IVC/9/002 Establishment of a Radiation Protection Service**  
To strengthen the capability of the radiation protection service for monitoring radiation workers and assessing radioactive contamination.  
RP 1989-1994  
Total current budget: Experts: 6.87 man-months  
Equipment: \$264,300  
Fellowships: \$42,670
- 9. LIB/9/007 Measurement of Radioactivity in Foodstuffs**  
To provide equipment and to train personnel for monitoring radioactivity in foodstuffs and the general environment.  
RP 1991-1992  
Total current budget: Experts: 1.63 man-months  
Equipment: \$88,410  
Fellowships: \$6,590
- 10. LIB/9/008 Emergency Planning and Preparedness**  
To improve radiological emergency planning and the level of preparedness.  
RP 1993-1994  
Total current budget: Experts: 2 man-months  
Equipment: \$30,000
- 11. LIB/9/010 Legislation, Licensing and Inspection**  
To review and update legislation, as well as licensing and inspection procedures, for the control of ionizing radiation.  
RP 1993  
Total current budget: Experts: 1.27 man-months  
Fellowships: \$10,000
- 12. MAG/9/002 Radiation Protection Services**  
To strengthen the radiation protection service to enable it to provide personnel dosimetry, quality control, calibration and environmental monitoring services in the country.  
RP 1988-1994  
Total current budget: Experts: 5.5 man-months  
Equipment: \$273,800  
Fellowships: \$14,566

- 13. MAR/9/002 Radiation Protection**  
To strengthen the radiation protection service by enabling it to provide personnel dosimetry, quality control and calibration services in the country.  
RP 1993-1995  
Total current budget: Experts: 3 man-months  
Equipment: \$140,000  
Fellowships: \$9,300
- 14. MOR/9/005 Radiation Protection**  
To improve and expand the existing radiation protection service.  
RP 1985-1988, 1991-1992  
Total current budget: Experts: 3.1 man-months  
Equipment: \$286,330  
Fellowships: \$18,089
- 15. MOR/9/008 Radiological Monitoring of Nuclear Installation**  
To establish the infrastructure for radiological monitoring of the environment at the Nuclear Research Centre in order to assure the safe operation of the research reactor and associated laboratories.  
RP 1993-1995  
Total current budget: Experts: 2 man-months  
Equipment: \$80,000  
Fellowships: \$37,800
- 16. MOR/9/009 Radiation Protection (Phase II)**  
To improve and expand the capabilities of the existing Central Radiation Protection Service.  
RP 1993-1994  
Total current budget: Experts: 2 man-months  
Equipment: \$70,000
- 17. NAM/9/002 Radiation Protection Infrastructure**  
To establish a national infrastructure for the safe use of radiation and radiation sources in the country.  
RP 1993-1995  
Total current budget: Experts: 8 man-months  
Equipment: \$180,000  
Fellowships: \$56,700
- 18. NER/9/006 Upgrading the Radiation Protection Inspectorate**  
To improve the effectiveness of the Radiation Protection Inspectorate in performing radiation monitoring related to uranium mining and milling.  
Extrabudgetary (France) 1991-1992  
Total current budget: Experts: 1.83 man-months  
Equipment: \$95,000





- 25. SUD/9/005 Radiation Protection (Phase II)**  
To assist with the establishment of a central facility for radiation safety monitoring.  
RP 1991-1994  
Total current budget: Experts: 3.13 man-months  
Equipment: \$94,310  
Fellowships: \$37,800
- 26. TUN/9/005 Radiation Protection**  
To provide radiation protection services for the medical field and for industrial activities where ionizing radiation is used. To develop internal dosimetry and environmental monitoring services in the country.  
RP 1983-1992  
Total current budget: Experts: 5.1 man-months  
Equipment: \$393,065  
Fellowships: \$13,354
- 27. TUN/9/008 Radiation Protection (Phase II)**  
To upgrade the radiation protection and environmental monitoring services in the country.  
RP 1993-1994  
Total current budget: Experts: 2 man-months  
Equipment: \$25,000  
Fellowships: \$12,300
- 28. UGA/9/004 Radiation Protection Service (Phase II)**  
To upgrade radiation protection legislation and regulations, to strengthen the licensing and inspection services, and to establish the necessary infrastructure for emergency planning and preparedness.  
RP 1993-1994  
Total current budget: Experts: 2 man-months  
Equipment: \$105,000  
Fellowships: \$18,450
- 29. URT/9/003 Radiation Protection (Phase II)**  
To develop the capability for calibrating and standardizing dose measurements and dosimetric equipment, to consolidate the capability for measuring environmental radioactivity, and to expand X-ray quality control services.  
RP 1993-1995  
Total current budget: Experts: 3 man-months  
Equipment: \$134,856  
Fellowships: \$9,900
- 30. ZAM/9/005 Radiation Protection Services (Phase II)**  
To strengthen the national radiation protection services.  
RP 1991-1992  
Total current budget: Experts: 1.73 man-months  
Equipment: \$61,240  
Fellowships: \$9,000

- 31. ZIM/9/003 Radiation Protection**  
To establish a national radiation protection service to improve radiation protection for radiation workers and the general public.  
RP 1988-1992  
Total current budget: Experts: 2.43 man-months  
Equipment: \$117,686  
Fellowships: \$18,900
- 32. RAF/9/011 Environmental Radiation Measurement and Harmonization (AFRA IX)**  
To assist the countries participating in the AFRA Agreement to strengthen the regional capability for environmental monitoring through the harmonization of approaches and measuring methods in the region, and to promote sharing of experience and resources.  
RP 1993-1995  
Total current budget: Experts: 10 man-months  
Group Training: \$70,000

**ANNEX IV**

**COUNTRY PROJECTS IN RADIATION PROTECTION  
AND RELATED AREAS IN AFRICA**

**(completed since 1984)**

- 1. ALG/9/003 Radiation Protection and Nuclear Safety**  
Radiation protection and nuclear safety planning in preparation for future research reactor installation.  
RP 1981  
Project completed: June 1985  
Assistance provided: Experts: 4.3 man-months
- 2. ALG/9/004 Internal Contamination Monitoring**  
To assess the feasibility of establishing an internal contamination laboratory equipped with a whole-body counter.  
RP 1984, 1986  
Project completed: April 1986  
Assistance provided: Experts: 0.3 man-months
- 3. ALG/9/006 Radiation Protection**  
To establish a monitoring system for personnel exposed to ionizing radiation.  
RP 1986-1987  
Project completed: May 1990  
Assistance provided: Experts: 3.1 man-months  
Equipment: \$85,502  
Fellowships: \$2,916
- 4. CMR/9/003 Radiation Protection**  
To establish an appropriate personnel monitoring system to cover all radiation workers, and to provide training.  
RP 1991-1992  
Project completed: December 1993  
Assistance provided: Experts: 1.3 man-months  
Equipment: \$78,130  
Fellowships: \$20,114
- 5. EGY/9/013 Personnel Dosimetry**  
To establish a personnel dosimetry and protection service.  
RP 1984  
Project completed: November 1986  
Assistance provided: Experts: 1 man-month  
Equipment: \$37,625

- 6. EGY/9/015 Radiation Monitoring System**  
To improve radiation safety at the INSHAS research reactor through a new radiation monitoring system.  
RP 1985-1987  
Project completed: January 1990  
Assistance provided: Equipment: \$362,001
- 7. EGY/9/016 Radiation Protection**  
To improve radiological safety at the radioisotope production laboratory through modernization of its facilities.  
RP 1985-1986  
Project completed: September 1988  
Assistance provided: Experts: 2.2 man-months  
Equipment: \$65,955
- 8. EGY/9/020 Radiological Safety**  
To improve radiological safety in the country by strengthening radiation protection regulatory activities.  
Extrabudgetary (USA) 1987, RP 1988  
Project completed: September 1991  
Assistance provided: Experts: 5.3 man-months  
Equipment: \$37,260
- 9. EGY/9/021 Occupational Radiation Protection**  
To establish an infrastructure for radiation monitoring as related to the mining and milling of and exploration for radioactive ores.  
RP 1988  
Project completed: October 1991  
Assistance provided: Experts: 2.3 man-months  
Equipment: \$54,030
- 10. EGY/9/023 Environmental Radioactivity Monitoring**  
To train Egyptian scientists and technicians in carrying out environmental studies and to develop regulations to control radioactive releases into the environment.  
RP 1989-1991  
Project completed: December 1993  
Assistance provided: Experts: 4.5 man-months  
Equipment: \$57,347  
Fellowships: \$34,036
- 11. ETH/9/004 Radiation Protection**  
To create a national centre for radiation protection in Ethiopia.  
RP 1983-1984 and 1986-1987  
Project completed: March 1990  
Assistance provided: Experts: 3.9 man-months  
Equipment: \$87,648  
Fellowships: \$9,567

- 12. GAB/9/003 Radiation Protection**  
To strengthen the local capability for environmental radioactivity monitoring with particular reference to mining and milling operations and to establish a national radiation protection authority.  
RP 1987  
Project completed: September 1988  
Assistance provided: Experts: 0.3 man-months
- 13. KEN/9/003 Radiation Protection**  
To establish a radiation protection service in Kenya.  
RP 1982  
Project completed: July 1984  
Assistance provided: Experts: 6.1 man-months  
Equipment: \$84,499
- 14. KEN/9/004 Radiation Protection**  
To extend the personnel monitoring service to cover the estimated 2600 workers in Kenya.  
RP 1986-1990  
Project completed: September 1993  
Assistance provided: Experts: 0.6 man-months  
Equipment: \$223,575  
Fellowships: \$6,865
- 15. LIB/9/004 Radiation Protection**  
To establish a radiation protection service for staff of the new centre for nuclear studies.  
RP 1982  
Project completed: October 1985  
Assistance provided: Experts: 15.1 man-months  
Equipment: \$25,343
- 16. LIB/9/006 Radiation Protection**  
To establish the radiation protection service for diagnostic radiology, quality assurance of X-ray machines and determination of radiation doses.  
RP 1989-1990  
Project completed: March 1992  
Assistance provided: Experts: 1 man-month  
Equipment: \$43,292
- 17. MLI/9/002 Radiation Protection**  
To establish a radiation protection centre with a capability to provide adequate personnel monitoring services.  
RP 1986 and 1989  
Project completed: July 1991  
Assistance provided: Experts: 1.7 man-months  
Equipment: \$87,482  
Fellowships: \$2,659



- 24. ZAM/9/004 Radiation Protection Services**  
To strengthen and expand radiation protection services.  
RP 1985-1990  
Project completed: March 1993  
Assistance provided: Experts: 4.6 man-months  
Equipment: \$127,469  
Fellowships: \$3,210
- 25 ZIM/9/002 Fellowship Training in Radiation Protection**  
To provide training in radiation protection in preparation for the  
establishment of a radiation protection service.  
Reserve 1987  
Project completed: September 1989  
Assistance provided: Fellowships: \$17,980