

**THE  
AGENCY'S TECHNICAL  
CO-OPERATION ACTIVITIES  
IN 1994**

**REPORT BY THE DIRECTOR GENERAL**

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**INTERNATIONAL ATOMIC ENERGY AGENCY**



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INTERNATIONAL ATOMIC ENERGY AGENCY



## **PREFACE**

Following its usual practice, the Board of Governors has requested the communication to the General Conference of the material it used in reviewing the Agency's technical co-operation activities in 1994: this material is accordingly reproduced in the present document. The review was carried out pursuant to paragraph 19 of the Revised Guiding Principles and General Operating Rules Governing the Provision of Technical Assistance by the Agency.<sup>1</sup>



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# INTRODUCTION

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The report on the Agency's Technical Co-operation Activities in 1994 follows the format used in past years to provide detailed data on the utilization of the various funds made available for technical co-operation activities. Drawn from this data are interpretations of the major events and developments during the year, which are organized in various classifications.

The review of the Agency's technical co-operation activities begins with a general overview of the year's developments, the resources available to the programme and the financial implementation of the programme. A review of evaluation activities concludes Part A of the report. These general descriptions are followed by detailed reviews of activities by various categories, presented in statistics and narrative context. The implementation summaries, tables, figures and annexes are presented in a standard format which facilitates comparison with previous years. The report concludes with a brief description of the accomplishments of each completed project during 1994, reflected in Annex XII.

While the format remains consistent with previous reports, efforts were made to streamline and refine the statistical presentations in order to enhance their clarity. Other enhancements include the introduction of colour graphics for the figures which support the narrative presentation. The modest cost increase of presenting programme illustrations in colour rather than black and white was considered to be greatly offset by the improved clarity and precision of this format.

Monetary sums are expressed in US dollars, and in most instances are rounded to the nearest hundred or thousand dollars. Percentages normally reflect rounding to the nearest tenth of a percent.

The glossary provides definition of terms and concepts that are used in the report and applied in respect of technical co-operation activities of the Agency. Financial terms reflect the Financial Regulations and Rules in effect for 1994, and do not refer to the New Financial Regulations and Rules which became effective on 1 January 1995.

An updated list of abbreviations used in the report is included.

# HIGHLIGHTS

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- An overall improvement was achieved in the preparation of the TC Programme for 1995-96 which included 11 new Model Projects. para 1, 3
- The financial implementation of the total TC Programme attained 69.7%, the highest rate ever achieved, with total new obligations reaching \$55.2 million. para 1, 23  
Implementation Summary I
- Each of the four Areas in TCPM reached an implementation rate exceeding 68%. This was especially significant for Middle East and Europe which repeatedly lagged behind the other areas in previous years. Implementation Summary I
- The unobligated balance of the TACF was reduced to \$18,259,000. Only \$9,030,000 was in useable funds which represented less than two months new obligations. para 154, 155
- Pledges to the TACF reached only 72.5% of the target, the second lowest on record and a full four percentage points below that recorded for 1993. Total resources reached \$52,756,000, which was about \$150,000 less than in 1993. para 21, 149  
Tables 1, 2
- TCIM sustained an increased output: expert assignments were up 9.9%, equipment delivery up 30.1%, fellowships and scientific visits up 9.3% and training course participants up 12.6%. para 131, 136,  
140, 144
- The Evaluation Section assessed the impact of the Agency's RAPAT and WAMAP programmes in four Asian countries and found that there is a need for greater government commitment in implementing their recommendations as well as for a better co-ordination between the two programmes. para 31
- The preparatory phase for the 1995 Review and Extension Conference of the States Party to the Treaty of the Non-Proliferation of Nuclear Weapons (NPT) was actively supported by the TC Department. A comprehensive paper was produced in connection with Article IV of the NPT. para 13
- The new Model Project concept guided the Department's strategy for realizing a new partnership in development with Member States based on technical co-operation activities that use nuclear technologies to produce lasting impacts on end users. para 4

■ The Policy Review Seminar in September, provided valuable guidance in the formulation of follow-up activities and the development of new strategies for delivering technical co-operation. para 2

■ Missions to other international and bilateral development organizations established stronger programmatic links and emphasized greater utilization of UN system resources to support Agency technical co-operation activities. para 5

# REVIEW OF THE AGENCY'S TECHNICAL CO-OPERATION ACTIVITIES

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## A. Overview

### 1. General Issues

#### *In-house developments*

1. In 1994, developments in the Agency's Technical Co-operation Programme reflected the concentration of efforts on increasing the delivery of a large and complex programme which consisted of over 1000 national and regional projects, training courses and workshops, regional co-operative arrangements, implementing the twelve Model Projects approved by the Board in the previous year and introducing new procedures and programming concepts in the 1995-1996 technical co-operation programme. The new biennial TC programme is more realistically budgeted, more closely connected to government priorities and end users and reflects a greater emphasis on consultation and firm commitment by governments. The financial rate of implementation for the total programme in 1994 is the highest ever achieved at 69.7%. Based on this experience, the Department of Technical Co-operation expects that an implementation rate of 70% or greater will be maintained during 1995-1996; in part because of the intense effort devoted to preparing the new biennial programme, and for reasons of procedure and management explained later in paragraph 6.

2. Developments were enhanced by the outcome of the Policy Review Seminar in September 1994 which examined the establishment of Action Plans to develop radiation protection and waste management infrastructures for Member States, the proposal for Medium Term Country Plans to ensure that the Agency's technical co-operation activities are fully linked to a country's sectoral or national development objectives, and the means and methods for ensuring that maximum impact occurs to the beneficiaries of the Agency's technical co-operation projects. This event provided invaluable guidance in the formulation of follow-up activities and in the development of strategies that were later outlined in the Technical Assistance and Co-operation Committee (TACC).

3. During the 1994 TACC meeting, the new two-year TC programme for 1995-1996 was presented, which included 11 additional Model Projects that further expand the scope and impact of nuclear technology on human

development. A broader geographic distribution of Model Projects has also been achieved in the 1995-1996 programme as such projects are now identified in all regions. Both ongoing and new Model Projects are described in detail in Part C of this Report.

4. The strategy that evolved during 1994 was outlined at the TACC meeting and discussed in informal meetings with G-77 Members and the Geneva Group. It is based on the premise that the Model Project concept is the central mechanism for realizing a new "partnership in development" with Member States. This partnership builds on the traditional role of the Agency in providing technical assistance to its national counterpart institution, by offering models of how nuclear based technologies can produce lasting, effective, and beneficial impacts on people and therefore improve human conditions in broad areas of application. Further development of the Model Project concept will be a priority for 1995 but, as the year began, several initiatives were already under way: planning country programme framework missions; organizing sectoral programming activities around "technology packages" which apply nuclear technology to thematic activities such as food security; strengthening co-ordination with other organizations; and improving programme management.

5. Strengthened co-operation with other development organizations and the mobilization of additional resources were given greater emphasis during 1994. Missions were fielded to establish programme links with the World Bank and regional development banks such as the African Development Bank (AfDB), Inter-American Development Bank (IDB), as well as special purpose funds such as the International Fund for Agricultural Development (IFAD). Bi-lateral development organizations were visited with the same objective including USAID and CIDA. New resource mobilization strategies were also pursued to promote greater utilization of UN system resources for programme development activities such as UNDP sectoral support; capacity building activities such as the World Bank's Institutional Development Facility (IDF); and for project identification and formulation activities such as the UNDP/GEF Project Development Facilities (PDF) and the World Bank's Project Preparation Facility (PPF).

6. Many lessons have been learned from the introduction of Model Projects, not the least of which is in programme management. Model Projects require a higher level of management than traditional projects, as is apparent from the more rigorous planning, organization, co-ordination and technical support associated with these projects. These additional steps and details produce projects which are better budgeted, more realistically planned, and therefore should be more effectively implemented. This is certainly the case when one adjusts for the exceptionally low financial implementation rate for the Model Project in Poland which is explained in paragraph 102. On this basis, the average implementation rate for Model Projects in 1994 is just over 80%, compared to the average of 71.5% for all TACF projects. Government commitment to support and follow the agreed workplan is particularly important to this success. During 1994, this commitment was prominent in most of the model projects particularly in those requiring significant activities by the recipient organizations such as construction of laboratories and irradiation facilities. In 1994, the Department began re-examining its project management procedures and project co-ordination activities in order to standardize,

streamline and simplify actions so as to emphasize higher priority activities. New system automation and productivity enhancements were initiated in 1994 to improve management functions. Better co-ordination between the TC Department and the Technical Divisions was also achieved in 1994, with the introduction of regular review meetings.

7. In response to the Board of Governors' request to introduce project assessment procedures, the Agency established the Programme Performance Assessment System (PPAS) in 1994. The purpose of the PPAS is to assess the merits of proposed projects in terms of potential benefits to Member States, to develop clear objectives and performance indicators for periodic review, and to develop systematic evaluation of the success and benefits of completed projects. These goals are fully integrated in the Model Project concept which incorporates clear manifestations of priority, objective, beneficiary, performance and systematic evaluation. The criteria for Model Project provided a ready reference for the appraisal of all proposals considered for the 1995-1996 TC programme.

8. A higher rate of financial implementation, while not an indication of programme performance, measures the utilization of resources. While the Agency's implementation rate is quite high compared to other UN organizations, Board members recommended continued efforts to raise the financial implementation. As a result of improved project design and management, the forecast for programme implementation is for continued increase, thereby further reducing the carry-over of unobligated resources.

9. Following the expression by the General Conference, at its 1994 regular session, contacts were made with the UN Special Co-ordinator to identify suitable technical assistance projects and the appropriate international organizations through which they could be implemented, for the Territories under the Jurisdiction of the Palestinian Authority. Technical and operational assessments were completed for three proposals in Israel, and one proposal for the Territories under the Jurisdiction of the Palestinian Authority in time for Board approval as part of the 1995-1996 TC programme. In December, the Department of Technical Co-operation participated in an interagency planning session in Gaza to identify priority areas for future development.

10. In accordance with the UN Security Council Resolution 748, all project activities for Libya were held in abeyance. In August 1994, with the approval of the Sanctions Committee, eight projects were reactivated after a thorough review of project objectives.

11. Implementation of all projects for Iraq are governed by UN Security Council Resolution 661. Late in the year the Agency proposed the resumption of five projects in the areas of agriculture and health. The Security Council approved the proposal at its 121st meeting on 22 February 1995.

12. The TC Information Systems Unit (TCSIS) made progress in 1994 in improving the ability of the Department to plan, implement and track TC projects. Over half of the work stations in TC were replaced, modern automated software systems were introduced, and the TC staff can now communicate by electronic mail with other Agency staff, TC counterpart institutions, suppliers and experts. TC staff received an average of

3 days/person of training in 1994 in use of the new systems. The mainframe TC project data was moved to network data tables, which will enable a wide range of users to access the information easily. A system to automate the work processes of the Fellowship Section is expected to be completed in mid-1995. A market survey was conducted of available project management software in preparation for development by the end of 1996 of a full Project Information Management System. Projects were also initiated to move existing systems for Experts, Training Courses, and Evaluation Sections to the Windows environment.

### *External developments*

13. The Department of Technical Co-operation actively participated in the preparatory phase for the 1995 Review and Extension Conference of the States Party to the Treaty of the Non-Proliferation of Nuclear Weapons (NPT) during 1994. This participation consisted in briefings to the Preparatory Committee meetings in New York and Geneva, briefings to the Non-Governmental Organizations (NGOs) and in the preparation of a background paper for the Conference entitled "Activities of the International Atomic Energy Agency Relevant to Article IV of the Treaty of Non-Proliferation of Nuclear Weapons".

14. A number of countries became Members of the Agency during 1994. Early in the year the Marshall Islands and Uzbekistan joined the Agency, followed by Kazakhstan, the Former Yugoslav Republic of Macedonia and, in October, the Republic of Yemen. These new Member States participated in a variety of technical co-operation activities, and in several instances Reserve Fund projects were established to address urgent or priority needs. Reserve Fund projects on radiation protection were also established for three States which were in the process of becoming Member States of the Agency: Kyrgyzstan, Latvia and Moldova.

15. The last few years have seen an increase in the number of signatories to the regional co-operative agreements for research, development and training related to nuclear science and technology in Asia and the Pacific (RCA), and Africa (AFRA). In 1994, Côte d'Ivoire and Niger joined AFRA which currently has 19 members. Through the accession of Myanmar and New Zealand, the total membership of RCA now comprises 14 developing and three developed countries. In Latin America, 18 of the 20 Member States continue to participate in ARCAL.

16. In June 1994, the situation related to safeguards in the Democratic People's Republic of Korea led to the adoption of a resolution by the Board of Governors to suspend non-medical assistance to the country. On 13 June 1994, DPRK announced its decision to withdraw from the IAEA.

17. The UN System continued to develop a co-ordinated response to the UN Conference on Environment and Development in Rio de Janeiro (UNCED). The Commission on Sustainable Development of ECOSOC convened in May 1994 to discuss a number of related issues, including radioactive waste management. As lead UN Agency responsible for implementation of this

chapter of Agenda 21, the IAEA prepared a comprehensive report on progress made and is ready to assist in any related activity if so requested by the Commission or any other organization concerned. The Commission also called attention to the needs of developing countries and economies in transition to establish or strengthen their capacities for the safe management of radioactive wastes, including spent radiation sources. The commitment to UNCED lends additional importance to the Interregional Model Project on Waste Management and to activities which assess the adequacy of national waste management infrastructure.

18. The year was also characterized by continuing concerns over declining donor support to international development co-operation and the ensuing financial constraints for many development organizations. Most multilateral and many bilateral assistance programmes experienced cutbacks during the year as capitals reprioritized official development assistance (ODA) channels and beneficiaries. The difficulties were particularly significant for those UN Organizations which depend on the funds of the United Nations Development Programme (UNDP) for their technical co-operation operations, but the Bretton-Wood institutions (IMF, World Bank) also came under financial pressure. An exception to these cutbacks was the Global Environment Facility, jointly administered by the World Bank, UNDP and United Nations Environmental Programme (UNEP), which was entrusted with a replenishment of \$2,200 million for assistance in the areas of biodiversity, global warming, international waters and ozone layer depletion during 1995-1997.

19. Many of the issues related to programme co-ordination and operational activities for development discussed at the ACC Consultative Committee on Programme and Operational Questions (CCPOQ) during 1994 related to the 1995 triennial General Assembly review of UN operational activities for development. G.A. Resolution 47/199 assigned a leadership role in field operations to the local UN Resident Co-ordinators. For the UN organizations without field representation, the function of the Resident Co-ordinator as UN System country representative is a primary focus in operational activities. The preparation of country strategy notes is another emphasis in Resolution 47/199. During 1994, the IAEA participated in one country strategy note meeting in the Ukraine, and provided written inputs to several others.

20. The UNDP support cost regime was reviewed by an independent evaluation team during 1994 that met with a number of UN agencies, UNDP offices and government representatives. Based on their recommendations, the Executive Board of UNDP approved a new \$5 million fund open to the 11 small UN technical agencies, including the IAEA. The new sectoral support facility will be demand-driven with resources allotted to thematic activities which fit the Sustainable Human Development criteria.

## 2. Resources and Delivery

New resources	\$52.8 million
Adjusted programme	\$78.0 million
New obligations	\$54.3 million
Implementation rate	69.7%
Disbursements	\$53.1 million

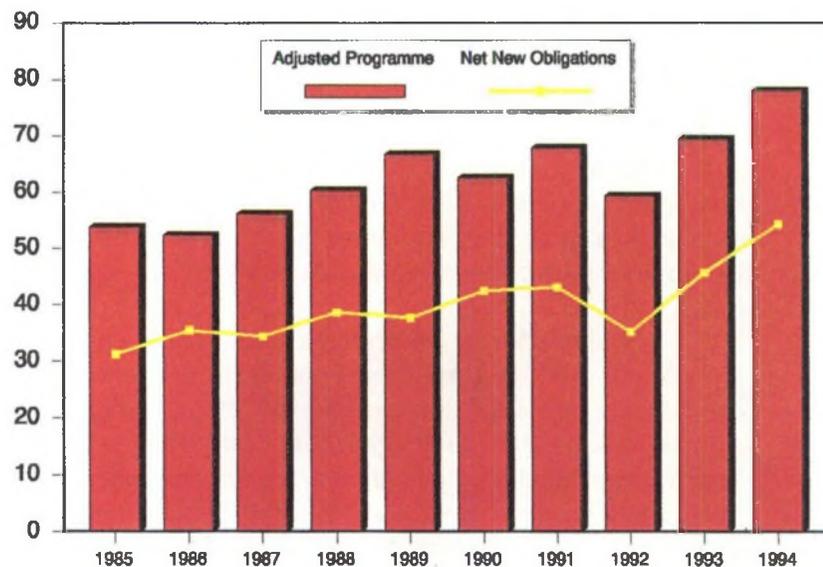
21. Total new resources for the Technical Co-operation Programme exceeded \$52 million for the second year in a row, although a small decline of about \$150,000 was recorded as compared with 1993. As can be seen in Table 1, three categories of funding increased - miscellaneous income of the TACF, funds from UNDP, and in-kind contributions. However, voluntary contributions of the TACF were down nearly one million dollars and the extrabudgetary funds were off almost \$1.5 million, declining by around 23%.

22. The relative weight of the various funding sources has changed somewhat from earlier years. The TACF increased its share to 84.8% from 82.9% registered for both 1992 and 1993. All other resources accounted for 15.2%: extrabudgetary 9.3%; in kind 3.3%; and UNDP 2.6%.

23. By the end of 1994 the total adjusted programme was \$78,002,000, an increase of 12.4% over 1993 (\$69,375,000) and an increase of 31.5% over 1992 (\$59,337,000). It is against this much higher adjusted programme that the financial implementation is measured. The implementation, i.e. the new funds obligated, reached a record height in 1994 of \$54.3 million, or around 19% more than the \$45.7 million obligated in 1993. In addition about \$830,000 of future year obligations were also placed in 1994, so that total new obligations reached \$55.2 million.

### IMPLEMENTATION SUMMARY - ALL FUNDS

(In millions of dollars)



24. The performance of each of the funds is analysed separately in Part E of this report. A detailed and comprehensive overview of the status of the programme at the end of 1994 is given in the Implementation Summaries I, II and III. The following table summarizes financial performance during the past five years.

**Rate of implementation by fund as a percentage  
of the adjusted programme**

	TACF %	Extrabudgetary funds %	Funds in trust %	UNDP %	Total %
1990	71.3	50.4	35.6	88.6	67.8
1991	67.6	52.2	45.0	47.1	63.6
1992	61.9	45.6	77.7	48.8	59.3
1993	68.5	52.4	51.6	76.9	65.9
1994	71.5	53.8	92.6	69.7	69.7

25. At the beginning of 1994 there were 1,124 operational projects including the newly approved Model Projects to start implementation in 1994. During the year 68 additional projects were included, namely 45 training courses (for the coming year), 17 Reserve Fund projects, five upgraded footnote-a/ projects and one UNDP project. The total operational projects during the year was therefore 1,192.

26. In total, 289 projects were completed in 1994, and their achievements are reported in Annex XII, with the exception of the 42 completed training courses. During the year, 20 projects were cancelled and the reasons are also recorded in Annex XII. At the end of the year there remained 883 operational projects.

### **3. Evaluation**

27. Nine national and regional project evaluations were conducted through both desk and field exercises in 1994. These evaluations included major technical sectors such as human health and industrial applications, as well as environmental monitoring and radioanalysis.

28. Twelve country programme summaries were prepared in 1994, which form an important basis for country framework activities. These twelve countries completed the review of the country programmes where the Agency's assistance delivered over ten years exceeded one million dollars. The routine monitoring activities of operational projects performed through the Interim Project Implementation Report (IPIR) system included follow-up of some 200 projects which provided valuable information about project implementation difficulties and the necessary corrective actions required. The status of the IPIR mechanism will be reviewed with the introduction of the new TCPM semi-

annual reporting system introduced for projects approved in 1994. Additionally, 24 interregional and AFRA courses were monitored through follow-up questionnaires.

29. An in-depth evaluation was conducted on three regional projects in Latin America and the Caribbean in non-destructive testing (NDT). It was found that some of the participating Member States had not succeeded in establishing national, regional or subregional NDT personnel qualification and certification schemes, and that the objective to develop sustainable co-operation networks and an active NDT Federation was not achieved. On the other hand, the availability and utilization of trained personnel to continue training activities at both the national and the regional level were clear signs of the projects' sustainability. Furthermore, the substitution of imported services by domestic NDT capacities also illustrated the projects' success. The recommendations will benefit the design of similar projects in other regions as they highlighted the need to determine the specific level and type of assistance best suited to the requirements of each country participating in regional projects.

30. An evaluation was initiated in 1994 to assess the use of nuclear and related technologies in the industrial sector in Malaysia. The evaluation compared nuclear with conventional technologies, and assessed the contribution made by the Agency's technical co-operation programmes to the development of that sector. The findings will be reported to the TACC in 1995.

31. The recommendations contained in the 1993 evaluation programme were followed up. As a result, evaluation missions visited four countries (Bangladesh, Indonesia, Philippines, Thailand) in the Asia and Pacific Region during 1994 to assess the impact of the Agency's RAPAT and WAMAP programmes and the status of the recommendations made by previous missions. In the countries visited, the evaluation found that both programmes had achieved their objectives. However, the need for greater government commitment in implementing RAPAT/WAMAP recommendations was recognized. Also recommended was the need to enhance co-ordination between the two programmes, and for more systematic follow-up using existing mechanisms of assistance such as national and regional technical co-operation projects.

32. Based upon the recommendations of the desk review conducted in 1993, a mission was fielded to Bulgaria to evaluate a project which supplied a sterilization facility for medical equipment. It was concluded that although the transfer of technology was achieved, no evidence was available that the facility had a significant impact on the local pharmaceutical industry or on the national health sector. In order to ensure the profitability of the investments made both by the Agency and by the Government, it was further recommended that active market development activities be initiated by the counterpart to introduce their services in the local pharmaceutical industry. The need for the counterpart to encourage enactment of governmental directives against the present use of ethylene oxide in sterilization was also emphasized.

33. Finally, in line with the recommendations which followed the Special Evaluation of Technical Co-operation with the Least Developed Member States in 1993, and the 1992 Evaluation of Manpower Development in Africa, an agreement has been reached between the Agency's TC Department and the

International Centre for Theoretical Physics (ICTP) in Trieste on the modalities of a new arrangement to train young scientists in basic sciences. The need to improve management skills was also pointed out. In this connection, national co-ordinators from four African LDCs received training at IAEA Headquarters in all sectors of the Agency's programme of technical co-operation; and a Second Regional Workshop on Project Design, Management and Evaluation Techniques was held in Addis Ababa in December 1994 which involved 10 counterparts from LDCs.

## **B. Review by Agency Programmes and Technical Divisions**

### **1. Agency Programmes**

34. In 1994 the growing emphasis on Nuclear Safety Programmes was again reflected in the delivery of the TC Programme, with disbursements increasing from 19.7% in 1993 to 22.9% in 1994. This represents the largest share of the programme delivery, followed closely by assistance in the field of agriculture, which accounted for \$11,922,400 or 22.4% of disbursements (up from \$9,136,600 or 20.2% in 1993). Assistance in these two fields alone now accounts for nearly half of all disbursements.

35. This means that some other programmes have received a smaller share of delivery. These include: Physical and Chemical Sciences with disbursements of \$9,187,200 or 17.3% of the total, down from 18.1% in 1993; Human Health with \$6,982,800 or 13.1% of the 1994 total, down from 14.4%; and Industry and Earth Sciences, which accounted for \$6,429,200 or 12.1% of the 1994 total, down from 14.5%.

36. This shift in emphasis is not a sudden redirection, but can be seen occurring over the past 10 years. In 1985, safety related activities accounted for less than 15% of total disbursements, while the Physical and Chemical Sciences accounted for approximately 20%, Human Health just under 10% and Industry and Earth Sciences approximately 15%. At that time, agriculture related activities already accounted for over 20%, a share which has remained relatively constant over the years. By 1990, safety's share was up to 17.6% of disbursements, with Physical and Chemical Sciences jumping to a high of 24.5% before returning to the level of 20% or less in 1991 and thereafter. Human Health accounted for 11.3% of disbursements in 1990, and Industry and Earth Sciences for 14.3%.

37. This shift can be most directly attributed to a major shift in the regions of Europe and Latin America. In 1985, safety related disbursements accounted for 22.6% of the programme delivery in Europe and for only 9.6% of disbursements in Latin America. In 1994 the share for Europe had exactly doubled to 45.2%, with Latin American increasing to 20.6%. More modest increases occurred in the other regions: from 9.2% to 13.1% in Africa; from 11.9% to 17.5% in Asia and the Pacific, and from 17.9% to 20.9% in the Middle East.

38. The flexible way in which the TC Programme responds to the needs of the various regions is reflected in the relative shares of major sectors. In Africa, disbursements on agriculture related activities account for the largest share by far, with 42.5% or \$5,475,600 in 1994, up from \$3,421,000, or 31.9% in 1993. In Asia and the Pacific activities are broadly based, with nuclear safety, agriculture, physical and chemical sciences and industry and earth sciences each accounting for between 16.8% and 18.8% of delivery. In Latin America the two largest sectors are agriculture, with \$2,679,300 or 23.1% and human health with \$2,592,800 or 22.3% of disbursements.

39. A summary by region and Agency programme for 1994 is provided in the following table.

**Technical Co-operation Disbursements by Agency Programme and Region**  
(in thousands of dollars)

PROGRAMME	Inter-regional	Africa	Latin America	Asia & Pacific	Europe	Middle East	TOTAL
A. Nuclear Power	648.1	198.3	360.9	1,223.0	989.4	14.6	3,434.3
B. Nuclear Fuel Cycle	109.9	158.8	187.2	628.3	249.6	7.3	1,341.1
C. Radioactive Waste Management	288.5	280.1	130.3	382.6	386.3	0.0	1,467.8
D. Food and Agriculture	498.0	5,475.6	2,679.3	2,480.0	586.8	202.7	11,922.4
E. Human Health	161.3	2,142.1	2,592.8	1,723.6	339.3	23.7	6,982.8
F. Industry and Earth Sciences	116.8	798.4	1,563.8	2,213.3	1,539.0	197.9	6,429.2
G. Physical and Chemical Sciences	746.9	2,385.6	1,785.2	2,310.6	1,054.0	904.9	9,187.2
H. Radiation Protection	511.8	1,381.0	1,896.7	1,127.3	1,286.8	361.2	6,564.8
I. Safety of Nuclear Installations	547.0	28.6	362.2	799.1	2,390.1	0.0	4,127.0
J. Safeguards	0.0	0.0	0.0	(8.4)	0.0	0.0	(8.4)
S. Direction and Support	1,090.4	47.6	59.5	322.5	75.3	13.4	1,608.7
X. Comparative Assessment	0.0	0.0	0.0	0.0	89.8	0.0	89.8
<b>TOTAL</b>	<b>4,718.7</b>	<b>12,896.1</b>	<b>11,617.9</b>	<b>13,201.9</b>	<b>8,986.4</b>	<b>1,725.7</b>	<b>53,146.7</b>

## 2. Technical Divisions

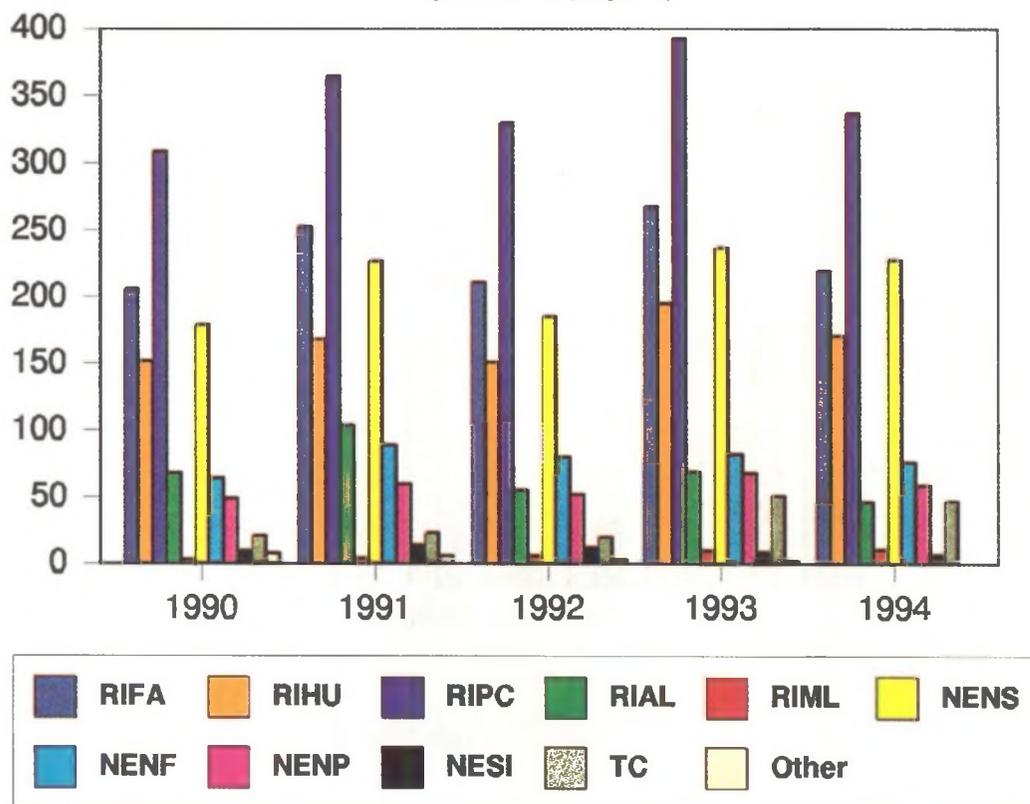
40. The technical support provided by the Technical Divisions was essential to achieving the highest rate of financial implementation ever recorded for the TC programme. Improved mechanisms, regular consultation and co-ordination with Technical Officers in the Department of Research and Isotopes and the Department of Nuclear Energy and Safety made possible a higher level of project and programme support to Member States. Fewer projects were operational in 1994 (1,192) than in 1993 (1,373), which gave some Technical Officers more time for project design, monitoring or other attributes of technical backstopping. As shown in the table below, these projects were managed by 177 Technical Officers, six less than in 1993. This represents an average of

6.7 projects per Technical Officer. The trend toward fewer projects per Technical Officer is important in view of the 23 Model Projects currently under implementation. The table below provides a statistical reference for the Technical Departments and Divisions which support the TC programme.

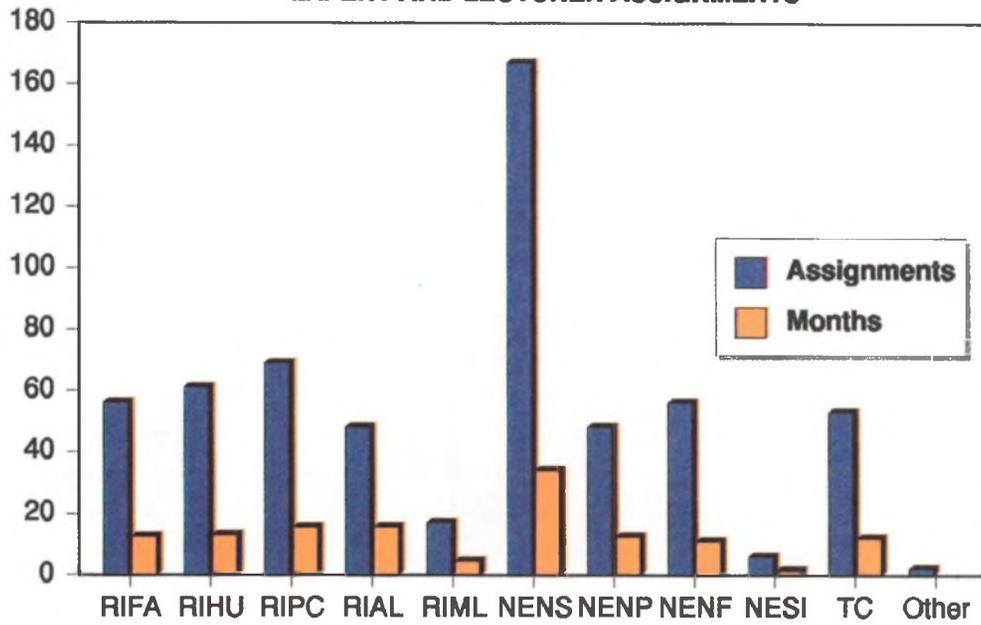
### TECHNICAL SUPPORT FOR TC PROGRAMME: 1994

Department/ Division	Number of Technical Officers	Number of projects supported	Number of fellowship applications evaluated	Number of expert/lecturer assignments	Number of months/days
<b>Research and Isotopes</b>					
RIFA	26	219	318	56	12/14
RIHU	17	170	222	61	13/01
RIPC	18	336	228	69	15/18
RIAL	12	45	102	48	15/09
RIML	6	10	6	17	4/17
Sub-total	79	780	876	251	60/29
<b>Nuclear Energy and Safety</b>					
NENS	48	227	318	167	34/07
NENP	18	58	150	48	12/09
NENF	24	75	85	56	10/26
NESI	4	6	7	6	1/16
Sub-total	94	366	560	277	59/28
TC	4	4	168	53	12/09
Other	-	42	-	2	0/04
<b>Total</b>	<b>177</b>	<b>1,192</b>	<b>1,604</b>	<b>583</b>	<b>132/10</b>

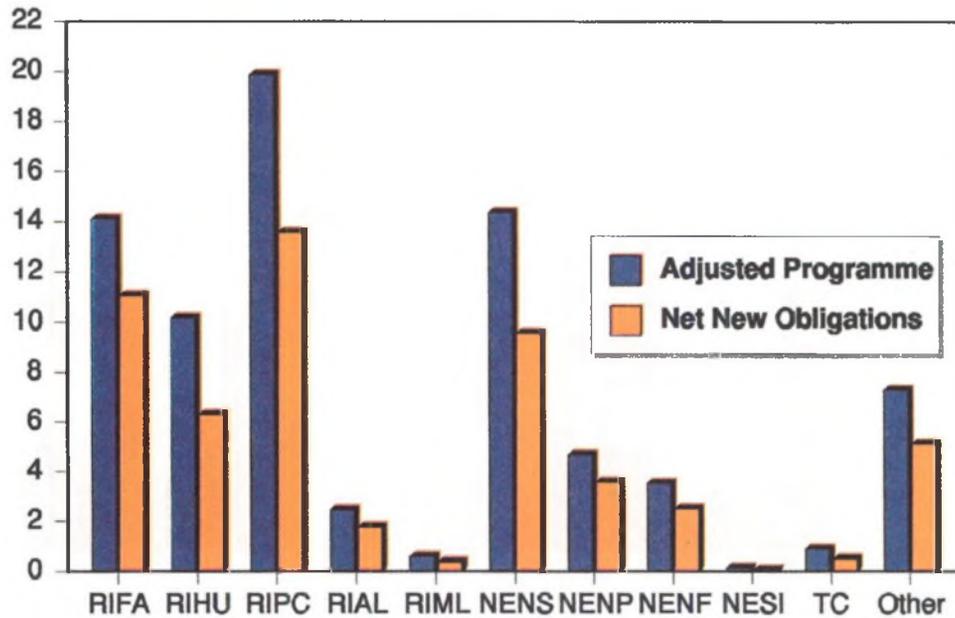
**PROJECT WORKLOAD BY DIVISION: 1990 - 1994**  
(number of projects)



**TECHNICAL SUPPORT FOR PROJECTS: 1994  
EXPERT AND LECTURER ASSIGNMENTS**



**IMPLEMENTATION BY DIVISION: 1994  
(in millions of dollars)**



41. In addition to the workload resulting from preparation of the new biennial programme for 1995-1996, an increase occurred in the number of fellowship applications evaluated by staff throughout the house. A total of 1,604 applications were evaluated in 1994, an increase of nearly 11% over the 1993 total of 1,447.

42. Agency staff also served as experts and lecturers for TC activities. In 1994, 583 such assignments were carried out for a total of just over 132 months. A detailed analysis of the contribution of the Technical Divisions to the success of the TC programme is given in the table and graphs above and also in Implementation Summary III.

## **C. Review by Area**

### **1. Africa**

43. During 1994, Africa led the four geographical regions in achieving the highest volume of programme resources delivered with a financial implementation rate of 68.9%, and continued a three year trend of increasingly higher implementation rates. This was accomplished despite the often unfavourable social and economic conditions in most African countries which can impede the delivery of technical assistance. Inadequate project staffing, aggravated by frequent personnel turnover, insufficient or poor local support and services for nuclear technology applications, and inadequate co-ordination and programming mechanisms at the national level remain the most persistent obstacles to implementing higher volumes of Agency technical co-operation in the region. Specific efforts by the Area Office to closely monitor project activities and strengthen communication and consultation with the Member States resulted in 57 projects being closed following the achievement of their objectives.

44. The dominating activities in the region during 1994 involved the implementation of the three Model Projects approved by the Board in December 1993 and the preparation of the 1995-96 TC biennium. The new two-year programme took on particular importance in light of the new objectives for TC activities which emphasize the practical impact of nuclear technology on social and economic development in recipient countries. Pre-project assistance missions fielded to Mali and Niger using UNDP Sectoral Support funds resulted in the identification and formulation of five projects in agriculture and human health, including a project to support the application of radioimmunoassay activities in Niger and a Model Project in Mali to improve sorghum and African rice characteristics and production. The three-year project in Mali will assist the Government in developing and releasing promising mutant varieties of African rice and sorghum, with direct economic benefit to farmers and to the country's food security.

45. Monitoring missions were undertaken in 1994 to Ethiopia, Kenya, Senegal, Sudan, Tanzania and Zambia. These were essential for assessing the development of local scientific infrastructure, identifying problems hindering

effective technology transfer and streamlining the national programmes. These missions also produced more effective integration of Agency-supported activities in the country development process and a stronger working relationship with UNDP.

46. A multi-disciplinary mission was fielded to Namibia to assess national expertise and infrastructure, identify potential sectors where nuclear techniques can play a major role in national development, and assist in the formulation of technically sound projects. The mission covered health, agriculture and the mining industry. A Reserve Fund project was approved for Namibia to establish a basic radiotherapy unit at Windhoek Central Hospital, following the recommendations of a pre-assistance mission that identified the urgent need to provide the affected population with curative and palliative radiotherapy.

47. Substantial efforts were made in 1994 to strengthen collaboration with FAO in sub-Saharan countries. Within the framework of the FAO strategy to increase food production in support of food security in low income food deficit countries (LIFDCs), a regional project was formulated. It has the objective of applying nuclear techniques to determine the efficiency and sustainability of crop/soil systems by assisting in the selection of inputs such as fertilizer forms, rates and methods of application, pesticide and herbicide formulations and improved cultivars. Such techniques will be included in "technology packages" designed for Ethiopia, Kenya, Niger, Senegal, Tanzania and Zambia.

48. In delivering technical assistance to the region, special attention was given to the needs of least developed countries (LDCs) to build critical capacity in nuclear technique based applications in priority areas of social and economic development, particularly agriculture and human health, in order to facilitate the achievement of sustainable development. One activity of the regional project which provided institutional support to LDCs is an alternative education training programme providing a "sandwich" approach to advanced degrees in basic sciences and nuclear technology. An arrangement with the International Centre for Theoretical Physics (ICTP), Trieste, will award fellowships to young scientists from LDCs to attend courses at the Centre and fulfil partial requirements for academic degrees. UNDP Sectoral Support also financed a regional workshop in Ethiopia to give participants from LDCs an opportunity to learn and apply an integrated approach to the design, management and evaluation of Agency TC projects. The workshop was attended by 24 national liaison officers and project counterparts from 10 countries, and provided a forum to address issues related to all stages of project design with emphasis on the institutional and infrastructural constraints specific to African LDCs. Recent changes in TC policies, programming and implementation practices were also reviewed, giving particular attention to the Model Project concept and its implications for programming activities. National Co-ordinators from four LDCs received additional training at Agency Headquarters in TC procedures, programmes and policies.

49. Applications of isotopes and ionizing radiation in food and agriculture continued to be the most important activities in the region. Substantial assistance was provided under seven regional projects and more than 60 national projects in 20 countries in plant nutrition, soil fertility, crop improvement, animal production and health, and pest control.

50. In soil science, isotope techniques were applied in Côte d'Ivoire to measure mineral and water inputs in order to optimize nutrient absorption by crop plants and identify better soil and water management practices. Biological nitrogen fixation studies played an important role in identifying and exploiting legume cultivars and symbiotic rhizobial strains capable of improving atmospheric nitrogen fixation for increased crop productivity, in assessing nitrogen economy in legume-cereal rotation systems, assessing nitrogen use efficiency in sugar beet and sugar cane, and identifying nitrogen-fixing trees. In several countries, important results were achieved in biological nitrogen fixation. Promising new strains of rhizobial inoculant and genotypes of legume species with high nitrogen fixation efficiency were identified. An important regional project on biological nitrogen fixation initiated in 1987 concluded its planned activities in 1994, having achieved its objectives of introducing the application of technologies such as the use of inoculants to improve nitrogen fixation or crop residues and organic wastes as a source of plant nutrients. The project has stimulated collaboration between the countries in the region. A training course and four research workshops were held during the life of the project.

51. Activities on the application of radiation in plant breeding and genetics continued to be supported by the Agency in eight countries. Counterparts were assisted in screening advanced mutant varieties, formulating experimental breeding programmes, and implementing in-vitro micropropagation techniques for mutation breeding of vegetatively propagated crops. Other Agency-supported activities involving multi-year TC projects and FAO/IAEA co-ordinated research programmes have resulted in the development and testing of promising new mutant varieties of some important basic food crops. Future efforts will be focused on ensuring suitability for full-field production and demonstrating the economic impact of these improved varieties. Achievements include varieties of barley and durum wheat in Algeria, barley in Libya, cassava in Ghana, wild African rice and sorghum in Mali and rice in Tanzania.

52. Another important area of technical co-operation in Africa is in the livestock sector, where the Agency continued to assist governments (through national and regional projects), research institutions and veterinary services in the region to improve their capacity to monitor the effectiveness of animal health control programmes and to diagnose animal diseases. Particular emphasis was placed on those activities with economic significance to sub-Saharan countries, such as rinderpest, trypanosomiasis, brucellosis and babesiosis, using nuclear-based immunoassay techniques. Algeria and Morocco were also assisted to evaluate and improve vaccination campaigns against African horse sickness. Support to Madagascar has contributed to establishing new capabilities for the diagnosis of swine fever, which is particularly relevant to the economy of the country. Co-operation and exchange of information between African countries in the area of animal health were promoted through two regional projects and the provision of backstopping services by regional experts. One regional workshop on diagnosis and control methods of animal trypanosomiasis was held in Kenya. Nutritional and managerial problems limiting smallholder systems of management in Africa, such as reproductive performance and productive efficiency of indigenous and crossbreed ruminant livestock species, were the subject of several research programmes that seek to devise simple, cost-effective methods to overcome the underlying constraints. Isotope application also supported nutrition studies which assessed the feasibility of using indigenous feed resources for

supplementary feeding of dairy cattle in Algeria, Cameroon, Morocco, Tanzania and Zimbabwe. An AFRA project addressed animal reproduction and nutrition issues at a regional training course held in Ethiopia.

53. Activities aimed at applying the sterile insect technique (SIT) in integrated pest management programmes have focused mainly on the tsetse fly in view of its important social and economic relevance to sub-Saharan countries. TC projects were operational in Ghana, Mali, Nigeria and Uganda. In Tanzania, the Model Project on Zanzibar Island suffered initially from lack of extrabudgetary funding. Contributions from Belgium, Canada, China, Sweden, the OPEC Fund, the UK and the USA, together with a substantial increase from the TACF, enabled implementation to proceed satisfactorily. In fact, the implementation rate for the project during 1994 was exceptionally high at 88.7%. With sufficient funding, full eradication of the tsetse fly is expected on the Island by 1997. Successful implementation of this project will have a lasting and significant impact on livestock development and the efficiency of farming systems in Zanzibar.

54. The use of isotopes for the assessment of water resources, especially in arid and semi-arid zones of the region, was a major category of technical co-operation in 1994. In view of the significant role isotope techniques can play in addressing water resources management issues, the Board of Governors approved a multi-year regional Model Project designed to utilize isotope hydrology techniques in combination with other investigations to estimate recharge rates of various aquifers in Egypt, Ethiopia, Libya, Mali, Morocco, Niger, Senegal and Sudan, and to provide data to develop water policy guidelines for optimal management of groundwater resources. This Model Project is based on a project identification outline developed at the planning seminar in Morocco in 1993. In Mauritius, isotope hydrology has established the link between different aquifers and demonstrated that the water supply can be expected to improve at certain times of the year if certain recommended management actions are taken.

55. In the human health sector, the assistance provided by the Agency was essentially concerned with the application of nuclear techniques for medical diagnosis and the treatment of cancer. Radioimmunoassay (RIA) activities continued to receive high priority in 15 national projects and two regional projects which focused on the establishment of bulk reagent-based "in-house" assays for thyroid related hormones. By the end of 1994, 75 RIA facilities had been established in the 21 African countries involved. Most of these laboratories are able to produce their own quality control sera standards for T3 and T4 assays. These achievements have led to a considerable decrease in the cost of the analyses, by at least a factor of 10. Technology needed to prepare the solid phase for the immunoradiometric assay of TSH has also been successfully transferred to the region. The efforts by the Agency over the past few years to promote good or standard RIA practices in the region have permitted the introduction of an external quality assessment scheme (EQAS) for thyroid related hormones to evaluate the analytical reliability of the assay procedures based on the bulk reagent methodology.

56. A Model Project in nuclear medicine began implementation in Tunisia in 1994 in order to establish an indigenous capability to screen newborn babies for neonatal hypothyroidism, thus providing sufficient time for prompt treatment to prevent irreversible neurological impairment and mental retardation. This

project is supporting a national programme involving nine major hospitals with fully functional RIA facilities, and required a national training workshop in June 1994 on the methodology and management of the operations. All necessary reagents have now been supplied for the screening programme to begin nationwide.

57. Projects to establish or upgrade nuclear medicine services for in-vivo diagnostics were operational in six countries in 1994. Assistance was provided to Ethiopia to develop basic infrastructure for in-house small scale manufacture of kits employed in the formulation of some technetium-99m radiopharmaceuticals. A gamma camera and accessories for clinical diagnosis and research were supplied to Kenyatta National Hospital. In Morocco, the Agency assisted the Ibn Sina Hospital to widen the scope of nuclear medicine by introducing bone, brain and kidney studies. The nuclear medicine facilities at the Muhimbili Medical Centre, Tanzania, were upgraded by introducing in-vivo techniques. In Uganda, the Agency continued assistance to Mulago Hospital by providing expert services and training personnel on the use of a gamma camera for clinical studies.

58. In the field of radiotherapy, assistance was resumed to Cameroon following the promulgation of the national radiation protection legislation; brachytherapy equipment was ordered for the Yaounde General Hospital and steps were taken to upgrade the teletherapy facilities at this hospital and at the General Hospital of Douala. Construction delays and lack of adequate radiation protection infrastructure have greatly affected the implementation of the radiotherapy project in Uganda. Strengthening capabilities in medical physics is the objective of Agency assistance to Algeria and Zimbabwe, while projects in Egypt, Libya, Morocco, Nigeria, Tanzania and Tunisia are assisting these countries in optimizing the utilization of radiotherapy equipment. Particular emphasis was given to improvement of the standard practice of radiotherapy in the region through expert services and on-the-job training in dose treatment planning, quality assurance, radiation dosimetry and preventive maintenance.

59. A Model Project on national radiotherapy and nuclear medicine network was initiated in Ghana in January 1994 to establish brachytherapy and nuclear medicine services in Accra and Kumasi. Extrabudgetary contributions were received from the USA for the purchase of brachytherapy equipment for Kumasi, and China agreed to donate about \$800,000 to meet priority project objectives. This project has received considerable national attention as a result of the establishment of a high level committee, under the patronage of the First Lady of Ghana, to monitor project activities. The Government of Ghana has released sufficient funds to construct adequate buildings in Accra and Kumasi to house the radiotherapy and nuclear medicine units. Construction of the building in Accra is already well ahead of schedule.

60. Increased emphasis continued to be placed on the establishment of adequate radiation safety infrastructure as an essential condition for building up viable nuclear technology capabilities in the region. Assistance was provided through more than 40 projects in 19 Member States, which established or strengthened legal frameworks, regulatory bodies and the technical capabilities required for enforcement of radiation safety standards. The Interregional Model Projects on radiation protection and waste management provided assistance to upgrade the infrastructure of Cameroon,

Ghana and Uganda. While implementation of an adequate radiation safety scheme in Cameroon has yet to be ensured, steps were taken in Uganda towards the effective enforcement of radiation safety standards through the formation of an Atomic Energy Control Board. A national authority competent in radiation safety matters was also established in Ethiopia.

61. Although efforts are still needed to ensure an acceptable level of radiation protection in the region, Agency support in 1994 has contributed to strengthening the technical capabilities of many countries in radiation protection, particularly with respect to personnel and environmental monitoring systems. Assistance was provided to Egypt, Mauritius and Zimbabwe to upgrade personnel dosimetry services. Côte d'Ivoire, Nigeria and Sudan benefitted from expert missions to consolidate their capability for measuring environmental radioactivity, particularly for food monitoring. A regional training course on environmental radiation measurement and harmonization was held in Morocco.

62. The region increased delivery of technical co-operation in the field of radioactive waste management by over 40% in 1994. Egypt received further assistance to upgrade the liquid and solid radioactive waste treatment facilities established with Agency assistance. Under the AFRA regional project, expert missions were fielded to advise on treatment of organic radioactive waste (Egypt, Morocco), disposal site selection (Kenya) and management of radioactive wastes in hospitals (Tanzania). A regional training course on radioactive waste management techniques was held in Egypt.

63. 1994 was a pivotal year for the AFRA Programme. Much effort was devoted to upstream activities that will provide new direction and vitality as the programme enters its second five year cycle (1996-2000). Intensive consultations with AFRA Member States and donor countries have resulted in new objectives which will guide the strategy for AFRA for the coming five years and define the essential parameters that will determine AFRA's ability to plan, manage and promote the region's development in the field of nuclear science and technology and to address the most pressing needs of its Member States. Several new guidelines and procedures were adopted in 1994 to improve the design, formulation and implementation of AFRA activities and to monitor its achievements more efficiently. The unanimous recommendation for the extension of the AFRA Agreement for a new period of five years illustrates the strong determination of AFRA Member States to share the expertise and facilities available in the region and their commitment to regional co-operation. Three new AFRA projects will begin implementation in 1995.

64. During the year nine AFRA projects were operational. The implementation of AFRA activities in 1994 produced several results that contributed to strengthening or establishing sustainable national and regional capacities in the areas of radiation safety, non-destructive testing techniques, local preparation of radioimmunoassay bulk reagents, food preservation, crop improvement, maintenance of nuclear instrumentation and irradiation processing. Twelve training courses and workshops and four co-ordination meetings took place covering all the areas of nuclear applications noted. Thanks to an extrabudgetary contribution from France and Spain, additional assistance was provided to several AFRA countries in support of their own efforts in the field of radioimmunoassay and non-destructive testing techniques.

65. Intensified monitoring by the Area Office, combined with increased consultations with Member States, resulted in increased training requests during the year and underscored the growing interest on the part of the recipient countries in the Agency's manpower development programmes. Training activities, aimed at upgrading the scientific and technical knowledge and professional skills of the personnel involved in planning, formulation and execution of Agency TC projects received particular attention. Under the training programme, a regional training course on radiation protection in medical practice, emphasizing occupational protection for medical staff and patient protection during diagnostic radiology and radiotherapy, was held in Tunisia, and a regional training course on system notification, registration, licensing and control of radiation sources and installations in Tanzania.

66. The Third Co-ordination Meeting on the Development of Radiation Protection was organized in Madagascar and attended by senior representatives from 15 African Member States to review the status of radiation safety in the region. A programme of activities to foster regional co-operation and increase the effectiveness of Agency support in the field was discussed and agreed upon.

67. During 1994, 145 fellows received training, totalling 520 months, under the regional manpower development projects. In addition 103 fellowships for a total duration of 458 months were awarded under individual TC projects. Fellowship training was supplemented by the organization of 14 regional training courses and eight technical workshops in virtually all areas of nuclear technology applications relevant to the Agency's TC programme in Africa. In view of the inadequacy of qualified manpower and the very large personnel turnover in certain countries, national training events were encouraged as an effective mechanism to broaden the local manpower base. This scheme was successfully implemented in Sudan where four national training courses in radioimmunoassay techniques, nuclear instrumentation and radiation protection were held in 1994. Altogether, 76 local participants, from various national institutions, have been trained through these events, which the Agency supported by providing lecturers and consumables.

## **2. Asia and the Pacific**

68. Of the four geographical regions, Asia and the Pacific, with 23.3% of the total adjusted programme, accounted for the second largest share of the TC programme in 1994. During the year, the region achieved its highest rate of overall implementation in the last five years at 68.4%.

69. Following special approval by the Board in December 1993, three Model Projects, two from China and one from Sri Lanka, became operational in 1994 and achieved an average implementation rate of almost 82%. In December 1994, the Board approved the 1995-96 TC programme, including two additional Model Projects: one in Bangladesh and the other in Mongolia. The project in Bangladesh seeks to establish the technical capacity for large scale production of biofertilizers (*Rhizobium inoculum*) in order to increase and sustain production of legumes such as lentil, chickpea and other stable food crops, thus contributing to Bangladesh's food security. In Mongolia, where the Government is in transition from planned to a market economy, resources are

not available to rehabilitate the only Oncology Centre in the country, which faces an increasing number of cancer patients. The Model Project will upgrade the teletherapy and brachytherapy services at the Oncology Research Centre in Ulan Bator, thus improving health services and survival rates for the affected population.

70. During 1994, a total of 302 country and 33 regional projects were operational, including 39 approved as footnote-a/ and two new UNDP projects: one on manpower development for the safe operation of nuclear power plants (China), and the other on the use of isotopes and radiation to strengthen technology and support environmentally sustainable development as part of the Regional Co-operative Agreement (RCA) Programme. Some 74 projects, including 17 approved as footnote-a/, were closed during 1994 after achieving their objectives. Efforts, which began in 1993, to improve the quality of the 1995-96 programme intensified in 1994, as new requests were appraised with reference to Model Project criteria and redesigned, if possible, to emphasize end-user beneficiaries and socio-economic impact. With the co-operation of Member States, the number of requests was reduced from 184 for the 1993-94 cycle to 149 for the 1995-96 cycle. The 24% rejection rate, compared with 30% for 1993-94, also reflects a further improvement in project design by Member States. As a result of improved project planning, 90% of the workplans, expert job descriptions and equipment specifications were received from the counterparts by late September 1994; nearly two months earlier than in previous years. This should lead to considerable improvement in the implementation of the 1995 programme.

71. Thailand has embarked on a national project to establish a multi-disciplinary Nuclear Research Centre, for which the Agency has been providing expert advice since 1993. A mission of three Agency staff members and one outside expert visited Bangkok early in the year to assist in preparing the final terms of reference. Several overseas suppliers have submitted bids for the Centre, which will contain a 5 MW research reactor, an isotope production facility and a waste management facility.

72. At the request of the Government of Malaysia, the Agency conducted an independent assessment of the contribution of nuclear technology to the industrial sector which covered activities supported from all external and internal sources of funding. An expert mission was fielded to Malaysia, and the report to be finalized in April 1995, will form the basis for support to the national programme under the next Five Year Development Plan.

73. Several countries with active nuclear power programmes received substantial assistance in that sector. Five national workshops were organized in Indonesia, covering NPP management, criteria for the choice of commercial NPPs, quality assurance in NPP construction, and the economics and financing of NPPs. Agency experts also assisted the Indonesian authorities in nuclear power plant siting. In 1994 two multi-expert missions were undertaken and recommendations were made to assist the Indonesian authorities in site selection. Efforts were also made to obtain support from donors and UNDP for a pipeline project in China on radioactive waste management that has been formulated according to UNDP Capacity 21 objectives. These efforts are continuing with the full support of the Government.

74. Assistance to Pakistan focused mainly on nuclear power related activities dealing with the safe operation of the Karachi Nuclear Power Plant (KANUPP) and safety related missions to the Chasma Nuclear Power Plant (CHASNUPP) site. Workshops on safety techniques were also held at KANUPP. Expert missions advised on the probabilistic safety assessment (PSA) of the 300 MW(e) Chasma NPP, and a reactor pressure vessel audit mission was fielded. An International Peer Review Service (IPERS) mission was fielded to the Republic of Korea for Yangwang 3 and 4, and a national training course was arranged on the safety optimization of NPP maintenance.

75. The Agency assisted Viet Nam to prepare a draft ordinance on radiation control, and to help establish a National Radiation Protection and Nuclear Safety Authority as a regulatory organization independent from the Viet Nam Atomic Energy Commission (VINATOM). This ordinance is expected to be enacted in early 1995.

76. In view of the importance of geothermal exploration to China, Indonesia and Philippines, a mission was fielded to explore the potential for Technical Co-operation among Developing Countries (TCDC) in that field, within the context of the ongoing Agency hydrology project on Isotopic techniques in geothermal hydrology. Geothermal activities in the Philippines have been supported by the Global Environmental Facility (GEF) with a \$30 million project and the World Bank has provided a loan for development of geothermal areas. Preparations were made during 1994 for a UNDP Sectoral Support mission to the Philippines to explore the potential for inter-Agency collaboration. This mission is linked to the First Country Programme Framework (CPF) exercise which will take place in the Philippines concurrently. The CPF process will provide a solid foundation for collaboration with other development organizations, within the context of government priorities and planning.

77. As part of the ongoing programme of training in TC project procedures, a regional workshop on the design, management and evaluation of the Agency's TC projects was organized in Malaysia and a similar national workshop took place in Thailand. During these workshops the Model Project concept was discussed and the Policy Review Seminar of September 1994 previewed. Four fellows, representing Bangladesh, Myanmar, Philippines and Sri Lanka, received two to three months training on TC procedures during the year. These activities have led to improvements in the quality and implementation of TC programmes in these countries.

78. The Government of China requested an International Regulatory Review Team (IRRT) mission to evaluate the effectiveness of the regulatory process as carried out by the National Nuclear Safety Administration (NNSA). A Reserve Fund project was approved to finance these expert services. Recommendations were made to strengthen regulatory practices in certain areas.

79. A Reserve Fund project for Indonesia on feed supplementation for increasing livestock production was approved in September 1994. The project is intended to extend the benefits of the technology to two areas, establishing demonstration facilities and providing training to increase livestock production. The project will use local expertise to transfer the technology to farmers to benefit the end users and local Government.

80. National training courses were organized: one on Radiation Protection in Industrial Radiology in Viet Nam, one on Radiation Protection in Myanmar, and one on Emergency Planning and Preparedness in Thailand. In the field of environmental protection, a national training course on the analysis of petroleum hydrocarbons in marine sediment samples was organized in Malaysia as part of the national project on marine contaminants and sediment transport.

81. The willingness of Member States of the region to become cash donors and make substantial in-kind contributions demonstrates RCA's growing maturity. Contributions from Australia, China, India, Indonesia, Japan, Republic of Korea, Malaysia, New Zealand, Philippines and Thailand could reach more than \$1.25 million in 1995. Two new governments, Myanmar and New Zealand, became party to the Agreement in 1994, bringing the total membership to seventeen.

82. Two long term experts were appointed to support technologies within the scope of the joint UNDP/RCA/IAEA project on the use of isotopes and radiation to strengthen technology and support environmentally sustainable development: one for non-destructive testing, based at the Office of Atomic Energy for Peace in Bangkok, and the other for tracer technology, based at the Malaysian Institute for Nuclear Technology and Research, Bangi. The Governments of Thailand and Malaysia are supporting these offices as part of their contribution to the RCA. The Chief Technical Officer of the project is based at the BATAN Centre for Application of Isotopes and Radiation, Jakarta, and this office is supported by the Government of Indonesia.

83. Fifteen TC projects were operational under the RCA Programme during 1994, four with associated Co-ordinated Research Programmes (CRPs). One additional CRP was not associated with a specific TC project, but integrated into RCA activities.

84. During the year, a number of major RCA events and meetings involving 372 participants were held which related to priority activities such as: isotope applications, radiation technology, nitrogen fixation of grain legumes, radioimmunoassay, radiation sterilization, radiation protection, training in nuclear medicine, computer assisted planning and dosimetry in radiotherapy of carcinoma of uterine cervix, compilation of human anatomical, physiological and metabolic characteristic in the region, environmental sampling, strategies for nuclear power programmes, data requirements of IAEA's planning models for energy, electricity and nuclear power with emphasis on the WASP model, nuclear information systems and emergency planning.

85. Twenty-three regional training events were carried out under the RCA and Regional Training Course Programme, giving training opportunities to 403 participants. A total of 282 expert assignments were made at the request of Member States. Major across-the-board cuts in funding at the end of 1994 for the joint UNDP/RCA/IAEA project on use of isotopes and radiation has significantly reduced the UNDP contribution. The cuts, applied to all projects in the UNDP Regional Programme in Asia, will affect project activities in 1995. Action is being taken to minimize the effects of these cuts on the project's integrity.

### **3. Latin America**

86. In December 1994 the Board approved six new Model Projects as part of the 1995-1996 technical co-operation programme for Latin America. These cover a wide range of activities: isotope hydrology and geochemistry (El Salvador); evaluation of nutrition supplements for children (Peru); screening for hypothyroidism in newborns (Uruguay); assessment of groundwater resources (Venezuela); training in nuclear medicine (Mexico); and a regional project to upgrade gamma cameras for nuclear medicine services. These new Model Projects are providing an incentive to Member States in the region to undertake projects with large impact and firm commitments from government. Therefore, the TC project requests received during 1994 for the 1995-96 Programme relate, in many cases, to activities with major impact and include the participation of the end users of the technologies to be transferred.

87. Technical co-operation in the region continued to be focused mainly on health, agriculture and radiation protection. Hydrology and environment related projects were also carried out in several countries. Technical co-operation in Haiti continued to be frozen owing to the political situation but is likely to be resumed during the latter part of 1995. Regional projects outside the ARCAL Programme continued in the areas of radiation protection, quality assurance in nuclear medicine, environmental pollution and industrial quality. These projects were implemented taking into account the activities and objectives of national projects.

88. The Agency continued its strong support to nuclear medicine and radiotherapy. In Nicaragua, a teletherapy unit with a treatment planning system and a therapy beam analyser was put into operation at the National Institute of Radiotherapy and Oncology. A teletherapy unit in Guatemala was upgraded by the provision of a cobalt-60 source. In Uruguay, a SPECT system was installed at the Nuclear Medicine Centre of the Clinical Hospital in Montevideo. In Bolivia, one gamma camera was supplied to a hospital in Cochabamba and another to a hospital in Santa Cruz; an after-loading brachytherapy system was also supplied to the Oncology Institute, Santa Cruz. A very remarkable achievement was the production of human TSH standard by biotechnological (recombinant DNA) methods at IPEN, in Brazil. This standard is now being used within and beyond the region. Advances were made in Brazil on the use of gamma irradiation for snake venom attenuation to improve treatment for snakebite and provide immunization for animals. A regional project on radioimmunoassay for thyroid related hormones successfully introduced the bulk reagent methodology and local reagent production for T3, T4 and TSH determinations. As a result, the region is now self-sufficient in the production of T3 and T4 reagents as well as for TSH except for production of I-125 used for labelling.

89. Significant achievements were made in the Agency's programme in Latin America to support the sterile insect technique (SIT) for the eradication of insect pests. Activities aimed at eradicating the Mediterranean fruit fly in several provinces in southern Argentina were scaled up during 1994, under a Model Project approved in December 1993 to support national efforts to increase fruit exports. Major progress was made in the Province of Mendoza where by the end of 1994 two hundred million sterile flies were being released each week over the half million hectares of orchards and urban areas of the

province. Commercial fruit crops are already free of the pest and full eradication in urban areas will be attempted in the 1995-1996 season. This project achieved an impressive implementation rate of 94.8% during 1994. In Guatemala, field evaluation of fruit fly genetic sexing strains developed by the Agency's Laboratories in Seibersdorf has demonstrated their effectiveness in large scale SIT programmes, with the result that the US Department of Agriculture in Hawaii has requested these strains for production at one of its mass rearing facilities. The mass rearing facility in Arica, Chile, initiated operations in 1994, and preventive releases of sterile fruit flies are now replacing insecticide sprays along the Chile-Peru border to deal with southern migration to fly free areas.

90. Activities in the areas of agriculture and animal husbandry during 1994 included the establishment of laboratories in Cuba to utilize nuclear techniques for plant tissue culture required in mutation breeding of sugar cane and for the development of new varieties of plantain. Laboratories were also set up for soil science studies and mutation breeding in Guatemala, where new varieties of rice and wheat continued their evaluation process.

91. In the area of nuclear power, project implementation in Brazil was delayed by the stoppage of Angra I and the pending decision on the completion of Angra II. Upgrading of the INEA research reactor at Santa Fe de Bogotá, Colombia, continued and a contract was signed with a supplier for the provision of a new reactor core. A regional project to facilitate exchange of experience at the managerial level in construction and operation of NPPs was successfully concluded, with the participation of Argentina, Brazil, Cuba and Mexico. The methods applied and the results obtained in the project will be used as a model for the Agency's promotion of nuclear power co-operation programmes in other regions of the world.

92. Under a regional project, studies are being carried out in Chile on atmospheric contamination, while water pollution is the subject of similar activities in Argentina, Ecuador and Venezuela. Knowledge of the impact of pesticides in the environment was advanced under projects in Brazil and Panama, while an analytical base was established for determination of heavy metals in the marine ecosystems of Cuba.

93. Several Latin American countries were undergoing restructuring processes in the nuclear sector. The Government of Argentina introduced important changes in this sector aimed at strengthening its technical capability. The nuclear activities were distributed into three organizations. Firstly, a new Atomic Energy Commission, which is dedicated to research and development, including advanced reactors, fuel cycle, waste management, decommissioning of nuclear facilities, nuclear medicine and other applications of radioisotopes. Secondly, the Nuclear Regulatory Authority, responsible for all the regulatory activities and, thirdly, a company dedicated to nuclear power generation, which is subjected to privatisation.

94. Efforts to strengthen radiation protection programmes in several countries continued in spite of local difficulties, and some positive results were achieved. In Guatemala a secondary standards dosimetry laboratory capable of providing services to the Central American and Caribbean region was put

into operation. In Brazil, progress was made in nationwide co-operation for the management of radioactive waste.

95. An ARCAL project to upgrade and expand national and regional capability for maintenance and repair of nuclear instruments was completed. Several laboratories were established to provide maintenance and repair services for the region, and three specialized regional training centres were created. The ARCAL project to promote the application of isotope techniques in hydrology was also completed during 1994, having successfully supported national field hydrology projects using isotope techniques in 12 participating countries. The project was originally approved as a footnote-a/ project in 1989, and made operational through an extrabudgetary contribution from Germany and through funds from the TACF.

96. The second phase of the ARCAL Programme, which has 18 participating Member States, was concluded in 1994. The programme has played a major role in the introduction and establishment of nuclear techniques in several countries of the region, and has effectively promoted the concept of co-operation among developing countries (TCDC) as an instrument for the implementation of regional programmes. ARCAL sponsors a forum for countries to meet regularly and discuss regional developments in their fields of interest. It has successfully established bilateral or multilateral collaboration in several fields without assistance from the Agency. Member States continued in 1994 to work on the implementation of a strategic plan to strengthen the ARCAL Programme for the third phase (1995-1999).

97. Three Reserve Fund projects were approved during 1994. In Venezuela, where the increasing demand for drinking water in Caracas has required the Government to increase its groundwater hydrology activities, the Agency supported the application of isotope techniques to define the proper exploitation of the available water resources in co-ordination with new drilling priorities. In Peru, a Reserve Fund project was approved in order to carry out preliminary measurements of the nutritional status of a sample population for the Institute of Nutritional Research, in preparation for a proposed Model Project on nuclear techniques to improve child nutrition, approved by the Board in December. Reserve Funds financed a regional project to ameliorate safety problems in the use of computerized Treatment Planning Systems in Bolivia, Brazil, Peru and Venezuela.

#### **4. The Middle East and Europe**

98. The main developments during 1994 related to the expansion of priority activities and the increased number of recipient countries in the two areas. The Area Office handled technical assistance projects from Portugal to Afghanistan in Central Asia, and from Yemen, near the Horn of Africa, to Estonia in the Baltic Sea. During 1994 three new states in Europe and Central Asia joined the Agency. Although several of the Newly Independent States (NIS) were not yet IAEA Member States, the Department of Technical Co-operation responded to the Board of Governor's request to send fact-finding missions to a number of these countries through joint programming activities

with UNDP, utilizing contingency funds approved by the Board. By the end of 1994, 37 Member States in the region were involved in the Agency's TC Programme.

99. This last decade has been one of rapid growth in the volume of the region's TC Programme. It has grown from \$7.7 million in 1985 to over \$18 million in 1994. Equally important is the fact that in recent years the programme has become much more complex with the new emphasis on impact and with efforts to address a wider range of technically and economically challenging issues. The introduction of three Model Projects in 1994 dealing with nuclear safety and electron beam purification of flue gases brought new impetus to the region's TC activities, which continued with the Board's approval in December 1994 of the 1995-1996 TC Programme that includes a new regional Model Project on rinderpest sero-monitoring. This project will be managed by the Section for West Asia. This new Section, formed from the reorganization of the former Middle East and Europe Section, will facilitate better response to the different needs of Member States in the two regions.

100. While the most obvious technical issue facing a number of countries in the region during 1994 was the introduction or continued utilization of nuclear power as a reliable, safe and economical energy source, the scope of the ongoing efforts in this region are much wider. Human health, industry, agriculture, water resources and animal production are other priority areas of technical co-operation being implemented. These activities have a strong socio-economic dimension that require higher levels of organization and government commitment. The growing number of projects in these areas has resulted in the introduction of a number of new procedures and programming mechanisms, mentioned in the General Issues section of this Report. During 1994, some 66 projects in the region were closed, most having achieved their objectives. This important step will have promising consequences on programme implementation during the next two years. The gradual shift to fewer and larger scale projects, combined with the restructuring of the two new Sections, will enable the Department to continue to provide high quality support to the governments of these regions within the confines of a very restricted administrative budget.

101. In the Eastern European sub-region a marked emphasis was placed during 1994 on nuclear safety, regulation, radioactive waste and spent fuel management, as well as reactor maintenance, including in-service inspection and quality assurance. Particular attention was given to ongoing nuclear power programmes in Bulgaria, Croatia, the Czech Republic, Hungary, Romania, Slovakia, Slovenia and Ukraine. Many institutions in the Middle East, on the other hand, continued to concentrate on the peaceful applications of atomic and isotope techniques in medicine, hydrology, agriculture and industry, radioisotopes and radiation. Nuclear techniques were applied to improve crop production, to determine and manage groundwater resources, to sterilize medical products, and for radioimmunoassay, non-destructive testing, quality control of industrial products, and the study of environmental pollution. Early warning environmental radiation monitoring systems have also been expanded in the region to deal with the possibility of a local or international radiation accident. The emphasis in many of these applications is making the technology serve people, an important link to applying sustainable human development to the Agency's TC activities.

102. In the area of environmental protection, the Agency continued to assist the Government of Poland with the development of electron beam technology to remove toxic pollutant gases such as SO<sub>2</sub> and NO<sub>x</sub> from industrial flue gases. This Model Project was initiated in 1994 to develop the first industrial scale plant utilizing electron beam technology at the Pomorzany electric power station in Szczecin. Several design and technical review meetings were held during the year and the equipment specifications were finalized. However, owing to delays in extrabudgetary funding, it was not possible to fully implement the planned activities for 1994. The financial implementation rate for the project during the year was only 2.8%, as it was deemed imprudent to commit the core budget beyond design and technical review functions without a firm extrabudgetary commitment. An extrabudgetary contribution of \$300,000 from UNIDO's Japanese funds in trust is expected to be confirmed shortly.

103. The high priority associated with nuclear safety within the European region was reflected in the increased number of safety review missions fielded in 1994 under the Agency's OSART and ASSET programmes. Eight ASSET seminars and review missions were carried out under TC projects, three of them in Ukraine. In 1994, IPERS and OSART missions were sent to the Krsko NPP at the request of the Government of Slovenia and financed from TACF. Assistance was also provided for upgrading nuclear and operational safety at the plant, including seminars and workshops organized and funded under a footnote-a/ project financed by the USA.

104. Member States operating WWER-type reactors continued to receive support from the Agency under the regional programme on in-service inspection (ISI) design. A workshop was held at Paks NPP on WWER-440 ISI of reactor pressure vessels. A second seminar on ISI was hosted by the Loviisa NPP in Finland. This is the first time that the results of the Agency's ISI programme and the experience of Paks and Loviisa NPPs were shared by all the WWER operating countries.

105. The Model Project for Hungary to improve the operational safety and the general safety culture at Paks NPP began a successful implementation in 1994 and is on schedule for 1995. The project will restructure the training system at Paks in accordance with the recommendations of TECDOC-525 (Systematic Approach to Training (SAT)), and upgrade the Paks maintenance training centre in order to enhance safety culture in line with INSAG-4 directives. This Model Project is a complex multi-year undertaking involving several institutions in Hungary, and an overall investment of over \$10 million. This contribution includes an Agency input (both core and extrabudgetary) as well as additional contributions from the USAID Programme and through the European Commission within the scope of the Poland and Hungary Action for Restructuring the Economy Regional Programme (PHARE). The implementation rate for the project in 1994 was over 80%, with all three planned objectives of the project achieved: the introduction of SAT in the training of NPP personnel; the upgrading of the maintenance training centre; and the enhancement of safety culture. The PHARE 93 project was launched to develop training programmes which would be implemented at the maintenance training centre, and was financed from extrabudgetary contributions by Japan, Spain and the USA. The success of this project is clearly due to the full support and commitment of the Government and its technical co-operation partners.

106. Increased emphasis was given to the development of adequate nuclear regulatory and licensing infrastructures, particularly through projects in Armenia, Bulgaria, Croatia, the Czech Republic, Romania, Slovakia, Slovenia and Ukraine. Under a regional project, several workshops and training courses were organized to share the regional experience on the development of national nuclear legislation, regulatory control of nuclear power plants, and licensing procedures during commissioning. The project workplan was established early in 1994 through a co-ordination meeting in Kiev where the entire region was represented together with experts from the European Union. Similarly, the Model Project for Slovakia, to strengthen nuclear safety and regulatory capabilities which began implementation in 1994, had significant impact on the Slovak National Regulatory Authority (NRA) by increasing staff. The expert advice provided during the missions led the NRA to develop an effective internal structure covering all its duties. The expert advice also enabled the NRA to develop a set of internal procedures including inspection guidelines and a programme of activities. The Agency provided management training to NRA staff on setting up an internal training organization and on specific inspection topics. The first draft of an internal training programme for NRA staff was prepared. Following the recommendations of the expert mission in January 1994, the NRA has prepared its first annual status report on the safety of nuclear installations in the country, including the significant safety actions taken.

107. Storage of spent fuel continued to be a pressing concern for Eastern European Member States operating WWER-type reactors. Previously, spent fuel from these countries was returned to the former USSR for reprocessing, but this solution for all spent fuel requirements is no longer guaranteed. The Agency continued to pay close attention to radioactive waste management and spent fuel storage, particularly in Ukraine, and to assist Bulgaria in putting into operation a radioactive waste treatment system. A regional project for WWER-type NPPs on radioactive waste management was completed and TECDOCs were published. As a result, recommendations have been made on existing policies, strategies, legislation, organization and the structure of regulatory bodies dealing with radioactive waste management, and on comparative evaluation of the radioactive waste management systems of WWER-type NPPs. A computer programme was developed as an evaluation tool.

108. Other regional TC projects relating to safety assessment of the WWER-type reactors were completed in 1994. Beginning in 1988 and completed at a total cost of \$453,342 in November 1994, the Agency provided an extensive programme of training and education for probabilistic safety assessment (PSA) practitioners and assisted in developing a plant specific Level 1 and Level 2 PSA in each participating country (Bulgaria, the Czech Republic, Hungary, Poland, Slovakia, Russia and Ukraine). In 1994 the activities concentrated on specific methodological support in the area of human factors (recoveries), data processing, Level-2 PSA, and treatment of external events, including seismic PSA and fire hazard analysis. Several basic PSA seminars were organized in Slovakia and Ukraine on PSA application for WWER reactors. A database was also developed using plant specific data input from eight WWER sites in all participating countries. Five TECDOCs were published relating to these activities. Based on the experience of regional co-operation on WWER-440, a similar safety assessment of WWER-1000/320 reactors has been initiated in response to a request from Bulgaria, the Czech Republic and Ukraine. Regional co-operation was successful on the MELSIM trainer/simulator installed

at Bohunice NPP which is used as a tool for severe accident simulation to evaluate accident management strategies, assess complex interfaces between emergency operating procedures and to provide accident management guidelines. China and Pakistan have also expressed interest in the simulator.

109. The first phase of the regional project on environmental restoration of contaminated nuclear sites was completed in 1994, and the final workshop, on the technologies available to support environmental restoration in the countries of the region was held in the Czech Republic. The second phase begins in 1995, with a more limited range of environmental conditions and focusing on uranium mining and milling.

110. Regional collaboration in the Middle East provided opportunities to pool knowledge and resources in nuclear research activities. Cyprus, Iran, Jordan, Kuwait, Saudi Arabia, Syria, Turkey and the United Arab Emirates have been active in several regional projects, while Lebanon recently joined a number of ongoing programmes. Afghanistan could not take part owing to the political situation in the country. Qatar continues to build up infrastructure and manpower to enable it to participate fully in the regional activities; Yemen is expected to join in the regional activities in the near future.

111. In the area of food security, activities in the regional project on nitrogen fixation and water balance studies during 1994 included a co-ordination meeting and a training workshop in Jordan where participants from Jordan, Cyprus, Syria, Saudi Arabia, Turkey and the United Arab Emirates presented results of their national activities in crop rotation, nitrogen fixation, fertigation (application of fertilizers to crops through drip irrigation) and other soil-water balance relationship studies. The project is designed to promote regional collaboration in agricultural practices with the objectives of increasing food production, and strengthening existing national projects in fertigation and biological nitrogen fixation in grains and legumes. Efforts to strengthen capabilities in the Middle East for monitoring food and environmental contamination by natural and man-made radionuclides also continued successfully in 1994. The establishment of food and environmental contamination laboratories is a common objective in several national TC projects, as well as in the regional project on environmental monitoring. The impact and sustainability of these projects is expected to be significant.

112. In 1987, a regional project was initiated to establish Early Warning Environmental Radiation Monitoring Systems (EWERMS) in the Middle East. By 1994, EWERMS stations had been established in most countries in the region with the capability to alert populations to higher than normal levels of radiation, such as would occur in the event of nuclear accident. The final Working Group Meeting on the development of EWERMS in the Middle East was organized in Syria.

113. In the field of isotope hydrology, the Agency has been promoting environmental studies to estimate the recharge rates of aquifers from rain and surface waters, the age of groundwater, and the interconnections between surface and groundwater in arid and semi-arid countries of the Middle East region. During the life of the regional project, which was completed in 1994, several expert missions were fielded to the participating countries in the region to advise on sampling, sample preparation, and on analytical and data interpretation techniques. Towards the end of the project, Agency staff and

experts carried out individual missions to Member States in the region to review national programmes and to advise on sampling techniques and the interpretation of results.

114. During 1994, the programme of regular regional training courses for the Middle East and Europe addressed a number of priority interests for its Member States. Most of the training related to radiation and nuclear safety and included topics such as seismic safety and risk-based optimization of tasks and procedures in NPPS, the management of spent radiation sources, and medical preparedness for radiation accidents. Other courses covered radiotherapy treatment planning and isotope and radiation techniques in agriculture. Participants from the region also took part in the interregional training programme, and in the training courses and workshops which were organized as national and regional project activities.

115. Since 1993, fact-finding missions have been sent to Belarus, Estonia, Kazakhstan, Latvia, Lithuania, Moldova and Uzbekistan. From this basis the Department of Technical Co-operation, in co-operation with the technical divisions (NENS and NENF), prepared a basic national and regional programme of assistance for these countries covering radiation protection infrastructure, nuclear safety, and waste management. The programme was approved by the Board of Governors in December and will be implemented within the 1995-96 TC Programme. It will cover some urgently needed activities such as radiation protection in human health and industry as well as dosimetry and calibration systems. However, the resources required to upgrade civil nuclear infrastructure in the NIS are beyond the means of the Agency. The UNDP and other funds could make a major contribution if they become available. By the end of 1994, total assistance delivered by the Agency to the NIS amounted to approximately \$1,400,000. A number of footnote-a/ projects for the NIS that were approved as part of the 1995-96 programme still await financing.

116. A joint UNDP/IAEA fact-finding mission was sent to Belarus which provided base data to determine and prioritize requirements to upgrade nuclear safety and radiation protection infrastructure. Other countries of the former USSR are also included in the project. A TC pre-project mission reviewed all proposals requested by the Government of Belarus for the next cycle. Both these missions contributed to the reformulation of Belarus' 1995-96 TC Programme.

117. UNDP Sectoral Support funds financed a multi-disciplinary expert mission to Croatia late last year to assess TC requirements in the energy and health sectors. The findings and recommendations of the mission are being used by the Government to formulate sectoral TC programmes and a high priority radiotherapy project for which funding is being sought from UNDP and other sources.

118. Reserve Fund projects included an ongoing assessment in Armenia of the seismic safety of the Medzamor NPP, and a new project opened in 1994 to support restructuring for the Armenian Regulatory Body. It should be recognized that the Agency's role in NPP assessments is only advisory.

119. The 1993 fact-finding mission to Estonia and Latvia made it possible to address some of the urgent needs in these countries through ongoing 1994 TC

projects in occupational dosimetry, radiation protection in hospitals and other sources, new nuclear safety legislation, radwaste treatment and disposal, and environmental monitoring. In April 1994, a training course on radiation protection and waste management in nuclear medicine was organized in Tallinn for participants from Estonia, Latvia, Lithuania, Belarus, and Ukraine. As a result of these activities, Reserve Fund projects to strengthen radiation protection and waste management infrastructure were established for Estonia and Latvia during 1994. In December 1994, the Government of Estonia requested the Agency to assist it in investigating the state of health of individuals suffering irradiation injuries as a result of an accident. A series of recommendations resulted and the full report was presented to the Government, including actions to improve the short term response to the problem of uncontrolled radiation sources.

120. In January 1994, a fact-finding mission was carried out in Lithuania, which was later invited to nominate participants to attend interregional training courses and other regional activities. Several trainees were sent to Spain for a special training programme on nuclear power safety issues, offered by the Government. The mission was also successful in co-ordinating IAEA assistance with the substantial bilateral assistance provided by Sweden to the Ignalina NPP. The result was a TC Reserve Fund project for Lithuania during 1994 to strengthen its radiation protection and waste management infrastructure.

121. In Kazakhstan, further radiological safety assessment reviews were conducted in conjunction with an ongoing Reserve Fund project designed to assess the radiological situation at the Semipalatinsk site. Another TC Reserve Fund project was later established for Kazakhstan to strengthen its radiation protection and waste management infrastructure. Kazakhstan participated in the second workshop under the regional project on environmental restoration held in April 1994 in Prague, as well as other regional activities and the interregional training courses. A fact-finding mission went to Kazakhstan in 1994, to investigate the possible causes of the Caspian Sea's water level fluctuations. This mission went on to visit Turkmenistan, Iran and Azerbaijan, and resulted in the formulation of a preparatory regional project to begin co-ordination activities and a footnote-a/ project to undertake a comprehensive study of the phenomenon using isotope hydrology techniques.

122. The pressing needs of Kyrgyzstan and Moldova, which are not yet IAEA Member States, obliged the DG to approve Reserve Fund projects in 1994 to assist authorities with urgently needed radiological assessments.

123. The former USSR was not a recipient of the Agency's technical co-operation. Its successor, the Russian Federation, has urgent needs related to operational safety of NPPs, environmental monitoring and restoration, and other pressing requirements. Experts from the country were invited to participate in several regional activities, especially those related to WWER safety and training, along with several interregional training courses during 1994. Fellowship training was also awarded to Russian nationals. A fact-finding mission concerning the regional Caspian Sea project visited Russia, as one of the five riparian states, in 1994.

124. Uzbekistan became a Member State of the Agency in 1994 and participated in various regional activities. With UNDP funding, an INSARR

mission was sent early in 1994. A Reserve Fund project was also established for Uzbekistan during 1994 to strengthen its radiation protection and waste management infrastructure.

## **5. Interregional**

125. Technical assistance provided by the Agency through national and regional projects was effectively supplemented in 1994 with interregional TC activities, including ten multi-year advisory and promotional projects and 18 interregional training courses covering a range of nuclear applications and supporting activities of common interest to a large number of developing Member States worldwide.

126. The year under review saw further strengthening of interregional activities in the fields of radiation protection and waste management. In addition to three ongoing interregional projects designed to assist developing Member States in planning radiation protection and waste management programmes, two different but integrated Model Projects were initiated to provide practical multi-component assistance to selected Member States with inadequate radiation safety infrastructure in order to upgrade to the levels established by the Agency. Basic guidelines have been elaborated to assess and improve radiation protection and waste management infrastructures in developing Member States and to support ongoing activities in six countries. Using this new integrated approach, the Agency carried out a detailed assessment of the existing radiation protection and waste management infrastructure in several Member States including Albania. As a result, a plan of action for the next few years was drawn up to address infrastructural components that are lacking or inadequate. Subject to approval of the plan by the Government of Albania, the Agency will provide assistance through two new national projects.

127. Five group training events and two expert missions were carried out under an interregional project designed to assist developing countries in siting and seismic review of research and power reactors. The capability of the participating countries to perform independent siting studies was strengthened, leading to increased safety of nuclear installations.

128. Under two multi-year interregional projects, three programme review missions and 23 pre-project assistance missions conducted in 1994 helped the countries concerned to tailor their requests for technical co-operation to the goals and priorities of their own national development and to design TC projects in such a way as to ensure effective implementation.

129. A total of 436 scientists and engineers from developing countries participated in interregional training courses in 1994. Half of the courses were devoted to nuclear power, nuclear fuel cycle, nuclear safety and radiation protection and covered such topics as electric system expansion planning, quality assurance in NPP operation and maintenance, qualification of NPP personnel, options in nuclear fuel cycle activities, safety assessment of NPPs and radioactive waste disposal facilities, prevention and management of accidents in NPP operation, and radiation protection. The rest of the courses were devoted to the application of isotopes and radiation in various sectors of

national economy and social infrastructure, in particular diagnosis and control of animal diseases, plant mutation breeding, insect and pest control, and studies of pesticides in food and the environment. Other training courses related to the application of isotopes and radiation in human health, hydrology, environmental research and monitoring, as well as on nuclear electronics and interfacing in nuclear experiments.

130. Interregional activities accounted for over 6% of the total adjusted TC programme for 1994, with an implementation rate of nearly 82%.

## D. Review by Component

### 1. Experts

131. The number of expert assignments delivered for the TC Programme rose significantly in 1994. The financial implementation rate of the expert component increased to 61.8%, the highest ever recorded, and the total number of assignments exceeded 3,200; once again a record. The number of months of expertise delivered went up almost 10% and the long observed trend towards shorter assignments has been arrested; for 1994 the average was 0.4 months or 12 days, up slightly from the year before. The productivity of the Experts Section has also increased rapidly in recent years: In 1989, 87 assignments per staff member were processed and reached 110 in 1992; 144 in 1993 and 155 in 1994. The two following tables provide a five year perspective on the delivery of expert services.

	Adjusted programme	New obligations	Implementation rate	Earmarkings
	\$ million	\$ million	%	\$ million
1990	17.6	10.0	57.0	7.6
1991	17.2	9.7	56.2	7.5
1992	16.1	9.0	55.9	7.1
1993	18.7	11.4	60.8	7.3
1994	20.8	12.9	61.8	7.9

	Number of persons	Number of assignments	Number of months	Months per assignment
1990	1,414	2,221	1,217	0.55
1991	1,463	2,306	1,160	0.50
1992	1,460	2,258	1,009	0.45
1993	1,861	2,978	1,172	0.39
1994	2,022	3,205	1,288	0.40
Increase over five years	43.0%	44.3%	5.8%	

132. As can be seen in Table 3A, in addition to 1,891 international expert assignments, 791 national experts and 509 lecturers were assigned. The number of national experts has increased once again and they are increasingly recognized as an important technical co-operation resource. Another trend may be noted: In previous years almost 30% of international expert assignments were filled by Agency staff members (29.5% in 1991; 30.2% in 1992; 27.6% in 1993). This percentage dropped to 24.3% in 1994 due to the present TC policy to recruit more international experts from Member States and thus allow the Agency staff more time for upstream work and technical project management.

133. The work of compiling the Expert Roster made significant progress during the year. By the end of 1994 the number of entries had increased to 7,360, or 53% more than registered one year earlier. The following table shows the composition of the Roster.

**Expert roster**

Main Field Code	Field	Total	Men	Women
0	General Atomic Energy Development	435	412	23
1	Nuclear Physics	579	558	21
2	Nuclear Chemistry	397	361	36
3	Prospecting, Mining and Processing of Nuclear Materials	341	334	7
4	Nuclear Engineering and Technology	1,336	1,316	20
5	Application of Isotopes and Radiation in Agriculture	1,281	1,190	91
6	Application of Isotopes and Radiation in Medicine	569	501	68
7	Application of Radiation and Isotopes in Biology	134	124	10
8	Application of Radiation and Isotopes in Industry and Hydrology	593	575	18
9	Safety in Nuclear Energy	1,695	1,614	81
TOTAL		7,360	6,985	375

134. The Experts Section encourages submission of Personal History Forms from prospective experts for inclusion in the Roster. The Section is particularly interested in receiving applications from experts from developing countries and from women, and is asking all country liaison officers to submit as many new names of experts as possible in order to upgrade the Roster.

135. Costs for expert services, which averaged \$11,100 in 1992 and 1993, decreased to \$10,700 in 1994. This decrease was due in part to the utilization of national experts. Of the total costs of experts and other project personnel

(excluding lecturers), over \$5 million, or almost 40%, was spent on travel and the rest on honoraria, daily subsistence allowance (DSA) and contingencies.

## 2. Equipment

136. Equipment, which traditionally has the largest share of the programme, maintained that position in 1994 with nearly 40% of the total adjusted programme. The implementation rate reached a record 75.5% for 1994, and this was measured against a much larger adjusted programme of \$30.7 million. The new obligations increased by over 21% to reach \$23.2 million and the programme carried forward to 1995 represented by the earmarkings dropped to \$7.5 million. A five year summary of the financial and statistical data is given below:

	Adjusted programme	New obligations	Implementation rate	Earmarkings	Disbursements	Number of purchase orders <sup>a)</sup>
	\$ million	\$ million	%	\$ million	\$ million	
1990	23.5	15.6	66.4	7.9	23.7	3,763
1991	29.6	19.1	64.6	10.5	19.2	3,772
1992	22.4	14.1	63.0	8.3	21.5	3,315
1993	27.6	19.1	69.3	8.5	17.6	3,612
1994	30.7	23.2	75.5	7.5	22.9	3,484

<sup>a)</sup> Including training course equipment and research contract orders

137. Equipment disbursements broken down by area can be found in Figure 4. Whereas the percentage of equipment purchased in Europe remained unchanged at 55%, that bought from North America declined some 2% and that bought from Asia & Pacific increased by 2%. On the recipient side Africa received, as in 1993, 30% of the equipment purchases, followed by Latin America (26%), Asia and Pacific (20%), Europe (18%), the Middle East (5%) and Interregional (1%).

138. In the past several years, overexposure of humans to various radioactive sources has been of great concern for the Secretariat. The TC Department in co-operation with the Nuclear Safety Division, has initiated activities aiming at identification and control of radiation sources associated with TC projects. With the help of an outside expert, the creation of a database was initiated in 1994 listing radioactive sources provided to Member States. This data will be available for searching, sorting or extracting according to various criteria.

139. The computerized database of vendors and potential suppliers contained 5,437 entries by the end of 1994 and is being continually updated and expanded. Firms not yet registered with the IAEA are invited to provide a list of their products in the Agency's field of competence.

### 3. Fellowships

140. The record number of 1,152 fellowships and scientific visits were provided during 1994. The number of fellowships increased by almost 8%, and the number of scientific visits were up by over 14%. The adjusted programme for this component reached \$14.2 million which was, as in 1993, about 18% of the total adjusted programme. The financial implementation rate reached 60.3% and earmarkings declined for the second successive year. A five year summary of the fellowship component is given below:

	Adjusted programme	New obligations	Implementation rate	Earmarkings	Number of fellows	Number of fellowship months	Number of visiting scientists	Number of visiting scientist months
	\$ million	\$ million	%	\$ million				
1990	9.7	6.8	69.9	2.9	814	3,260	243	148
1991	10.9	6.6	60.6	4.3	747	2,926	203	120
1992	12.0	6.0	49.8	6.0	764	2,865	191	114
1993	12.8	7.1	55.5	5.7	828	2,696	226	136
1994	14.2	8.6	60.3	5.6	893	2,924	259	168
Increase over five years (%)					10	(10)	7	14

141. The average cost for a fellowship month increased marginally from \$2,542 in 1993 to \$2,633 in 1994, which is still significantly lower than the \$3,150 budgeted for the year; the costs for scientific visits, due to lower air fares amongst other factors, was reduced to \$7,180 per month. The trend towards shorter fellowships noted in the last few years stopped in 1994. The duration of both fellowships and scientific visits increased slightly - the average fellowship from 3.25 to 3.27 months and the average scientific visit from 18 to 19 days. A concerted effort is planned to increase this average duration further during 1995.

142. The most important factors limiting the Secretariat's ability to fully implement the fellowship provisions are the number and timeliness of applications received. It has been determined that in order to get the fellows into the field on time, applications to be implemented during the first year of a biennial cycle must reach the Agency by August of the preceding year. Applications for fellowships during the second year of the cycle must be received by November of the previous year. In 1993, less than 10% of the applications for implementation in 1994 were received in time and there were only 1,390 new applicants. There was a marked improvement during 1994 when 50% of the applications were received on time for implementation in 1995 and the total reached 1,690.

143. Further information on the fellowship component can be found in the figures, tables and annexes of this report. Table 3B shows trainees in the field by place of study while Table 6B lists the recipient Member States with number of fellowships and scientific visits. Table 7 shows in column 3 the value of the fellowships provided to each recipient country.

#### 4. Training Courses

144. During 1994 the Training Courses Section organized and implemented 18 interregional and 95 regional training activities. In addition 14 national training courses and workshops were held. As can be seen in the following table, the number of participants increased by over 12% to total 1,633 and the number of months delivered reached 1,224 which represents nearly a 15% increase.

	Adjusted programme	New obligations	Implementation rate	Earmarkings	Number of courses	Number of participants	Number of months
	\$ million	\$ million	%	\$ million			
1990	9.6	8.3	86.6	1.3	108	1,358	1,188
1991	7.5	6.1	81.6	1.4	109	1,401	1,066
1992	6.8	5.0	73.9	1.8	86	1,199	858
1993	8.2	6.6	80.4	1.6	100	1,450	1,066
1994	10.0	8.1	81.1	1.9	113	1,633	1,224

145. The number of nominations made by the Member States has been increasing in recent years. Whereas 2,852 applications were received in 1992, the total for 1993 was 3,437 and for 1994 no less than 4,129. This can, in part, be explained by the larger number of interregional and regional courses and, in part, by the increase in the number of Member States receiving assistance.

146. More information on the group training component can be found in the figures, tables and annexes of this report. Table 3B shows participants in the field by place of study and Table 6B lists them according to their nominating country. A full list of all training activities is given in Annex II. It should be noted that 96 countries received assistance via training courses in 1994. This includes 12 Member States of FAO participating in courses jointly organized under the auspices of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

#### 5. Sub-contracts and Miscellaneous

147. Sub-contracts is a component used for hiring a firm to provide a host of services, usually covering one or more of the traditional components. This component has increased slightly from 1993 to reach \$1.3 million in 1994. New obligations were about \$820,000 and the implementation rate equalled 62.9%. A comparative table of this component is given below. In the last three columns statistics on the TCIM Sections managing the contracts for each year are given.

	Adjusted Programme	New Obligations	Implementation rate	Earmarkings	Number of contracts raised By Implementing Section		
	\$ thousands	\$ thousands	%	\$ thousands	Experts	Field Procurement	Training Courses
1990	1,528.0	1,108.9	72.6	419.1	7	15	0
1991	1,822.8	1,000.3	54.9	822.5	5	6	1
1992	1,163.2	453.8	39.0	709.4	9	3	0
1993	1,255.7	878.5	70.0	377.2	6	6	0
1994	1,303.6	820.1	62.9	483.5	9	6	0

148. In 1994 the adjusted programme for the Miscellaneous Component was \$982,000 of which \$805,000 was obligated, resulting in an implementation rate of about 82%. This component is used to cover miscellaneous expenses which are not directly attributable to individual projects or for which detailed accounting would add significantly to overhead costs. Such expenses include costs of radiation protection services (41% of total disbursements), insurance premiums (34%) and UNDP field office charges and reimbursement of support services (19%). Other expenses, such as mission cancellation costs, publication charges, etc., account for the remaining 6%. In a very few projects a small miscellaneous component is provided to cover printing costs, shipment of publications, etc..

## E. Review by Fund

### 1. Technical Assistance and Co-operation Fund

New resources	\$44.7 million (84.8% of total)
Adjusted programme	\$65.7 million (84.2% of total)
New obligations	\$47.0 million (86.6% of total)
Implementation rate	71.5%
Disbursements	\$44.5 million (83.8% of total)

149. In 1994 new resources to the Technical Assistance and Co-operation Fund (TACF) rose about 2% from 1993 to reach \$44.7 million (see Table 1). This is particularly alarming since the increase was only due to miscellaneous income. Actually, the TACF lost value in 1994 given the dollar rate of inflation. The total value of pledges declined to 72.5% of the target from 76.5% in 1993. This level of pledges to target is the second lowest ever recorded (see Table 2). Particularly disappointing is the large number of countries not pledging at all - a record number of 66 (see Annex IV). This included many developing countries, which are receiving substantial TC assistance.

150. Miscellaneous income was the bright spot in the resource picture for 1994. The total of over \$2,862,000 represents the highest amount ever recorded for this category of income. This comprised: interest and other income in excess of \$1,337,000; assessed programme costs of \$1,478,637; and realized gains on exchange of \$46,344. The interest income was less than in 1993 but the result was very satisfactory considering the prevailing low interest rates in 1994. The payment of assessed programme costs, which is the 8% charge levied on the recipient Member States for assistance received, declined in 1994 to the lowest amount paid since 1989. As can be seen in the Agency's Accounts (Schedule D.1), a total of \$6,332,692 was outstanding at the end of 1994; of this amount \$822,883 related to assessments for 1993 and \$938,313 for 1992. This unfortunate development reverses the trend of the previous two years where the amounts collected for assessed programme costs had increased. It should be noted that the assessed programme costs are not voluntary and that the Secretariat will make renewed efforts to collect the outstanding amounts. The exchange gains, although modest, reversed a longstanding trend of losses reaching back to 1984. In fact, the average annual loss incurred between 1984 and 1993 was in excess of \$2.3 million.

151. During 1994 extensive use was made of tools provided to the Secretariat for keeping the TACF-financed programme attuned to the possibilities for implementation. A large number of projects were rephased (see Annex X), in many instances bringing forward components which were first planned for 1995 or later. Also, overprogramming was exercised during the year and the fund was designed to be somewhat overprogrammed at year end. However, since there were no losses on exchange, a small surplus of \$381,000 remained. This surplus was less than 0.5% of the total resources of \$80,917,000 and is dramatically lower than the \$5,436,000 left unprogrammed at the end of 1993. A comparison of the last ten years with the balance at year end is given below.

**Resources available and programme commitments by year end (\$)**

	Available financial resources	Programme commitments	Balance
1985	24,638,000	26,928,000	(2,290,000)
1986	22,815,000	25,852,000	(3,037,000)
1987	17,509,000	25,511,000	(8,002,000)
1988	25,209,000	30,046,000	(4,837,000)
1989	33,256,000	36,581,000	(3,325,000)
1990	31,211,000	29,199,000	2,012,000
1991	34,292,000	32,966,000	1,326,000
1992	29,069,000	28,490,000	579,000
1993	36,187,000	30,751,000	5,436,000
1994	36,369,000	35,988,000	381,000

152. The unobligated balance, after rising significantly in 1992 and 1993, was reduced to \$19,117,000 by the end of 1994. After subtraction of future year obligations of \$858,000 the remaining unobligated balance was \$18,259,000, as seen in the Agency's Accounts. This can be compared with \$23,165,000, less \$1,833,000, equalling \$21,332,000, at the end of 1993.

153. Of the \$19,117,000 at the year end, \$18,736,000 was earmarked for projects to be carried over to 1995 and form part of the new programme. These earmarkings, which are given in detail in Implementation Summary II, can be broken down by component as follows:

**Earmarkings at year end by component**

Component	Earmarkings (\$)	Percentage of total earmarkings
Experts	5,553,000	29%
Equipment	6,306,000	34%
Fellowships	5,258,000	28%
Training courses	1,319,000	7%
Sub-contracts	148,000	1%
Miscellaneous	152,000	1%
<b>Total</b>	<b>18,736,000</b>	<b>100%</b>

154. The unobligated balance, \$19,117,000, at the end of 1994 did not consist entirely of cash nor did it consist solely of currencies being utilized by the programme. A summary of the constituent amounts is given below.

**Calculation of useable unobligated balance (\$)**

Unobligated balance current year	<b>19,117,000</b>
Obligated against future years	(858,000)
Unobligated balance all years	<b>18,259,000</b>
Pledges not yet paid	(5,748,000)
Non-convertible currencies which cannot be utilized	(1,837,000)
Currencies which are difficult to convert and can only be utilized slowly	(1,644,000)
Resources available for 1995 TC Programme obligations	<b>9,030,000</b>

155. While \$9,030,000 at the beginning of 1995 appears to be a significant cushion, it should be compared with the amount of new obligations being raised on a monthly basis. Using figures from January/February 1995, this represented less than two months new obligations for the Fund (\$9,166,000).

156. Implementation in financial terms rose sharply in 1994 for the second consecutive year. The 71.5% rate was the highest since 1986. New obligations against the current programme increased from \$38.5 million to \$47.0 million. When future year new obligations are considered, the figure rises to \$47.8 million, as can be seen in the following table.

**Current and future year new obligations (\$)**

	New obligations for current year	New obligations for future years	Total new obligations
1990	33,422,585	1,198,156	34,620,741
1991	35,124,387	3,834,615	38,959,002
1992	29,393,068	154,272	29,547,340
1993	38,523,853	1,831,823	40,355,676
1994	46,969,252	832,789	47,802,041

157. In 1994, 20 projects were financed from the Reserve Fund (see Annex VIII). Of these, 17 were new projects of which 11 dealt exclusively with nuclear safety. Four of these were in Member States which had recently joined the Agency and could not be part of the TC Programme for 1993-94 (Armenia, Kazakhstan, Lithuania and Uzbekistan). The Board increased the approval for the Reserve Fund by 35% from \$850,000 for 1993 to \$1,150,000 for 1994. Almost 74% of the higher amount was allotted and the observation noted in previous years, that lower rates of reserve fund utilization are recorded in the first year of the biennial programme, is still valid, as can be seen in the table below, where the second years are shaded.

**Reserve Fund utilization**

	Number of projects	Amount allotted (\$)	Amount approved by Board (\$)	% of Board amount allotted
1989	25	493,475	600,000	82%
1990	22	685,400	700,000	98%
1991	23	524,840	700,000	75%
1992	22	695,211	750,000	93%
1993	16	526,554	850,000	62%
1994	20	845,809	1,150,000	74%

## 2. Extrabudgetary resources (including funds in trust)

New resources	\$4.9 million (9.3% of total)
Adjusted programme	\$10.3 million (13.2% of total)
New obligations	\$6.0 million (11.0% of total)
Implementation rate	58.1%
Disbursements	\$5.7 million (10.8% of total)

158. Extrabudgetary new resources reached \$4.9 million in 1994, the second lowest level in twelve years, dropping 23% from the 1993 level. These resources include funds-in-trust contributions for 1994 (\$0.1 million), consisting of funds for activities in the country of the donor, which were lower than for previous years (\$1.2 million in 1993 and \$0.8 million in 1992).

159. The USA remained the largest single donor, followed by the UK and France. Indonesia joined the group of donors contributing to the RCA programme in Asia. Details of individual donor contributions are shown in Table 5. The following table gives an overview of the programmes receiving financial support in 1994 from various donors.

Support by programme for selected extrabudgetary donors

Programme	Australia	Belgium	France	Japan	Spain	Sweden	UK	USA
A. Nuclear Power			X		X			
B. Nuclear Fuel Cycle								
C. Radioactive Waste Management			X		X	X		X
D. Food and Agriculture		X	X			X	X	X
E. Human Health	X		X				X	X
F. Industry and Earth Sciences	X		X	X	X			
G. Physical and Chemical Sciences								X
H. Radiation Protection	X			X				X
I. Safety of Nuclear Installations			X	X	X			X

160. In addition to existing extrabudgetary resources, TACF savings amounting to \$1.1 million were made available; thus project and project components totalling \$5.4 million were upgraded from the 1994 footnote-a/ programme of \$13.9 million. This is the highest amount allocated for footnote-a/ approvals in the last five years. Not included in this figure is an amount of \$0.4 million which was offered for fellowships using Type II resources. Most of the projects supported were ongoing and only five became operational for the first time.

**Summary of footnote-a/ approvals and upgrading**

	Approved footnote-a/ projects (\$)	Footnote-a/ projects and components made operational (\$)	Share of footnote-a/ projects made operational
1990	6,967,500	4,359,800	62.6%
1991	16,205,200	4,491,519	27.7%
1992	14,027,400	1,858,100	13.2%
1993	12,096,900	4,550,560	37.6%
1994	13,997,550	5,485,836	39.2%

161. Utilization of extrabudgetary resources is often subject to conditions that limit the Secretariat's flexibility. In spite of these constraints, it was possible to maintain the level of new obligations at \$6 million in 1994 against a decreasing adjusted programme. The overall implementation rose to 58.1%, following the trend registered in other parts of the TC Programme.

162. The Model Project initiative has guided the Secretariat into many new paths, one of which is the search for alternative sources of funding. In particular, for the project on tsetse fly eradication on Zanzibar Island, contacts were established with the International Fund for Agricultural Development (IFAD) and the African Development Bank (AfDB) to seek financial support. The negotiations are promising and show that these institutions are willing to provide favourable financial terms to support requests from national governments, especially when national government commitment is firmly reflected in a Model Project.

### **3. UNDP**

<b>New resources</b>	<b>\$1.4 million (2.6% of total)</b>
<b>Adjusted programme</b>	<b>\$2.0 million (2.6% of total)</b>
<b>New obligations</b>	<b>\$1.3 million (2.4% of total)</b>
<b>Implementation rate</b>	<b>69.7%</b>
<b>Disbursements</b>	<b>\$1.1 million (2.1% of total)</b>

163. New obligations under the UNDP-funded programme increased by almost 30%, while the adjusted programme was 42% higher than in the preceding year. However, implementation was down from 76.9% in 1993 to 69.7% in 1994.

164. During the year the Agency increased its efforts to identify joint programme activities with UNDP. However, several limitations have been realized. Firstly, the UNDP's emphasis on country level programming places the IAEA, along with other UN organizations without field representation, at an operational disadvantage. Despite continued efforts to keep UN Resident Co-ordinators briefed about the Agency's field of activity, nuclear applications in

programmes and projects at the country level which involve social and economic objectives are seldom considered. UNDP surveys confirm that the Agency's field of expertise is largely unknown in UNDP field offices and national planning authorities alike. Secondly, with UNDP concentrating its resources in the least developed countries (LDCs), the Agency must clearly establish its role and expertise in such areas as environment and natural resource management and food security. It should be noted that Sectoral Programming and Country Programme Frameworks are mechanisms to match nuclear technology to the development needs of LDCs. Thirdly, pledges to UNDP's core fund continue to fall far behind predictions for the fifth cycle. In 1994, ongoing operational activities during the 5th programming cycle (1992-1996) were cut by 30%. IPF resources for several countries and regions remain over-committed, while no decision has been taken regarding the programme beyond 1996.

165. The Global Environment Facility (GEF) was replenished during the past year, with 26 countries pledging \$2,200 million. The fund, which is jointly administered by the World Bank, UNDP and United Nations Environment Programme (UNEP), provides financing for activities addressing global warming, biodiversity, international waters and ozone depletion. Approximately half of the funds will be managed by UNDP as a trust fund. Currently, additional funding is sought from GEF for assistance to the riparian countries of the Caspian and the Black Sea. The Agency attended several GEF briefings during 1994 and made a presentation to the GEF staff. During 1994, one new UNDP/GEF project was approved, which finances the participation of the IAEA Marine Environment Laboratory, Monaco, in the Black Sea project.

166. UNDP approved an expansion of the regional project in Latin America on non-destructive testing in quality control. This ongoing IAEA project is expected to lay the foundation for a UNIDO project in quality control, in which the Agency would participate as Implementing Agency. The UNDP project on environmental rehabilitation of Lake Manzala in Egypt achieved its objectives and was concluded during the year. The second phase of the joint RCA/UNDP/IAEA project on the use of isotopes and radiation to strengthen technology met financial difficulties towards the end of the year as the UNDP decommitted 30% of approved project funds for 1994 and 1995. Furthermore, funding beyond 1995 awaits the decision of the UNDP Executive Board.

167. In addition to the technical co-operation projects, UNDP provided sectoral support funds for IAEA missions in 1994. These resources enabled a successful programme formulation mission to Mali and Niger. In Croatia, a sectoral support mission assisted the country in planning the reconstruction of its health and energy sectors. Funding was also approved for a regional workshop for LDCs on project design, management and evaluation. The workshop, which took place in Addis Ababa, Ethiopia, was greatly appreciated by the participating countries.

#### 4. Assistance in kind

New resources	\$1.8 million (3.3% of total)
Disbursements	\$1.8 million (3.3% of total)

168. Assistance in kind is only recorded at year end, and the new resources are automatically calculated to be equivalent to disbursements. The concepts of "adjusted programme", "new obligations" and "implementation rate" do not apply. In 1994, the volume of assistance in kind did not change significantly and reached \$1.8 million.

169. Assistance in kind is recorded according to strict criteria, and such assistance is only reported for equipment actually transported from one country to another. Credit is given to donor countries when experts are made available for services outside their own country, or when a country pays for the services of an expert from another country. Similar criteria exist for training course participants. Fellowship inputs are based on the utilization of Type II resources.

170. Over 73% of in-kind support was provided for training activities, comprising 292 months of fellowship training, stipends and travel costs for 81 regional training course participants, and the assignment of 57 lecturers. Cost-free fellowships from the USA, the largest contributor, amounted to \$0.7 million (see Annex 1). A five year comparison of in-kind contributions by component is given below.

171. Projects in Tanzania and Poland benefited from equipment donations from China and Japan respectively.

Comparative summary of in-kind contributions (\$)

	Experts	Equipment	Fellowships	Group training	Total
1990	318,100	125,000	1,333,900	436,800	2,213,800
1991	310,500	0	1,115,800	275,200	1,701,500
1992	272,900	0	792,500	236,300	1,301,700
1993	448,100	0	901,700	292,400	1,642,200
1994	302,700	164,000	984,300	301,600	1,752,600

## IMPLEMENTATION SUMMARY I

### ALL FUNDS\*

Description	Adjusted Programme	Share of Total Programme	New Obligations	Implementation Rate	Earmarkings
	(\$)	(%)	(\$)	(%)	(\$)
<b>Current year</b>					
<b>Area breakdown</b>					
Africa	18,546,101	23.8%	12,770,270	68.9%	5,775,831
Asia & Pacific	18,199,899	23.3%	12,454,256	68.4%	5,745,643
Latin America	17,574,516	22.5%	12,043,301	68.5%	5,531,215
Middle East & Europe	18,006,650	23.1%	12,393,306	68.8%	5,613,344
Interregional	4,751,747	6.1%	3,892,151	81.9%	859,596
Global	923,411	1.2%	788,165	85.4%	135,246
<b>Total</b>	<b>78,002,324</b>	<b>100.0%</b>	<b>54,341,449</b>	<b>69.7%</b>	<b>23,660,875</b>
<b>Component breakdown</b>					
Experts	20,836,992	26.7%	12,881,944	61.8%	7,955,048
Equipment	30,673,932	39.3%	23,162,275	75.5%	7,511,657
Fellowships	14,220,497	18.2%	8,570,701	60.3%	5,649,796
Training Courses	9,985,424	12.8%	8,101,874	81.1%	1,883,550
Sub-contracts	1,303,612	1.7%	820,057	62.9%	483,555
Miscellaneous	981,867	1.3%	804,598	81.9%	177,269
<b>Total</b>	<b>78,002,324</b>	<b>100.0%</b>	<b>54,341,449</b>	<b>69.7%</b>	<b>23,660,875</b>
<b>Fund breakdown</b>					
TACF	65,704,849	84.2%	46,969,252	71.5%	18,735,597
UNDP	1,959,525	2.5%	1,366,639	69.7%	592,886
Extrabudgetary	9,185,341	11.8%	4,938,522	53.8%	4,246,819
Funds-in-Trust	1,152,609	1.5%	1,067,036	92.6%	85,573
<b>Total</b>	<b>78,002,324</b>	<b>100.0%</b>	<b>54,341,449</b>	<b>69.7%</b>	<b>23,660,875</b>
<b>Current and future years</b>					
Current	78,002,324	78.1%	54,341,449	69.7%	23,660,875
Future	21,843,241	21.9%	832,789	3.8%	21,010,452
<b>GRAND TOTAL</b>	<b>99,845,565</b>	<b>100.0%</b>	<b>55,174,238</b>		<b>44,671,327</b>

\* As at 31 December 1994

**IMPLEMENTATION SUMMARY II**  
**TECHNICAL ASSISTANCE AND CO-OPERATION FUND\***

Description	Adjusted Programme	Share of Total Programme	New Obligations	Implementation Rate	Earmarkings
	(\$)	(%)	(\$)	(%)	(\$)
<b>Current year</b>					
<b>Area breakdown</b>					
Africa	15,391,151	23.5%	10,770,660	70.0%	4,620,491
Asia & Pacific	14,405,622	21.9%	10,348,512	71.8%	4,057,110
Latin America	14,482,269	22.0%	10,037,904	69.3%	4,444,365
Middle East & Europe	15,970,353	24.3%	11,222,764	70.3%	4,747,589
Interregional	4,532,043	6.9%	3,801,247	83.9%	730,796
Global	923,411	1.4%	788,165	85.4%	135,246
<b>Total</b>	<b>65,704,849</b>	<b>100.0%</b>	<b>46,969,252</b>	<b>71.5%</b>	<b>18,735,597</b>
<b>Component breakdown</b>					
Experts	16,065,002	24.5%	10,512,362	65.4%	5,552,640
Equipment	25,727,111	39.1%	19,421,448	75.5%	6,305,663
Fellowships	13,699,703	20.9%	8,441,329	61.6%	5,258,374
Training Courses	8,684,361	13.2%	7,365,869	84.8%	1,318,492
Sub-contracts	576,321	0.9%	427,970	74.3%	148,351
Miscellaneous	952,351	1.4%	800,274	84.0%	152,077
<b>Total</b>	<b>65,704,849</b>	<b>100.0%</b>	<b>46,969,252</b>	<b>71.5%</b>	<b>18,735,597</b>
<b>Current and future years</b>					
Current	65,704,849	75.1%	46,969,252	71.5%	18,735,597
Future	21,843,241	24.9%	832,789	3.8%	21,010,452
<b>GRAND TOTAL</b>	<b>87,548,090</b>	<b>100.0%</b>	<b>47,802,041</b>		<b>39,746,049</b>

\* As at 31 December 1994

## IMPLEMENTATION SUMMARY III

### ALL FUNDS BY DEPARTMENT AND DIVISION\*

Description	Adjusted Programme	Share of Total Programme	New Obligations	Implementation Rate	Earmarkings
	(\$)	(%)	(\$)	(%)	(\$)
<b>Current year</b>					
<b>DEPARTMENT OF RESEARCH AND ISOTOPES</b>					
Joint FAO/IAEA Division	14,095,495	18.1%	11,070,104	78.5%	3,025,391
Division of Human Health	10,145,087	13.0%	6,268,078	61.8%	3,877,009
Division of Physical and Chemical Sciences	19,864,871	25.4%	13,570,391	68.3%	6,294,480
The Agency's Laboratories	2,462,910	3.2%	1,770,929	71.9%	691,981
Marine Environment Laboratory, Monaco	587,374	0.8%	371,268	63.2%	216,106
<b>Total</b>	<b>47,155,737</b>	<b>60.5%</b>	<b>33,050,770</b>	<b>70.1%</b>	<b>14,104,967</b>
<b>DEPARTMENT OF NUCLEAR ENERGY AND SAFETY</b>					
Division of Nuclear Safety	14,350,996	18.4%	9,549,575	66.5%	4,801,421
Division of Nuclear Power	4,660,886	6.0%	3,566,326	76.5%	1,094,560
Division of Scientific and Technical Information	124,028	0.2%	61,873	49.9%	62,155
Division of Nuclear Fuel Cycle and Waste Management	3,524,997	4.5%	2,505,949	71.1%	1,019,048
<b>Total</b>	<b>22,660,907</b>	<b>29.1%</b>	<b>15,683,723</b>	<b>69.2%</b>	<b>6,977,184</b>
<b>DEPARTMENT OF TECHNICAL CO-OPERATION</b>	<b>894,719</b>	<b>1.1%</b>	<b>497,565</b>	<b>55.6%</b>	<b>397,154</b>
<b>GLOBAL</b> (not distributed by Department)	<b>7,290,961</b>	<b>9.3%</b>	<b>5,109,391</b>	<b>70.1%</b>	<b>2,181,570</b>
<b>GRAND TOTAL</b>	<b>78,002,324</b>	<b>100.0%</b>	<b>54,341,449</b>	<b>69.7%</b>	<b>23,660,875</b>

\* As at 31 December 1994

## Explanatory Notes to Figures

### **Figure 1. Resources available for Agency technical co-operation programmes: 1985-1994**

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This figure shows all resources made available to the Agency for technical co-operation activities from all funds for the programme years 1985-1994. Amounts given for UNDP resources correspond to total claims against UNDP resources for projects where the IAEA acts as Executing or Implementing Agency during each calendar year. These amounts are also used in the Agency's Accounts, reflecting UNDP's requirement to report expenditures as the sum of cash disbursements plus unliquidated obligations. UNDP funds for 1985-1994 also include resources made available by the UNDP-administered United Nations Fund for Science and Technology for Development. Amounts shown as extrabudgetary funds refer to resources made available for activities planned for execution in the year shown. It should be noted that the amounts shown in Figure 1 do not include resources made available for future years.

### **Figure 2. Disbursements by component: 1985-1994**

---

The total assistance provided during the ten year period 1985-1994 (\$439,382,500) is broken down by year and type of input (training, experts and equipment), irrespective of the source of funds.

### **Figure 3. Technical co-operation personnel services by region: 1994**

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A graphic presentation is given of (i) the origin of technical co-operation field personnel (ii) their destination and (iii) the time spent in the field, grouped by geographic region.

### **Figure 4. Distribution of equipment disbursements by region: 1994**

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Total disbursements for equipment, grouped by origin and recipient regions, are shown in this figure; individual recipient countries are shown in Table 7. Table 3C lists the equipment by country of origin.

### **Figure 5. Summary data on training programmes: 1994**

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This graphic presentation shows where trainees studied, where they came from and how much training was received by their home regions. Information on the training provided to nationals of individual recipient countries is given in Table 6B.

#### **Figure 6. Disbursements by programme: 1994**

---

The overall expenditure by Agency Programme are shown in a summary bar chart.

#### **Figure 7. Technical assistance and co-operation disbursements by programme and region: 1994**

---

The bar chart illustrates the different emphasis to the various Agency Programmes in each region. (Please note that the scales are different for each region.)

#### **Figure 8. Distribution of technical co-operation disbursements by source and region: 1994**

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In this graphic presentation, disbursements from the Technical Assistance and Co-operation Fund, extrabudgetary funds, assistance in kind and from UNDP funds are shown for each region, as are total disbursements from all funds by region.

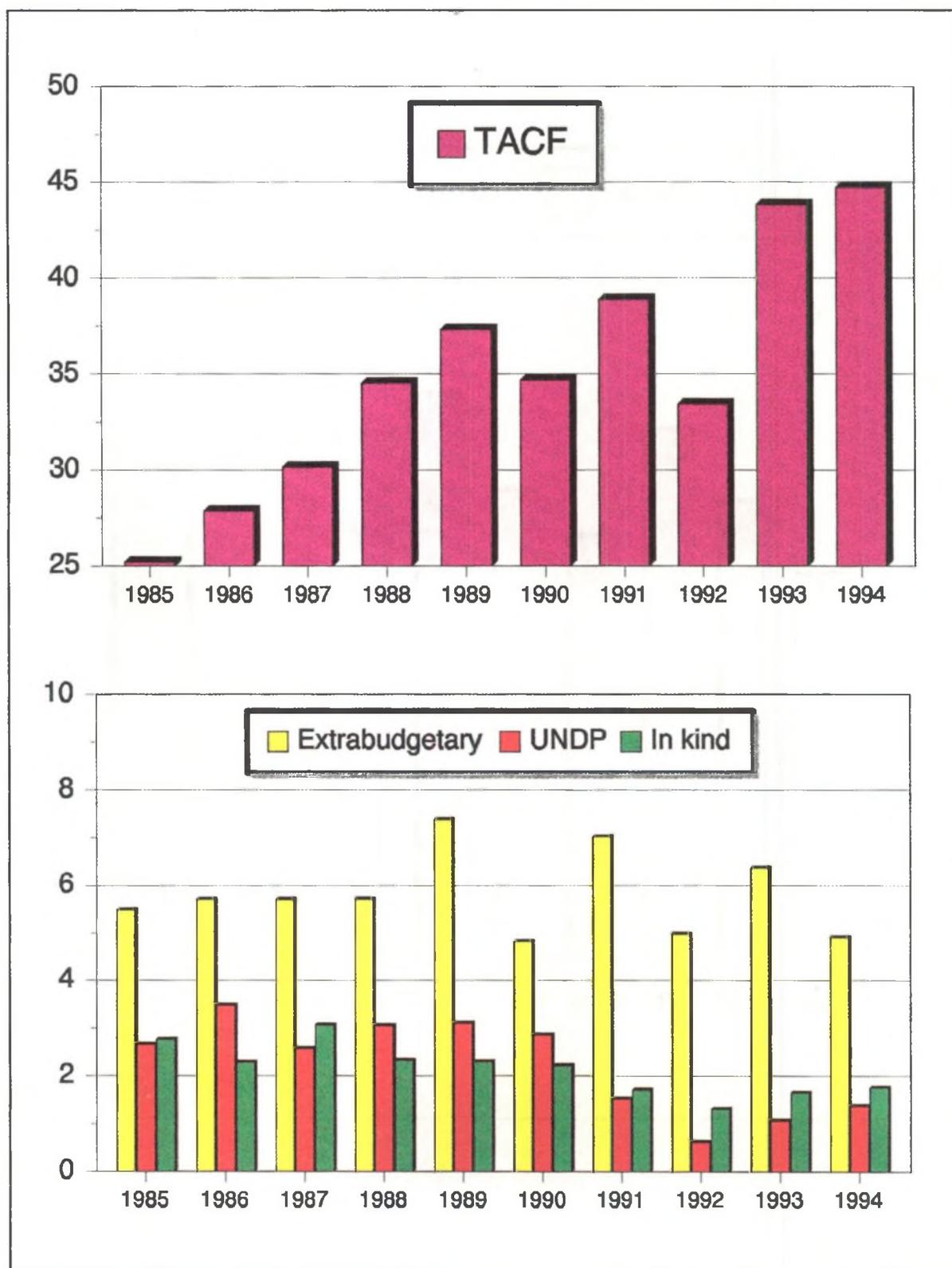
#### **Figure 9. Utilization of the Technical Assistance and Co-operation Fund**

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The bar chart shows, over a ten-year period, the total resources available to the Technical Assistance and Co-operation Fund year by year - each year including the unobligated and unspent funds of prior years - as well as the disbursements and obligations incurred against these resources as at 31 December of each year. Obligations incurred against future years for approved multi-year projects are shown separately, reflecting the status at the end of 1994. The line chart below it shows, in per cent, the unobligated balance, unliquidated obligations and disbursements for the same ten-year period.

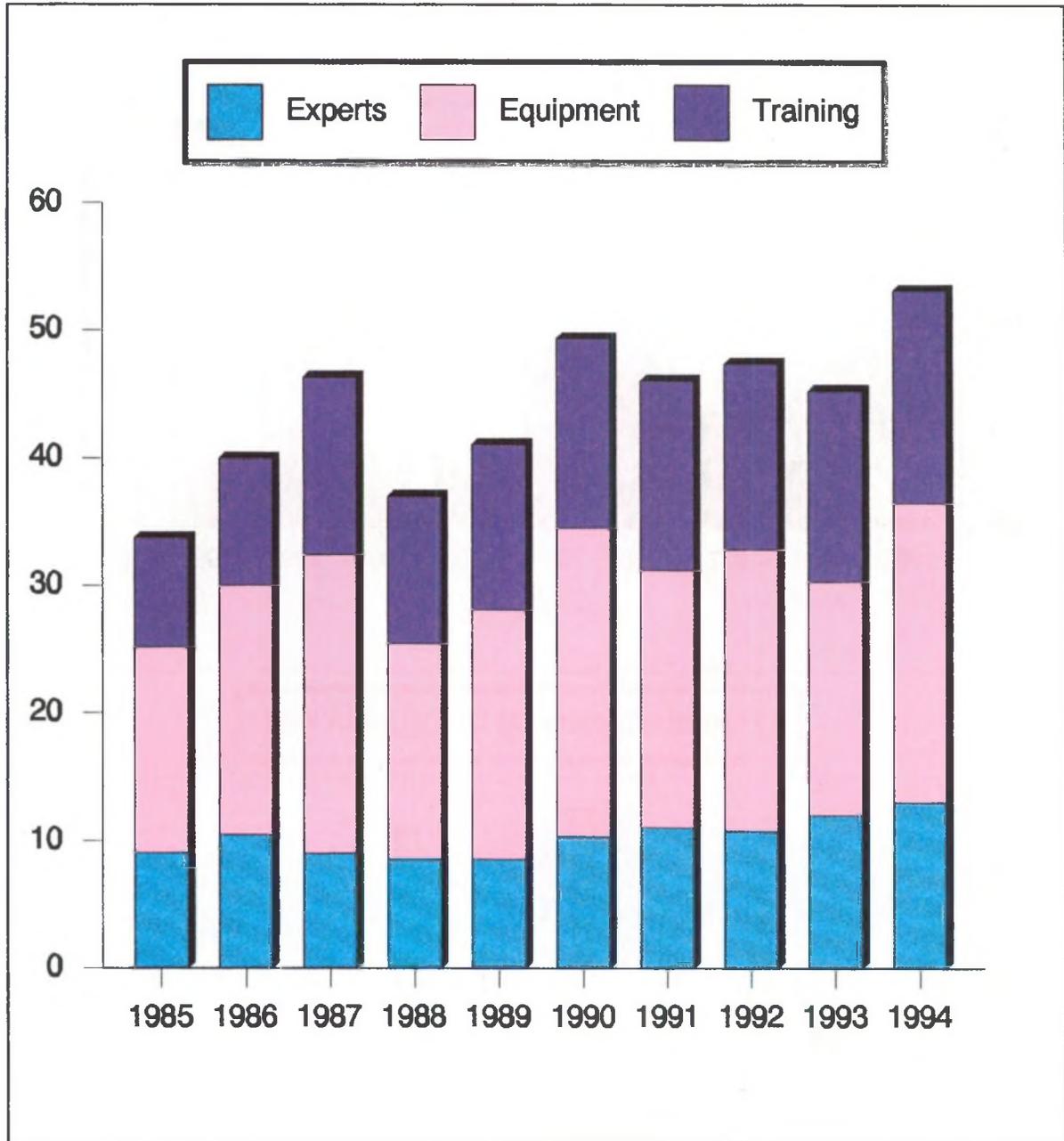
FIGURE 1

RESOURCES AVAILABLE FOR AGENCY  
TECHNICAL CO-OPERATION PROGRAMMES: 1985-1994  
(in millions of dollars)



**FIGURE 2**

**DISBURSEMENTS BY COMPONENT: 1985-1994**  
(in millions of dollars)

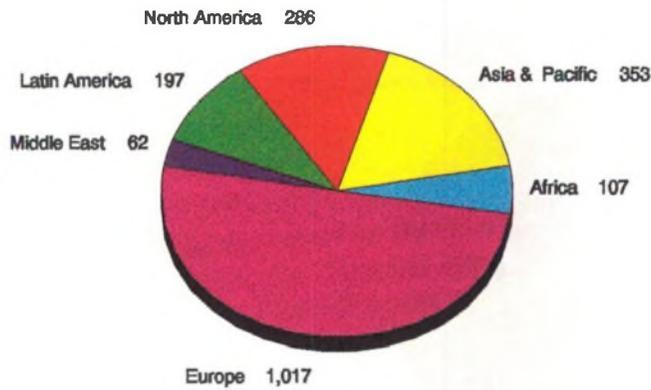


**FIGURE 3**

**TECHNICAL CO-OPERATION  
PERSONNEL SERVICES BY REGION: 1994**

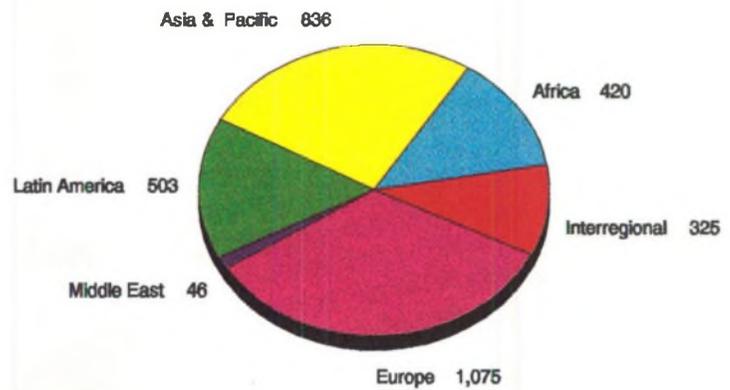
**Where they came from:**

2,022 project personnel



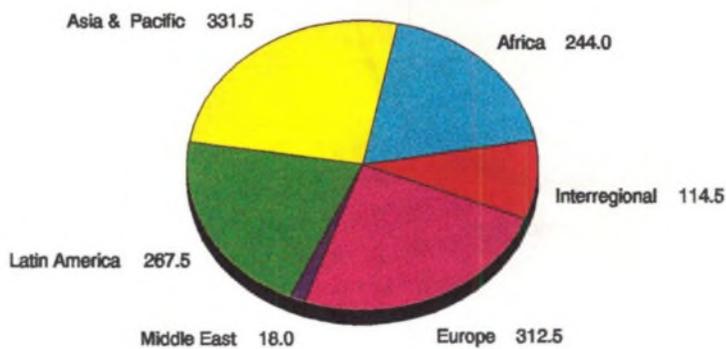
**Where they went:**

3,205 assignments



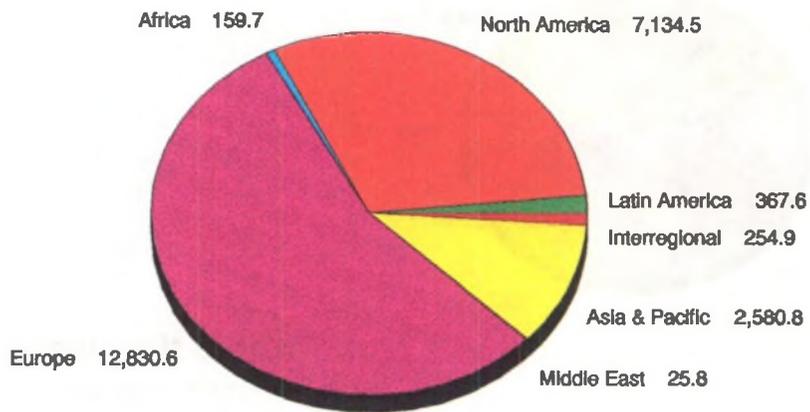
**For how long:**

1,288 months

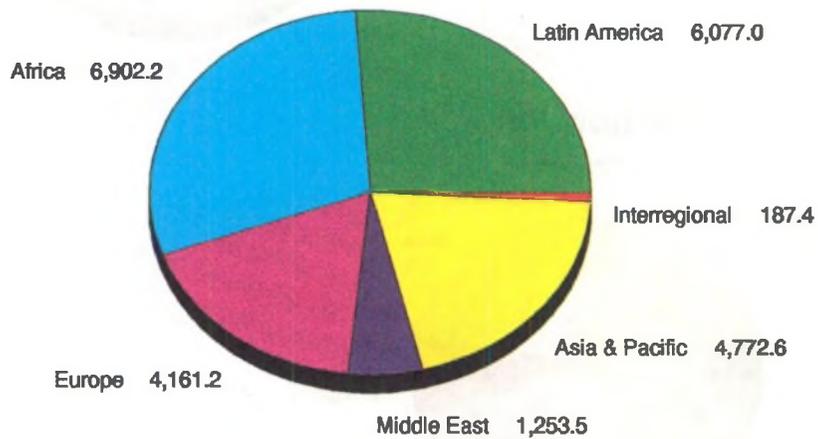


**FIGURE 4**  
**DISTRIBUTION OF EQUIPMENT DISBURSEMENTS**  
**BY REGION: 1994**  
(in thousands of dollars)

**Where it came from: \$23,353.9**

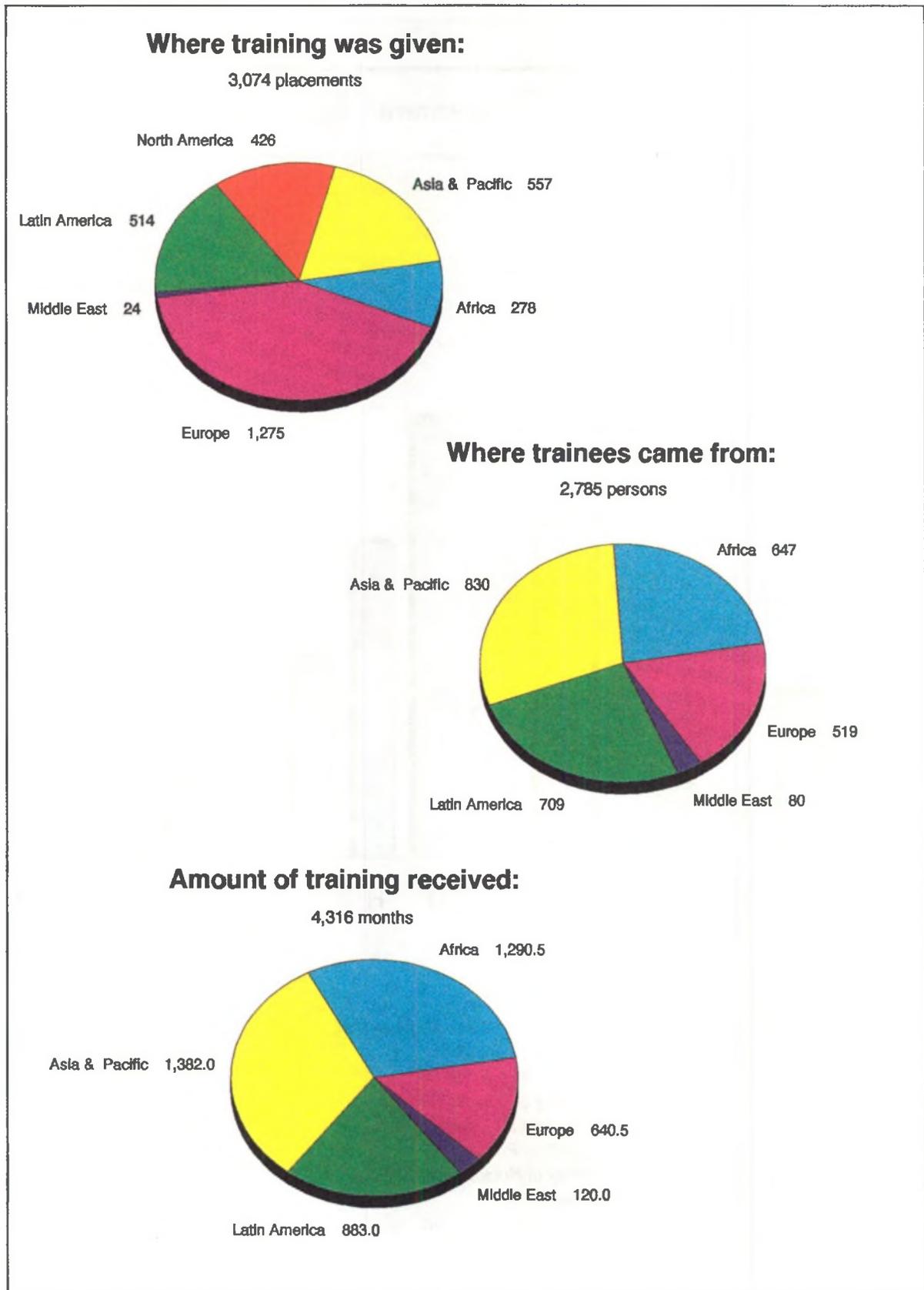


**Where it went: 23,353.9**



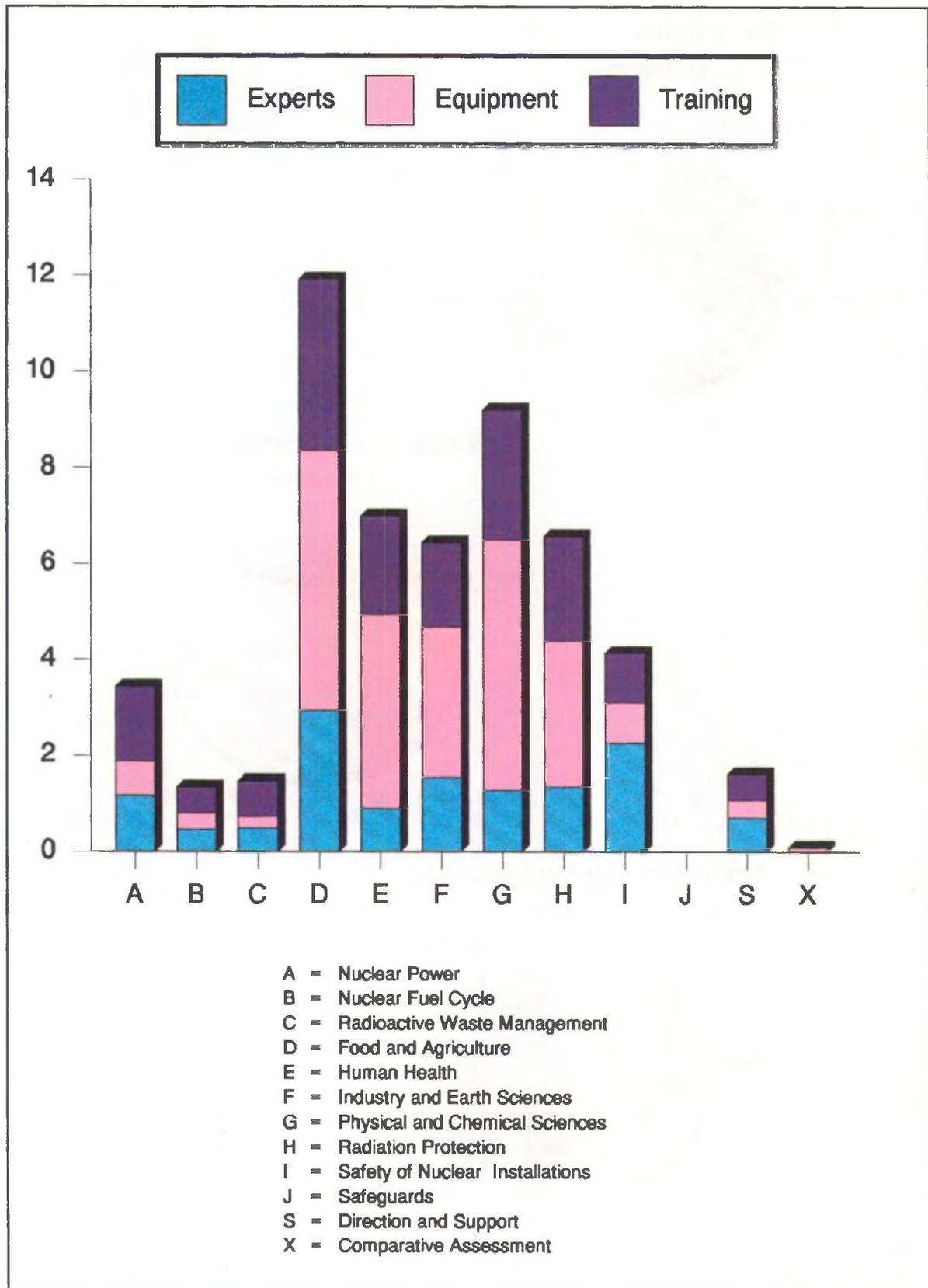
**FIGURE 5**

**SUMMARY DATA ON TRAINING PROGRAMMES: 1994**



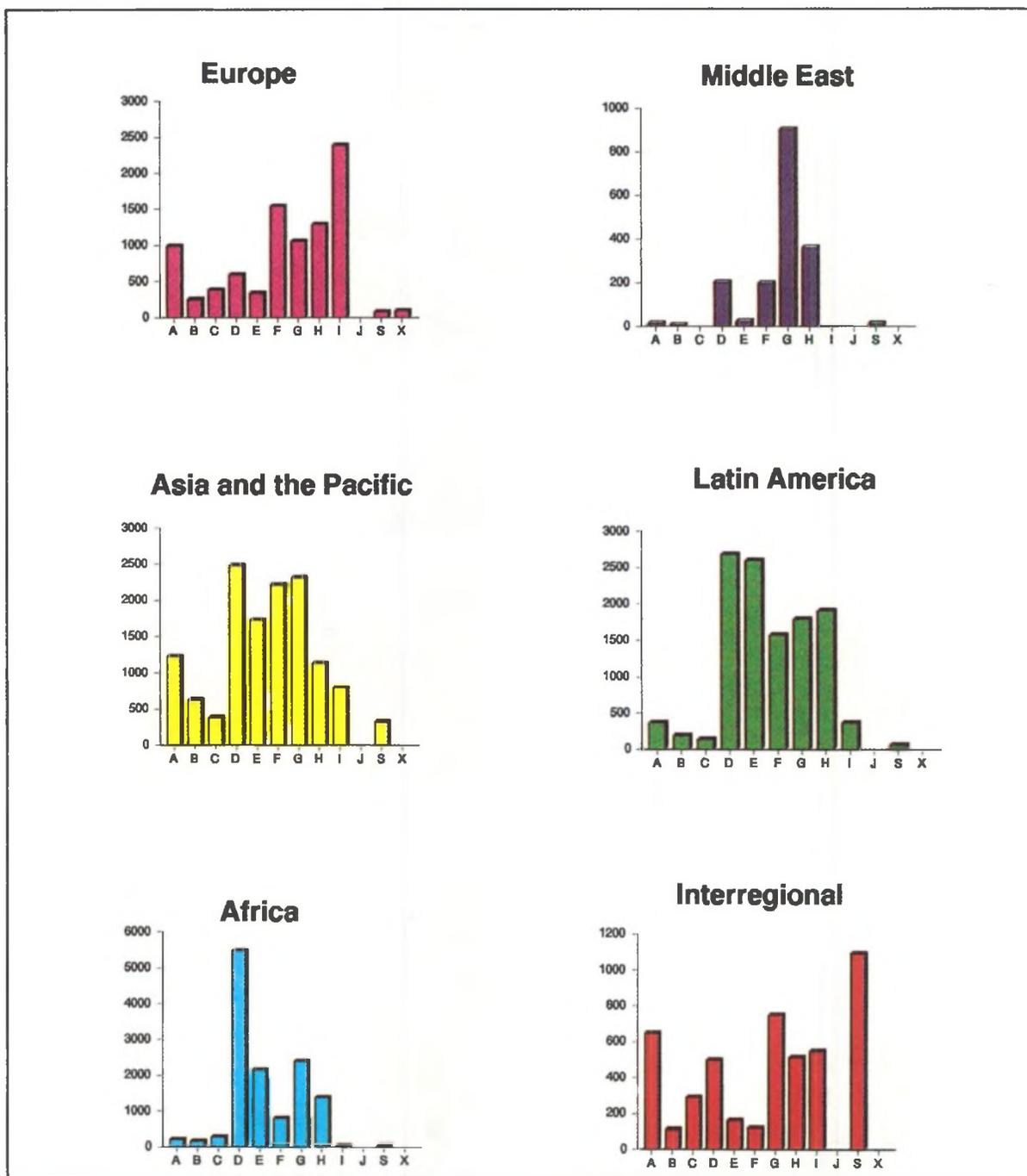
**FIGURE 6**

**DISBURSEMENTS BY PROGRAMME: 1994**  
(in millions of dollars)



**FIGURE 7**

**TECHNICAL ASSISTANCE AND CO-OPERATION DISBURSEMENTS  
BY PROGRAMME AND REGION: 1994**

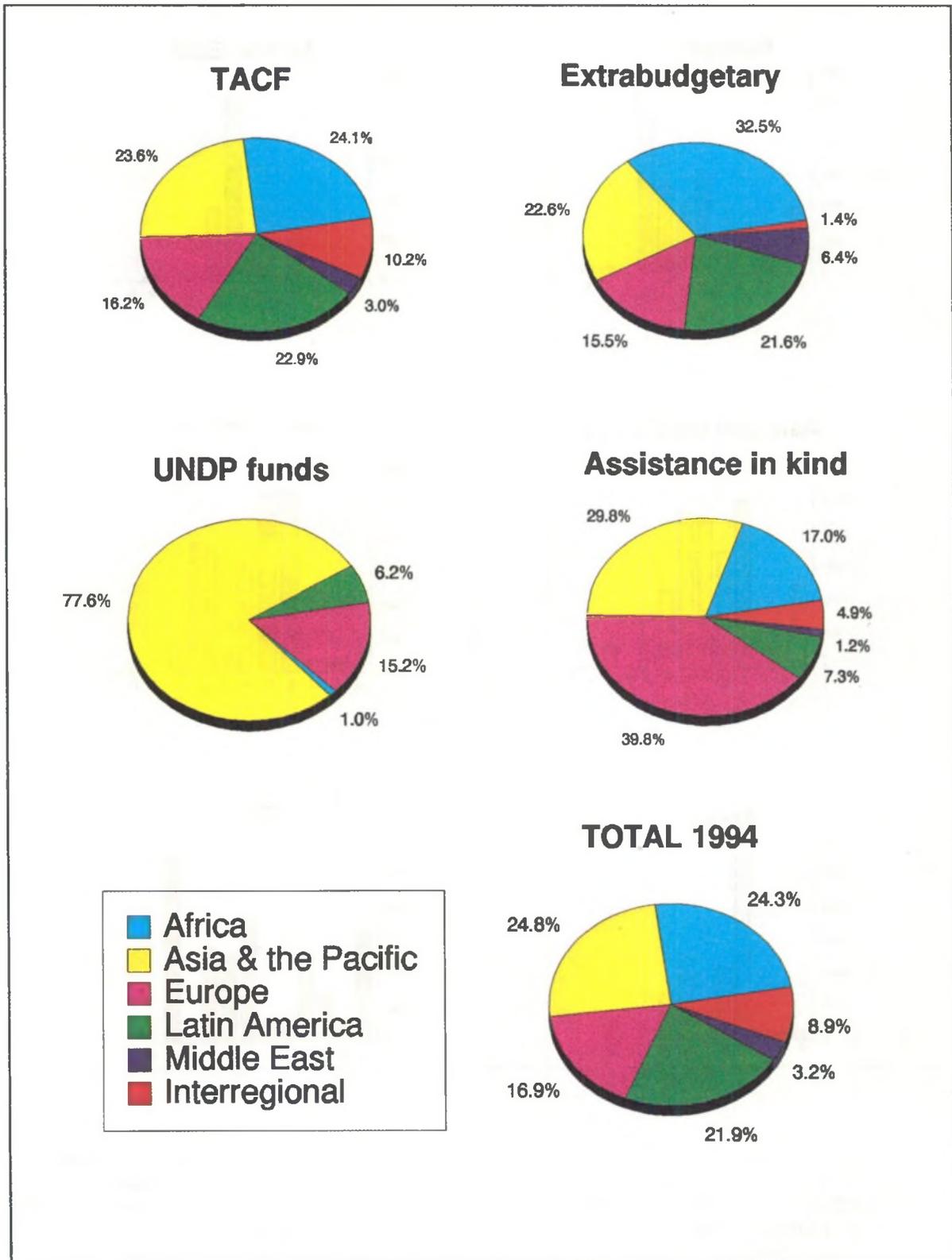


A = Nuclear Power  
 B = Nuclear Fuel Cycle  
 C = Radioactive Waste Management  
 D = Food and Agriculture  
 E = Human Health  
 F = Industry and Earth Sciences

G = Physical and Chemical Sciences  
 H = Radiation Protection  
 I = Safety of Nuclear Installations  
 J = Safeguards  
 S = Direction and Support  
 X = Comparative Assessment

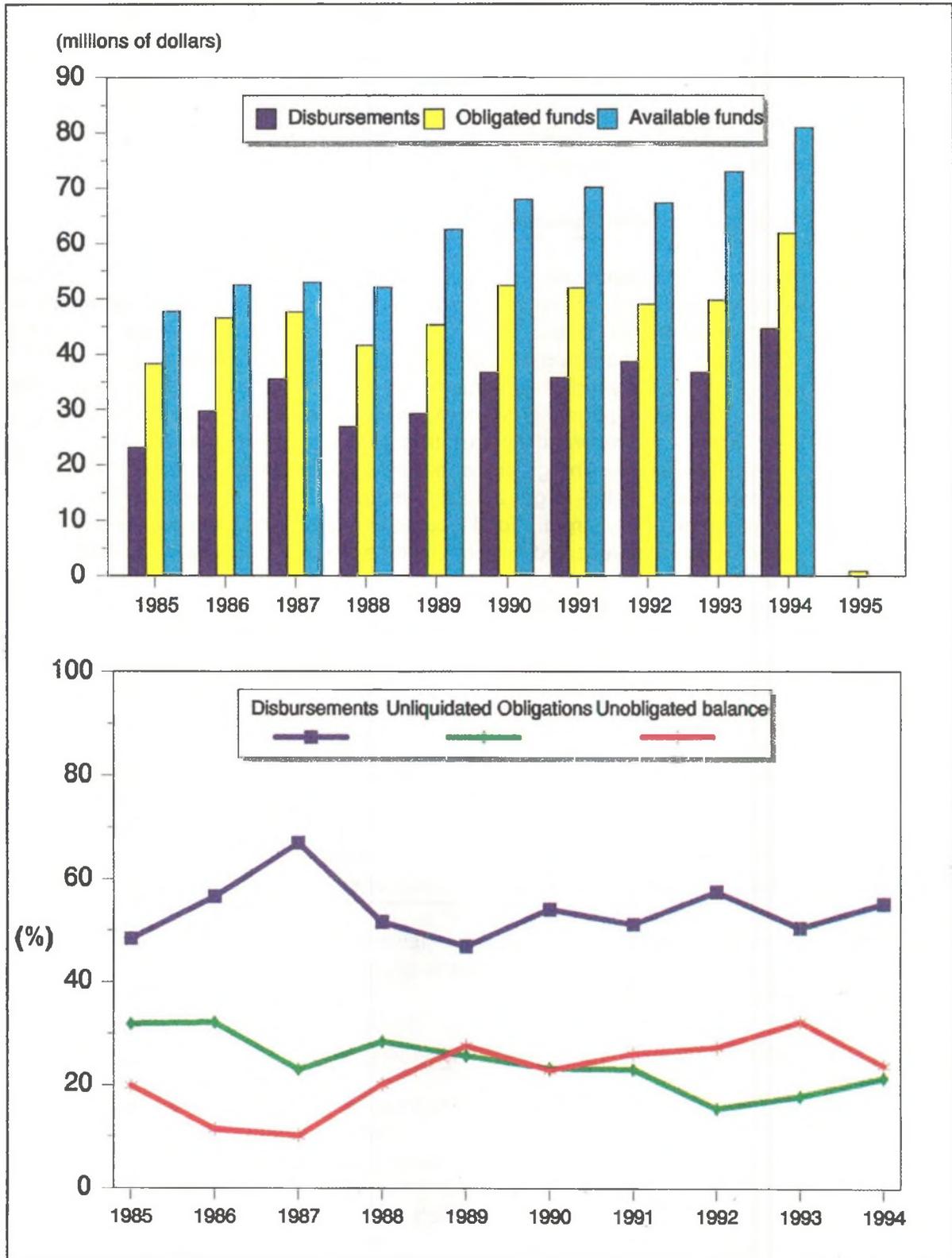
**FIGURE 8**

**DISTRIBUTION OF TECHNICAL CO-OPERATION DISBURSEMENTS BY SOURCE AND REGION: 1994**



**FIGURE 9**

**UTILIZATION OF THE TECHNICAL ASSISTANCE  
AND CO-OPERATION FUND**  
(status at year end)



## Explanatory Notes to Tables

### Table 1. Available resources: 1985-1994

This table is directly related to Figure 1, but shows resources over a ten-year period. The Technical Assistance and Co-operation Fund is broken down by its various components; other resources (extrabudgetary funds, assistance in kind and UNDP) are shown separately, together with their sub-totals. For an explanation of the miscellaneous income for 1994, please see text section E.1.

### Table 2. Technical Assistance and Co-operation Fund: 1985-1994

The ten-year development of the target, of the amounts pledged and of the funds actually made available are shown (see Annex IV for contributions made by Member States to the Technical Assistance and Co-operation Fund for 1994). It should be noted that, in this table, voluntary contributions are shown not by the year in which they became available but for the programme year for which they were pledged. Therefore, new pledges or withdrawals against prior year targets are recorded against that year and the percentages for earlier years may change. The graph beneath the table shows, for a ten-year period, the percentage of the target actually pledged. It also shows total income as a percentage of the target. Total income comprises the pledges, the assessed programme costs received, interest income and gains/losses on exchange.

### Table 3A. Project personnel by place of origin: 1994

This table shows the number of individuals, who undertook technical co-operation assignments during 1994. They came from 107 countries. From a total of 3,205 assignments, 42% were carried out by experts from developing countries, 39.7% by experts from developed countries and 18.3% by IAEA staff. It should be noted that IAEA staff, as well as staff of other international organizations, are listed under their nationalities. The numbers of such staff involved are given in the footnote.

### Table 3B. Trainees in the field by place of study: 1994

A breakdown is given for trainees (fellows, training course participants and visiting scientists) based on the place of study. There were 80 places of study involved.

### Table 3C. Equipment by country of origin: 1994

This table lists the total equipment purchases made by country of origin, which may differ from the country where the vendor is located. Both disbursements and number of purchase orders placed are given. Disbursements can be made for equipment ordered in previous years; likewise there may be purchase orders placed for equipment for which payments will be made in future years. It should be noted that \$435,507 was spent on equipment for training courses.

**Table 4. Distribution of technical co-operation disbursements by type: 1990-1994**

---

This financial table shows technical assistance disbursements from all funds during the last five years, broken down by programme component. It is the only table that shows the balance for assistance in kind. This balance represents the estimated value of months of training beyond the end of 1994 for fellows who had already started their studies in 1994. "Miscellaneous" refers to disbursements in all components for telex charges, health insurance, copying fees and for other minor items or services. In 1994, it also included a charge for radiation protection services.

**Table 5. Extrabudgetary funds for technical co-operation activities by donor as at 31 December 1994**

---

This table shows the status of all extrabudgetary funds, including the monies received, their utilization and the balance remaining for further implementation for each donor fund. The amounts footnoted in the table under c and d are not recorded as income in the Agency's Accounts as these are receivables.

**Table 6A. Technical co-operation personnel services: 1994**

---

A list is given of 80 recipient countries showing the number of assignments undertaken and months provided to each country. Persons not serving on country projects are shown under intercountry projects and training courses.

**Table 6B. Recipients of training abroad: 1994**

---

The list shows the 98 recipient countries, number of trainees and the total months of training received in 1994.

**Table 7. Financial Summary: 1994**

---

This major table shows, by type of assistance and by source, the total technical assistance furnished to 88 countries as well as to intercountry projects and training courses. Fellowship disbursements from regional manpower development projects have been distributed to the individual recipient countries. The figures used represent disbursements incurred during the current year. In the case of UNDP, they also include disbursements against prior-year obligations.

**Table 8. Financial Summary: 1958-1994**

---

A summary is given of all assistance provided since the beginning of the Agency's technical co-operation activities in 1958.

**Table 9. Women's participation in technical co-operation activities**

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This table shows the involvement of women in the Agency's technical co-operation programme by human resource category. Numbers and percentages are given for the base year 1981 and for 1993 and 1994. The total number of women involved reached 1,153 of which 1,006 or 87.3% were from developing countries.

**TABLE 1****AVAILABLE RESOURCES: 1985-1994**

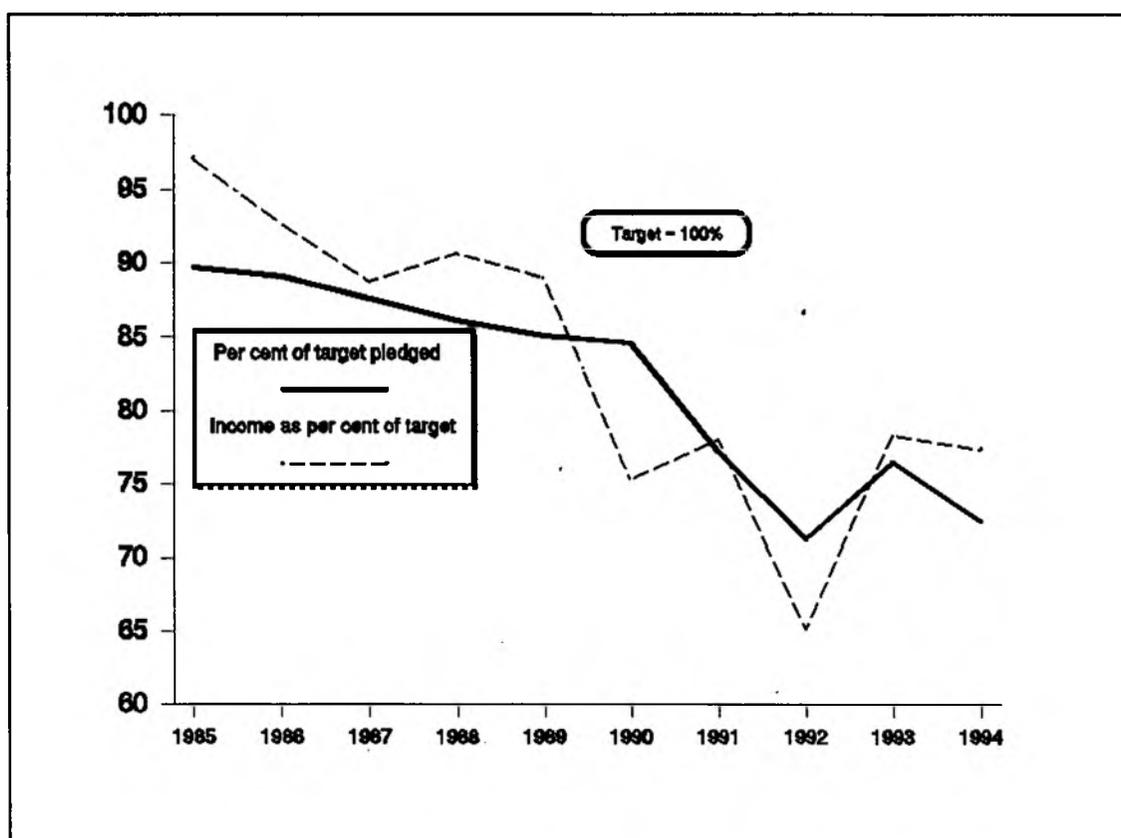
(in thousands of dollars)

Year	Technical Assistance and Co-operation Fund			Other resources				Grand total (1+5)
	Voluntary contributions	Miscellaneous income	Sub-total	Ex-trabudgetary funds	Assistance in kind	UNDP	Sub-total	
	(1a)	(1b)	(1)	(2)	(3)	(4)	(5)	
1985	23,258	1,939	25,197	5,484	2,765	2,654	10,903	36,100
1986	26,779	1,081	27,860	5,702	2,282	3,480	11,464	39,324
1987	29,749	404	30,153	5,700	3,066	2,568	11,334	41,487
1988	32,743	1,767	34,510	5,710	2,322	3,051	11,083	45,593
1989	35,681	1,631	37,312	7,375	2,295	3,106	12,776	50,088
1990	38,849	(4,189)	34,660	4,820	2,214	2,856	9,890	44,550
1991	38,444	438	38,882	7,018	1,702	1,513	10,233	49,115
1992	37,616	(4,205)	33,411	4,975	1,302	620	6,897	40,308
1993	42,856	981	43,837	6,367	1,642	1,059	9,068	52,905
1994	41,868	2,862	44,730	4,907	1,752	1,367	8,026	52,756
1985-1994	347,843	2,709	350,552	58,058	21,342	22,274	101,674	452,226

**TABLE 2**

**TECHNICAL ASSISTANCE AND CO-OPERATION FUND: 1985-1994**

Programme Year	Target for voluntary contributions to the Technical Assistance & Co-operation Fund	Amount Pledged	Per cent of target pledged	Income available for technical co-operation programmes	Income as per cent of target
1985	26,000,000	23,314,101	89.7	25,252,982	97.1
1986	30,000,000	26,732,785	89.1	27,813,735	92.7
1987	34,000,000	29,772,162	87.6	30,175,831	88.8
1988	38,000,000	32,710,534	86.1	34,478,116	90.7
1989	42,000,000	35,732,734	85.1	37,360,724	89.0
1990	45,500,000	38,503,592	84.6	34,313,843	75.4
1991	49,000,000	37,816,993	77.2	38,255,458	78.1
1992	52,500,000	37,452,844	71.3	34,163,238	65.1
1993	55,500,000	42,466,893	76.5	43,447,859	78.3
1994	58,500,000	42,418,928	72.5	45,281,016	77.4



**TABLE 3A**

**PROJECT PERSONNEL BY PLACE OF ORIGIN: 1994**

Place of origin	Total individuals <sup>a)</sup>	Assignments				Total
		International experts <sup>b)</sup>	National experts	Lecturers <sup>c)</sup>	Other project personnel	
Albania	4	0	4	0	0	4
Algeria	13	3	14	1	0	18
Argentina	45	57	7	18	0	82
Armenia	4	1	5	0	0	6
Australia	46	59	0	18	0	77
Austria	36	43	0	15	4	62
Bangladesh	12	5	9	3	0	17
Barbados	1	0	1	0	0	1
Belarus	7	0	9	0	0	9
Belgium	28	32	0	6	0	38
Bolivia	6	5	5	4	0	14
Brazil	35	27	7	11	3	48
Bulgaria	32	12	57	3	0	72
Canada	69	89	0	17	0	106
Chile	16	11	6	4	0	21
China	35	31	16	8	0	55
Colombia	9	12	5	0	0	17
Costa Rica	5	4	2	1	0	7
Cote d'Ivoire	1	3	0	0	0	3
Croatia	20	22	14	6	0	42
Cuba	11	9	5	3	0	17
Cyprus	4	3	5	0	0	8
Czech Republic	49	29	66	9	0	104
Denmark	5	5	0	2	0	7
Dominican Republic	2	3	1	0	0	4
Ecuador	3	0	3	0	0	3
Egypt	17	7	11	7	0	25
El Salvador	3	2	1	0	0	3
Estonia	6	0	6	1	0	7
Ethiopia	3	1	2	0	0	3
Finland	20	28	0	3	0	31
France	103	117	0	26	0	143
Germany	100	111	0	44	2	157
Ghana	9	6	3	2	0	11
Greece	6	2	3	3	0	8

Place of origin	Total individuals <sup>a)</sup>	Assignments				Total
		International experts <sup>b)</sup>	National experts	Lecturers <sup>c)</sup>	Other project personnel	
Guatemala	6	7	2	1	0	10
Guyana	1	0	1	0	0	1
Hungary	48	44	35	9	0	88
Iceland	1	1	0	0	0	1
India	47	48	10	10	0	68
Indonesia	19	7	18	1	0	26
Iran, Islamic Rep.	20	9	18	0	0	27
Ireland	2	3	0	0	0	3
Israel	10	15	0	5	0	20
Italy	28	44	0	6	0	50
Jamaica	1	0	1	0	0	1
Japan	36	47	0	8	0	55
Jordan	14	0	14	0	0	14
Kazakhstan	9	1	10	0	0	11
Kenya	3	0	2	1	0	3
Korea, Republic of	18	6	11	2	0	19
Kuwait	2	0	2	0	0	2
Kyrgyzstan	1	0	1	0	0	1
Latvia	3	0	3	0	0	3
Lebanon	7	0	7	0	0	7
Libyan Arab J.	7	0	9	0	0	9
Lithuania	7	0	7	0	0	7
Madagascar	2	0	2	0	0	2
Malaysia	20	11	14	1	0	26
Mali	2	1	0	0	2	3
Mauritius	1	4	0	0	0	4
Mexico	21	28	6	7	0	41
Moldova	3	1	2	0	0	3
Mongolia	6	0	7	0	0	7
Morocco	9	5	10	1	0	16
Myanmar	2	0	2	0	0	2
Netherlands	16	21	0	4	0	25
New Zealand	5	4	0	3	0	7
Nicaragua	1	0	1	0	0	1
Nigeria	7	2	2	3	0	7
Norway	4	6	0	0	0	6
Pakistan	30	14	24	2	0	40
Panama	3	0	3	0	0	3

Place of origin	Total Individuals <sup>a)</sup>	Assignments				Total
		International experts <sup>b)</sup>	National experts	Lecturers <sup>c)</sup>	Other project personnel	
Paraguay	2	0	2	0	0	2
Peru	11	7	5	2	0	14
Philippines	13	7	10	1	1	19
Poland	45	50	38	16	0	104
Portugal	9	2	3	4	0	9
Romania	22	14	14	1	0	29
Russian Federation	60	47	40	14	1	102
Saudi Arabia	10	0	10	0	0	10
Senegal	1	0	0	1	0	1
Singapore	6	2	5	0	0	7
Slovakia	20	7	34	4	0	45
Slovenia	29	32	14	9	0	55
South Africa	8	4	1	4	0	9
Spain	45	53	0	22	0	75
Sri Lanka	14	28	8	6	0	42
Sudan	3	0	3	0	0	3
Sweden	25	41	0	22	0	63
Switzerland	8	13	0	2	0	15
Syrian Arab Rep.	12	3	11	1	0	15
Thailand	10	4	8	0	0	12
Trinidad & Tobago	1	0	1	0	0	1
Tunisia	9	4	8	1	0	13
Turkey	18	14	10	2	0	26
Uganda	1	1	0	0	0	1
Ukraine	29	5	40	0	0	45
United Arab Emirates	7	0	8	0	0	8
UK	152	161	0	46	1	208
United Rep. Tanzania	6	6	5	0	0	11
USA	217	281	0	54	0	335
Uruguay	7	1	4	3	0	8
Venezuela	7	10	3	8	0	21
Viet Nam	14	11	11	0	0	22
Yugoslavia	9	13	1	7	0	21
Zaire	5	2	3	0	0	5
<b>TOTAL</b>	<b>2,022</b>	<b>1,891</b>	<b>791</b>	<b>509</b>	<b>14</b>	<b>3,205</b>

<sup>a)</sup> Includes 203 IAEA staff members and 5 other international organization members. <sup>b)</sup> Includes 407 assignments of IAEA staff members and 3 assignments of other international organization members as International experts. <sup>c)</sup> Includes 176 assignments of IAEA staff members and 3 assignments of other international organization members as lecturers.

**TABLE 3B****TRAINEES IN THE FIELD BY PLACE OF STUDY: 1994**

Place of Study	Fellows	Visiting scientists	Training course participants	Total <sup>a</sup>
Argentina	22	9	72	103
Australia	20	6	64	90
Austria	16	14	0	30
Belgium	13	12	0	25
Bolivia	1	0	0	1
Brazil	22	4	46	72
Bulgaria	0	5	0	5
Burkina Faso	2	0	0	2
Canada	50	17	31	98
Chile	12	2	69	83
China	12	4	59	75
Colombia	5	0	0	5
Costa Rica	8	0	0	8
Cote d'Ivoire	1	0	0	1
Croatia	1	0	5	6
Cuba	0	0	33	33
Cyprus	1	1	0	2
Czech Republic	3	3	0	6
Denmark	4	5	0	9
Ecuador	1	0	42	43
Egypt	4	0	28	32
El Salvador	0	0	4	4
Estonia	0	0	7	7
Ethiopia	0	0	21	21
Finland	3	3	14	20
France	52	27	46	125
Germany	33	27	76	136
Ghana	1	0	18	19
Greece	7	4	0	11
Guatemala	0	6	0	6
Hungary	39	17	46	102
India	36	4	42	82
Indonesia	1	0	15	16
Iran, I.R.	0	0	5	5
Israel	0	1	0	1
Italy	17	9	0	26
Japan	20	8	71	99
Jordan	0	0	14	14
Kenya	0	1	56	57
Korea, Republic of	3	8	34	45

Place of Study	Fellows	Visiting scientists	Training course participants	Total <sup>a</sup>
Madagascar	0	0	16	16
Malaysia	11	3	55	69
Mali	0	0	16	16
Mexico	12	10	31	53
Morocco	0	3	29	32
Netherlands	16	5	0	21
New Zealand	0	2	0	2
Norway	1	2	0	3
Pakistan	7	3	0	10
Panama	0	0	18	18
Paraguay	3	0	14	17
Philippines	1	0	0	1
Poland	30	8	0	38
Portugal	1	0	0	1
Romania	0	3	0	3
Russian Federation	28	6	14	48
Singapore	1	0	0	1
Slovakia	2	3	42	47
Slovenia	7	0	0	7
South Africa	1	1	0	2
Spain	34	22	60	116
Sri Lanka	2	0	0	2
Swaziland	1	0	0	1
Sweden	13	3	0	16
Switzerland	1	7	0	8
Syrian A.R.	0	0	9	9
Thailand	8	7	41	56
Tunisia	0	0	27	27
Turkey	2	4	16	22
UK	86	19	0	105
Ukraine	1	0	0	1
U.R. Tanzania	6	2	21	29
USA	96	54	178	328
Uruguay	3	1	39	43
Venezuela	3	0	22	25
Viet Nam	1	3	0	4
Zambia	0	0	9	9
Zimbabwe	0	0	14	14
IAEA	124	48	157	326
European Nuclear Res. Center	1	2	0	3
<b>TOTAL</b>	<b>910</b>	<b>418</b>	<b>1,746</b>	<b>3,074</b>

<sup>a</sup> The difference between the number of trainees (2,785 see Table 6B) and the number of places of study (3,074) is due to the fact that a number of fellows, training course participants and visiting scientists went to more than one country/place.

**TABLE 3C**  
**EQUIPMENT BY COUNTRY OF ORIGIN: 1994**

Country	Disbursements (\$ thousand)	New purchase orders placed
ALGERIA	0.0	1
ARGENTINA	96.5	25
AUSTRALIA	83.4	18
AUSTRIA	2,792.6	593
BANGLADESH	2.5	0
BELGIUM	127.1	21
BRAZIL	21.9	4
BULGARIA	2.6	1
CANADA	551.3	29
CHILE	68.1	7
CHINA	1,443.6	37
COLOMBIA	3.6	2
COSTA RICA	35.2	3
CROATIA	62.0	2
CUBA	30.1	4
CZECH REPUBLIC	35.8	10
DENMARK	141.3	37
ECUADOR	2.0	2
EL SALVADOR	9.4	4
ETHIOPIA	0.2	1
FINLAND	210.4	15
FRANCE	1,706.0	130
GABON	0.0	1
GERMANY	2,066.3	333
GHANA	(0.1)	0
GREECE	68.5	2
HONDURAS	55.8	3
HONG KONG	123.9	18
HUNGARY	537.3	23
INDIA	193.5	18
INDONESIA	2.5	1
IRAN, ISLAMIC REPUBLIC OF	4.6	2
IRELAND	9.8	6
ISRAEL	3.0	3
ITALY	133.1	28
JAPAN	622.5	55
KENYA	6.5	1
LIECHTENSTEIN	0.5	1
MADAGASCAR	0.0	1
MALAYSIA	0.0	1
MALI	8.8	1
MAURITANIA	0.0	1
MEXICO	38.4	5
MONGOLIA	0.4	1

Country	Disbursements (\$ thousand)	New purchase orders placed
MOROCCO	0.0	1
MYANMAR	0.2	1
NAMIBIA	1.9	3
NETHERLANDS	244.2	70
NEW ZEALAND	73.8	4
NICARAGUA	0.6	1
NIGER	1.4	1
NIGERIA	2.0	2
NORWAY	13.5	2
PAKISTAN	0.7	1
PARAGUAY	0.1	0
PERU	1.4	1
PHILIPPINES	10.3	3
POLAND	497.1	19
PORTUGAL	0.0	1
ROMANIA	(4.0)	2
RUSSIAN FEDERATION	502.5	19
SENEGAL	0.0	1
SIERRA LEONE	2.4	3
SINGAPORE	6.0	2
SLOVAKIA	26.5	3
SLOVENIA	11.6	1
SPAIN	67.7	8
SRI LANKA	3.7	3
SWEDEN	193.8	20
SWITZERLAND	292.6	42
SYRIAN ARAB REPUBLIC	0.4	0
TAIWAN, CHINA	0.3	1
THAILAND	8.3	7
TUNISIA	8.4	0
TURKEY	0.0	4
UGANDA	3.7	1
UNITED ARAB EMIRATES	22.4	3
UNITED KINGDOM	3,091.8	480
UNITED REPUBLIC OF TANZANIA	122.5	19
UNITED STATES OF AMERICA	6,583.2	892
URUGUAY	0.0	3
VENEZUELA	4.5	2
VIET NAM	0.6	0
ZAIRE	0.1	1
ZAMBIA	1.9	1
<b>TOTAL COUNTRIES</b>	<b>23,099.0</b>	<b>3,079</b>
<b>LOCAL COSTS</b>	<b>254.9</b>	
<b>TOTAL</b>	<b>23,353.9</b>	

**TABLE 4**  
**DISTRIBUTION OF TECHNICAL CO-OPERATION DISBURSEMENTS**  
**BY TYPE: 1990 - 1994**  
(in thousands of dollars)

Year	Source	Experts		Equipment		Fellowships		Visiting scientists		Training courses		Sub-contracts		Miscellaneous		TOTAL		Unliquidated obligations	In-kind balance	TOTAL
		\$	%	\$	%	\$	%	\$	%	\$	%	\$	%	\$	%	\$	\$			
1990	UNDP funds	835.5	25.7	1,103.8	34.0	534.1	16.4	163.1	5.0	460.9	14.2	138.8	4.3	13.9	0.4	3,250.1	100.0	0.0	0.0	3,250.1
	Agency funds	7,211.9	19.7	18,000.9	49.0	5,111.5	13.9	872.2	2.4	4,867.3	13.3	109.8	0.3	531.3	1.4	36,704.9	100.0	0.0	0.0	36,704.9
	Extrabudgetary funds	1,414.2	19.7	4,430.6	61.7	181.9	2.5	19.7	0.3	674.0	9.4	462.5	6.4	0.0	0.0	7,182.9	100.0	0.0	0.0	7,182.9
	Assistance in kind	318.0	14.4	125.0	5.6	1,302.9	58.9	31.1	1.4	436.8	19.7	0.0	0.0	0.0	1.0	2,213.8	100.0	0.0	0.0	2,213.8
	Total	9,779.6	19.8	23,660.3	47.9	7,130.4	14.5	1,086.1	2.2	6,439.0	13.0	711.1	1.4	545.2	1.2	49,351.7	100.0	0.0	0.0	49,351.7
1991	UNDP funds	675.8	35.7	479.3	25.4	151.9	8.0	13.1	0.7	361.8	19.1	189.5	10.0	19.6	1.1	1,891.0	100.0	0.0	0.0	1,891.0
	Agency funds	7,905.0	22.1	15,236.0	42.5	5,413.0	15.1	777.8	2.2	5,426.8	15.2	528.4	1.5	513.6	1.4	35,800.6	100.0	0.0	0.0	35,800.6
	Extrabudgetary funds	1,461.5	21.9	3,503.1	52.4	198.1	3.0	25.8	0.4	928.9	13.9	565.2	8.4	0.0	0.0	6,682.6	100.0	0.0	0.0	6,682.6
	Assistance in kind	310.5	18.2	0.0	0.0	1,101.0	64.7	14.8	0.9	275.2	16.2	0.0	0.0	0.0	0.0	1,701.5	100.0	0.0	0.0	1,701.5
	Total	10,352.8	22.5	19,218.4	41.7	6,864.0	14.9	831.5	1.8	6,992.7	15.2	1,283.1	2.8	533.2	1.1	46,075.7	100.0	0.0	0.0	46,075.7
1992	UNDP funds	284.1	26.0	324.0	29.6	139.3	12.7	6.7	0.6	159.0	14.6	169.0	15.5	11.1	1.0	1,093.2	100.0	0.0	0.0	1,093.2
	Agency funds	8,199.4	21.2	17,405.2	45.1	5,742.1	14.9	1,057.0	2.7	5,370.2	13.9	250.4	0.6	610.0	1.6	38,634.3	100.0	0.0	0.0	38,634.3
	Extrabudgetary funds	1,367.8	21.4	3,782.0	59.2	199.1	3.1	58.7	0.9	629.1	9.9	351.4	5.5	2.6	0.0	6,390.7	100.0	0.0	0.0	6,390.7
	Assistance in kind	272.9	21.0	0.0	0.0	770.8	59.2	21.7	1.7	236.3	18.1	0.0	0.0	0.0	0.0	1,301.7	100.0	0.0	0.0	1,301.7
	Total	10,124.2	21.4	21,511.2	45.4	6,851.3	14.4	1,144.1	2.4	6,394.6	13.5	770.8	1.6	623.7	1.3	47,419.9	100.0	0.0	0.0	47,419.9
1993	UNDP funds	559.2	41.2	384.8	28.4	22.5	1.7	31.1	2.3	230.6	17.0	111.3	8.2	15.8	1.2	1,355.3	100.0	0.0	0.0	1,355.3
	Agency funds	9,473.6	25.8	13,844.7	37.7	5,879.3	16.0	994.8	2.7	5,765.7	15.7	120.8	0.3	639.4	1.8	36,718.3	100.0	0.0	0.0	36,718.3
	Extrabudgetary funds	1,161.8	20.8	3,418.2	61.2	74.9	1.4	33.2	0.6	546.7	9.8	347.4	6.2	0.0	0.0	5,582.2	100.0	0.0	0.0	5,582.2
	Assistance in kind	448.1	27.3	0.0	0.0	877.5	53.4	24.1	1.5	292.5	17.8	0.0	0.0	0.0	0.0	1,642.2	100.0	0.0	0.0	1,642.2
	Total	11,642.7	25.7	17,647.7	39.0	6,854.2	15.1	1,083.2	2.4	6,835.5	15.1	579.5	1.3	655.2	1.4	45,298.0	100.0	0.0	0.0	45,298.0
1994	UNDP funds	637.8	57.7	68.9	6.6	36.9	3.3	65.2	5.9	197.5	17.9	94.6	8.6	4.5	0.4	1,105.4	100.0	592.9	0.0	1,698.3
	Agency funds	10,153.4	22.8	19,169.0	43.0	6,630.4	14.9	1,087.8	2.4	6,571.1	14.8	225.4	0.5	711.2	1.6	44,548.3	100.0	18,109.7	0.0	62,658.0
	Extrabudgetary funds	1,330.2	23.2	3,516.5	61.3	65.3	1.1	34.3	0.6	442.2	7.7	351.9	6.1	0.0	0.0	5,740.4	100.0	3,070.0	0.0	8,810.5
	Assistance in kind	302.7	17.3	164.0	9.3	965.3	55.1	19.0	1.1	301.6	17.2	0.0	0.0	0.0	0.0	1,752.6	100.0	0.0	187.5	1,940.0
	Total	12,424.1	23.4	22,918.4	43.1	7,697.9	14.5	1,206.3	2.3	7,512.4	14.1	671.9	1.3	715.7	1.3	53,146.7	100.0	21,772.6	187.5	75,106.8
1990-1994	UNDP funds	2,992.4	34.4	2,360.8	27.2	884.7	10.2	279.2	3.2	1,409.8	16.2	703.2	8.1	64.9	0.7	8,695.0	100.0	592.9	0.0	9,287.9
	Agency funds	42,943.3	22.3	83,655.8	43.5	28,776.3	15.0	4,789.6	2.5	28,001.1	14.5	1,234.8	0.6	3,005.5	1.6	192,406.4	100.0	18,109.7	0.0	210,516.1
	Extrabudgetary funds	6,735.5	21.3	18,650.4	59.1	719.3	2.3	171.7	0.5	3,220.9	10.2	2,078.4	6.6	2.6	0.0	31,578.8	100.0	3,070.0	0.0	34,648.9
	Assistance in kind	1,652.2	19.2	289.0	3.3	5,017.5	58.3	110.7	1.3	1,542.4	17.9	0.0	0.0	0.0	0.0	8,611.8	100.0	0.0	187.5	8,799.2
	Total	54,323.4	22.5	104,956.0	43.5	35,397.8	14.7	5,351.2	2.2	34,174.2	14.1	4,016.4	1.7	3,073.0	1.3	241,292.0	100.0	21,772.6	187.5	263,252.1

**TABLE 5**  
**EXTRABUDGETARY FUNDS FOR TECHNICAL CO-OPERATION**  
**ACTIVITIES BY DONOR**

(as at 31 December 1994)

Donor	Funds available 1 January 1994	New funds in 1994	Total funds available	Disbursements in 1994	Unliquidated obligations at year-end	Unobligated balance
<b>Part A: Funds for activities where donor is not recipient</b>						
Australia	387,639	362,318	749,957	141,092	64,960	543,905
Belgium	251,011	93,750	344,761	137,616	51,711	155,434
Canada	189,394	0	189,394	173,734	15,193	467
Chile	6,050	10,000	16,050	5,040	0	11,010
Colombia	2,863	0	2,863	0	1,683	1,180
Finland	10,806	0	10,806	0	0	10,806
France	877,162	595,575	1,472,737	328,811	291,078	852,848
Germany	387,016	0	387,016	227,270	53,692	106,054
Indonesia	0	40,000	40,000	0	0	40,000
Italy	58,244	(58,244)	0	0	0	0
Japan	602,616	482,212 <sup>a</sup>	1,084,828	457,604	85,933	541,291
Korea, Rep. of	293,608	40,000	333,608	14,819	0	318,789
Malaysia	10,000	10,000	20,000	0	0	20,000
Philippines	2,520 <sup>b</sup>	1,264 <sup>b</sup>	3,784	0	0	3,784
Spain	337,018	310,309	647,327	314,831	175,725	156,771
Sweden	68,273	111,388	179,661	126,114	30,182	23,365
UK	1,705,614 <sup>c</sup>	667,000 <sup>d</sup>	2,372,614	970,964	275,233	1,126,417
UNCTF	198,560	0	198,560	198,490	0	70
USA	2,779,843	2,119,378 <sup>e</sup>	4,899,221	1,700,451	1,064,817	2,133,953
<b>sub-total</b>	<b>8,168,237</b>	<b>4,784,950</b>	<b>12,953,187</b>	<b>4,796,836</b>	<b>2,110,207</b>	<b>6,046,144</b>
<b>Part B: Funds for activities where donor is recipient</b>						
Bolivia	0	10,000	10,000	0	8,600	1,400
Bulgaria	78,000	0	78,000	73,737	0	4,263
Chile	32,342	0	32,342	31,027	0	1,315
China	70,980	0	70,980	54,742	15,995	243
Colombia	654,807	0	654,807	0	654,806	1
Ecuador	139	0	139	14	0	125
Ghana	119,361	0	119,361	58,959	59,341	1,061
Iran, Islamic Rep.	200,105	0	200,105	170,552	12,942	16,611
Mexico	0	92,537 <sup>f</sup>	92,537	0	0	92,537
Nicaragua	293,041	0	293,041	226,040	67,000	1
Nigeria	75	0	75	0	0	75
Pakistan	4,666	0	4,666	4,139	0	527
Portugal	550	0	550	361	0	189
Romania	0	8,665	8,665	1,044	0	7,621
Saudi Arabia	3,109	0	3,109	14	0	3,095
Syrian Arab Rep.	242,337	0	242,337	176,813	63,925	1,599
U.A. Emirates	246,861	0	246,861	146,195	77,188	23,478
Uruguay	0	15,000	15,000	0	0	15,000
<b>sub-total</b>	<b>1,946,373</b>	<b>126,202</b>	<b>2,072,575</b>	<b>943,637</b>	<b>959,797</b>	<b>169,141</b>
<b>TOTAL</b>	<b>10,114,610</b>	<b>4,911,152</b>	<b>15,025,762</b>	<b>5,740,473</b>	<b>3,070,004</b>	<b>6,215,285</b>

<sup>a</sup> Additional funds provided under non-TC programme for the RCA project in Asia. <sup>b</sup> Included in Miscellaneous Income of the TACF in the Agency's Accounts. <sup>c</sup> Includes receivable of \$187,110. <sup>d</sup> Represents receivable of \$667,000. <sup>e</sup> Includes \$100,000 future-year project provisions. <sup>f</sup> Represents future-year project provisions.

TABLE 6A

## TECHNICAL CO-OPERATION PERSONNEL SERVICES: 1994

Recipient	Number of assignments	Number of months
Albania	5	1.0
Algeria	8	2.0
Argentina	55	31.0
Armenia	31	8.0
Bangladesh	15	9.0
Belarus	4	1.0
Bolivia	6	1.5
Brazil	22	9.5
Bulgaria	33	11.5
Cameroon	1	1.0
Chile	26	12.0
China	64	28.5
Colombia	22	10.0
Costa Rica	9	4.5
Cote d'Ivoire	5	2.5
Croatia	17	4.0
Cuba	15	7.0
Cyprus	5	1.5
Czech Republic	30	5.5
Dem. P.R. Korea	1	0.5
Dominican Republic	2	0.5
Ecuador	10	4.0
Egypt	36	18.5
El Salvador	13	5.5
Estonia	2	0.5
Ethiopia	4	5.0
Ghana	17	10.5
Greece	6	2.5
Guatemala	12	6.0
Hungary	50	11.5
Indonesia	69	28.0
Iran, Islamic Rep.	59	22.5
Jordan	8	4.0
Kazakhstan	2	1.0
Kenya	7	4.5
Korea, Rep. of	28	13.5
Kyrgyzstan	3	1.0
Lebanon	6	1.5
Libyan Arab J.	6	4.0
Madagascar	5	3.0
Malaysia	41	25.5
Mali	8	3.0
Mauritius	4	2.5

Recipient	Number of assignments	Number of months
Mexico	48	18.0
Mongolia	15	10.5
Morocco	11	5.0
Myanmar	14	9.0
Namibia	9	4.0
Nicaragua	11	4.0
Niger	4	2.0
Nigeria	6	6.0
Pakistan	84	33.5
Panama	5	1.0
Paraguay	8	6.0
Peru	20	8.0
Philippines	21	11.0
Poland	27	9.5
Portugal	8	4.0
Romania	48	13.5
Saudi Arabia	11	4.5
Senegal	3	1.0
Sierra Leone	5	3.5
Slovakia	46	10.0
Slovenia	26	8.0
Sri Lanka	20	9.5
Sudan	8	4.5
Syrian Arab Rep.	11	5.0
Thailand	27	14.5
Tunisia	14	4.5
Turkey	12	4.0
Uganda	1	1.0
Ukraine	25	7.0
United Arab Emirates	10	3.0
UK (Hong Kong)	1	0.5
U.R. Tanzania	30	35.5
Uruguay	9	3.0
Venezuela	13	6.0
Viet Nam	8	4.0
Zambia	6	5.0
Zimbabwe	4	4.0
<b>Sub-total</b>	<b>1,401</b>	<b>613.0</b>
Intercountry Projects	1,295	561.5
Training Courses	509	113.5
<b>Sub-total</b>	<b>1,804</b>	<b>675.0</b>
<b>TOTAL</b>	<b>3,205</b>	<b>1,288.0</b>

**TABLE 6B**  
**RECIPIENTS OF TRAINING ABROAD: 1994**

Recipient	Fellows		Visiting Scientists		Training Course Participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Afghanistan	6	17.5	0	0.0	0	0.0	6	17.5
Albania	7	26.0	0	0.0	2	2.5	9	28.5
Algeria	10	32.0	5	2.0	34	24.5	49	58.5
Armenia	0	0.0	0	0.0	10	6.0	10	6.0
Argentina	15	55.0	23	17.0	44	28.5	82	100.5
Bangladesh	17	65.0	2	1.0	35	23.0	54	89.0
Barbados	0	0.0	0	0.0	4	4.0	4	4.0
Belarus	1	2.0	0	0.0	12	11.5	13	13.5
Belize	0	0.0	0	0.0	1	1.0	1	1.0
Bolivia	5	11.0	2	1.0	16	11.5	23	23.5
Brazil	20	38.0	12	7.0	48	47.0	80	92.0
Bulgaria	19	69.0	12	8.5	35	27.5	66	105.0
Cameroon	4	17.5	4	2.0	5	5.0	13	24.5
Chile	11	28.0	7	5.0	23	19.0	41	52.0
China	30	94.5	10	6.5	60	50.0	100	151.0
Colombia	6	17.0	2	1.5	28	25.5	36	44.0
Costa Rica	4	9.0	1	0.5	22	8.0	27	17.5
Cote d'Ivoire	3	8.0	0	0.0	4	3.0	7	11.0
Croatia	6	16.0	2	1.5	11	15.5	19	33.0
Cuba	38	91.0	2	1.5	41	42.5	81	135.0
Cyprus	0	0.0	1	0.5	6	4.0	7	4.5
Czech Republic	5	22.5	1	1.0	30	18.5	36	42.0
Dem. P.R. Korea	5	10.5	0	0.0	0	0.0	5	10.5
Dominican Rep.	4	11.0	0	0.0	11	10.0	15	21.0
Ecuador	7	18.0	1	0.5	18	15.0	26	33.5
Egypt	33	125.0	5	3.0	29	20.5	67	148.5
El Salvador	9	22.5	0	0.0	7	2.5	16	25.0
Estonia	0	0.0	0	0.0	2	1.0	2	1.0
Ethiopia	15	61.5	1	0.5	17	11.0	33	73.0
Ghana	22	87.5	2	3.5	30	25.0	54	116.0
Greece	0	0.0	1	0.5	4	4.5	5	5.0
Guatemala	15	34.0	0	0.0	22	22.5	37	56.5
Guinea	0	0.0	0	0.0	1	1.0	1	1.0
Guyana	0	0.0	0	0.0	1	0.5	1	0.5
Hungary	15	38.5	6	1.0	30	18.5	51	58.0
Honduras	0	0.0	0	0.0	2	1.5	2	1.5
India	0	0.0	0	0.0	39	23.5	39	23.5
Indonesia	31	83.0	8	5.5	44	28.0	83	116.5
Iran, I.R.	33	104.0	5	3.0	13	12.0	51	119.0
Israel	0	0.0	0	0.0	1	2.0	1	2.0
Jamaica	1	3.0	1	1.0	4	2.0	6	6.0

Recipient	Fellows		Visiting Scientists		Training Course Participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Jordan	4	9.0	4	2.0	12	17.5	20	28.5
Kazakhstan	0	0.0	0	0.0	8	4.0	8	4.0
Kenya	16	53.0	1	2.0	23	15.5	40	70.5
Korea, Republic of	16	60.0	6	3.5	27	17.0	49	80.5
Lao, P.D.R.	0	0.0	0	0.0	1	1.0	1	1.0
Latvia	0	0.0	0	0.0	3	1.5	3	1.5
Lebanon	1	1.0	0	0.0	4	4.0	5	5.0
Libyan Arab J.	16	75.5	1	6.0	10	11.0	27	92.5
Lithuania	0	0.0	0	0.0	17	9.0	17	9.0
Madagascar	3	8.0	0	0.0	12	10.5	15	18.5
Malawi	0	0.0	0	0.0	2	2.5	2	2.5
Malaysia	17	59.0	15	8.5	28	16.5	60	84.0
Mali	6	27.5	0	0.0	6	4.5	12	32.0
Mauritius	5	12.0	1	1.0	6	5.0	12	18.0
Mexico	20	54.0	9	4.0	48	35.0	77	93.0
Mongolia	21	74.0	3	2.5	15	10.5	39	87.0
Morocco	16	69.5	6	3.0	19	18.5	41	91.0
Myanmar	22	74.0	4	3.0	10	8.5	36	85.5
Namibia	0	0.0	0	0.0	4	2.5	4	2.5
Nepal	0	0.0	0	0.0	1	1.5	1	1.5
Nicaragua	4	24.5	0	0.0	8	4.5	12	29.0
Niger	11	41.0	0	0.0	4	7.0	15	48.0
Nigeria	13	62.0	2	1.0	18	11.0	33	74.0
Oman	0	0.0	0	0.0	1	1.0	1	1.0
Pakistan	28	90.0	11	8.5	31	24.5	70	123.0
Panama	2	4.0	1	1.0	12	8.5	15	13.5
Paraguay	3	8.0	2	1.0	12	8.5	17	17.5
Peru	12	32.5	1	0.5	32	23.5	45	56.5
Philippines	26	94.0	3	2.5	35	18.0	64	114.5
Poland	10	37.5	4	2.5	11	13.0	25	53.0
Portugal	3	4.0	0	0.0	1	0.5	4	4.5
Romania	23	52.5	13	6.5	38	34.0	74	93.0
Russian Federation	0	0.0	0	0.0	20	13.0	20	13.0
Saudi Arabia	2	2.5	2	1.0	6	4.5	10	8.0
Senegal	1	3.0	1	1.0	8	6.0	10	10.0
Sierra Leone	6	32.5	0	0.0	8	6.5	14	39.0
Singapore	0	0.0	0	0.0	5	1.5	5	1.5
Slovakia	6	17.0	3	1.5	21	11.5	30	30.0
Slovenia	3	7.0	1	1.5	20	18.0	24	26.5
Sri Lanka	16	71.5	2	2.0	25	17.0	43	90.5
Sudan	10	35.0	0	0.0	25	18.5	35	53.5
Suriname	0	0.0	0	0.0	2	2.5	2	2.5
Syrian A.R.	26	60.5	4	2.5	13	12.5	43	75.5
Thailand	20	70.5	4	2.0	33	16.5	57	89.0

Recipient	Fellows		Visiting Scientists		Training Course Participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
The former Yugoslav Republic of Macedonia	0	0.0	0	0.0	1	0.5	1	0.5
Trinidad and Tobago	0	0.0	0	0.0	2	0.5	2	0.5
Tunisia	8	21.5	5	2.5	13	10.0	26	34.0
Turkey	13	41.0	5	3.0	24	22.5	42	66.5
Uganda	15	71.0	3	2.0	11	10.0	29	83.0
Ukraine	3	12.0	5	2.5	45	28.0	53	42.5
U.R. Tanzania	13	56.5	3	2.0	26	22.0	42	80.5
Uruguay	6	15.5	6	3.0	19	11.0	31	29.5
Venezuela	5	16.0	3	2.0	22	9.5	30	27.5
Viet Nam	23	68.5	5	3.0	39	25.5	67	97.0
Zaire	8	32.5	3	2.0	14	6.5	25	41.0
Zambia	9	23.0	1	0.5	17	13.0	27	36.5
Zimbabwe	5	23.0	0	0.0	9	8.0	14	31.0
TOTAL	893	2,924.0	259	168.0	1,633	1,224.0	2,785	4,316.0

(1) Number of trainees. (2) Number of months of training received.

**TABLE 7**  
**FINANCIAL SUMMARY: 1994**  
(in thousands of dollars)

Recipient	ASSISTANCE PROVIDED, BY TYPE						ASSISTANCE PROVIDED, BY SOURCE					Unliq. oblig.	TOTAL
	Experts	Equip-ment	Fellow-ships	Training Courses	Sub-contracts	Total	UNDP	TACF	Extra-bud.	In kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
AFGHANISTAN	0.0	0.0	35.8	0.0	0.0	35.8	0.0	35.8	0.0	0.0	35.8	5.3	41.1
ALBANIA	8.5	154.0	62.0	0.0	0.0	224.5	4.5	220.0	0.0	0.0	224.5	172.7	397.2
ALGERIA	16.8	392.0	98.7	0.0	0.0	507.5	0.0	507.5	0.0	0.0	507.5	370.1	877.6
ARGENTINA	490.2	438.5	291.5	2.5	3.1	1,225.8	0.0	1,206.5	0.0	19.3	1,225.8	391.6	1,617.4
ARMENIA	103.5	4.9	0.0	0.0	0.0	108.4	0.0	103.5	0.0	4.9	108.4	49.3	157.7
BANGLADESH	96.5	330.4	174.9	0.0	0.0	601.8	0.0	471.0	105.5	25.3	601.8	185.4	787.2
BELARUS	0.0	212.0	5.0	0.0	0.0	217.0	0.0	18.5	198.5	0.0	217.0	15.1	232.1
BOLIVIA	19.6	414.5	30.3	0.0	0.0	464.4	0.0	415.1	49.3	0.0	464.4	205.9	670.3
BRAZIL	153.3	272.5	198.6	0.0	0.0	624.4	0.0	540.4	84.0	0.0	624.4	309.8	934.2
BULGARIA	111.7	232.9	223.8	0.0	0.0	568.4	0.0	273.6	156.1	138.7	568.4	195.6	764.0
CAMEROON	7.8	31.7	63.6	0.0	0.0	103.1	0.0	103.1	0.0	0.0	103.1	275.9	379.0
CHILE	164.6	221.7	172.6	0.0	0.0	558.9	0.0	524.5	31.6	2.8	558.9	126.5	685.4
CHINA	391.2	597.0	347.9	0.0	0.0	1,336.1	211.7	1,022.8	63.1	38.5	1,336.1	720.0	2,056.1
COLOMBIA	139.7	265.2	53.6	0.0	0.0	458.5	0.0	411.2	44.7	2.6	458.5	1,302.2	1,760.7
COSTA RICA	55.2	161.2	22.2	0.0	0.0	238.6	0.0	229.3	9.3	0.0	238.6	107.2	345.8
COTE D'IVOIRE	23.9	58.0	21.3	0.0	0.0	103.2	0.0	103.2	0.0	0.0	103.2	45.6	148.8
CROATIA	32.9	186.1	35.8	0.0	0.0	254.8	0.0	247.7	0.0	7.1	254.8	24.6	279.4
CUBA	68.9	413.7	227.1	0.0	73.9	783.6	0.0	690.8	73.9	18.9	783.6	600.0	1,383.6
CYPRUS	14.2	175.2	5.2	0.0	0.0	194.6	0.0	194.6	0.0	0.0	194.6	5.6	200.2
CZECH REPUBLIC	57.5	6.3	80.5	0.0	0.0	144.3	0.0	56.5	13.4	74.4	144.3	13.6	157.9
DEM. P.R. KOREA	12.2	192.4	25.0	0.0	0.0	229.6	0.0	229.6	0.0	0.0	229.6	6.0	235.6
DOMINICAN REP.	3.7	60.2	23.4	0.0	0.0	87.3	0.0	87.3	0.0	0.0	87.3	35.1	122.4
ECUADOR	58.1	320.4	44.8	2.0	0.0	425.3	0.0	413.8	4.6	6.9	425.3	92.9	518.2
EGYPT	192.3	273.8	312.2	0.0	0.0	778.3	10.5	659.9	53.0	54.9	778.3	570.9	1,349.2
EL SALVADOR	75.1	94.5	29.9	0.0	0.0	199.5	0.0	185.0	14.5	0.0	199.5	91.5	291.0
ESTONIA	0.8	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.8	0.8	128.5	129.3
ETHIOPIA	50.7	174.1	147.7	0.0	0.0	372.5	0.0	364.8	0.0	7.7	372.5	282.7	655.2
GHANA	104.8	815.4	246.7	0.0	0.0	1,166.9	0.0	902.4	199.8	64.7	1,166.9	390.0	1,556.9
GREECE	27.2	284.8	7.8	0.0	0.0	319.8	0.0	314.8	5.0	0.0	319.8	69.1	388.9
GUATEMALA	65.9	125.2	83.1	0.0	0.0	274.2	0.0	252.1	22.1	0.0	274.2	159.2	433.4
HUNGARY	142.4	420.1	142.2	0.0	0.0	704.7	0.0	499.6	99.0	106.1	704.7	390.3	1,095.0
INDONESIA	385.9	320.3	370.4	0.0	0.0	1,076.6	0.2	852.7	136.3	87.4	1,076.6	258.5	1,335.1
IRAN, I.R.	316.6	831.7	290.2	0.0	0.0	1,438.5	0.0	1,260.8	170.5	7.2	1,438.5	661.4	2,099.9
JAMAICA	(0.4)	33.4	9.7	0.0	0.0	42.7	0.0	42.7	0.0	0.0	42.7	14.2	56.9
JORDAN	60.5	124.4	34.6	0.0	0.0	219.5	0.0	175.6	43.9	0.0	219.5	111.0	330.5
KAZAKHSTAN	7.6	1.1	0.0	0.0	32.5	41.2	0.0	41.2	0.0	0.0	41.2	102.1	143.3
KENYA	58.8	334.6	110.1	0.0	0.0	503.5	0.0	298.2	160.8	44.5	503.5	136.2	639.7
KOREA, REP. OF	176.9	20.9	206.7	0.0	0.0	404.5	0.0	386.2	0.0	18.3	404.5	93.4	497.9
KYRGYZSTAN	18.8	0.0	0.0	0.0	0.0	18.8	0.0	18.8	0.0	0.0	18.8	95.0	113.8
LATVIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	125.0	125.0
LEBANON	22.0	43.7	3.9	0.0	0.0	69.6	0.0	69.6	0.0	0.0	69.6	24.5	94.1
LIBYAN A.J.	54.7	96.4	158.4	0.0	0.0	309.5	0.0	309.5	0.0	0.0	309.5	250.0	559.5
LITHUANIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	125.2	125.2

Recipient	ASSISTANCE PROVIDED, BY TYPE						ASSISTANCE PROVIDED, BY SOURCE					Unliq. oblig.	TOTAL
	Experts	Equip-ment	Fellow-ships	Training Courses	Sub-con-tracts	Total	UNDP	TACF	Extra-bud.	In kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
MADAGASCAR	57.1	107.2	22.5	0.0	0.0	186.8	0.0	186.8	0.0	0.0	186.8	19.1	205.9
MALAYSIA	282.6	173.4	262.7	0.0	0.0	718.7	0.0	679.1	35.8	3.8	718.7	170.5	889.2
MAU	32.4	96.3	57.6	0.0	0.0	186.3	0.0	164.7	0.0	21.6	186.3	55.2	241.5
MAURITIUS	22.1	83.5	38.8	0.0	0.0	144.4	0.0	144.4	0.0	0.0	144.4	141.8	286.2
MEXICO	260.7	556.8	176.8	0.0	0.0	994.3	0.0	743.3	247.1	3.9	994.3	220.7	1,215.0
MOLDOVA	0.0	2.1	0.0	0.0	0.0	2.1	0.0	2.1	0.0	0.0	2.1	29.5	31.6
MONGOLIA	111.5	294.8	188.3	0.0	0.0	594.6	0.0	594.6	0.0	0.0	594.6	118.4	713.0
MOROCCO	75.2	471.8	193.0	0.0	0.0	740.0	0.0	459.5	216.4	64.1	740.0	292.8	1,032.8
MYANMAR	79.2	150.4	166.7	0.0	0.0	396.3	0.0	393.3	0.0	3.0	396.3	171.1	567.4
NAMIBIA	57.6	49.5	0.0	0.0	0.0	107.1	0.0	107.1	0.0	0.0	107.1	149.7	256.8
NICARAGUA	43.2	493.6	42.2	3.0	0.0	582.0	0.0	356.0	226.0	0.0	582.0	112.4	694.4
NIGER	22.7	146.3	108.6	0.0	0.0	277.6	0.0	224.0	48.1	5.5	277.6	72.1	349.7
NIGERIA	64.9	315.3	166.5	0.0	0.5	547.2	0.0	492.2	52.6	2.4	547.2	149.2	696.4
PAKISTAN	382.4	276.5	283.6	2.0	0.0	944.5	0.0	933.0	4.1	7.4	944.5	322.7	1,267.2
PANAMA	21.6	208.9	21.7	0.0	0.0	252.2	0.0	252.2	0.0	0.0	252.2	38.0	290.2
PARAGUAY	53.5	92.8	33.7	0.0	0.0	180.0	0.0	180.0	0.0	0.0	180.0	24.6	204.6
PERU	105.5	395.5	77.7	0.0	0.0	578.7	0.0	513.5	62.0	3.2	578.7	381.4	960.1
PHILIPPINES	135.8	414.0	273.0	0.0	0.0	822.8	0.0	685.1	122.7	15.0	822.8	226.8	1,049.6
POLAND	128.8	802.4	108.7	0.0	0.0	1,039.9	0.0	782.3	89.1	168.5	1,039.9	193.0	1,232.9
PORTUGAL	50.6	254.4	9.5	0.0	0.0	314.5	0.0	311.3	3.2	0.0	314.5	62.0	376.5
ROMANIA	155.3	602.7	255.3	0.0	104.0	1,117.3	33.0	913.6	120.9	49.8	1,117.3	605.7	1,723.0
SAUDI ARABIA	57.1	0.0	16.7	0.0	0.0	73.8	0.0	73.8	0.0	0.0	73.8	0.0	73.8
SENEGAL	24.3	51.9	18.4	0.0	0.0	94.6	0.0	94.6	0.0	0.0	94.6	24.3	118.9
SIERRA LEONE	23.9	149.1	60.1	0.0	0.0	233.1	0.0	233.1	0.0	0.0	233.1	54.1	287.2
SINGAPORE	30.0	0.0	0.0	0.0	0.0	30.0	0.0	30.0	0.0	0.0	30.0	0.0	30.0
SLOVAKIA	109.4	104.2	58.8	0.0	0.0	272.4	0.0	228.3	0.0	44.1	272.4	114.8	387.2
SLOVENIA	98.1	166.9	20.0	0.0	0.0	285.0	0.0	185.4	80.2	19.4	285.0	23.2	308.2
SRI LANKA	99.5	220.9	230.9	0.0	0.0	551.3	0.0	495.3	7.9	48.1	551.3	167.6	718.9
SUDAN	60.0	119.6	80.7	0.0	0.0	260.3	0.0	260.3	0.0	0.0	260.3	96.0	356.3
SYRIAN ARAB REP.	56.1	877.7	175.1	0.0	0.0	1,108.9	0.0	910.3	176.8	21.8	1,108.9	355.2	1,464.1
THAILAND	211.6	229.0	243.3	0.0	18.6	702.5	0.0	516.5	116.5	69.5	702.5	304.3	1,006.8
TUNISIA	49.6	416.8	54.3	9.3	0.0	530.0	0.0	522.5	7.5	0.0	530.0	252.0	782.0
TURKEY	51.9	212.0	116.8	0.0	0.0	380.7	5.2	371.3	0.0	4.2	380.7	142.6	523.3
UGANDA	11.4	236.4	142.4	0.0	0.0	390.2	0.0	390.2	0.0	0.0	390.2	145.6	535.8
UK (HONG KONG)	8.2	0.0	0.0	0.0	0.0	8.2	0.0	8.2	0.0	0.0	8.2	11.0	19.2
UKRAINE	58.8	66.2	38.7	0.0	0.0	163.7	0.0	150.5	0.0	13.2	163.7	132.0	295.7
URUGUAY	50.9	562.0	56.8	0.0	0.0	669.7	0.0	621.0	45.4	3.3	669.7	83.0	752.7
UZBEKISTAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.5	88.5
UNITED ARAB EMIRATES	46.2	207.7	0.0	0.0	0.0	253.9	0.0	107.7	146.2	0.0	253.9	81.5	335.4
UNITED REP. OF TANZANIA	445.1	1,390.8	186.9	0.0	130.5	2,153.3	0.0	1,392.9	740.4	20.0	2,153.3	800.5	2,953.8
VENEZUELA	60.3	235.0	48.5	0.0	0.0	343.8	0.0	343.8	0.0	0.0	343.8	80.0	423.8
VIET NAM	36.4	393.5	228.9	(0.4)	0.0	658.4	0.0	658.4	0.0	0.0	658.4	251.6	910.0
ZAIRE	0.0	81.2	140.0	0.0	0.0	221.2	0.0	221.2	0.0	0.0	221.2	142.7	363.9
ZAMBIA	66.6	76.4	46.4	0.0	0.0	189.4	0.0	178.6	0.0	10.8	189.4	101.0	290.4
ZIMBABWE	56.8	121.0	56.4	0.0	0.0	234.2	0.0	209.3	24.9	0.0	234.2	68.8	303.0
<b>SUB-TOTAL</b>	<b>7,645.5</b>	<b>21,041.7</b>	<b>8,904.2</b>	<b>18.4</b>	<b>363.1</b>	<b>37,972.9</b>	<b>265.1</b>	<b>32,061.5</b>	<b>4,312.7</b>	<b>1,333.6</b>	<b>37,972.9</b>	<b>16,411.7</b>	<b>54,384.6</b>

Recipient	ASSISTANCE PROVIDED, BY TYPE						ASSISTANCE PROVIDED, BY SOURCE					Unliq. oblig.	TOTAL
	Experts	Equipment	Fellowships	Training Courses	Sub-contracts	Total	UNDP	TACF	Extra-bud.	In kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
<b>Intercountry Projects</b>													
INTERREGIONAL	988.6	10.0	0.0	3,020.3	0.0	4,018.9	0.0	3,852.9	80.8	85.2	4,018.9	717.7	4,736.6
REGIONAL AFRICA	921.2	740.8	0.0	893.9	0.0	2,555.9	0.0	2,190.9	362.4	2.6	2,555.9	885.4	3,441.3
REGIONAL EUROPE & MIDDLE EAST	1,392.4	208.1	0.0	897.5	115.5	2,613.5	125.8	2,294.3	127.6	65.8	2,613.5	1,057.7	3,671.2
REGIONAL ASIA & PACIFIC	947.6	301.3	0.0	1,267.6	135.2	2,651.7	646.4	1,274.1	532.5	198.7	2,651.7	1,448.2	4,099.9
REGIONAL LATIN AMERICA	528.8	632.4	0.0	1,414.7	58.1	2,634.0	68.1	2,174.8	324.4	66.7	2,634.0	1,091.8	3,725.8
REGIONAL WEST ASIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	4.9
<b>SUB-TOTAL</b>	<b>4,778.6</b>	<b>1,892.6</b>	<b>0.0</b>	<b>7,494.0</b>	<b>308.8</b>	<b>14,474.0</b>	<b>840.3</b>	<b>11,787.0</b>	<b>1,427.7</b>	<b>419.0</b>	<b>14,474.0</b>	<b>5,205.7</b>	<b>19,679.7</b>
<b>MISCELLANEOUS</b>													
MISCELLANEOUS	162.0	306.1	123.2	104.9	3.6	699.8	0.0	699.8	0.0	0.0	699.8	155.1	854.9
<b>GRAND TOTAL</b>	<b>12,586.1</b>	<b>23,240.4</b>	<b>9,027.4</b>	<b>7,617.3</b>	<b>675.5</b>	<b>53,146.7</b>	<b>1,105.4</b>	<b>44,548.3</b>	<b>5,740.4</b>	<b>1,752.6</b>	<b>53,146.7</b>	<b>21,772.5</b>	<b>74,919.2</b>

**TABLE 8**  
**FINANCIAL SUMMARY: 1958-1994**  
(in thousands of dollars)

Recipient	Assistance provided, by type						Assistance provided, by source				
	Experts	Equipment	Fellowships	Training courses	Sub-contracts	Total	UNDP	Agency	Extra-bud. <sup>a)</sup>	In kind	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
AFGHANISTAN	394.6	471.9	237.4	0.0	0.0	1,103.9	92.9	929.2	0.0	81.8	1,103.9
ALBANIA	286.3	2,174.4	573.2	38.5	0.0	3,072.4	275.2	2,733.6	0.0	63.6	3,072.4
ALGERIA	771.7	3,574.3	851.4	0.0	0.0	5,197.4	21.7	5,024.6	0.0	151.1	5,197.4
ARGENTINA	4,311.8	3,357.7	2,166.2	2.5	3.1	9,841.3	5,148.9	4,105.5	17.5	569.4	9,841.3
ARMENIA	126.7	4.9	0.0	0.0	0.0	131.6	0.0	126.7	0.0	4.9	131.6
BANGLADESH	1,558.6	6,990.6	3,822.0	0.0	0.0	12,371.2	63.8	8,784.1	1,883.4	1,639.9	12,371.2
BELARUS	6.4	260.8	17.0	0.0	0.0	284.2	0.0	84.3	199.9	0.0	284.2
BOLIVIA	812.7	3,216.0	583.4	27.1	0.0	4,639.2	159.5	3,616.0	686.1	177.6	4,639.2
BRAZIL	7,217.6	8,545.1	3,403.1	0.0	0.0	19,165.8	5,674.9	9,213.5	3,389.3	888.1	19,165.8
BULGARIA	763.2	5,508.6	3,742.1	0.0	474.8	10,488.7	543.9	8,031.6	886.7	1,026.5	10,488.7
CAMEROON	615.8	892.7	372.4	0.0	0.0	1,880.9	297.3	1,476.3	88.3	19.0	1,880.9
CAPE VERDE	3.5	0.1	0.0	0.0	0.0	3.6	3.6	0.0	0.0	0.0	3.6
CHILE	3,512.4	5,194.3	2,280.8	0.0	0.0	10,987.5	3,615.1	6,588.6	251.3	532.5	10,987.5
CHINA	2,886.3	3,962.6	4,456.7	6.3	8.1	11,320.0	2,984.3	7,266.3	626.6	442.8	11,320.0
COLOMBIA	1,963.9	5,155.2	1,446.5	0.0	0.0	8,565.6	1,693.6	5,034.9	1,087.6	749.5	8,565.6
COSTA RICA	1,202.2	2,064.3	437.8	0.0	7.0	3,711.3	618.1	2,512.2	383.5	197.5	3,711.3
COTE D'IVOIRE	618.7	1,226.6	282.7	0.0	0.0	2,128.0	73.4	1,904.6	119.8	30.2	2,128.0
CROATIA	66.0	355.8	51.7	0.0	0.0	473.5	0.0	459.6	0.0	13.9	473.5
CUBA	1,041.6	7,767.2	1,356.4	0.0	73.9	10,239.1	2,259.5	7,676.1	113.1	190.4	10,239.1
CYPRUS	226.8	1,287.6	274.7	0.0	31.0	1,820.1	24.1	1,423.0	205.9	167.1	1,820.1
CZECH & SLOVAK F.R.	122.0	219.9	1,512.0	0.0	0.0	1,853.9	6.2	1,301.8	77.7	468.2	1,853.9
CZECH REPUBLIC	142.7	6.4	171.8	0.0	0.0	320.9	0.0	126.4	22.4	172.1	320.9
DEM. P.R. KOREA	493.6	5,142.2	1,032.9	0.0	0.0	6,668.7	0.0	6,137.7	52.6	478.4	6,668.7
DOMINICAN REP.	336.3	1,301.4	357.3	0.0	0.0	1,995.0	0.0	1,958.9	3.9	32.2	1,995.0
ECUADOR	1,815.5	5,806.0	1,160.6	2.0	16.9	8,801.0	547.5	6,451.7	1,299.2	502.6	8,801.0
EGYPT	4,459.2	14,100.7	5,571.9	99.6	1,260.8	25,492.2	2,139.5	12,209.1	8,309.0	2,834.6	25,492.2
EL SALVADOR	468.1	1,380.0	284.3	0.0	0.0	2,132.4	14.1	1,569.1	371.4	177.8	2,132.4
ESTONIA	0.8	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.8	0.8
ETHIOPIA	801.4	1,736.5	962.9	0.0	0.0	3,500.8	437.5	2,822.4	48.8	192.1	3,500.8
GABON	89.6	90.7	29.3	0.0	0.0	209.6	0.0	197.0	0.0	12.6	209.6
GHANA	1,190.5	4,666.6	3,257.8	0.0	0.0	9,114.9	354.5	5,983.5	1,211.4	1,565.5	9,114.9
GREECE	2,101.5	3,085.5	1,458.4	0.0	0.0	6,645.4	1,561.9	3,599.8	757.7	726.0	6,645.4
GUATEMALA	648.6	2,633.5	631.3	0.0	224.9	4,138.3	56.2	3,034.1	925.9	122.1	4,138.3
HAITI	81.4	161.2	14.8	0.0	0.9	258.3	0.9	257.4	0.0	0.0	258.3
HONDURAS	0.0	0.0	0.7	0.0	0.0	0.7	0.0	0.7	0.0	0.0	0.7
HUNGARY	463.9	9,014.6	2,398.1	0.0	0.0	11,876.6	720.3	9,296.4	1,153.9	706.0	11,876.6
ICELAND	76.6	798.3	152.3	0.0	0.0	1,027.2	0.0	846.9	53.2	127.1	1,027.2
INDIA	1,015.8	3,801.6	2,709.9	0.0	0.0	7,527.3	2,920.3	1,293.2	2,149.0	1,164.8	7,527.3
INDONESIA	6,082.1	6,102.1	3,859.0	7.2	38.0	16,088.4	2,512.1	9,666.8	2,491.3	1,418.2	16,088.4
IRAN, I.R.	2,416.1	4,870.0	2,175.9	0.0	211.7	9,673.7	2,122.8	6,535.1	615.5	400.3	9,673.7
IRAQ	882.1	1,315.6	1,024.5	0.0	18.3	3,240.5	242.5	2,540.2	25.0	432.8	3,240.5
IRELAND	6.7	42.7	19.4	0.0	0.0	68.8	0.0	57.3	10.0	1.5	68.8
JAMAICA	383.0	1,027.3	85.9	0.0	55.0	1,551.2	15.3	1,356.8	108.3	70.8	1,551.2
JORDAN	959.5	1,838.1	558.2	0.0	0.0	3,355.8	89.3	2,836.7	316.0	113.8	3,355.8

Recipient	Assistance provided, by type						Assistance provided, by source				
	Experts	Equip-ment	Fellow-ships	Training courses	Sub-con-tracts	Total	UNDP	Agency	Extra-bud. <sup>(a)</sup>	In kind	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
KAZAKHSTAN	7.6	1.1	0.0	0.0	32.5	41.2	0.0	41.2	0.0	0.0	41.2
KENYA	1,178.9	2,395.9	1,545.4	0.0	0.0	5,120.2	97.2	3,284.7	1,067.4	670.9	5,120.2
KOREA, REP. OF	4,684.7	2,251.0	5,189.8	0.0	0.0	12,125.5	1,206.8	6,898.4	1,551.4	2,468.9	12,125.5
KYRGYZSTAN	18.8	0.0	0.0	0.0	0.0	18.8	0.0	18.8	0.0	0.0	18.8
LATVIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LEBANON	270.5	382.6	142.6	0.0	0.0	795.7	139.3	601.8	31.4	23.2	795.7
LIBERIA	117.3	29.0	0.0	0.0	0.0	146.3	60.2	29.8	0.0	56.3	146.3
LIBYAN A.J.	1,084.0	1,149.4	1,554.0	0.0	0.0	3,787.4	7.3	3,124.1	563.6	92.4	3,787.4
LITHUANIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MADAGASCAR	1,530.8	2,096.7	416.3	0.0	0.0	4,043.8	1,436.6	2,295.7	244.2	67.3	4,043.8
MALAWI	5.1	0.0	0.0	0.0	0.0	5.1	5.1	0.0	0.0	0.0	5.1
MALAYSIA	2,791.1	4,652.8	2,265.6	0.0	0.0	9,709.5	1.6	7,695.3	1,385.7	626.9	9,709.5
MALI	954.1	1,780.7	568.0	0.0	0.0	3,302.8	13.4	3,001.8	143.4	144.2	3,302.8
MAURITIUS	217.3	514.7	114.3	0.0	0.0	846.3	0.0	842.5	3.8	0.0	846.3
MEXICO	3,985.7	3,685.2	2,256.4	0.0	564.8	10,492.1	419.3	6,668.7	2,369.7	1,034.4	10,492.1
MOLDOVA	0.0	2.1	0.0	0.0	0.0	2.1	0.0	2.1	0.0	0.0	2.1
MONGOLIA	965.7	2,817.6	790.5	0.0	0.0	4,573.8	0.0	4,538.4	10.6	24.8	4,573.8
MOROCCO	2,272.3	3,177.4	1,275.6	0.0	18.0	6,743.3	909.6	4,539.9	881.3	412.5	6,743.3
MYANMAR	1,176.6	2,242.4	614.4	0.0	0.0	4,033.4	537.0	3,389.8	0.0	106.6	4,033.4
NAMIBIA	142.6	84.5	18.9	0.0	0.0	246.0	0.0	242.2	0.0	3.8	246.0
NICARAGUA	317.1	1,561.0	269.7	3.0	0.0	2,150.8	0.0	1,918.1	226.0	6.7	2,150.8
NIGER	531.1	1,331.1	391.2	0.0	0.0	2,253.4	0.0	2,060.7	105.0	87.7	2,253.4
NIGERIA	3,476.1	4,898.0	2,824.5	0.0	298.0	11,496.6	980.9	5,042.6	4,259.0	1,214.1	11,496.6
PAKISTAN	2,979.9	5,540.8	4,924.2	47.0	112.0	13,603.9	1,842.0	9,896.2	426.7	1,439.0	13,603.9
PANAMA	573.8	1,854.1	372.3	0.0	0.0	2,800.2	4.1	2,442.7	212.3	141.1	2,800.2
PARAGUAY	447.6	1,612.8	428.1	0.0	0.0	2,488.5	0.0	2,214.2	149.7	124.6	2,488.5
PERU	4,173.9	8,226.4	1,889.1	2.7	58.6	14,350.7	3,907.6	6,403.6	3,121.6	917.9	14,350.7
PHILIPPINES	2,964.8	5,600.0	4,590.1	0.0	90.8	13,245.7	1,964.4	7,341.4	1,582.8	2,357.1	13,245.7
POLAND	555.7	8,015.0	3,783.7	5.6	0.0	12,360.0	202.9	9,602.4	1,546.3	1,008.4	12,360.0
PORTUGAL	642.2	4,859.0	510.0	0.0	0.0	6,011.2	0.0	4,650.7	1,170.7	189.8	6,011.2
ROMANIA	1,935.8	6,688.9	2,026.0	0.0	328.5	10,979.2	3,256.1	6,827.3	397.3	498.5	10,979.2
SAUDI ARABIA	322.7	49.9	111.2	0.0	0.0	483.8	0.0	456.5	11.2	16.1	483.8
SENEGAL	609.7	1,612.3	328.6	0.0	0.0	2,550.6	345.8	1,977.8	154.7	72.3	2,550.6
SIERRA LEONE	585.7	860.0	412.2	0.0	0.0	1,857.9	174.5	1,547.9	12.4	123.1	1,857.9
SINGAPORE	548.6	1,256.8	232.8	0.0	0.0	2,038.2	0.0	1,868.4	103.3	66.5	2,038.2
SLOVAKIA	181.9	138.8	95.9	0.0	0.0	416.6	0.0	315.0	2.0	99.6	416.6
SLOVENIA	218.8	206.1	47.2	0.0	0.0	472.1	0.0	281.2	137.3	53.6	472.1
SPAIN	386.0	95.4	105.0	0.0	0.0	586.4	0.0	507.3	56.0	23.1	586.4
SRI LANKA	1,470.0	4,245.2	2,404.2	0.0	0.0	8,119.4	307.9	6,328.6	760.3	722.6	8,119.4
SUDAN	1,080.4	2,968.3	2,635.9	0.0	13.4	6,698.0	296.7	5,118.5	580.2	702.6	6,698.0
SYRIAN A.R.	1,137.5	4,229.1	1,245.1	0.0	255.5	6,867.2	693.2	5,099.7	942.2	132.1	6,867.2
THAILAND	4,013.2	6,267.6	6,505.4	19.0	22.4	16,827.6	2,025.3	9,033.8	2,771.1	2,997.4	16,827.6
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA	0.0	0.0	2.9	0.0	0.0	2.9	0.0	2.9	0.0	0.0	2.9
TUNISIA	959.3	2,486.7	565.8	9.3	0.0	4,021.1	141.2	3,152.8	541.8	185.3	4,021.1
TURKEY	2,689.3	4,436.6	3,917.9	0.0	278.7	11,322.5	2,568.8	6,646.9	130.8	1,976.0	11,322.5
UGANDA	553.7	1,295.0	711.2	0.0	0.0	2,559.9	131.0	2,373.7	0.0	55.2	2,559.9
UK (HONG KONG)	200.1	213.0	62.7	0.0	0.0	475.8	0.0	466.8	0.0	9.0	475.8

Recipient	Assistance provided, by type						Assistance provided, by source				
	Experts	Equip- ment	Fellow- ships	Training courses	Sub- con- tracts	Total	UNDP	Agency	Extra- bud. <sup>a)</sup>	In kind	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
UKRAINE	258.7	198.0	87.3	0.0	0.0	544.0	0.0	484.6	0.0	59.4	544.0
URUGUAY	1,053.4	3,718.3	720.0	0.0	0.0	5,491.7	193.1	3,968.5	1,004.0	326.1	5,491.7
USSR	0.0	50.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	50.0
U.A. EMIRATES	188.1	1,207.4	28.1	0.0	0.0	1,423.6	0.0	579.9	842.3	1.4	1,423.6
U.R. TANZANIA	1,506.2	3,592.8	1,378.6	0.0	130.5	6,608.1	9.6	5,216.1	1,155.4	227.0	6,608.1
VENEZUELA	1,651.3	2,460.4	726.4	24.7	0.0	4,862.8	396.5	4,062.8	191.0	212.5	4,862.8
VIET NAM	974.7	6,489.6	3,069.7	23.3	0.0	10,557.3	31.4	9,566.6	139.5	819.8	10,557.3
YUGOSLAVIA	1,587.8	7,272.0	2,817.1	0.0	37.3	11,714.2	3,061.7	5,780.1	1,936.3	936.1	11,714.2
ZAIRE	834.9	2,466.1	1,199.8	0.0	0.0	4,500.8	578.8	3,265.2	206.5	450.3	4,500.8
ZAMBIA	1,793.5	3,373.9	1,053.6	0.0	0.0	6,221.0	152.5	5,601.1	180.9	286.5	6,221.0
ZIMBABWE	314.0	578.4	217.9	0.0	0.0	1,110.3	0.0	1,044.1	42.5	23.7	1,110.3
OTHER COUNTRIES <sup>b)</sup>	851.6	1,086.0	1,907.0	0.0	0.0	3,844.6	736.4	1,803.0	26.5	1,278.7	3,844.6
<b>SUB-TOTAL</b>	<b>119,396.0</b>	<b>271,455.5</b>	<b>127,134.9</b>	<b>317.8</b>	<b>4,665.4</b>	<b>522,969.6</b>	<b>66,126.5</b>	<b>349,284.6</b>	<b>63,319.3</b>	<b>44,239.2</b>	<b>522,969.6</b>
INTERREGIONAL	15,566.2	5,269.4	17,041.9	21,695.1	563.8	60,136.4	1,845.2	50,513.5	4,648.8	3,128.9	60,136.4
REGIONAL AFRICA	5,997.9	3,981.7	353.7	4,480.4	129.7	14,943.4	332.8	13,445.3	1,039.3	126.0	14,943.4
REG. ARAB STATE	36.3	11.3	39.0	7.0	0.0	93.6	93.6	0.0	0.0	0.0	93.6
REG. ASIA & PACIFIC	9,920.7	5,298.8	2,737.0	10,308.5	754.2	29,019.2	10,440.3	10,321.0	5,888.0	2,369.9	29,019.2
REG. EUROPE	3,903.8	1,547.7	113.5	2,933.1	1,879.7	10,377.8	428.2	9,012.9	666.2	270.5	10,377.8
REG. LATIN AMERICA	8,313.7	7,650.1	1,659.9	9,518.3	1,056.6	28,198.6	3,110.6	16,082.7	6,503.6	2,501.7	28,198.6
REG. MIDDLE EAST	5.8	1.2	5.3	0.0	0.0	12.3	12.3	0.0	0.0	0.0	12.3
<b>SUB-TOTAL</b>	<b>43,744.4</b>	<b>23,760.2</b>	<b>21,950.3</b>	<b>48,942.4</b>	<b>4,384.0</b>	<b>142,781.3</b>	<b>16,263.0</b>	<b>99,375.4</b>	<b>18,745.9</b>	<b>8,397.0</b>	<b>142,781.3</b>
MISCELLANEOUS	1,223.5	2,164.5	860.7	577.7	40.1	4,866.5	23.2	4,843.3	0.0	0.0	4,866.5
<b>GRAND TOTAL</b>	<b>164,363.9</b>	<b>297,380.2</b>	<b>149,945.9</b>	<b>49,837.9</b>	<b>9,089.5</b>	<b>670,617.4</b>	<b>82,412.7</b>	<b>453,503.3</b>	<b>82,065.2</b>	<b>52,636.2</b>	<b>670,617.4</b>

<sup>a)</sup> The assistance provided from extrabudgetary funds prior to 1977 is included under assistance "in kind".

<sup>b)</sup> Includes the following countries which have not received technical assistance during the last ten or more years: Austria, Chad, Democratic Kampuchea, Denmark, Finland, France, Germany, Israel, Italy, Japan, Kuwait, Monaco, the Netherlands, New Zealand, Niue, Norway, St. Christopher, Somalia, South Africa, Sweden, Switzerland and the United States of America.

**TABLE 9**  
**WOMEN'S PARTICIPATION IN TECHNICAL CO-OPERATION**

	1981			1993			1994		
	Total	of which women	% of women	Total	of which women	% of women	Total	of which women	% of women
<b>Fellows</b>	570	97	17.0	828	181	21.9	894	208	23.3
<b>Visiting scientists</b>	65	7	10.8	226	42	18.6	260	53	20.4
<b>Training course participants</b>	511	46	9.0	1450	331	22.8	1633	399	24.4
<b>Project counterparts</b>	519	64	12.3	1605	231	14.4	1458	210	14.4
<b>International experts</b>	319	7	2.2	1124	80	7.1	1217	83	6.8
<b>National experts</b>	12	0	0.0	488	59	12.1	580	56	9.7
<b>Lecturers</b>	119	2	1.7	395	43	10.9	402	38	9.5
<b>Other project personnel</b>	11	9	81.8	7	5	71.4	9	7	77.8
<b>TC Professional staff</b>	34	5	14.7	48	12	25.0	51	14	27.5
<b>TC General Service staff</b>	54	48	88.9	88	81	92.0	93	85	91.4

## Explanatory Notes to Annexes

### Annex I. Disbursements of extrabudgetary and in-kind contributions: 1994

Related to Table 5, this Annex shows, by donor and by type, the technical co-operation disbursements made during 1994 utilizing extrabudgetary resources and, separately, contributions in kind. The Agency must occasionally depend on donor countries for information about the value of in-kind inputs that have been provided.

### Annex II. Training courses: 1994

The courses organized by the Agency in 1994 are listed together with the number of participants and the amounts obligated. This is the only table in which local participants and participants not financed from training course resources are shown. Data on the more than 10 courses conducted for individual Member States are not included.

### Annex III. Published reports: 1994

Technical co-operation project reports published in 1994 are listed by country.

### Annex IV. Voluntary contributions pledged and paid to the Technical Assistance and Co-operation Fund for 1994

Data on voluntary contributions by Member States to the Technical Assistance and Co-operation Fund are given in this table. Figures reflect the status as at 31 December 1994. This Annex shows a grand total of \$59,365,800; however, all other tables in this report refer to the target of \$58,500,000 approved by the Board. The difference represents the contributions expected from new Member States since they were not included in the 1994 scale of assessment.

### Annex V. Cost-free fellowships offered and awarded: 1994

Information is made available in this table on cost-free fellowships offered by Member States. Columns 3 and 4 show the number of fellows who started their training in 1994 and the duration in months (1994 and beyond) of their assignment. Columns 5 and 6 show information on all cost-free fellows receiving training in the calendar year 1994 regardless of when their assignment started.

### Annex VI. Approved and on-going UNDP projects as at 31 December 1994

This table includes two projects for which IAEA acts only as an associated agency.

## **Annex VII. Footnote-a/ projects made operational or extended during 1994**

These projects are shown with the source of the funds that made upgrading to operational status or extension possible.

## **Annex VIII. Approvals against the Reserve Fund in 1994**

Information is provided on Reserve Fund approvals for new and existing projects.

## **Annex IX. Net programme changes by recipient: 1994**

In accordance with the Revised Guiding Principles, information on changes to approved projects is provided. As 1,360 changes were involved, the list only shows the net changes that took place in each country. Detailed data by project are available on request.

## **Annex X. Net rephasings undertaken during 1994**

As a result of dynamic programming, which was approved as part of the Board's 1983 policy review, it is possible for the Secretariat to reallocate project funds originally intended for use in the current year to future years and vice versa. This mechanism, known as "rephasing", may be invoked in cases where project requirements differ from those originally foreseen, so as to keep project plans realistic. The Annex shows only net changes per country to projects rephased in 1994.

## **Annex XI. Extrabudgetary contributions for activities relating to technical co-operation which are not included in the technical co-operation programme: 1994**

At the request of some Member States, information is provided in this annex concerning activities which have technical co-operation aspects but which are initiated and implemented without the involvement of the Department of Technical Co-operation. They are therefore not included in the technical co-operation databases from which all other tables and figures in this report are produced.

## **Annex XII. Projects concluded during 1994: Achievements**

Brief accomplishment summaries are given for projects - excluding training courses - which were "operationally" completed during 1994. For the projects cancelled during this period, the reasons leading to their cancellation are given. A project is "operationally completed" when all experts have completed their assignments, all equipment has been delivered and all fellows have returned home. As bills may still be outstanding, "financial completion" may in some cases still follow. The achievement summaries show only what was accomplished during the lifetime of the project and indicate the degree to which the objectives had been met at the time of the project's completion. The achievements are sorted by country alphabetically. In each case the description is preceded by the objectives of the project.

## ANNEX I

### DISBURSEMENTS OF EXTRABUDGETARY AND IN-KIND CONTRIBUTIONS: 1994

#### A. Assistance for activities where donor is not recipient (in thousands of dollars)

Donor	Extrabudgetary						In-kind					Total
	Experts	Equip-ment	Fellow-ships	Training courses	Sub-con-tracts	Sub-total	Experts	Equip-ment	Fellow-ships	Training courses	Sub-total	
<b>Countries</b>												
ALGERIA	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	1.4	1.4
ARGENTINA	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0.0	0.0	8.4	17.2	17.2
AUSTRALIA	75.4	0.0	0.0	25.1	40.6	141.1	3.6	0.0	46.4	30.0	80.0	221.1
AUSTRIA	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	1.9	6.1	6.1
BELGIUM	103.2	0.0	0.0	0.0	34.4	137.6	3.4	0.0	0.0	0.0	3.4	141.0
BRAZIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	9.9	9.9
BULGARIA	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	5.4	5.4
CANADA	14.0	159.7	0.0	0.0	0.0	173.7	27.6	0.0	0.0	6.1	33.7	207.4
CHILE	0.0	0.0	0.0	5.0	0.0	5.0	0.0	0.0	0.0	2.4	2.4	7.4
CHINA	0.0	0.0	0.0	0.0	0.0	0.0	3.2	20.0	21.8	43.4	88.4	88.4
CZECH REPUBLIC	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.6	2.2	2.2
DENMARK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	3.6	10.7	10.7
DOMINICAN REP.	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	3.2	3.2
EGYPT	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	2.6	2.6
ESTONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	15.4	15.4
ETHIOPIA	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	1.4	1.4
FINLAND	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	4.0	4.0
FRANCE	83.2	213.5	4.6	27.5	0.0	328.8	16.9	0.0	23.2	3.4	43.5	372.3
GERMANY	49.1	139.9	0.0	26.5	11.8	227.3	8.6	0.0	32.3	9.9	50.8	278.1
HUNGARY	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.8	3.6	3.6
INDIA	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	15.4	25.8	25.8
ITALY	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	2.5	3.3	3.3
JAPAN	211.2	0.0	0.0	246.4	0.0	457.6	29.6	144.0	0.0	0.0	173.6	631.2
KOREA, REPUBLIC OF	14.8	0.0	0.0	0.0	0.0	14.8	0.0	0.0	0.0	86.5	86.5	101.3
MEXICO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	7.5	7.5
NETHERLANDS	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6	0.6
NEW ZEALAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
PERU	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	2.8	2.8
POLAND	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	3.0	3.0
ROMANIA	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	8.2	11.0	11.0
RUSSIAN FED.	0.0	0.0	0.0	0.0	0.0	0.0	34.2	0.0	0.0	0.0	34.2	34.2
SENEGAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	6.5	6.5
SINGAPORE	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	1.2	1.2
SLOVAKIA	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	1.4	1.4
SOUTH AFRICA	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	1.8	1.8
SPAIN	43.4	46.3	11.7	5.8	207.6	314.8	11.6	0.0	99.6	0.8	112.0	426.8
SWEDEN	39.7	26.9	0.0	59.5	0.0	126.1	0.0	0.0	0.0	1.6	1.6	127.7
THAILAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7	6.7
UNITED KINGDOM	279.6	587.5	77.0	26.4	0.5	971.0	22.4	0.0	22.4	1.9	46.7	1,017.7
UKRAINE	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	2.8	2.8
USA	412.1	1,211.4	0.0	20.0	57.0	1,700.5	78.6	0.0	731.5	12.8	822.9	2,523.4
VENEZUELA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	2.4	2.4
SUB-TOTAL	1,325.7	2,385.2	93.3	442.2	351.9	4,598.3	302.7	164.0	984.3	289.6	1,740.6	6,338.9

Donor	Extrabudgetary						In-kind					Total
	Experts	Equip-ment	Fellow-ships	Training courses	Sub-con-tracts	Sub-total	Experts	Equip-ment	Fellow-ships	Training courses	Sub-total	
<b>International Organizations</b>												
EUROPEAN UNION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	2.4	2.4
PAHO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	9.6	9.6
UNCTF	0.0	198.5	0.0	0.0	0.0	198.5	0.0	0.0	0.0	0.0	0.0	198.5
SUB-TOTAL	0.0	198.5	0.0	0.0	0.0	198.5	0.0	0.0	0.0	12.0	12.0	210.5
<b>GRAND TOTAL</b>	<b>1,325.7</b>	<b>2,583.7</b>	<b>93.3</b>	<b>442.2</b>	<b>351.9</b>	<b>4,796.8</b>	<b>302.7</b>	<b>164.0</b>	<b>984.3</b>	<b>301.6</b>	<b>1,752.6</b>	<b>6,549.4</b>

**B. Assistance for activities where donor is recipient**  
(in thousands of dollars)

Donor	Project Title	Project	Experts	Equipment	Fellowships	Total
BULGARIA	Site and seismic safety of nuclear power plants	BUL/9/012	0.0	73.7	0.0	73.7
CHILE	Mediterranean fruit fly eradication	CHI/5/015	0.0	24.7	6.3	31.0
CHINA	Safety analysis for PWR Fuels	CPR/4/008	0.0	29.8	0.0	29.8
	Radioimmunoassay	CPR/6/002	0.0	25.0	0.0	25.0
GHANA	Miniature neutron source reactor	GHA/1/010	0.0	59.0	0.0	59.0
IRAN, I.R.	Sero-monitoring of rinderpest using nuclear techniques	IRA/5/009	0.0	170.6	0.0	170.6
NICARAGUA	Upgrading radiotherapy services	NIC/6/004	0.0	226.0	0.0	226.0
PAKISTAN	Corrosion fatigue testing	PAK/4/037	0.0	3.9	0.0	3.9
	Design and safety review of Chasma Nuclear Power Plant	PAK/9/017	0.2	0.0	0.0	0.2
PORTUGAL	Neutron scattering spectrometer	POR/1/005	0.0	0.4	0.0	0.4
ROMANIA	Radioimmunoassay standardization and quality control	ROM/6/010	0.0	1.0	0.0	1.0
SYRIAN A.R.	Miniature neutron source reactor	SYR/4/004	0.0	128.8	0.0	128.8
	Isotope hydrology for improvement of water management	SYR/8/005	0.0	40.0	0.0	40.0
	Radiation protection (PHASE II)	SYR/9/007	0.0	8.0	0.0	8.0
UNITED ARAB EMIRATES	Radioactive environmental and food contamination	UAE/9/003	4.3	141.9	0.0	146.2
<b>TOTAL</b>			<b>4.5</b>	<b>932.8</b>	<b>6.3</b>	<b>943.6</b>

## ANNEX II

### TRAINING COURSES: 1994

Project title and code	Place(s) and dates	Source of Funds	Participation <sup>a</sup>			Amount(s) expended <sup>b</sup> (\$)
			(1)	(2)	(3)	
Interregional training course on electric system expansion planning (WASP), INT/0/057/001	Argonne, IL, USA 14 March - 6 May	Agency	30	0	0	230,658
Interregional training course on nuclear techniques in environmental research and monitoring, INT/2/009/001	Seibersdorf, Austria 29 August - 23 September Bratislava, Slovakia 5 September - 17 September Zagreb, Croatia 5 September - 17 September	Agency	25	0	0	114,448
Interregional training course on quality assurance in nuclear power plant operation and maintenance, INT/4/116/001	Buenos Aires, Argentina 31 October - 2 December	Agency	23	1	0	201,368
Interregional training course on qualification of NPP operation personnel, INT/4/117/001	Karlsruhe, Germany 4 October - 28 October	Agency	24	1	0	119,954
Interregional training course on nuclear fuel cycle activities: evaluation of options, INT/4/118/001	Gif-Sur-Yvette, France 24 October - 11 November	Agency	22	0	0	114,980
Interregional training course on nuclear electronics, INT/4/119/001	Xian, SN, China 21 March - 17 June	Agency	19	0	1	252,483
Interregional training course on interfacing in nuclear experiments, INT/4/120/001	Jakarta, Indonesia 1 August - 30 September	Agency	15	0	2	207,213
Interregional training course on use of radiation and isotopes in insect control and entomology, INT/5/131/001	Gainesville, FL, USA 4 May - 15 June	Agency USA	22	0	0	135,684 2,934
Interregional training course on advances in plant mutation techniques, INT/5/132/001	Seibersdorf, Austria 24 May - 1 July	Agency	23	0	0	202,388
Interregional training course on use of immunoassay and molecular methods for animal diseases diagnosis and control, INT/5/133/001	Seibersdorf, Austria 24 October - 25 November	Agency	25	0	0	186,665
Interregional training course on radiotracer and conventional techniques for studies of pesticides in food and the environment, INT/5/134/001	Seibersdorf, Austria 6 April - 13 May	Agency	20	0	0	132,944
Interregional training course on health effects of low-dose ionizing radiation, INT/6/044/001	Tokyo, Japan 28 February - 18 March	Agency	15	0	0	134,424
Interregional training course on techniques for environmental isotope analysis in hydrology and geochemistry, INT/8/029/001	Vienna, Austria 5 September - 24 September Neuherberg, Germany 25 September - 29 September	Agency	27	1	0	120,278
Interregional training course on use of PSA in the operation of nuclear power plants: risk-based prioritization of operational tasks, INT/9/138/001	Argonne, IL, USA 17 January - 4 February	Agency	31	1	0	140,768
Interregional training course on safety assessment methodologies for near-surface radioactive waste disposal facilities, INT/9/139/001	Argonne, IL, USA 14 February - 4 March	Agency	27	1	0	118,471
Interregional training course on prevention and management of accidents in operation of NPPs, INT/9/140/001	Argonne, IL, USA 16 May - 27 May Fredericton, New Brunswick, Canada 28 May - 10 June	Agency	31	2	0	155,087
Interregional post-graduate educational course on radiation protection, INT/9/141/001	Argonne, IL, USA 19 September - 18 November	Agency	23	0	0	207,116
Interregional training course on radiation protection, INT/9/142/001	Gif-Sur-Yvette, France 2 May - 6 July	Agency	24	0	0	198,052
Regional training course on interfacing of PCs with scientific equipment, RAF/4/004/005	Seibersdorf, Austria 6 June - 1 July	Agency	10	0	0	38,934
Regional workshop on troubleshooting and repair of typical power supplies applied in nuclear instruments and PCs, RAF/4/004/006	Lusaka, Zambia 5 September - 23 September	Agency	9	0	3	26,927
Regional training course on maintenance of multichannel analyzers, liquid scintillation counters and gamma counters (AFRA IV), RAF/4/009/001	Rabat, Morocco 28 November - 9 December	Agency	9	0	3	25,126
Regional workshop on troubleshooting, repair and maintenance of X-ray generator (Siemens model 710H) (AFRA IV), RAF/4/009/002	Nairobi, Kenya 5 December - 16 December	Agency	13	0	5	37,513
Fourth regional research workshop on biological nitrogen fixation, RAF/5/010/004	Nairobi, Kenya 14 March - 25 March	Agency	15	0	3	30,243

Project title and code	Place(s) and dates	Source of Funds	Participation <sup>a</sup>			Amount(s) expended <sup>b</sup> (\$)
			(1)	(2)	(3)	
Regional workshop on medfly release and control, RAF/5/013/007	Tozeur, Tunisia 5 September - 14 October	Agency	7	0	0	25,646
Regional training course on techno-economic feasibility of food irradiation (AFRA II), RAF/5/021/003	Addis Ababa, Ethiopia 14 November - 25 November	Agency	12	0	4	42,472
Regional training course on animal reproduction and nutrition (AFRA VIII), RAF/5/027/001	Debre Zeit, Ethiopia 23 May - 3 June	Agency	9	0	3	30,648
Regional workshop on diagnostic methods on trypanosomiasis, RAF/5/028/001	Nairobi, Kenya 16 May - 10 June	United Kingdom	13	0	0	31,794
Regional training course on in-vitro and mutation techniques for crop improvement (AFRA X), RAF/5/029/001	Legon-Accra, Ghana 5 December - 16 December	Agency	12	0	3	42,372
Regional training course on use of isotope and radiation techniques in soil fertility and plant nutrition studies, RAF/5/030/001	Nairobi, Kenya 6 June - 8 July	Agency	16	0	4	114,032
FAO/IAEA/SIDA regional workshop in field and laboratory studies on pesticides and non-target organisms, RAF/5/033/001	Arusha, U.R.Tanzania 30 November - 16 December	Sweden	7	0	1	45,245
Regional workshop on external quality assessment scheme (EQAS) in radioimmunoassay for thyroid related hormones, RAF/6/006/002	Harare, Zimbabwe 25 April - 29 April	Agency	14	0	7	33,222
Regional training course on hospital radiopharmacy, RAF/6/011/001	Rabat, Morocco 14 November - 25 November	Agency	12	0	0	51,171
Regional workshop on applications of XRF methods for monitoring of environmental pollution, RAF/8/015/003	Seibersdorf, Austria 17 October - 21 October	Agency	12	0	0	28,132
Regional training course on irradiation processing (AFRA III), RAF/8/016/002	Legon-Accra, Ghana 18 July - 29 July	Agency	6	0	4	42,860
Regional training course on non-destructive testing of ultrasonics (level II) (AFRA VI), RAF/8/017/002	Cairo, Egypt 24 January - 11 February	Agency	13	0	3	44,927
Regional training course on non-destructive testing of radiography (level II) (AFRA VI), RAF/8/017/003	Tunis, Tunisia 3 October - 21 October	Agency Spain	11	0	3	28,339 6,150
Regional training course on the use of nuclear techniques in sediment transport studies, RAF/8/020/001	Bamako, Mali 21 November - 2 December	Agency	16	0	4	60,411
Workshop on regional co-operation in radiation protection, RAF/9/005/011	Antananarivo, Madagascar 9 May - 12 May	Agency	16	0	0	44,917
Regional workshop on standardization of dose measurements at national calibration laboratories, RAF/9/005/012	Seibersdorf, Austria 7 November - 18 November	Agency	15	0	0	37,940
Regional training course on radioactive waste management techniques (AFRA I), RAF/9/007/002	Cairo, Egypt 28 May - 15 June	Agency	15	0	6	48,178
Regional training course on environmental radiation measurement and harmonization (AFRA IX), RAF/9/011/001	Rabat, Morocco 5 September - 16 September	Agency	8	0	5	36,645
Regional training course on radiation protection in medical practice: occupational protection of medical staff & protection of patient in diagnostic radiology and radiotherapy, RAF/9/012/001	Tunis, Tunisia 17 October - 4 November	Agency	9	0	5	63,581
Regional training course on system of notification, registration, licensing and control of radiation sources and installations, RAF/9/013/001	Dar Es Salaam, U.R.Tanzania 10 October - 4 November	Agency	14	0	5	76,629
Regional (RCA) training course on industrial application of non-destructive testing and evaluation, RAS/0/015/021	Taejeon, Korea, Republic of 30 June - 21 July	Korea, R.	15	0	0	gift in kind
Regional (RCA) workshop on external dose assessment techniques, RAS/0/015/022	Taiyuan, SX, China 19 July - 26 July	Agency	11	0	3	9,427
UNDP/RCA/IAEA regional seminar on radiation technology for biomedical applications, RAS/0/015/023	Shanghai, China 12 December - 16 December	Agency	10	0	6	9,374
Regional workshop on project design, evaluation and management of IAEA technical co-operation projects in the Asia and Pacific region, RAS/0/020/001	Bangi, Selangor, Malaysia 31 January - 9 February	Agency	22	5	2	74,024
Regional (RCA) workshop on quality assurance in nuclear medicine imaging - hardware and software aspects, RAS/4/008/003	Bangkok, Thailand 12 December - 16 December	Agency	13	0	3	34,660
Regional (RCA) workshop on upgrading of analogue gamma cameras with IBM PCs and relevant software, RAS/4/008/004	Bangi, Selangor, Malaysia 4 September - 22 September	Agency	14	0	2	59,205
Regional (RCA) training course on research reactor utilization, RAS/4/011/008	Sydney-Menai, Australia 26 April - 13 May	Agency	12	0	0	46,573
Regional research coordination meeting on the use of isotope in studies to improve yield and N <sub>2</sub> fixation of grain legumes in the tropics and sub-tropics of Asia, RAS/5/021/008	Hyderabad, India 7 November - 11 November	UNDP	6	0	0	39,936

Project title and code	Place(s) and dates	Source of Funds	Participation <sup>a</sup>			Amount(s) expended <sup>b</sup> (\$)
			(1)	(2)	(3)	
IAEA/FAO regional training course on nuclear and associated techniques for pesticide studies, RAS/5/026/001	New Delhi, India 24 October - 25 November	Agency	12	0	4	97,941
Regional (RCA) training on the use of the computers in nuclear medicine, RAS/6/016/004	Lucas Heights, Australia 31 October - 2 December	Agency	12	0	0	127,536
Regional training course on radioimmunoassay and immunoscintigraphy for the early detection and management of cancer, RAS/6/023/001	Seoul, Korea, Republic of 5 September - 16 September	Agency	19	0	3	86,792
Regional (RCA) training course on open learning techniques applied to radiation sterilization of tissue grafts, RAS/7/003/007	Suzhou, JS, China 13 June - 24 June	Agency	19	0	4	93,303
Regional training course on strategies and methodologies for applied marine radioactivity studies, RAS/7/007/001	Lucas Heights, Australia 31 October - 11 November	Agency	15	1	0	151,652
Regional executive management seminar on the application of nucleonic control systems to coal processing operations, RAS/8/064/006	Mae Moh, Lampang, Thailand 28 November - 30 November	Australia	5	0	8	20,399
Regional workshop on the application of nucleonic control systems to coal processing operations, RAS/8/064/007	Mae Moh, Lampang, Thailand 28 November - 9 December	Australia	10	0	11	29,116
Regional training course on fundamental aspects of radiation technology and environmental applications, RAS/8/070/003	Takasaki, Gunma, Japan 6 June - 17 June	Japan	15	4	0	66,171
Regional seminar on electron beam technology for purification of flue gases, RAS/8/070/004	Takasaki, Gunma, Japan 17 October - 21 October	Japan	15	4	0	58,160
UNDP/RCA/IAEA regional workshop on radiational processing in industry - process control and dosimetry, RAS/8/070/005	Takasaki, Gunma, Japan 19 December - 22 December	Japan	14	0	0	48,867
Regional workshop on environmental and industrial applications to nuclear analytical techniques, RAS/8/071/001	Bombay, India 24 January - 11 February	UNDP	14	0	1	44,847
Regional training course on application of isotope techniques in process optimization, RAS/8/071/003	Bombay, India 7 November - 25 November	UNDP	10	0	3	57,710
Regional workshop on use of tracer technology in surface water effluent studies, RAS/8/071/004	Bangi, Selangor, Malaysia 5 September - 21 September	UNDP	19	0	1	70,282
Regional training course on radiation sterilization - validation, routine control and application of ISO standard, RAS/8/071/005	Bangkok, Thailand 4 July - 15 July	UNDP	13	7	3	40,928
Regional (RCA) workshop on calibration of dosimeters and survey instruments for photons, RAS/9/006/012	Ibaraki, Japan 28 November - 2 December	Japan	13	1	0	48,072
Regional workshop on off-site planning and countermeasures for radiological emergencies, RAS/9/013/001	Lucas Heights, Australia 12 September - 23 September	Agency	25	0	0	108,695
Regional training course on nuclear power plant management, RER/0/008/001	Trnava, Slovakia 12 September - 16 September	Agency	13	0	3	37,314
Regional training course on integrated energy and electricity planning for nuclear power development with emphasis on the ENPEP, RER/0/009/001	PAKS, Hungary 5 September - 14 October	Agency	29	0	0	176,190
Regional workshop on steam generators collectors inspection, RER/4/003/006	Loviisa, Finland 29 August - 31 August	Agency	14	0	0	29,254
Regional training course on advanced PSA methods and PSA applications in nuclear power plants, RER/4/006/001	Madrid, Spain 20 June - 1 July	Agency	13	0	0	39,860
Regional training course on nuclear power plant maintenance and maintenance personnel training, RER/4/006/002	Obninsk, Russian Federation 22 August - 9 September	Agency	14	0	6	71,133
Regional training course on nuclear instrumentation, RER/4/009/001	Istanbul, Turkey 31 October - 9 December	Agency	8	0	5	144,283
Regional training course on mutation breeding for improvement of stress tolerance in basic food crops, RER/5/008/001	Damascus, Syrian A.R. 7 November - 1 December	Agency	9	0	5	64,252
Regional training course on the production and control of TC-99M generators and TC-99M radiopharmaceuticals, RER/6/005/002	Teheran, Iran 14 May - 30 May	Agency	5	0	8	27,892
Regional training course on myocardial scintigraphy with TC-99M based radiopharmaceuticals, RER/6/006/001	Budapest, Hungary 19 September - 27 September	Agency	17	1	6	50,371
Regional training course on early warning environmental radiation monitoring systems (EWERMS), RER/9/003/009	Amman, Jordan 11 April - 20 April	Agency	14	0	4	25,846
Regional workshop on radioactive waste management at WWER type reactors, RER/9/010/001	San Francisco, USA 7 March - 11 March	Agency	14	1	0	38,620
Regional training course on interim storage of spent fuel from nuclear power plants, RER/9/021/001	Madrid, Spain 14 November - 25 November	Agency	18	0	0	81,231

Project title and code	Place(s) and dates	Source of Funds	Participation <sup>a</sup>			Amount(s) expended <sup>b</sup> (\$)
			(1)	(2)	(3)	
Regional training course on strategies and methodologies for applied marine radioactivity and environmental isotopes studies, RER/9/022/001	Istanbul, Turkey 14 November - 25 November	Agency	8	0	4	66,650
Regional training course on regulatory control of NPPs, RER/9/023/001	Trnava, Slovakia 31 October - 11 November	Agency	22	0	2	68,311
Regional training course on operational safety assessment techniques, RER/9/028/001	Madrid, Spain 3 October - 21 October	Agency	29	2	0	156,872
Regional training course on safe transport of radioactive material, RER/9/029/001	Braunschweig, Germany 3 May - 19 May	Agency	25	1	0	99,991
Regional workshop on radiation protection and waste management in nuclear medicine, RER/9/030/001	Tallinn, Estonia 12 April - 22 April	Sweden	7	0	6	25,355
Regional workshop on development of methodologies for evaluation of analytical data (ARCAL IV), RLA/2/003/020	Montevideo, Uruguay 27 June - 8 July	Agency	4	0	1	22,655
Regional II meeting of project investigators (ARCAL IV), RLA/2/003/021	Panama City, Panama 25 July - 29 July	Agency	11	0	0	26,401
Regional workshop on production and labelling of radiopharmaceuticals for palliative therapy of metastatic bone pain (ARCAL XV), RLA/2/007/006	Santiago, Chile 28 November - 9 December	Agency	9	0	1	29,717
Advanced regional workshop on the synthesis of modern radiopharmaceuticals (ARCAL XV), RLA/2/007/007	La Habana, Cuba 28 November - 16 December	Agency	11	0	0	55,770
Regional workshop on assembly of multichannel analyzer cards (ARCAL II), RLA/4/008/011	Mexico City, Mexico 7 February - 6 May	Agency	4	0	1	37,302
Regional seminar on recent developments in nuclear instrumentation (ARCAL II), RLA/4/008/012	La Habana, Cuba 7 November - 18 November	Agency Germany Colombia	14	0	3	46,447 7,572 1,683
Final regional meeting of project coordinators (ARCAL II), RLA/4/008/013	La Habana, Cuba 21 November - 25 November	Agency	14	0	1	19,863
National training course on optimization and characterization of nuclear analytical equipment (ARCAL II), RLA/4/008/014	Mexico City, Mexico 11 July - 22 July	Agency <sup>C</sup>	1	0	0	363
National training course on maintenance of nuclear detectors (ARCAL II), RLA/4/008/016	Mexico City, Mexico 17 October - 28 October	Agency <sup>C</sup>	2	0	0	639
Regional workshop on immunoassay and related techniques in nutrition and livestock reproduction research (ARCAL III), RLA/5/028/006	Santiago, Chile 7 March - 11 March	Agency	15	0	3	56,705
Regional training course on the use of ELISA techniques, epidemiology and data analysis in diagnostics of animal diseases and monitoring of control programmes (ARCAL III), RLA/5/028/007	Asuncion, Paraguay 26 September - 7 October	Agency	14	0	0	41,864
National training course on epidemiology and data analysis in ELISA for the diagnosis of animal diseases (ARCAL III), RLA/5/028/008	Soyapango, S. Salvador, El Salvador 18 July - 29 July	Agency	4	0	0	7,156
Regional workshop on immunoassay for surveillance, monitoring and control of foot-and-mouth disease in South America (ARCAL III), RLA/5/028/009	Buenos Aires, Argentina 7 November - 11 November	Agency	4	0	1	25,984
Regional training course on fruit flies in Latin America with special emphasis on the sterile insect technique, RLA/5/032/001	Tapachula, Chiapas, Mexico 3 October - 4 November	Agency	20	0	5	146,586
Regional workshop on neonatal hypothyroid screening (ARCAL VIII), RLA/6/016/013	Quito, Ecuador 14 November - 18 November	Agency	14	0	0	31,768
Regional workshop on quality control of spect systems, RLA/6/020/001	Santiago, Chile 26 September - 30 September	Agency	15	0	12	39,566
Regional training course on radiopharmacy, RLA/6/021/001	Montevideo, Uruguay 13 June - 1 July	Agency	15	0	2	65,433
Regional training course on paediatric nuclear medicine, RLA/6/022/001	Santiago, Chile 5 September - 16 September	Agency	20	1	3	67,611
Regional training course on radiotherapy treatment planning, RLA/6/023/001	Caracas, Venezuela 25 April - 13 May	Agency	22	0	15	78,807
Regional training course on nucleonic control systems and tracer techniques in the mining and metallurgy industries (ARCAL XVI), RLA/8/016/013	Santiago, Chile 17 October - 28 October	France	9	2	2	38,647
Regional training course on radiation sterilization: standards and regulations, process validation and dose setting (ARCAL XVI), RLA/8/016/014	Buenos Aires, Argentina 16 May - 27 May	Agency	11	0	8	50,515
Regional training course on fundamental aspects of radiation chemistry and applications (ARCAL XVI), RLA/8/016/015	Quito, Ecuador 15 August - 26 August	Agency	14	0	2	39,870

Project title and code	Place(s) and dates	Source of Funds	Participation <sup>a</sup>			Amount(s) expended <sup>b</sup> (\$)
			(1)	(2)	(3)	
Regional workshop on industrial gamma and electron beam processing: process control, calibration and dosimetry (ARCAL XVI), RLA/8/016/016	Sao Paulo, S.P., Brazil 9 May - 13 May	Agency	11	0	4	38,543
Regional training course on quality and control of testing laboratories, RLA/8/017/115	Limeira, S.P., Brazil 21 February - 25 February	Agency Germany	15	0	0	4,453 20,887
Regional workshop on quality improvement in rotatory machines by vibration analysis, RLA/8/017/116	Quito, Ecuador 21 February - 25 February	Agency	14	0	0	23,772
Regional workshop on problems of leaks in dams and reservoirs: identification of two problems to be studied (ARCAL XVIII), RLA/8/018/001	San Luis Potosi, Mexico 11 April - 15 April	Agency	4	0	10	8,880
Regional training course on radiation protection in medical practices, RLA/9/014/001	Rio de Janeiro, R.J., Brazil 1 August - 19 August	Agency	20	1	4	129,460
Regional working group meeting on upgrading regulations on radiation protection in accordance with basic standard regulations published jointly by FAO, IAEA, ILO, NEA/OECD, PAHO & WHO (ARCAL XVII), RLA/9/016/001	Montevideo, Uruguay 25 July - 29 July	Agency	5	0	0	7,690
Regional workshop on thermoluminescence dosimetry (ARCAL XVII), RLA/9/016/003	Montevideo, Uruguay 5 December - 16 December	Agency	15	0	5	63,884
National workshop on physical dosimetry (ARCAL XVII), RLA/9/016/004	Santiago, Chile 19 October - 21 October	Agency <sup>c</sup>	1	0	0	1,912
Sub-regional training course on radiation protection in diagnostic radiology, RLA/9/017/002	Panama City, Panama 25 July - 29 July	Agency	7	2	8	11,652
Educational regional training course on radiation protection and nuclear safety, RLA/9/019/001	Buenos Aires, Argentina 4 April - 7 October	Agency	16	0	0	235,085
Regional training course on management of low level radioactive waste, RLA/9/020/001	Buenos Aires, Argentina 7 November - 25 November	Agency	18	0	6	113,325

<sup>a</sup> The figures under (1) denote the number of award-holders whose cost of participation was met out of project funds; those under (2) denote the number of participants who attended at the expense of their government, or of another organization on programme; those under (3) denote the number of local participants. No stipends or international travel costs were paid out of project funds in respect of participants shown under (2) and (3).

<sup>b</sup> The amounts expended (i.e. disbursements plus unliquidated obligations) do not include expenditures by host governments for local lecturers or facilities. They also do not give the final cost of the training course, since accounts may be settled in the following year.

<sup>c</sup> Represents costs for participant(s) only. Course organized and funded regionally.

## ANNEX III

### PUBLISHED REPORTS: 1994

Recipient	Subject of report	Project code	Author(s)/Corporate Author	Reference no.
ALBANIA	Country programme summary: The Agency's Technical Co-operation Programme with Albania, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/07
BANGLADESH	Country programme summary: The Agency's Technical Co-operation Programme with Bangladesh, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/03
BULGARIA	Sterilization of medical products- A field evaluation review	BUL/8/008	Evaluation Section, Dept. of TC, IAEA	IAEA-PDE-94/01
CHINA	Main steam bypass system operation and maintenance	CPR/4/015	Stubley, Philip Harold	IAEA/UNDP-CPR/91/221-01
	Simulator software development		Feng, Chiachu Peter	IAEA/UNDP-CPR/91/221-02
	Seminar on the technical support functions		Groon, Stuart	IAEA/UNDP-CPR/91/221-03
	Seminar on the technical support functions		Bouget, Yves-Herve	IAEA/UNDP-CPR/91/221-04
	Seminar on the technical support functions		Kofron, Kurt Lukas	IAEA/UNDP-CPR/91/221-05
	Seminar on steam generator maintenance, cleaning and repair		Barber, D.	IAEA/UNDP-CPR/91/221-06
	Consulting on outage management planning and scheduling		Hansson, Nils Bertil Roland	IAEA/UNDP-CPR/91/221-07
	Seminar on quality assurance in NPP operation		Wieckowski, George	IAEA/UNDP-CPR/91/221-08
	Steam generator maintenance, cleaning and repair		Esposito, John Nicholas	IAEA/UNDP-CPR/91/221-09
	Seminar on safety culture		Hall, Alan Christopher Mavko, Borut Dusic, Milorad	IAEA/UNDP-CPR/91/221-10
	Probabilistic safety assessment		Leonard, Mark Thomas Kolaczowski, Alan	IAEA/UNDP-CPR/91/221-11
	Emergency operation procedures		Walsh, Lawrence Ambrose	IAEA/UNDP-CPR/91/221-12
	Revision of safety analysis report		Almeida, Claudio Ubirajara Cou Elias, David	IAEA/UNDP-CPR/91/221-13
CYPRUS	Country programme summary: The Agency's Technical Co-operation Programme with Cyprus, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/10
HUNGARY	International PEER review service for the level-1 Probabilistic safety assessment of Paks NPP	HUN/9/014	Lanore, Jeanne-Marie Blin, Andre Ernest Corenwinder, Francois Gubler, Reinhard	IAEA-TA-2465
ICELAND	Country programme summary: The Agency's Technical Co-operation Programme with Iceland, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/11
INDONESIA	Country programme summary: The Agency's Technical Co-operation Programme with Indonesia, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/01
MALAYSIA	Country programme summary: The Agency's Technical Co-operation Programme with Malaysia, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/05/CORR.
MYANMAR	Country programme review		Boussaha, Ali Poshyachinda, Makumrong Nemoto, Shinichiro Shane Naqvi, Syed Hasan Mujtaba	IAEA-TC-PM-014
	A desk evaluation review of project MYA/6/015 - Hormonal studies on pituitary adrenal disorders	MYA/6/015	Evaluation Section, Dept. of TC, IAEA	IAEA-PDE-94/02
PARAGUAY	Country programme summary: The Agency's Technical Co-operation Programme with Paraguay, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/06
PHILIPPINES	Country programme summary: The Agency's Technical Co-operation Programme with the Philippines, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/04
PORTUGAL	Country programme summary: The Agency's Technical Co-operation Programme with Portugal, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/08
REGIONAL AFRICA	A desk evaluation review of project RAF/4/004 - Nuclear instruments maintenance	RAF/4/004	Evaluation Section, Dept. of TC, IAEA	IAEA-PDE-94/03
	A desk evaluation review of project RAF/9/005 - radiation protection development	RAF/9/005	Evaluation Section, Dept. of TC, IAEA	IAEA-PDE-94/04

Recipient	Subject of report	Project code	Author(s)/Corporate Author	Reference no.
REGIONAL ASIA	Review meeting for the joint UNDP/RCA/IAEA project for Asia and the Pacific - RAS/92/073	RAS/8/071	Department of TC, IAEA	IAEA-RCA-94-04
	National counterparts meeting for the joint UNDP/RCA/IAEA project for Asia and the Pacific - RAS/92/073	RAS/8/071	Department of TC, IAEA	IAEA-RCA-94-05
	Project performance evaluation report for the joint UNDP/RCA/IAEA project for Asia and the Pacific - RAS/92/073	RAS/8/071	Department of TC, IAEA	IAEA-RCA-94-06
	National coordinators meeting and mid-term review for the RCA project on Radiation	RAS/7/003	Department of TC, IAEA	IAEA-RCA-94-12
	Progress in RPF Phase III	RAS/5/020	Tape, Norman W. Pothisiri, Pakdee Moore, Phillip Byong Whi Lee	IAEA/UNDP-RAS/89/044-09
ROMANIA	ASSET mission to the Cernavoda nuclear power plant in Romania	ROM/9/016	Department of TC, IAEA	IAEA-TA-2468
SYRIA	Country programme summary: The Agency's Technical Co-operation Programme with the Syrian Arab Republic, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/09
THAILAND	Country programme summary: The Agency's Technical Co-operation Programme with Thailand, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/02
UNITED ARAB EMIRATES	Country programme summary: The Agency's Technical Co-operation Programme with the United Arab Emirates, 1984-1994		Evaluation Section, Dept. of TC, IAEA	IAEA-CPS-94/12
UK (HONG KONG)	A desk evaluation review of project HOK/1/004 (Calibration facilities for dosimetry)	HOK/1/004	Evaluation Section, Dept. of TC, IAEA	IAEA-PDE-94/01
UGANDA	Country programme review		Aslam, Javed Boussaha, Ali Klassen, Waldemar Ismail, Yousoff Bin Cardenas Valdes, Rene Felipe	IAEA-TC-PM-015
UKRAINE	Zaporozhe NPP in Ukraine	UKR/9/004	Department of TC, IAEA	IAEA-TA-2467
VIET NAM	A desk evaluation review of project VIE/4/009 - Design and production of nuclear instruments	VIE/4/009	Evaluation Section, Dept. of TC, IAEA	IAEA-PDE-94/05
ZAMBIA	Country programme review		Aslam, Javed Ismail, Yusof Bin Klassen, Waldemar	IAEA-TC-PM-013
GENERAL	A special evaluation review of the IAEA's regional NDT projects in Latin America and the Caribbean		Evaluation Section, Dept. of TC, IAEA	IAEA-SER-94/01
	Special evaluation review - General conclusions arising from a field evaluation of the Agency's RAPAT and WAMAP programmes in the Asia and Pacific region		Evaluation Section, Dept. of TC, IAEA	IAEA-SER-94/02
	A special evaluation of the Agency's RAPAT and WAMAP programmes in the Asia and the Pacific region, 1984-1993		Evaluation Section, Dept. of TC, IAEA	IAEA-SE-94/03
	Twenty third general conference meeting of representatives of RCA member states - Background papers		Department of TC, IAEA	IAEA-RCA-94-01
	RCA annual report 1993		Department of TC, IAEA	IAEA-RCA-94-02
	Sixteenth RCA working group meeting		Department of TC, IAEA	IAEA-RCA-94-03
	Regional RCA project: Radiation protection infrastructure - Expert advisory group meeting		Department of TC, IAEA	IAEA-RCA-94-07
	Sixteenth RCA working group meeting report		Department of TC, IAEA	IAEA-RCA-94-08
	Twenty third general conference meeting of representatives of RCA member states - Report		Department of TC, IAEA	IAEA-RCA-94-10
	Tripartite review meeting on the use of isotopes and radiation to strengthen technology and support environmentally sustainable development		Department of TC, IAEA	IAEA-RCA-94-11
Expert advisory group meeting report on the use of radiation sterilized allograft in clinical/surgical practice, and strategies for dissemination of the information to medical practitioners, with particular reference to orthopaedics		Department of TC, IAEA	IAEA-RCA-94-13	

## ANNEX IV

### VOLUNTARY CONTRIBUTIONS PLEDGED AND PAID TO THE TECHNICAL ASSISTANCE AND CO-OPERATION FUND FOR 1994 (as at 31 December 1994)

Member State	Base rate %	Share of \$58.5 million target for voluntary contributions for 1994 using base rate <sup>a/</sup>	Pledged	Paid
AFGHANISTAN	0.01	5,850	0	0
ALBANIA	0.01	5,850	5,850	0
ALGERIA	0.16	93,600	0	0
ARGENTINA	0.58	339,300	303,030	303,030
AUSTRALIA	1.55	906,750	878,378	878,378
AUSTRIA	0.77	450,450	450,450	450,450
BANGLADESH	0.01	5,850	5,850	5,850
BELARUS	0.49	286,650	31,481	0
BELGIUM	1.09	637,650	0	0
BOLIVIA	0.01	5,850	0	0
BRAZIL	1.63	953,550	300,000	0
BULGARIA	0.13	76,050	10,000	550
CAMBODIA	0.01	5,850	0	0
CAMEROON	0.01	5,850	0	0
CANADA	3.19	1,866,150	1,370,370	1,370,370
CHILE	0.08	46,800	46,800	0
CHINA	0.79	462,150	462,150	462,150
COLOMBIA	0.13	76,050	50,000	50,000
COSTA RICA	0.01	5,850	0	0
COTE D'IVOIRE	0.02	11,700	11,700	11,700
CROATIA	0.13	76,050	8,000	0
CUBA	0.09	52,650	52,650	52,650
CYPRUS	0.02	11,700	0	0
DEM. P.R. KOREA <sup>a/</sup>	0.05	29,250	29,250	0
DENMARK	0.67	391,950	391,950	391,950
DOMINICAN REPUBLIC	0.02	11,700	0	0
ECUADOR	0.03	17,550	0	0
EGYPT	0.07	40,950	398	398
EL SALVADOR	0.01	5,850	0	0
ESTONIA	0.07	40,950	0	0
ETHIOPIA	0.01	5,850	0	0
FINLAND	0.58	339,300	339,300	339,300
FRANCE	6.15	3,597,750	3,597,750	0
GABON	0.02	11,700	0	0
GERMANY	9.15	5,352,750	4,611,405	4,611,405
GHANA	0.01	5,850	5,000	0
GREECE	0.36	210,600	0	0
GUATEMALA	0.02	11,700	0	0
HAITI	0.01	5,850	0	0

Member State	Base rate %	Share of \$58.5 million target for voluntary contributions for 1994 using base rate <sup>a/</sup>	Pledged	Paid
HOLY SEE	0.01	5,850	0	0
HUNGARY	0.19	111,150	111,150	111,150
ICELAND	0.03	17,550	17,550	17,550
INDIA	0.37	216,450	216,450	216,450
INDONESIA	0.16	93,600	50,000	50,000
IRAN, I.R	0.79	462,150	20,000	20,000
IRAQ	0.13	76,050	0	0
IRELAND	0.19	111,150	50,000	50,000
ISRAEL	0.24	140,400	0	0
ITALY	4.40	2,574,000	0	0
JAMAICA	0.01	5,850	0	0
JAPAN	12.76	7,464,600	7,464,600	7,464,600
JORDAN	0.01	5,850	0	0
KENYA	0.01	5,850	0	0
KOREA, REPUBLIC OF	0.71	415,350	257,400	257,400
KUWAIT	0.26	152,100	0	0
LEBANON	0.01	5,850	0	0
LIBERIA	0.01	5,850	0	0
LIBYAN A. J.	0.25	146,250	0	0
LIECHTENSTEIN	0.01	5,850	6,000	6,000
LUXEMBOURG	0.06	35,100	0	0
MADAGASCAR	0.01	5,850	0	0
MALAYSIA	0.12	70,200	70,200	70,200
MALI	0.01	5,850	0	0
MAURITIUS	0.01	5,850	0	0
MEXICO	0.90	526,500	0	0
MONACO	0.01	5,850	0	0
MONGOLIA	0.01	5,850	0	0
MOROCCO	0.03	17,550	17,550	17,550
MYANMAR	0.01	5,850	0	0
NAMIBIA	0.01	5,850	1,000	0
NETHERLANDS	1.54	900,900	900,900	900,900
NEW ZEALAND	0.25	146,250	0	0
NICARAGUA	0.01	5,850	0	0
NIGER	0.01	5,850	0	0
NIGERIA	0.21	122,850	0	0
NORWAY	0.56	327,600	327,600	327,600
PAKISTAN	0.06	35,100	35,100	35,100
PANAMA	0.02	11,700	0	0
PARAGUAY	0.02	11,700	0	0
PERU	0.06	35,100	0	0
PHILIPPINES	0.07	40,950	40,950	40,950
POLAND	0.48	280,800	280,800	280,800
PORTUGAL	0.21	122,850	0	0

Member State	Base rate %	Share of \$58.5 million target for voluntary contributions for 1994 using base rate <sup>a/</sup>	Pledged	Paid
QATAR	0.05	29,250	0	0
ROMANIA	0.17	99,450	99,450	0
RUSSIAN FEDERATION	6.88	4,024,800	462,416	462,416
SAUDI ARABIA	0.98	573,300	0	0
SENEGAL	0.01	5,850	0	0
SIERRA LEONE	0.01	5,850	0	0
SINGAPORE	0.12	70,200	0	0
SLOVENIA	0.09	52,650	52,650	36,539
SOUTH AFRICA	0.42	245,700	0	0
SPAIN	2.03	1,187,550	185,985	185,985
SRI LANKA	0.01	5,850	5,000	5,000
SUDAN	0.01	5,850	0	0
SWEDEN	1.14	666,900	666,900	666,900
SWITZERLAND	1.19	696,150	696,150	696,150
SYRIAN ARAB REPUBLIC	0.04	23,400	2,000	2,000
THAILAND	0.11	64,350	64,350	64,350
TUNISIA	0.03	17,550	0	0
TURKEY	0.28	163,800	163,800	163,800
UGANDA	0.01	5,850	0	0
UKRAINE	1.92	1,123,200	0	0
UNITED ARAB EMIRATES	0.22	128,700	0	0
UK	5.15	3,012,750	2,909,750	2,909,750
U. R. OF TANZANIA	0.01	5,850	2,000	0
USA	25.00	14,625,000	13,936,865	13,936,865
URUGUAY	0.04	23,400	15,000	0
VENEZUELA	0.50	292,500	0	0
VIET NAM	0.01	5,850	5,850	5,850
YUGOSLAVIA	0.16	93,600	0	0
ZAIRE	0.01	5,850	0	0
ZAMBIA	0.01	5,850	0	0
ZIMBABWE	0.01	5,850	0	0
<b>SUB-TOTAL</b>	<b>100.00</b>	<b>58,500,000</b>	<b>42,097,178</b>	<b>37,930,036</b>
<b>New Members:</b>				
ARMENIA <sup>b/</sup>	0.13	76,050	0	0
CZECH REPUBLIC <sup>c/</sup>	0.42	245,700	245,700	245,700
KAZAKHSTAN <sup>d/</sup>	0.35	204,750	0	0
LITHUANIA <sup>e/</sup>	0.15	87,750	0	0
MARSHALL ISLANDS <sup>f/</sup>	0.01	5,850	0	0
SLOVAKIA <sup>c/</sup>	0.13	76,050	76,050	76,050

Member State	Base rate %	Share of \$58.5 million target for voluntary contributions for 1994 using base rate <sup>a/</sup>	Pledged	Paid
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA <sup>a/</sup>	0.02	11,700	0	0
UZBEKISTAN <sup>h/</sup>	0.26	152,100	0	0
YEMEN <sup>v/</sup>	0.04	5,850	0	0
<b>SUB-TOTAL</b>	<b>1.48</b>	<b>865,800</b>	<b>321,750</b>	<b>321,750</b>
<b>GRAND TOTAL</b>	<b>101.48</b>	<b>59,365,800</b>	<b>42,418,928</b>	<b>38,251,786</b>

<sup>a/</sup> The Democratic People's Republic of Korea withdrew from the Agency on 13 June 1994.

<sup>b/</sup> Armenia became a Member of the Agency on 27 September 1993.

<sup>c/</sup> The Czech Republic and the Slovakia became Members of the Agency on 27 September 1993.

<sup>d/</sup> Kazakstan became a Member of the Agency on 14 February 1994.

<sup>e/</sup> Lithuania became a Member of the Agency on 18 November 1993.

<sup>f/</sup> Marshall Islands became a Member of the Agency on 26 January 1994.

<sup>g/</sup> The Former Yugoslav Republic of Macedonia became a Member of the Agency on 25 February 1994.

<sup>h/</sup> Uzbekistan became a Member of the Agency on 26 January 1994.

<sup>v/</sup> The Republic of Yemen became a Member of the Agency on 14 October 1994.

## ANNEX V

### COST-FREE FELLOWSHIPS: 1994

Donor	Number of fellowships offered in months	Number of fellows placed	Number of months placed	Number of fellows trained	Number of months of training
AUSTRIA	a	2	9	3	13
CHINA	a	7	9	7	9
DENMARK	a	1	3	1	3
FRANCE	a	4	6	6	9
GERMANY	a	3	6	4	12
SPAIN	a	12	26	16	37
UNITED KINGDOM	a	2	5	3	6
USA	b	44	189	52	203

- a No formal offer made however type II fellowships have been accepted.
- b A specific amount of money was made available (\$1,500,000) for administration and placement of fellows rather than a given number of months.

## ANNEX VI

### APPROVED AND ON-GOING UNDP PROJECTS AS AT 31 DECEMBER 1994

(in thousands of dollars)

Recipient	Short title	Project code	Total amount approved	Prior to 1994	Approved budgets		
					1994	1995	1996
<b>A. Projects executed by the IAEA</b>							
ALBANIA	Strengthening of nuclear techniques applications using research reactor	ALB87001	157	157	0	0	0
CHINA	Manpower development for safe operation of nuclear power plants	CPR91221	976	126	164	675	11
EGYPT	National centre for radiation technology, PHASE III	EGY89015	331	305	26	0	0
INDONESIA	Agricultural production, PHASE II	INS88013	448	448	0	0	0
ROMANIA	Nuclear safety	ROM87002	511	474	37	0	0
TURKEY	Industrial sterilization of medical supplies	TUR88040	701	701	0	0	0
REGIONAL ASIA	Food irradiation process control and acceptance	RAS89044	539	533	6	0	0
	Increasing the capabilities of common grain legumes	RAS89045	970	847	116	7	0
	The use of isotopes and radiation to strengthen technology and support environmentally sustainable development	RAS92073	3,037	217	1,139	823	858
REGIONAL EUROPE	Strengthening radiation and nuclear safety infrastructures in countries of the former USSR	RER93006	500	264	236	0	0
REGIONAL LATIN AMERICA	Non-destructive testing in quality control programmes	RLA92021	228	28	200	0	0
<b>Sub-total</b>			8,398	4,100	1,924	1,505	869
<b>B. Projects for which IAEA is associated agency</b>							
CHINA	Nuclear safety administration	CPR85067	617	617	0	0	0
REGIONAL EUROPE	Environmental management and protection of the Black Sea	RER93G31	60	0	35	25	0
<b>Sub-total</b>			677	617	35	25	0
<b>TOTAL</b>			9,075	4,717	1,959	1,530	869

## ANNEX VII

### FOOTNOTE-a/ PROJECTS MADE OPERATIONAL OR EXTENDED DURING 1994

Recipient	Project title and code	Expert services (months)	Equipment (\$)	Fellowships (\$)	Training courses (\$)	Sub-contracts (\$)	Source <sup>a)</sup>
ALBANIA	Isotopes in nuclear medicine ALB/6/005	0	100,000	0	0	0	TACF
BANGLADESH	Modernization of nuclear medicine BGD/6/011	0	150,000	0	0	0	USA
CHINA	Safety featured engineering CPR/9/018	3	0	0	0	0	FRA
COLOMBIA	Modernization of research reactor IANRI COL/4/013	4	150,000	0	0	0	USA
	Brachytherapy COL/6/006	1	65,000	0	0	0	USA
CZECH REPUBLIC	Quality assurance in commissioning and operation of NPPS, CZR/4/003	1	0	0	0	0	FRA
GHANA	National radiotherapy and nuclear medicine network, GHA/6/009	1	0	0	0	0	TACF
		1	140,000	0	0	0	USA
HUNGARY	Establishing university courses in nuclear engineering, HUN/0/002	0	47,000	0	0	0	TACF
	Quality assurance in nuclear power plant operation, HUN/4/011	1	0	0	0	0	FRA
	Enhancement of safety in NPP operation HUN/9/014	9	0	0	0	0	FRA
	Control of low and intermediate level radioactive waste, HUN/9/015	1	0	0	0	0	FRA
		1	0	2,900	0	0	SPA
	Countrywide environmental radiation monitoring database, HUN/9/016	1	20,000	12,600	0	0	TACF
	Strengthening training for operational safety at PAKS NPP, HUN/9/019	3	0	0	0	0	USA
0		0	0	0	92,900	SPA	
INDONESIA	University research and teaching in agriculture, INS/5/022	7	100,000	0	0	0	USA
KENYA	Nitrogen fixation by multipurpose tree species, KEN/5/015	1	15,000	0	0	0	UK
	Pesticide research KEN/5/016	0	10,000	0	0	0	USA
	Gamma camera KEN/6/010	3	0	0	0	0	USA
MALAYSIA	Nuclear Instrumentation centre MAL/4/006	1	35,000	0	0	0	USA
MEXICO	Quality control applied to the use of ionizing radiation, MEX/1/017	1	75,000	0	0	0	USA
	Molecular analysis of the genetic effects of radiation, MEX/7/007	8	28,000	18,900	0	0	UK
MOROCCO	Establishment of local teaching and training laboratory, MOR/0/006	2	20,000	0	0	0	USA
	Radioisotope production and labelling MOR/4/010	2	100,000	0	0	0	USA
	Study on food irradiation MOR/5/018	2	62,000	0	0	0	FRA
	Establishment of a non-destructive testing laboratory, MOR/8/006	1	70,000	0	0	0	FRA

Recipient	Project title and code	Expert services (months)	Equipment (\$)	Fellowships (\$)	Training courses (\$)	Sub-contracts (\$)	Source <sup>a)</sup>
PHILIPPINES	Biological nitrogen fixation PHI/5/024	1	25,000	18,900	0	0	UK
POLAND	Computer based methods for calibration electron beam technology for flue gas purification phase III, POL/8/013	6	0	0	0	0	JPN
ROMANIA	Support of Cernavoda training centre ROM/0/004	0	0	0	0	78,200	SPA
	Radioimmunoassay standardization and quality control, ROM/6/010	0	8,700	0	0	0	TACF
SLOVAKIA	Quality assurance in commissioning and operation of NPPS, SLR/4/002	1	0	0	0	0	FRA
		11	15,000	25,200	0	0	TACF
	Strengthening the nuclear safety regulatory body, SLR/9/005	3	0	0	0	0	USA
SLOVENIA	Enhancement of operational safety at Krsko NPP, SLO/9/004	9	0	0	0	0	USA
TUNISIA	Screening of newborns for neonatal hypothyroidism, TUN/6/005	0	30,000	0	20,000	0	TACF
UNITED REP.OF TANZANIA	Tsetse fly eradication on Zanzibar Island, URT/5/016	8	210,000	0	0	0	USA
		12	90,000	0	0	30,000	UK
		13	420,540	0	0	147,000	TACF
		0	189,400	0	0	0	CAN
		0	42,400	0	0	0	SWE
	6	0	0	0	32,000	BEL	
	Radiotherapy facility and therapy dosimetry system, URT/6/007	2	150,000	0	0	0	USA
ZIMBABWE	Radioimmunoassay of thyroid related hormones, ZIM/2/002	4	0	0	0	0	USA
REGIONAL AFRICA	Animal trypanosomiasis RAF/5/028	3	80,000	0	30,000	50,000	UK
	Local preparation of radioimmunoassay reagents (AFRA V), RAF/6/007	2	50,000	0	30,000	0	FRA
	Non-destructive testing techniques RAF/8/017	0	20,000	0	14,500	0	SPA
REGIONAL ASIA AND PACIFIC	Strengthening nuclear medicine in RCA member states, RAS/6/022	1	0	0	0	57,700	AUL
	Isotopes and radiation in industry and the environment (RCA), RAS/8/069	6	43,500	0	87,000	0	AUL
	Isotopes and radiation in industry and strengthening of radiation protection infrastructures (RCA), RAS/9/006	1	0	0	0	74,100	AUL
REGIONAL EUROPE	Safety analysis of WWER-1000 RER/9/020	0	0	0	0	22,100	SPA
REGIONAL LATIN AMERICA	Industrial applications of nuclear technology (ARCAL XVI), RLA/8/016	3	24,000	0	40,000	0	FRA
	Radiation protection for central america and caribbean, RLA/9/017	2	50,000	0	0	0	USA
INTERREGIONAL	Upgrading radiation protection infrastructure, INT/9/143	4	52,000	0	50,000	0	USA
	Upgrading waste management infrastructure, INT/9/144	4	0	0	0	0	USA

<sup>a)</sup> Explanation of abbreviations: AUL = Australia; BEL = Belgium; CAN = Canada; FRA = France; JPN = Japan; SPA = Spain; SWE = Sweden; TACF = Technical Assistance and Co-operation Fund; UK = United Kingdom; USA = United States of America.

## ANNEX VIII

### APPROVALS AGAINST THE RESERVE FUND IN 1994

Recipient	Project title and number	Expert M/D	Expert \$	Equipment \$	Sub-contracts \$	Total \$
<b>A. New Projects</b>						
ARMENIA	Restructuring nuclear safety regulatory body, ARM/9/003	3/15	37,800	12,200	0	50,000
CHINA	International regulatory review team (IRRT) mission, CPR/0/006	6/00	46,000	0	0	46,000
ESTONIA	Radiation protection and waste management services upgrading, EST/9/002	0/00	0	50,000	0	50,000
INDONESIA	Feed supplementation for increasing livestock production, INS/5/023	0/00	0	25,000	25,000	50,000
KAZAKHSTAN	Strengthening radiation and nuclear safety infrastructure, KAZ/9/002	1/00	10,800	0	39,200	50,000
	Radiation protection and waste management services upgrading, KAZ/9/003	0/00	0	50,000	0	50,000
KYRGYZSTAN	Occupational and environmental monitoring, KIG/9/002	1/01	10,500	39,500	0	50,000
LATVIA	Radiation protection and waste management services upgrading, LAT/9/002	0/00	0	50,000	0	50,000
LITHUANIA	Radiation protection and waste management services upgrading, LIT/9/002	0/00	0	50,000	0	50,000
MALAYSIA	Contribution of nuclear technology to the industrial sector, MAL/8/013	6/00	50,000	0	0	50,000
MOLDOVA	Development of radiation monitoring capability, MOL/9/002	0/00	0	50,000	0	50,000
NAMIBIA	Basic radiotherapy unit, NAM/6/002	2/00	20,700	0	0	20,700
PERU	Nuclear techniques to improve child nutrition, PER/7/003	0/15	5,400	44,600	0	50,000
REGIONAL EUROPE	Radiation protection and waste management in nuclear medicine, RER/9/030	0/02	1,549	0	0	1,549
REGIONAL LATIN AMERICA	Treatment planning system for radiotherapy, RLA/9/021	0/00	0	0	41,600	41,600
UZBEKISTAN	Radiation protection and waste management services upgrading, UZB/9/002	0/00	0	50,000	0	50,000
VENEZUELA	Groundwater resources in the Caracas Valley, VEN/8/010	1/15	16,200	32,600	0	48,800
<b>Sub-total</b>		<b>21/18</b>	<b>198,949</b>	<b>453,900</b>	<b>105,800</b>	<b>758,649</b>

Recipient	Project title and number	Expert M/D	Expert \$	Equipment \$	Sub- contracts \$	Total \$
<b>B. Supplementary Assistance to Existing Projects</b>						
ARMENIA	Selismic safety re-evaluation of Medzamor Nuclear Power Plant, ARM/9/002	3/00	32,400	17,600	0	50,000
LEBANON	Radiation protection, LEB/9/002	0/00	0	35,000	0	35,000
TURKEY	Rinderpest Seromonitoring, TUR/5/017	0/00	0	2,160	0	2,160
<b>Sub-total</b>		3/00	32,400	54,760	0	87,160
<b>TOTAL</b>		24/18	231,349	508,660	105,800	845,809

## ANNEX IX

### NET PROGRAMME CHANGES BY RECIPIENT: 1994

RECIPIENT	EXPERTS MONTHS	EQUIPMENT \$	FELLOWS \$	GROUP TRAINING \$	SUB- CONTRACTS \$	MISC. \$	TOTAL \$
AFGHANISTAN	(3/01)	(208,653)	(67,150)	0	0	0	(308,563)
ALBANIA	(8/18)	(796,574)	(204,966)	0	0	0	(1,094,420)
ALGERIA	(14/00)	174,410	(5,715)	0	0	0	17,495
ARGENTINA	0/01	10,038	31,272	0	20,000	0	61,670
ARMENIA	6/00	67,600	0	0	0	0	132,400
BANGLADESH	0/09	77,280	(38,741)	0	0	0	41,779
BELARUS	(5/14)	(93,660)	3,000	0	0	0	(149,700)
BOLIVIA	(7/21)	31,360	(1,193)	0	0	0	(52,993)
BRAZIL	(7/12)	16,605	70,307	0	0	0	6,992
BULGARIA	(9/24)	37,960	8,555	0	0	0	(59,325)
CAMEROON	(2/01)	23,960	(21,635)	0	0	0	(19,635)
CHILE	(4/18)	47,313	(13,650)	0	0	0	(16,017)
CHINA	(3/13)	136,410	(50,900)	0	0	0	48,430
COLOMBIA	(6/06)	285,024	17,932	0	0	0	235,995
COSTA RICA	(2/10)	35,061	(14,554)	0	0	0	(4,693)
COTE D'IVOIRE	(7/24)	(49,060)	(700)	0	0	0	(134,000)
CROATIA	(3/09)	6,260	(35,200)	0	0	0	(64,580)
CUBA	(5/25)	32,120	31,179	0	0	0	299
CYPRUS	(1/21)	13,591	(6,040)	0	0	0	(10,809)
CZECH REPUBLIC	(2/10)	(6,058)	(68,453)	0	0	0	(99,711)
DOMINICAN REPUBLIC	(1/08)	5,175	(2,636)	0	0	0	(11,141)
ECUADOR	(0/18)	38,350	(8,131)	0	0	0	23,739
EGYPT	(2/16)	2,955	18,400	0	0	0	(6,005)
EL SALVADOR	(0/15)	14,768	(12,419)	0	0	0	(3,051)
ESTONIA	0/21	75,300	0	0	0	0	82,860
ETHIOPIA	(6/27)	(11,940)	18,000	0	(15,000)	0	(83,460)
GHANA	(1/10)	3,195	48,454	0	0	0	37,249
GREECE	(11/05)	(15,254)	(59,525)	0	0	0	(195,379)
GUATEMALA	(2/24)	84,451	62,837	0	0	0	117,048
HUNGARY	(11/20)	132,997	(103,297)	0	(7,920)	300	(103,920)
INDONESIA	(0/20)	(648)	(45,511)	0	0	0	(53,359)
INTERREGIONAL	6/00	10,800	(32,410)	7,891	39,800	0	90,881
IRAN, ISLAMIC REPUBLIC OF	1/18	338,900	361,540	0	0	0	717,720
JAMAICA	(2/15)	1,020	2,880	0	0	0	(23,100)
JORDAN	(4/28)	96,320	(55,800)	0	0	0	(12,760)
KAZAKHSTAN	1/00	50,000	0	0	(5,000)	0	55,800
KENYA	(3/24)	18,925	(32,916)	0	0	0	(55,031)

RECIPIENT	EXPERTS MONTHS	EQUIPMENT \$	FELLOWS \$	GROUP TRAINING \$	SUB-CONTRACTS \$	MISC. \$	TOTAL \$
KOREA, REPUBLIC OF	(4/04)	0	(8,938)	0	0	0	(53,578)
KYRGYZSTAN	(0/29)	59,500	0	0	0	0	49,060
LATVIA	0/00	75,500	0	0	0	0	75,500
LEBANON	2/28	55,225	0	0	0	0	86,905
LIBYAN ARAB JAMAHIRIYA	0/20	19,449	(19,800)	0	0	0	6,849
LITHUANIA	0/00	75,300	0	0	0	0	75,300
MADAGASCAR	0/17	11,133	(14,253)	0	0	0	3,000
MALAYSIA	(5/16)	27,560	(8,200)	0	0	0	(40,400)
MALI	(1/12)	19,490	(10,400)	0	(10,000)	0	(16,030)
MAURITIUS	(1/00)	17,300	3,500	0	0	0	10,000
MEXICO	(18/08)	28,249	9,937	0	(56,000)	0	(215,094)
MOLDOVA	0/00	50,000	0	0	0	0	50,000
MONGOLIA	(4/15)	23,829	(12,247)	0	0	0	(37,018)
MOROCCO	(8/04)	73,910	(9,861)	0	0	0	(23,791)
MYANMAR	(5/00)	37,500	(67,700)	0	0	0	(84,200)
NAMIBIA	(1/07)	14,280	(42,900)	0	0	0	(41,940)
NICARAGUA	(0/19)	24,051	(17,400)	0	0	0	(189)
NIGER	(3/26)	10,188	(21,600)	0	0	0	(53,172)
NIGERIA	(1/25)	37,289	(29,010)	0	0	0	(11,521)
PAKISTAN	2/16	25,394	(61,513)	0	0	0	(8,759)
PANAMA	(0/26)	34,220	(29,266)	0	0	0	(4,406)
PARAGUAY	(1/00)	9,300	0	0	0	0	(1,500)
PERU	(1/12)	28,179	38,126	0	0	0	51,185
PHILIPPINES	(8/27)	89,908	(24,900)	0	0	0	(31,112)
POLAND	3/06	123,509	(40,562)	(1,000)	0	0	116,507
PORTUGAL	(2/29)	(664)	(40,362)	0	0	0	(73,066)
REGIONAL AFRICA	(0/28)	35,480	(170,256)	97,572	(50,000)	0	(97,284)
REGIONAL ASIA AND PACIFIC	(1/20)	(27,540)	50	52,208	4,919	1,849	13,485
REGIONAL MIDDLE EAST AND EUROPE	56/05	50,506	(858,555)	252,653	40,644	17,245	109,094
REGIONAL LATIN AMERICA	(1/18)	73,498	(26,456)	123,555	41,356	0	194,674
ROMANIA	(13/01)	361,265	(3,365)	(10,000)	(5,000)	0	202,140
SAUDI ARABIA	(0/18)	(2,188)	(922)	0	0	0	(9,590)
SENEGAL	0/00	3,200	(3,200)	0	0	0	0
SIERRA LEONE	(0/02)	(48,980)	(300)	0	0	0	(50,000)
SLOVAKIA	(7/24)	107,240	(55,483)	0	0	0	(32,483)
SLOVENIA	(1/08)	24,431	3,540	0	0	0	14,291
SRI LANKA	(6/02)	41,484	37,862	0	0	0	13,826
SUDAN	(3/24)	3,267	(25,865)	0	0	0	(63,638)
SYRIAN ARAB REPUBLIC	(12/26)	104,960	7,105	0	0	0	(26,895)

RECIPIENT	EXPERTS MONTHS	EQUIPMENT \$	FELLOWS \$	GROUP TRAINING \$	SUB- CONTRACTS \$	MISC. \$	TOTAL \$
THAILAND	(6/10)	17,054	33,019	0	(6,406)	0	(24,733)
TUNISIA	(3/26)	12,331	15,289	0	0	0	(14,140)
TURKEY	(5/24)	102,444	(70,719)	0	0	0	(30,915)
UGANDA	(2/29)	17,850	11,750	0	0	0	(2,440)
UKRAINE	(2/18)	(11,553)	6,964	0	0	0	(32,669)
UNITED ARAB EMIRATES	(0/08)	(41,163)	(40,950)	0	0	0	(84,993)
U.R. TANZANIA	21/22	686,035	26,547	0	174,040	0	1,121,342
URUGUAY	(0/09)	75,128	(26,060)	0	0	0	45,828
UZBEKISTAN	0/00	50,000	0	0	0	0	50,000
VENEZUELA	(1/05)	24,600	(7,743)	(6,000)	0	0	(1,743)
VIET NAM	(3/18)	62,800	9,200	0	0	0	33,120
YUGOSLAVIA	(2/27)	(5,914)	0	0	0	0	(37,234)
ZAIRE	(3/13)	(86,320)	19,450	0	0	0	(103,950)
ZAMBIA	(0/29)	3,990	7,450	0	0	0	1,000
ZIMBABWE	(11/01)	8,455	10,800	0	0	0	(99,905)
TOTAL CHANGES 1994	(209/11)	3,298,262	(1,715,386)	516,879	165,433	19,394	23,422

## ANNEX X

### NET REPHASINGS UNDERTAKEN DURING 1994

Recipient	Project component	Net allotted/ Net rephased	Current year	1995	1996
ALGERIA	Equipment	Allotted	65,245	60,000	0
	(\$)	Rephased	60,000	-60,000	0
ARGENTINA	Experts	Allotted	7/14	2/00	0/00
	(M/D)	Rephased	0/00	-1/00	0/00
	Equipment	Allotted	96,120	100,000	0
	(\$)	Rephased	97,000	-97,000	0
	Fellowships	Allotted	55,549	0	0
	(\$)	Rephased	11,400	0	0
BOLIVIA	Experts	Allotted	1/00	1/00	0/00
	(M/D)	Rephased	0/00	-1/00	0/00
	Equipment	Allotted	303,722	160,000	60,000
	(\$)	Rephased	134,400	-123,000	0
CAMEROON	Equipment	Allotted	90,000	90,000	0
	(\$)	Rephased	90,000	-90,000	0
CHINA	Equipment	Allotted	40,000	90,000	0
	(\$)	Rephased	90,000	-90,000	0
CUBA	Equipment	Allotted	23,500	10,000	10,000
	(\$)	Rephased	10,000	-10,000	0
	Fellowships	Allotted	6,341	3,300	6,900
	(\$)	Rephased	0	6,900	-6,900
HUNGARY	Equipment	Allotted	341,700	250,000	155,000
	(\$)	Rephased	250,000	-250,000	0
INTERREGIONAL	Experts	Allotted	54/00	7/00	0/00
	(M/D)	Rephased	-5/00	5/00	0/00
KENYA	Equipment	Allotted	109,140	15,000	0
	(\$)	Rephased	10,200	-10,200	0
	Fellowships	Allotted	36,900	19,800	0
	(\$)	Rephased	4,200	-4,200	0
LIBYAN ARAB JAMAHIRIYA	Experts	Allotted	2/00	2/00	0/00
	(M/D)	Rephased	-2/00	0/00	2/00
	Equipment	Allotted	20,000	0	0
	(\$)	Rephased	-20,000	0	20,000
	Fellowships	Allotted	18,900	19,800	0
	(\$)	Rephased	-18,900	0	18,900

Recipient	Project component	Net allotted/ Net rephased	Current year	1995	1996
MAURITIUS	Equipment	Allotted	25,000	20,000	0
	(\$)	Rephased	20,000	-20,000	0
MEXICO	Equipment	Allotted	32,000	58,000	0
	(\$)	Rephased	5,600	-5,600	0
	Fellowships	Allotted	18,900	19,800	0
	(\$)	Rephased	2,000	-2,000	0
MONGOLIA	Equipment	Allotted	102,112	30,000	0
	(\$)	Rephased	30,000	-30,000	0
NIGERIA	Equipment	Allotted	60,000	30,000	0
	(\$)	Rephased	20,000	-20,000	0
PAKISTAN	Equipment	Allotted	60,000	60,000	60,000
	(\$)	Rephased	46,000	-46,000	0
PANAMA	Fellowships	Allotted	9,492	3,300	0
	(\$)	Rephased	3,300	-3,300	0
PARAGUAY	Equipment	Allotted	39,260	7,000	0
	(\$)	Rephased	7,000	-7,000	0
PERU	Experts	Allotted	1/11	1/00	0/00
	(M/D)	Rephased	0/10	-0/10	0/00
	Equipment	Allotted	38,000	10,000	0
	(\$)	Rephased	1,000	-1,000	0
	Fellowships	Allotted	9,300	6,600	0
	(\$)	Rephased	6,600	-6,600	0
REGIONAL EUROPE	Experts	Allotted	19/00	2/00	0/00
	(M/D)	Rephased	2/00	-2/00	0/00
	Equipment	Allotted	334,627	20,000	0
	(\$)	Rephased	20,000	-20,000	0
REGIONAL LATIN AMERICA	Experts	Allotted	84/15	12/00	0/00
	(M/D)	Rephased	4/00	-4/00	0/00
ROMANIA	Equipment	Allotted	403,000	375,000	130,000
	(\$)	Rephased	109,000	-109,000	0
TUNISIA	Equipment	Allotted	144,720	70,000	0
	(\$)	Rephased	50,000	-50,000	0
UGANDA	Equipment	Allotted	156,060	45,000	0
	(\$)	Rephased	22,600	-22,600	0
U.R. TANZANIA	Equipment	Allotted	79,856	55,000	0
	(\$)	Rephased	22,000	-22,000	0

Recipient	Project component	Net allotted/ Net rephased	Current year	1995	1996	
VIET NAM	Equipment	Allotted	90,000	60,000	0	
	(\$)	Rephased	60,000	-60,000	0	
TOTALS	Experts	Allotted	169/10	27/00	0/00	
	(M/D)	Rephased	-0/20	-3/10	2/00	
	Experts	Allotted	1,472,933	303,600	0	
	(\$)	Rephased	-7,200	-38,000	24,000	
	Equipment	Allotted	2,654,063	1,615,000	415,000	
	(\$)	Rephased	1,134,800	-1,143,400	20,000	
	Fellowships	Allotted	155,382	72,600	6,900	
	(\$)	Rephased	8,600	-9,200	12,000	
	TOTAL ALLOTTED			4,282,378	1,991,200	421,900
	TOTAL REPHASED			1,136,200	-1,190,600	56,000

## ANNEX XI

### EXTRABUDGETARY CONTRIBUTIONS FOR ACTIVITIES RELATING TO TECHNICAL CO-OPERATION WHICH ARE NOT INCLUDED IN THE TECHNICAL CO-OPERATION PROGRAMME: 1994

Donor	Activity	Funds Received \$
ARGENTINA	Nuclear desalination project	5,000
BRAZIL	International Centre for Theoretical Physics, Trieste	35,000
CANADA	Nuclear desalination project	18,700
EUROPEAN UNION	International Centre for Theoretical Physics, Trieste	516,300
ITALY	International Centre for Theoretical Physics, Trieste	13,870,400
	Improvement of basic food crops in Africa through plant breeding including the use of induced mutations	280,000
JAPAN	Nuclear medicine	60,000
	Radiation protection	35,000
	International Centre for Theoretical Physics, Trieste	39,100
KUWAIT	International Centre for Theoretical Physics, Trieste	97,800
LIBYAN A.J	Nuclear desalination project	49,900
SPAIN	International Centre for Theoretical Physics, Trieste	15,000
	Assistance in the implementation of the next nuclear power plant in the Czech Republic	70,900
SWEDEN	International Centre for Theoretical Physics, Trieste	544,000
	IAEA Marine Environment Laboratory, Monaco	420,800
	Adverse side effects on flora and fauna from the use of organochlorine pesticides on the African Continent	267,800
	Agroecological effects resulting from the use of persistent pesticides in Central America	194,300
SWITZERLAND	International Centre for Theoretical Physics, Trieste	26,800
UNEP	IAEA Marine Environment Laboratory, Monaco	560,000
UNESCO	International Centre for Theoretical Physics, Trieste	428,000
UNIDO	International Centre for Theoretical Physics, Trieste	32,000
UK	International Centre for Theoretical Physics, Trieste	30,100
USA	International Centre for Theoretical Physics, Trieste	12,000
	International Arctic Sea assessment project	135,000
	Feasibility study in Saudi Arabia on seawater desalination	325,000
	Effect of infection in children of the Andean Region in South America	100,000
	Development of a novel stable isotope method and protocol	50,000
	Use of isotope techniques to help eradicate vitamin A deficiency disorders	117,000
	Use of isotope techniques to improve maternal and child nutrition	107,000
UNU	International Centre for Theoretical Physics, Trieste	400,000
OTHER DONORS <sup>a/</sup>	International Centre for Theoretical Physics, Trieste	277,000
	IAEA Marine Environment Laboratory, Monaco	155,100
<b>TOTAL</b>		<b>19,275,000</b>

<sup>a/</sup> Includes contributions from various international organizations and national institutes.

## ANNEX XII

### PROJECTS CONCLUDED DURING 1994: ACHIEVEMENTS

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#### ALGERIA

##### **ALG/1/011      NUCLEAR DATA BANK**

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APPROVED: **1991**

COMPLETED: **1994-09-26**

TOTAL COST: \$ **93,785**

To strengthen nuclear data processing facilities and to help generate, collect, process and disseminate nuclear data.

The Government requested Agency assistance in establishing a self-sustaining team capable of generating multi-group nuclear constants and data and in setting up basic nuclear data libraries for research reactor physics experiments. The Agency provided a powerful computer facility and accessories as well as expert advice on data processing. Two staff members from the Centre for the Development of Energy Systems received fellowship training. A national training course was organized for 12 nuclear engineers and nuclear physicists from groups operating the two available research reactors. The team is now operational.

##### **ALG/1/012      LASER-INDUCED PLASMA DIAGNOSTICS**

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APPROVED: **1991**

COMPLETED: **1994-11-11**

TOTAL COST: \$ **82,060**

To expand the diagnostics capability of the laboratory for characterization of basic parameters of laser-induced plasma and to train the staff.

Agency assistance was requested to enable the Thermonuclear Fusion Laboratory of the Centre for the Development of Advanced Technologies, Algiers, to upgrade its X-ray spectroscopy facility. The Agency provided a radiation detector and electronics, a molecular pump and related equipment. The Centre is now carrying out plasma physics studies and teaching post-graduate students from other centres in the country.

##### **ALG/2/004      NEUTRON ACTIVATION ANALYSIS**

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APPROVED: **1991**

COMPLETED: **1994-09-21**

TOTAL COST: \$ **119,284**

To apply neutron activation analysis using the existing research reactor and to extend its application to other sectors.

The project was designed to support the programme of the Centre for the Development of Nuclear Techniques, Draria, for optimizing the possible utilization of its 1 MW research reactor. The Agency supplied two semiconductor detectors and electronics, with related equipment, as well as expert services for streamlining and developing neutron activation analysis procedures and introducing new analytical methods. Two fellowships were awarded. The Centre can now undertake the determination of rare earths and perform multi-elemental analysis in geological samples.

##### **ALG/3/004      URANIUM EXTRACTION FROM PHOSPHORIC ACID**

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APPROVED: **1991**

COMPLETED: **1994-09-22**

TOTAL COST: \$ **62,588**

To investigate the removal and possible recovery of uranium from the phosphoric acid produced in Algeria.

The project was designed to assist the Materials Development Centre, Algiers, to investigate the removal and possible recovery of uranium from the phosphoric acid produced in the country. The Agency supplied a complete facility and supporting equipment for a bench-scale investigation of uranium recovery from this phosphoric acid. Two fellowships were awarded in Syria where the same programme and facility have been set up. Procedures and techniques for the chemical and instrumental analyses of the various feed and product streams of the uranium recovery process have been introduced. The Centre has now developed the infrastructural capacity to decide reasonably on the issue of removal of uranium from phosphoric acid produced in the country.

**ALG/5/015 RADIOISOTOPES IN AGRICULTURE**

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APPROVED: 1991

COMPLETED: 1994-09-21

TOTAL COST: \$ 146,361

To increase the yields of cereal and horticultural crops through efficient use of fertilizers, using tracer techniques.

The project was intended to assist the Centre for the Development of Nuclear Techniques, Algiers, in establishing an agricultural laboratory for studies on optimizing nitrogen fertilizer efficiency. Two staff members received fellowship training. The Agency provided an emission spectrometer, related equipment and N-15 labelled fertilizer. The agricultural laboratory is now routinely carrying out studies on fertilizer use and its relation to water and plants.

**ALG/6/006 NUCLEAR MEDICINE**

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APPROVED: 1989

COMPLETED: 1994-09-27

TOTAL COST: \$ 141,929

To improve the quality of medical examinations and to increase the number of dynamic examinations through image processing.

The project was intended to assist the Pierre et Marie Curie University Hospital, Algiers, to improve its clinical examinations. The Agency supplied a complete data processing system which has been attached to the gamma camera purchased by the hospital. One project-related fellowship was granted for practical training in France. Three project-related expert missions were planned but were not implemented owing to the situation in Algeria.

**ALG/7/002 RADIOSTERILIZATION OF BIOLOGICAL TISSUES**

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APPROVED: 1993

COMPLETED: 1994-09-21

TOTAL COST: \$ 30,714

To develop an indigenous capability for local economic production of radiation-sterilized biological tissues for clinical and surgical use.

This project was designed to help develop a local capability for the production of radiation-sterilized human tissue for medical purposes at the Irradiation Technology Laboratory of the Centre for the Development of Nuclear Techniques, Algiers. The Agency provided equipment and the services of an expert in radiation-induced effects on tissues. The project has stimulated scientific studies on bone, ligament and skin transplantation, using the available equipment and expertise.

**ALG/9/007 ENVIRONMENTAL MONITORING**

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APPROVED: 1991

COMPLETED: 1994-10-28

TOTAL COST: \$ 121,847

To strengthen the capability of the existing radiation protection centre to undertake regular monitoring of the air-soil-food chain and to train researchers and technicians.

The Agency provided the Radiation Protection and Safety Centre, Algiers, with equipment including a thermoluminescence dosimetry system, radiation detectors and computer software. An expert advised on programme design, permissible radionuclide levels in foodstuffs and the environment, and on sampling methods. Recommendations were made concerning the radiation emergency plan under preparation, which forms part of a national programme for environment monitoring. Three project-related fellowships were awarded. The Centre has initiated the preparation of a radiation emergency plan and a marine environmental programme along the coast.

**ARGENTINA****ARG/4/079 CYCLOTRON PRODUCTION OF RADIOISOTOPES**

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APPROVED: 1991

COMPLETED: 1994-11-10

TOTAL COST: \$ 68,966

To train personnel to use a cyclotron for production of radioisotopes, mainly for radiopharmaceuticals.

The National Atomic Energy Commission acquired a 40 MeV negative-ion proton cyclotron for the production of radionuclides of medical importance, which is operating at the Ezeiza Nuclear Centre. Three experts gave advice on radionuclide production and on radiochemical laboratory and hot cell technology. Over five months of individual training were provided in radiochemical techniques and advanced quality control techniques. The Agency supplied a liquid chromatograph and awarded two fellowships. The project has helped to elaborate short and medium term programmes for the use of the cyclotron (the first in Argentina) for radionuclide production. Construction of the

radiochemical facilities is being completed in spite of delays, and the production of radionuclides and radiopharmaceuticals to meet the needs of the national nuclear medicine community is expected to begin in 1995.

#### **ARG/4/081 APPLICATION OF TANDEM ACCELERATOR**

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APPROVED: **1991**

COMPLETED: **1994-11-21**

TOTAL COST: \$ **223,530**

To improve the capability for R&D in materials sciences and radiobiological studies using the existing tandem accelerator.

The Department of Physics and Radiobiology of the National Atomic Energy Commission operates the TANDAR facility, which is used by researchers both in Argentina and from other countries in the region for fundamental and applied research in a variety of fields. The project was designed to improve the general experimental infrastructure of the facility. The Agency provided a computer with associated units, which was integrated into TANDAR's existing data collection system, so that the Laboratory now has a modern data acquisition system suitable for accelerator-based technologies. Six expert missions provided training in the use of the data acquisition system and the application of charged particle beams. Three scientific visits were awarded to facilities similar to TANDAR. The Laboratory now has the equipment and expertise to use particle-induced X-ray emission spectroscopy and particle-induced gamma emission for determination of the profiles of surfaces of materials irradiated by high energy heavy-ion beams.

#### **BANGLADESH**

#### **BGD/1/008 SECONDARY STANDARDS DOSIMETRY LABORATORY**

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APPROVED: **1985**

COMPLETED: **1994-01-20**

TOTAL COST: \$ **328,673**

To establish a national laboratory for the calibration of radiation measuring equipment.

The Bangladesh Atomic Energy Commission has undertaken a programme to promote the safe use of ionizing radiation, particularly in medicine, agriculture and industry, and sought Agency assistance to establish a national laboratory for the calibration of radiation measuring equipment. The Agency provided major equipment including a Co-60 irradiator, a multi-purpose and a panoramic gamma irradiator, and a neutron irradiator. Six expert missions advised and assisted on construction, installation, and calibration of the equipment and gave on-the-job training. One physicist participated in a regional training course on radiation dosimetry, and one fellowship was awarded. A national laboratory for calibrating radiation measuring equipment is now available, used mainly for radiation protection and environmental dosimetry. It is also providing calibration services to the radiotherapy departments that operate Co-60 teletherapy units and deep therapy X-ray machines. Radiation dosimetry in Bangladesh has become more accurate and the application of ionizing radiation has become safer.

#### **BGD/4/009 RESEARCH REACTOR UTILIZATION**

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APPROVED: **1983**

COMPLETED: **1994-01-20**

TOTAL COST: \$ **693,409**

To develop the capability for neutron activation analysis, neutron scattering and spectroscopy using the existing research reactor for applications in nuclear chemistry, radiochemistry and nuclear materials analysis and testing.

The Bangladesh Atomic Energy Commission installed the 3 MW TRIGA Research Reactor at the Atomic Energy Research Establishment (AERE), Dhaka, in September 1986. The Government sought Agency assistance to set up three major experimental facilities around the reactor: neutron scattering, neutron radiography and neutron activation analysis. The Agency provided major equipment including a triple-axis neutron spectrometer and a liquid nitrogen production plant. Ten expert missions provided training and advice. Eight long term fellowships and two scientific visits were awarded. The AERE is now capable of performing neutron activation analysis, neutron scattering and spectroscopy, thereby promoting better utilization of the research reactor for materials testing and analysis, and for environmental and geological samples analysis, nuclear data measurements, reactor physics and fuel management studies. Under this project nine scientists have received post-graduate degrees. The work is being continued under the ongoing project BGD/4/018.

#### **BGD/4/013 REPAIR AND MAINTENANCE OF NUCLEAR INSTRUMENTS, DHAKA**

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APPROVED: **1989**

COMPLETED: **1994-01-20**

TOTAL COST: \$ **51,419**

To acquire laboratory facilities and expertise for R&D activities in nuclear electronics.

Under this footnote-a/ project, made operational through an extrabudgetary contribution from the USA, the necessary test equipment was provided to the Electronics Division of the Atomic Energy Centre (AEC), Dhaka, to enable it to

repair and maintain all the nuclear Instrumentation at the Centre. Two expert missions on quality control and preventive maintenance were undertaken and one fellowship was awarded. The capability of the AEC to repair and maintain its nuclear Instruments has been considerably strengthened and the work is being continued under the ongoing project BGD/4/017.

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**BGD/5/010      FOOD IRRADIATION**

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APPROVED: **1983**

COMPLETED: **1994-12-30**

TOTAL COST: **\$ 1,135,638**

To establish a multi-purpose irradiation facility for disinfection and storage of food and medical supplies.

The Bangladesh Atomic Energy Commission (BAEC) has initiated a programme for food preservation by irradiation and has already established an experimental irradiation facility, carrying out pilot scale studies on potatoes, onions, shrimps, dried fish and spices. Under this footnote-a/ project, funded by TACF, with a contribution from the USA, the Agency provided a semi-industrial Co-60 gamma irradiator and related equipment. Eleven expert missions assisted in the design and construction of the irradiation facility. Two project-funded and five project-related fellowships as well as one project-funded and one project-related scientific visits were awarded. BAEC has established a joint venture with a local firm for the installation and operation of the facility. Considerable progress has been achieved in R&D work on disinfection of food and agricultural products, sprout inhibition of potatoes and onions, preservation of fresh fish and meat, shelf-life extension of fruit and vegetables, and studies of the techno-economic and commercial feasibility of irradiated food and agricultural products. A highly qualified cadre of scientific and technical staff has been built up, and consumers and traders have begun to realize the advantages of irradiation.

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**BGD/6/008      RADIATION PROCESSING TECHNOLOGY**

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APPROVED: **1988**

COMPLETED: **1994-02-09**

TOTAL COST: **\$ 140,318**

To develop a capability for radiation processing technology with a view to promoting a wide range of industrial applications.

The Institute of Nuclear Science and Technology, Dhaka, has carried out some research on the industrial applications of radiation polymerization such as polymer modification and curing of surface coatings in order to improve the quality of local low grade wood and certain wood-related materials. A study on wood-plastic composite has been in progress since November 1985, supported by an Agency research contract. Two experts undertook three missions to give advice and on-the-job training in studies on the use of the ultraviolet machine provided by the Agency for radiation curing of surface coating on wood and wood products, leather, plastic and paper and on radiation vulcanization of natural rubber. The Agency provided testing equipment and chemicals and awarded one long term fellowship. The project has contributed to building up the infrastructure to support an industrial scale radiation curing facility.

**BELARUS**

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**BYE/8/002      NEW TECHNOLOGY FOR DISPOSAL OF RADIOACTIVE CONTAMINATED WOOD**

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APPROVED: **1993**

COMPLETED: **1994-08-18**

TOTAL COST: **\$ 2,888**

To develop compaction and gasification techniques for the safe disposal of local concentrations of radionuclide contamination in wood and other plant material.

Forests cover over seven million hectares in Belarus, and forestry is an increasingly important sector of the economy. Over 20% of national forest was affected by radioactive contamination from the Chernobyl accident. In order to make use of the contaminated forest areas, practical and economic methods of obtaining timber with safe levels of radioactivity are being investigated. The Luikov Heat and Mass Transfer Institute, Minsk, has been developing a technique for the safe and effective disposal of contaminated wood. The radial distribution of radioactivity in the tree is observed to be concentrated in the bark and outer layers, and by stripping the outer layers of wood the remaining timber is left relatively free from contamination. The waste product is burned in the field in a specially built trench. A low cost filtration method is being developed to decontaminate the exhaust gases produced. An Agency expert reviewed the ongoing work and made recommendations on decontamination techniques.

## **BOLIVIA**

### **BOL/6/017 BRACHYTHERAPY SERVICE**

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APPROVED: **1992**

COMPLETED: **1994-09-27**

TOTAL COST: \$ **51,920**

To set up a brachytherapy service to provide treatment to cancer patients.

Under this Reserve Fund project, expert services were provided to plan and organize brachytherapy activities at a national level. A programme was outlined and, as a first step, a treatment planning system and a remote control afterloading brachytherapy unit, including some radiotherapy equipment, partially funded under the project BOL/6/019, was provided to the Institute of Oncology, San Juan de Dios Hospital, Santa Cruz. The hospital has upgraded its infrastructure and can now provide brachytherapy services to the local population. The activities will be continued under the project BOL/6/020.

## **BRAZIL**

### **BRA/4/029 STUDY OF MULTI-LAYER SEMICONDUCTOR STRUCTURE**

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APPROVED: **1988**

COMPLETED: **1994-06-30**

TOTAL COST: \$ **139,484**

To upgrade an existing electron spin resonance spectrometer; to train graduate students in advanced research activities in semiconductor physics.

This footnote-a/ project was implemented by the Physics Department of the Federal University of Minas Gerais as a continuation of the project BRA/4/029, and was financed by an extrabudgetary contribution from Germany. The equipment required to complete the spectrometer, including a semiconductor detector and a cryogenic apparatus, was supplied. Expert services to assist in the installation of the spectrometer, to set up experiments and to train the local staff were also provided. A modern computer-controlled spectrometer is now operating to measure electron paramagnetic resonance (EPR) and electron nuclear double resonance (ENDOR) and to set up optically detected magnetic resonance (ODMR), as well as for utilization in research in semiconductor physics. Special software developed by a magnetic resonance group at the University of Paderborn, Germany, was installed to analyse the ENDOR spectra. Experiments were initiated for semiconductor physics research as part of a joint project with the University of Paderborn. The level of academic research and the possible applications in industry have been considerably strengthened.

### **BRA/4/039 PRODUCTION OF MOLYBDENUM-99**

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APPROVED: **1989**

COMPLETED: **1994-12-19**

TOTAL COST: \$ **67,728**

To provide basic infrastructure for the establishment of a plant to produce sufficient Tc-99m to meet the national demand in nuclear medicine.

The Institute for Nuclear Energy and Research (IPEN) of the National Nuclear Energy Commission, São Paulo, requested Agency assistance to establish the basic infrastructure for a Government project to set up a plant for fission Mo-99 to meet the increasing demand for Tc-99m for medical purposes. Three expert missions carried out a feasibility study and advised on the requirements for upgrading the reactor. Basic equipment was supplied, including a liquid scintillation counter, and nine fellowships were awarded. IPEN now has the technological basis to set up a pilot-scale plant with a view to expanding into a commercial plant, provided, however, that financial support is given by the Government.

### **BRA/4/041 CREEP IN IRRADIATED MATERIALS**

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APPROVED: **1991**

CANCELLED: **1994-05-17**

TOTAL COST: \$ **9,971**

To improve the capacity to perform creep measurements and to perform simulation experiments on materials for use in a reactor or high radiation environments.

The project was cancelled as it could not be implemented. Germany no longer manufactures the required equipment and could not provide experts since work on the subject has been discontinued. The Technical Officer visited the Institute for Nuclear Energy and Research, São Paulo, to determine whether alternative suppliers and experts could meet the requirements of the project, but without success. However, one fellowship had been awarded and was completed. Brazil agreed to cancel the project.

**BRA/5/021 PLANT MUTATION BREEDING**

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APPROVED: 1991

COMPLETED: 1994-12-19

TOTAL COST: \$ 63,946

To improve sugar cane and banana breeding using tissue culture techniques and mutation induction, with the aim of obtaining disease-resistant varieties.

The Centre for Nuclear Energy In Agriculture of the University of São Paulo requested Agency assistance to use tissue culture to obtain disease-resistant material in sugar cane and banana. The Agency provided equipment to complete the In-vitro culture laboratory as well as three experts and one fellowship. Infrastructure for an in-vitro culture laboratory for mutation breeding and improvement of the two crops was established, which could also be used eventually for other crops. Cell and tissue culture techniques for in-vitro irradiation of sugar cane was developed. Plant regeneration was achieved from callus cultures initiated from leaf explants. Attempts to regenerate plants of sugar cane from suspension cultures and protoplasts were not successful. In banana, irradiation of material grown in vitro and the subsequent in-vitro multiplication resulted in the production of over 2000 plants which were transferred to the field for selection for resistance to Fusarium wilt disease. This material is still undergoing field trials for selection and further breeding.

**BRA/5/023 STUDIES ON PESTICIDE RESIDUES IN FOOD AND THE ENVIRONMENT**

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APPROVED: 1991

COMPLETED: 1994-05-27

TOTAL COST: \$ 228,899

To identify, by means of radiochemistry and other analytical techniques, the residues arising from pesticide use in soils, plants and food.

To amplify studies conducted under research contracts, the Radioisotope Centre of the Instituto Biológico, São Paulo, requested Agency assistance to examine the fate of pesticides and the threats to human health and the environment due to their inappropriate use. Experiments on the behaviour in soil and plants of two herbicides, atrazine and diuron, were used to develop facilities and skills. A lysimeter station was established to allow the use of C-14 labelled pesticides in outdoor conditions; the technique of supercritical fluid extraction of pesticide residues was introduced, and advances were made in the use of radiolabelled pesticides and chromatographic procedures. Experts gave advice on pesticide residue problems and analysis and assisted in experiments on the uptake of pesticides by plants. Equipment provided included a gas chromatograph, a liquid scintillation counter, a radiation detector and a spectrophotometer. Two fellowships and a scientific visit were awarded. The Centre is now capable of playing a significant role in evaluating the environmental behaviour of pesticides in Brazil and is actively contributing to the development of guidelines for pesticide testing.

**BRA/6/011 DETOXIFICATION OF SNAKE VENOMS AND DEVELOPMENT OF RIA KITS**

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APPROVED: 1991

COMPLETED: 1994-06-30

TOTAL COST: \$ 79,884

To produce venom attenuated by gamma radiation for immunization of animals, and to develop a radioimmunoassay kit to determine the presence of antigens in bitten persons.

About 20,000 cases of snakebite are reported annually in Brazil, of which about 13% are due to the South American rattlesnake whose venom can be fatal if not properly treated. The Department of Applications In Biological Sciences of the Institute for Nuclear Energy and Research requested Agency assistance in the use of gamma radiation together with conventional treatments. The Agency provided the necessary equipment, including a gamma counter and an electrophoresis system, and awarded a fellowship. The Butantan Institute, which produces most of the antiofphidic sera in Brazil, carried out the immunological services. An attenuation of crotalic venom toxicity with maintenance of immunological properties was obtained. In addition, a highly specific antiserum against crotalic venom was developed and is being used to build radioimmunoassay kits. Irradiated venom was found to induce no lesions in horses used for the immunization process. It was proven that gamma irradiation is a powerful tool for snake venom attenuation, and that the toxoid obtained can be used in large scale antiserum production without any of the disadvantages of immunization by local venoms. The results were reported in 18 papers presented at national conferences, and two papers published in a national journal. The Institute is continuing these activities independently.

**BRA/9/038 MANAGEMENT OF LOW- AND INTERMEDIATE-LEVEL WASTES**

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APPROVED: 1991

COMPLETED: 1994-04-19

TOTAL COST: \$ 59,394

To establish and develop facilities for the treatment of low and medium level radioactive wastes.

The Institute for Nuclear Energy and Research (IPEN), São Paulo, is the largest institution in Brazil utilizing nuclear techniques. A large amount of low and intermediate nuclear waste is generated since IPEN manages not only its own wastes but also those from hospitals, universities and industries in the area. As IPEN is planning the production of

Mo-99 by irradiation of enriched uranium, a separate cementation plant needed to be designed for disposal of the cemented waste form containing the waste solution from the first Mo separation step. Four expert missions were fielded to assist in planning and design of the plant and the characterization and evaluation of cemented waste products including the design and qualification of waste packages. The Agency provided data processing equipment, solid calibrated sources and a mixer. Three fellowships were awarded and some staff training was provided. IPEN's capability for the treatment of wastes has been significantly strengthened.

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**BRA/9/040 TROPICAL RADIOECOLOGY**

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APPROVED: 1991

COMPLETED: 1994-05-31

TOTAL COST: \$ 47,877

To obtain data on the behaviour of radionuclides in a tropical agricultural environment.

This footnote-a/ project was made operational through an extrabudgetary contribution from France. The fellowship was financed from Agency funds. The Institute for Radiation Protection and Dosimetry, Rio de Janeiro, requested assistance to develop resources to obtain data on the transfer factors of radionuclides from Brazilian soils to crop plants. Such data are scarce and are necessary for devising appropriate countermeasures against nuclear accidents. Cs-137 was chosen for the experiments, taking advantage of conditions created by the Golanla accident. Five characteristic soil types were identified together with several crop plants. A lysimeter station was established and, in a preliminary experiment, using soil from the Golanla region, transfer factors for Cs-137 to the root, stem, leaf and grain of soybean were determined. Facilities are now available to extend the work to other soils, other crops (cassava, beans) and other radionuclides (Co-60, Ra-228). An expert advised on the research programme. Equipment was provided, mainly for radiological protection. One fellowship and one scientific visit were awarded. The follow-up project BRA/5/031 has been approved with footnote-a/ status.

**BULGARIA**

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**BUL/4/003 CONSTRUCTION OF A NEUTRON GENERATOR**

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APPROVED: 1985

COMPLETED: 1994-08-31

TOTAL COST: \$ 373,726

To assist in designing, manufacturing and installing a high yield neutron generator for neutron activation analysis and cross-section measurements.

The Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences, Sofia, has been applying neutron activation analysis (NAA) as a basic technique, using a low yield neutron generator. To increase the accuracy of the measurements and to extend the range of isotopes determined by NAA, a more powerful neutron generator was required. Under this footnote-a/ project, made operational through an extrabudgetary contribution from the USSR, a high yield neutron generator was provided. Agency personnel visited the suppliers in the USSR to discuss procurement and planning, and experts from the vendor visited the Institute to advise on the installation of the equipment. One staff member received training in advanced experimental methods in neutron physics. The neutron generator has, so far as we know, not yet been installed because the building to house the generator and experimental hall is not yet completed.

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**BUL/5/008 NUCLEAR TECHNIQUES IN CROP PRODUCTION**

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APPROVED: 1986

COMPLETED: 1994-02-20

TOTAL COST: \$ 395,169

To develop cultivars of economically important crop plants through radiation-induced mutations.

The Institute of Genetics of the Bulgarian Academy of Sciences has been endeavouring to obtain high yielding and disease-resistant cultivars of major crop plants. The Agency provided the Institute, which is the principal and coordinating counterpart, and 13 other agricultural institutions with expert advice on mutation breeding in wheat, barley and other vegetatively propagated crops. Three international conferences were organized; twelve fellowships and three scientific visits were awarded. The Agency supplied equipment, laboratory instruments and large amounts of chemicals. The use of radiation-induced mutations has improved plant breeding and led to the development of new cultivars of economically important crops.

APPROVED: **1989**COMPLETED: **1994-08-31**TOTAL COST: **\$ 104,026**

To perform feasibility studies for radioactive waste treatment technology, to train specialists in radioactive waste management and to assist in putting a waste treatment system into operation.

Operation of the Kozloduy NPP led to an accumulation of large amounts of liquid and solid unconditioned radioactive wastes at the site, which increased the risk of radiological incidents and contamination of the environment. During the first stage of the project (1989-1990) the Agency provided expert missions to advise on the selection of appropriate technologies and equipment for treatment and conditioning of the accumulated radioactive wastes. The container for conditioned (cemented) waste, which was developed in Bulgaria, was tested in accordance with IAEA recommendations. Further expert assistance (1990-1993) was concentrated on radioactive waste management regulations, particularly in developing scientifically based liquid discharge limits for the NPP according to ICRP recommendations and IAEA guidelines. One fellowship was awarded. In 1994 the NPP received a license for releases according to the new release limits. The equipment for waste treatment and conditioning is currently being installed and operated.

**CHILE****CHI/1/017 TESTING OF REACTOR FUEL ASSEMBLIES**

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APPROVED: **1991**COMPLETED: **1994-12-19**TOTAL COST: **\$ 4,680**

To determine the various stresses to which fuel elements and related components may be subjected, under both normal and accident conditions.

This project was carried out in close co-operation between the Chilean Nuclear Energy Commission (CCHEN), at its Lo Aguirre Reactor Centre, and the National Hydraulics Institute (INH). The Agency provided expert assistance related to out-of-pile testing of MTR fuel assemblies as well as a data acquisition system. During implementation of the project, its objectives were slightly amended, aiming at the determination of hydraulic parameters of fuel elements under normal working conditions. A test model for four fuel elements was elaborated and a loop of hydraulic tests was implemented at the INH.

**CHI/2/009 TRACE-ELEMENT ANALYSIS**

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APPROVED: **1989**COMPLETED: **1994-05-31**TOTAL COST: **\$ 70,200**

To provide facilities for chemical and physical treatment of samples to be analysed with nuclear techniques in order to minimize systematic errors caused by contaminating agents.

This project was implemented at the La Reina Centre of the Chilean Nuclear Energy Commission (CCHEN) to provide optimum conditions for the clean treatment of samples to be analysed with nuclear techniques. The Agency supplied some additional basic equipment for the analytical chemistry laboratory. Expert services for the design, specifications and utilization of clean rooms and testing under normal working conditions were provided. Training was also given in setting up and operating the clean rooms. CCHEN now has an analytical laboratory with the clean rooms required for carrying out analysis of chemical and physical samples and avoiding systematic measuring errors caused by contaminating agents. CCHEN is now providing advisory services on the design of clean rooms to other countries in the region.

**CHI/2/011 QUALITY CONTROL OF RADIOISOTOPES AND RADIOPHARMACEUTICALS**

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APPROVED: **1991**COMPLETED: **1994-05-27**TOTAL COST: **\$ 50,217**

To improve quality control of radioisotopes and radiopharmaceuticals.

This project was initiated at the La Reina Centre of the Chilean Nuclear Energy Commission (CCHEN) in order to ensure the chemical, radiochemical and radionuclide purity of the raw materials to be irradiated and of the radioactive products. The Agency provided two experts together with some equipment. One fellowship and one scientific visit were awarded, and a seminar was held on quality control in hospital radiopharmacy. Radioanalytical techniques such as gamma spectrometry and high-precision liquid chromatography were applied for quantifying various radioisotopes produced by CCHEN. The specific activity of Tc-99m and I-131 was determined and will provide key information for future labelling of more sophisticated molecules such as monoclonal antibodies. CCHEN's capability for quality control of radioisotopes and radiopharmaceuticals has been considerably improved.

APPROVED: **1991**COMPLETED: **1994-05-25**TOTAL COST: \$ **35,774**

To enable the existing laboratory to date geological samples of more recent origin to assist in determining mineralization in Chile.

The project was designed to upgrade the K-Ar Geochronology Laboratory of the National Geology and Mining Service (SERNAMEM) through the installation of a more efficient argon (Ar) extraction table for the existing mass spectrometer, allowing a more accurate absolute age determination at the lower level (less than 10 million years). Two expert missions assisted in the construction, installation and testing of the new argon extraction table provided by the Agency and awarded a fellowship. The Laboratory, which has performed about 2500 K-Ar age determinations during the past 10 years, is now able to determine more accurately Upper Miocene and younger rock formations and alteration zones commonly associated with valuable mineralization, particularly gold. This improvement will help identify more accurately the metallogenic provinces of the various mineral deposits associated with such rock formations.

**CHI/4/015****REACTOR FUEL MATERIALS**

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APPROVED: **1989**COMPLETED: **1994-10-27**TOTAL COST: \$ **134,716**

To develop reflector and control elements and materials and fuel with burnable poisons.

The Chilean Nuclear Energy Commission (CCHEN) proposed to install a facility at its Nuclear Materials Department for the fabrication of MTR fuel, including fuel with burnable absorbers, needed for the two research reactors at La Reina and Lo Aguirre in order to convert the two reactor cores from high to medium enriched U-235 fuel, including the technology for the fabrication of control rods and reflectors. The national programme was initiated in 1982, and the facility for fabrication of low enriched fuel was built. After review in 1992, the project was focused on the technique of fuel fabrication to make high density fuel with medium enrichment, including the fabrication of fuel plates and oxide and silicide powders, and to apply the technology to quality control of components, fuel plates and assemblies. The Government gave high priority to the project and covered 50% of the cost of a high vacuum induction furnace. The Agency provided furnace accessories and ion nitriding equipment, expert services and training. One scientific visit was also awarded. Fuel plates made of natural uranium were completed, and the facility was successfully tested.

**CHI/6/010****RADIOPHARMACEUTICAL DEVELOPMENT**

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APPROVED: **1989**COMPLETED: **1994-10-27**TOTAL COST: \$ **51,164**

To label autologous blood cells, utilize bifunctional chelating agents, and develop new radiopharmaceuticals for in-vivo diagnosis.

This project was intended to assist the Radiopharmacy Group at the Chilean Commission for Nuclear Energy (CCHEN) to develop new radiopharmaceuticals for use in nuclear medicine. The Agency provided expert services on the organic synthesis of radiopharmaceuticals, some equipment and a scientific visit. The Group developed new Tc-99m-based radiopharmaceuticals, established modern analytical and autoradiography techniques for quality evaluation and control of radiopharmaceuticals. They also trained Chilean and other Latin American specialists and technicians through national and regional courses as well as Agency fellowships awarded for training at CCHEN. The Group is now carrying out routine production of the new radiopharmaceuticals developed during the project and transferring the new techniques to other nuclear medicine centres. Locally produced radiopharmaceuticals and the new techniques are being utilized in Chile and in other countries in the region. The work will continue under the project CHI/4/019.

**CHI/6/011****APPLICATION OF TOMOGRAPHY IN NUCLEAR MEDICINE**

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APPROVED: **1991**COMPLETED: **1994-12-19**TOTAL COST: \$ **339,488**

To introduce gamma camera based computer tomography to diagnose heart disease, with facilities for teaching and research.

The project was intended to introduce computer tomography (SPECT) for diagnosis of heart disease at the University of Chile's Clinical Hospital, Santiago. With an additional funds-in-trust contribution from the Government, the Agency supplied a gamma camera with data processing equipment. Experts trained the staff in its use and assisted in establishing quality control procedures for SPECT imaging as well as advising on the clinical applications of SPECT. The equipment was installed in December 1991 and by March 1994 a total of 1320 SPECT tomography studies had

been performed. Agency experts provided training to medical technicians and medical doctors and arranged special training courses with participation from other hospitals. Following an Agency recommendation, a medical physicist has been added to the nuclear medicine team.

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**CHI/6/012 RADIOIMMUNOASSAY FOR THE DIAGNOSIS OF CHAGAS DISEASE**

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APPROVED: **1991**

COMPLETED: **1994-11-10**

TOTAL COST: \$ **37,939**

To establish radioimmunoassay methods using recombinant antigens to diagnose Chagas' disease.

Chagas' disease is endemic in Chile. The chronic stage causes permanent damage to the heart and other organs, and therefore early diagnosis is important. The Government requested Agency assistance to establish radioimmunoassay methods at the Department of Biochemistry of the University of Chile Medical School in Santiago. This footnote-a/ project was made operational through an extrabudgetary contribution from Germany, which also provided an expert to train local staff. The equipment supplied by Germany included a radiation contamination monitoring and gamma counting system. The Agency provided some additional equipment and reagents and awarded a fellowship. Acute and congenital cases of Chagas' disease have been diagnosed using the newly developed *Trypanosoma cruzi* recombinant antigens. The development of new antigens is being pursued also for use as markers of pathology, indicators of chemotherapy efficacy or to develop protection against the infection. The work will be followed up under the new project CHI/6/015 approved with footnote-a/ status.

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**CHI/9/013 RADIATION PROTECTION**

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APPROVED: **1988**

COMPLETED: **1994-10-27**

TOTAL COST: \$ **362,216**

To upgrade the existing infrastructure and to design an overall development plan to meet the national demand for radiation protection services.

Following the recommendations of a RAPAT mission in December 1985, this project was designed to provide comprehensive assistance to the Chilean Nuclear Energy Commission (CCHEN). Five expert missions, monitoring equipment and a spectrometer were provided. Seventeen fellowships and a scientific visit were also awarded. Additional local training was provided by CCHEN for its own staff and those of the Ministry of Health. More than 300 professionals have been trained, with consequent improvement in radiation protection services. Expert services helped to transfer specialized know-how in radiological and secondary standards dosimetry, radiation protection and radioecology. Close co-operation was established between CCHEN and the Ministry of Health, to their mutual benefit. These activities will continue under the project CHI/9/018.

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**CHI/9/016 RADIOACTIVE WASTE MANAGEMENT**

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APPROVED: **1989**

COMPLETED: **1994-09-16**

TOTAL COST: \$ **197,128**

To establish the technology and facilities for solid waste treatment and to determine the requirements for waste treatment and conditioning on the basis of environmental impact.

This project is a follow-up to CHI/9/010 and was intended to assist the Nuclear Research Centres of the Chilean Nuclear Energy Commission (CCHEN) at Lo Aguirre and La Reina to establish a conditioning and storage facility for spent sealed radiation sources at La Reina and to construct a waste treatment facility for other wastes at Lo Aguirre. The Agency provided most of the instruments required to equip the waste treatment facility and supporting laboratories, including a cementation plant, a waste compactor, air monitoring equipment, non-destructive testing and other equipment. Five expert missions advised on the selection of treatment and conditioning processes and on the design and operation of a low level treatment facility. One fellowship was awarded. Spent sealed sources are now being collected from users and, after registration, are stored in an interim storage facility at La Reina. A waste treatment plant was constructed at Lo Aguirre and, with the addition of the appropriate laboratories, has enabled CCHEN to meet all requirements for safe handling, treatment and conditioning of low level radioactive waste and spent sealed sources in Chile. Both installations were furnished with the necessary environmental and personnel monitoring equipment for plant workers.

## CHINA

### **CPR/0/006 INTERNATIONAL REGULATORY REVIEW TEAM (IRRT) MISSION**

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APPROVED: 1994

COMPLETED: 1994-10-28

TOTAL COST: \$ 44,383

To conduct an objective review of nuclear regulatory practices and to make recommendation for upgrading these practices to international standards.

The Agency fielded an International Regulatory Review Team (IRRT) of seven senior experts from 23 April to 10 May 1994, to evaluate the effectiveness of the regulatory process as carried out by the National Nuclear Safety Administration (NNSA). The areas reviewed were: governmental organization; nuclear safety legislation; role, responsibility and organization of the regulatory body; regulation and guides; licensing process; requirements on the applicants/licensees; assessment during the licensing process; regulatory inspection and enforcement; and emergency preparedness. The team made recommendations on the need to improve inspection procedures during plant operation, training of inspectors, operational experience feedback needs, emergency preparedness activities, public information actions, and further development of safety culture.

### **CPR/4/007 COMPUTER-AIDED DESIGN IN 600 MW(E) PWR ENGINEERING**

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APPROVED: 1989

COMPLETED: 1994-12-02

TOTAL COST: \$ 182,017

To develop computer-aided design methodology for the Qinshan NPPs and to establish engineering databases for piping and other disciplines.

China's second and third 600 MW NPPs at Qinshan are being designed and constructed. The Beijing Institute of Nuclear Engineering is developing computer-aided design (CAD) methodology for the overall design of NPPs and, in particular, for piping design and synthesis. The Agency provided expert advice and organized national seminars and a national workshop on CAD applications and overall design of NPPs. Two fellowships and three scientific visits were also awarded. A 3-D graphics workstation system with software was provided, tested and installed. The capabilities of the Institute have been considerably strengthened for the application of CAD to NPPs.

### **CPR/4/009 IN-CORE PWR FUEL MANAGEMENT**

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APPROVED: 1991

COMPLETED: 1994-10-27

TOTAL COST: \$ 210,727

To improve in-core fuel management using computer codes for the PWR reactor of the Qinshan NPP.

The Qinshan NPP was the first plant of indigenous design constructed in China. Accurate power distribution data is essential for its safe and reliable operation. The Agency organized a two-week workshop at Qinshan on in-core fuel management (IFM) for PWRs, with the participation of experts from France and the USA, attended by 46 engineers from 12 institutions in China. During the workshop the Agency experts recommended that (a) the IFM practice for designing, operating and licensing NPPs should be institutionalized; (b) a standard methodology and code package should be selected; (c) a reload safety evaluation process should be developed with well defined responsibilities; and (d) guidelines for benchmarking and qualification of IFM codes should be established to meet safety and quality assurance requirements. The Agency provided a computer system and awarded four fellowships. An important contribution has been made to the better management of fuel burnup at the Qinshan NPP, with consequent improvement in the safe and economical operation of the plant.

### **CPR/7/002 RADIATION STERILIZATION OF TISSUE GRAFTS**

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APPROVED: 1989

COMPLETED: 1994-10-27

TOTAL COST: \$ 76,256

To develop new covering substances for burn wounds using radiation-sterilization.

The project was first approved with footnote-a/ status and was upgraded in 1990. The Burns Plastic Surgery Department of the Suzhou Medical College has developed pigskin dressings as a temporary substitute for skin damaged by severe burns, which can often prove fatal. Radiation-sterilization of such dressings by gamma radiation from Co-60 sources has been shown to prevent cross-infection. Agency experts advised on clinical grafting of bone, fascia and dura tissues, and lectured to doctors and research fellows at the hospital and at the Radiation Medicine Research Institute. The Agency provided an ultra low temperature freezer and surgical equipment. The Department has produced locally sufficient quantities of sterile pigskin dressings to treat over 400 burn patients with outstanding success. The upgraded capability in radiation-sterilization of skin tissue has led to improvement in graft surgery and reduction of human suffering. Quality control will be addressed in the follow-up project CPR/7/004.

**CPR/8/006      RADIATION CROSS-LINKING AND CURING APPLICATIONS**

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APPROVED: **1991**COMPLETED: **1994-01-18**TOTAL COST: \$ **112,974**

To upgrade R&D capabilities in radiation cross-linking and radiation curing for industrial applications.

Agency assistance was requested in support of a national research project on curing kinetics based at the Applied Radiation Institute of the Shanghai University of Science and Technology. The Agency provided testing and radiotherapy equipment required to conduct the technological investigations. Two expert missions assisted in solving some of the practical problems encountered in industrial applications of ultra violet curing and in the preparation of biomedical hydrogel material by radiation cross-linking. Two fellowships and two scientific visits were awarded. TCDC was effective in promoting the transfer of technology for radiation cross-linking and radiation curing applications to the national industry.

**CPR/9/007      SOLIDIFICATION OF RADIOACTIVE WASTES**

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APPROVED: **1987**COMPLETED: **1994-01-28**TOTAL COST: \$ **226,587**

To study polymer solidification techniques for organic radioactive wastes, to characterize the solidified products and assess their long term behaviour, and to develop a pilot plant for the treatment of radwaste.

The project was designed to initiate studies on polymer solidification of radioactive wastes leading to the establishment of a pilot plant for the treatment of radioactive waste generated in various nuclear activities. The Agency provided an X-ray spectrometer system. Three expert missions advised on design and operation of the pilot plant and on the characterization of solid waste forms. Three fellowships and five scientific visits were awarded. Following the experts' recommendations, significant changes were introduced in the original flowsheet of the pilot plant process. A remote control pilot plant with a capacity of 200 kg per day has been set up and the technology subsequently transferred to a nuclear industrial facility. A mobile version will be built for disposal of waste generated at Qinshan NPP.

**CPR/9/008      PLANNING AND PREPAREDNESS FOR EMERGENCY RESPONSE**

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APPROVED: **1988**COMPLETED: **1994-12-30**TOTAL COST: \$ **137,977**

To formulate regulations, standards and guides for emergency planning; to establish an adequate display system for dose assessment; to train emergency response personnel; to plan and conduct emergency exercises.

China's nuclear power programme envisages that several NPPs will be in operation by the end of the century. To assist the Bureau of Safety, Protection and Health of the Ministry of Nuclear Industry and the Institute of Radiation Protection, the Agency provided expert services and training on planning and preparedness for emergency response, review of on-site and off-site emergency plans, probabilistic safety analysis and computer programs for dose assessment. A computer system and software were supplied. The basis now exists for the preparation of regulations and guides and for the establishment of a technical support centre for emergency planning and preparedness to deal with emergency situations at NPPs.

**CPR/9/009      SEVERE ACCIDENT ANALYSIS AND MANAGEMENT**

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APPROVED: **1989**COMPLETED: **1994-11-21**TOTAL COST: \$ **19,571**

To provide training activities to improve the local capability for severe accident analysis and accident management evaluation at Qinshan NPP.

The 300 MW Qinshan NPP was designed with a very conservative pressurizer volume and emergency core cooling system. It was therefore considered necessary to undertake a study of severe accidents with risk-dominant sequences in order to be able to take appropriate steps for accident management and to plan emergency measures. Under this footnote-a/ project, made operational through an extrabudgetary contribution from France, the Agency organized a two-week seminar on severe accident and accident management for 20 participants and a national training course on safety philosophy and practice, covering severe accident analysis, modelling and management, with 28 participants. Two fellowships were awarded under the regional manpower project.

**CPR/9/013 MEDICAL TREATMENT OF RADIATION INJURY**

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APPROVED: **1991**COMPLETED: **1994-10-28**TOTAL COST: \$ **130,615**

To improve the capability for diagnosis and treatment of radiation injuries and to establish better medical preparedness for nuclear accidents.

Radioisotopes are used extensively in China in agriculture, industry and medicine, as well as at NPPs. The Institute of Radiation Medicine, Beijing, in co-operation with other hospitals, has been treating radiation accident victims since 1963, and a growing number of cases with late effects are now being encountered. The Agency provided expert advice on treatment of local radiation injuries, haemopoietic cell culture and laboratory techniques and the use of new radioprotectors. ELISA and ultrasonic diagnostic equipment was also supplied. Five fellowships and two scientific visits were awarded. Diagnosis and treatment of radiation injuries at the Institute have been upgraded, and the capability for better medical preparedness for nuclear accidents has been strengthened.

**CPR/9/014 LOW- AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE DISPOSAL**

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APPROVED: **1991**COMPLETED: **1994-10-28**TOTAL COST: \$ **161,134**

To assist in site selection for a repository of low and intermediate level radioactive wastes, assessment of performance, safety and risks of a waste disposal system and the preparation of laws, regulations and standards, thereby enhancing the local capability for these activities.

The nuclear power programme of China envisages that 6000 MW of electricity are to be generated by NPPs by the end of the century. To deal with the disposal of the large quantities of low and intermediate level radioactive wastes that will be generated by these plants, the Government has undertaken studies for site selection for repositories in several areas. The Agency provided subsurface geophysical radar equipment and computer software to assist in these studies, complemented by extensive expert advice. One fellowship and two scientific visits were also awarded. The project has strengthened the local capability for site selection for a repository of low and intermediate level radioactive wastes, for assessment of performance, safety and risks of a waste disposal system and for the preparation of the necessary laws, regulations and standards.

**COLOMBIA****COL/4/011 UPGRADING OF RESEARCH REACTOR INSTRUMENTATION (PHASE II)**

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APPROVED: **1991**COMPLETED: **1994-08-26**TOTAL COST: \$ **182,657**

To renew the control and safety rod mechanisms of the IAN-R1 research reactor.

This footnote-a/ project is a continuation of COL/4/009 and was made operational through an extrabudgetary contribution from the USA, supplemented from the TACF and some funds-in-trust. It was intended to modernize the IAN-R1 research reactor at the Institute of Nuclear Science and Alternative Energies, Santa Fe de Bogota, including renewal of its control and safety rod mechanisms. The Agency supplied the necessary reactor control rod systems, detectors and computer accessories. Expert services were provided in nuclear safety and in neutronic calculations for the fuel conversion of the reactor to low enriched uranium (the latter service was in preparation for the follow-up project COL/4/012 which deals with the reactor core conversion). A scientific visit was also awarded. The control and safety rod mechanisms of the research reactor were replaced while progressive modernization of its instrumentation was carried out according to the latest safety standards.

**COL/5/012 RADIOIMMUNOASSAY TECHNIQUES IN ANIMAL REPRODUCTION**

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APPROVED: **1989**COMPLETED: **1994-05-31**TOTAL COST: \$ **83,395**

To improve reproductive efficiency in cattle and sheep through isotope-aided studies on physiological parameters connected with their reproduction, including environment and nutrition.

The project was implemented at three institutions: the Institute of Nuclear Sciences and Alternative Energies (INEA), the Colombian Institute for Agriculture and Livestock (ICA) and the National University of Colombia (NUC). The Agency provided expert services on radioimmunoassay (RIA) techniques and the development of a solid phase RIA kit, as well as equipment, including a beta-gamma counter and ELISA instrumentation. INEA was in charge of the local organization and developed a number of assays for progesterone, T3 and T4. The latter two assays were primarily developed for human sera but were later partially validated for cattle sera. Technical staff from ICA and NUC were successfully trained at INEA on the use of RIA, especially the FAO/IAEA RIA kits. The NUC conducted several experiments on the reproductive physiology of dairy cattle reared under the high plateau conditions of Bogota, and to evaluate the major factors affecting their reproductive performance. Later on, studies were conducted to evaluate

the use of carnation flowers as feed - a common practice among local farmers at the onset of ovarian activity and milk productive performance, but more detailed studies are needed. Owing to manpower constraints, the ICA, which is the foremost institution for livestock research in Colombia, had a rather limited participation in the project. Many experiments were initiated to study reproduced components in indigenous cattle and sheep breeds but very little action was taken by the counterpart. Although the project undoubtedly yielded some meaningful results, any future project in the field of animal science should be based on more active participation of the major national institution in this field and the appropriate manpower should be put at its disposal.

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**COL/5/013                      RADIATION INDUCED MUTATION BREEDING (PHASE II)**

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APPROVED: **1991**

COMPLETED: **1994-12-19**

TOTAL COST: **\$ 53,319**

To obtain rice varieties resistant to aluminium and manganese toxicity and with tolerance to salinity; to develop sorghum, wheat and barley varieties resistant to and tolerant of diseases, pests, drought and adverse soil conditions.

This project was approved as a joint mutation breeding programme of the Institute of Nuclear Sciences and Alternative Energies (INEA), the Colombian Institute for Agriculture and Livestock (ICA) and the Faculty of Agronomy at the National University (UN). Unfortunately, the lack of national financial resources and some institutional changes led to the discontinuation of ICA's and UN's participation. As a consequence, research on barley had to be abandoned and wheat breeding activities considerably reduced for lack of staff. However, for the research on breeding sorghum and rice, INEA found a new partner in the Federation of Rice Growers (FEDEARROZ). For sorghum, new material was identified and, after mutations induced by radiation, will be planted in the experimental fields belonging to FEDEARROZ. The main thrust of joint efforts was directed towards breeding new rice varieties, and a mutant is at present being evaluated for possible release on a larger scale. The Agency provided some laboratory and minor agricultural equipment, and awarded fellowship training to one staff member. Four expert missions were undertaken during which mutation breeding activities were prepared for banana and plantain, giving rise to the project COL/5/015. Mutation breeding in rice and plantain will continue under the project COL/5/017 with closer participation of the potential end users.

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**COL/8/016                      USE OF RADIOISOTOPES IN INDUSTRY**

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APPROVED: **1990**

COMPLETED: **1994-05-31**

TOTAL COST: **\$ 160,480**

To establish a programme of radioisotope applications in industry with particular emphasis on the mining industry.

This project, at the Institute of Nuclear Science and Alternative Energies (INEA), Bogota, has only partially achieved the objectives. After an initial planning mission by an Agency staff member to adjust INEA's activities in this field to the actual requests from industry, the two main counterparts received extensive training abroad through Agency fellowships. Equipment delivered included radiation detectors and monitoring items as well as a scanning electron microscope provided under a funds-in-trust arrangement with INEA. Although the project fell short of establishing a full scale programme of radioisotope applications in industry, it has carried out a series of joint projects with industry using radiotracers or other nuclear techniques with the following results: a material inventory of electrolytic cells was prepared for a local firm; residential times in separators were determined in order to optimize the time needed for oil-water separation (in an oil company); residential times were measured in a rotary kiln and electric furnace (in a ferronickel factory); and a system based on nuclear techniques for thickness control of cords was developed.

**COSTA RICA**

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**COS/5/011                      MUTATION BREEDING (PHASE II)**

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APPROVED: **1991**

COMPLETED: **1994-12-19**

TOTAL COST: **\$ 84,088**

To obtain genetically resistant varieties of common bean, yam and banana by using induced mutations and in-vitro culture techniques.

The School of Agricultural Sciences at the National University in Heredia has been receiving Agency assistance since 1987 for the introduction and application of radiation-based mutation breeding techniques to various crops of major significance. In this second phase the Agency provided laboratory electrophoresis, meteorological and agricultural equipment, expert services for yam mutagenesis and training in mutation breeding techniques for two staff members. Bean seeds have been irradiated with 100 Gy gamma rays and various interesting mutants were obtained. The counterpart established a protocol for in-vitro culture of common bean, one for callus induction and one for plant regeneration. Mutation induction is now being combined with these established in-vitro techniques. The difficulties of in-vitro culture of yam have been overcome with the assistance of an Agency expert and in-vitro culture of pathogen-free material and meristem culture is now working well. Work has started on in-vitro mutagenesis through irradiation with gamma rays and will continue for the production of disease-resistant mutants in yam. Banana and

plantain micropropagation is working very well. Mutations have been induced through irradiation with gamma rays in vitro, and selection of the mutants was carried out in co-operation with CATIE in Turrialba. Eleven promising clones were evaluated for yield and tolerance to the devastating fungal disease Black Sigatoka, which can cause total crop loss. The banana clone is now under extensive evaluation before an official release of the planting material to farmers. The evaluation and development of this clone was performed in close co-operation with the National Association for Banana Growers and in the last year also with the Banana Growers Corporation, CORBANA. If accepted, the new material will be made available through the Ministry of Agriculture and Livestock. A mutant cultivar of rice was developed with tolerance to Pyricularia (rice blast), which can cause yield losses of up to 60%. Many farmers and farmer associations are interested in the material produced and the University has been able to establish official collaboration contracts with farmer organizations. The Co-60 source at the University of Costa Rica supplied by the Agency is now available for mutation breeding activities at the National University. A new project (COS/5/D17) will further extend the practical work and aim at the actual planting of disease-resistant varieties of banana/plantain and rice.

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**COS/5/012                      MEDFLY RESEARCH LABORATORY**

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APPROVED: 1991

COMPLETED: 1994-05-25

TOTAL COST: \$ 147,784

To establish an R&D support unit for the national programme to eradicate the Mediterranean fruit fly (medfly) from Central America; to conduct research in Costa Rica and in other Central American countries to improve the efficiency of medfly eradication; to train local staff.

Under the co-ordination of the School of Biology of the University of Costa Rica (UCR), San Jose, an integrated national programme of management and control of the Mediterranean fruit fly (medfly) was carried out. The Agency participated in the programme since 1991, together with the European Community, the UCR and the Ministry of Agriculture, and supplied a refurbished gamma irradiator and accessories for the mass rearing of flies. Expert missions introduced genetic sexing, and a staff member was awarded a scientific visit to the Agency's Laboratory at Selbersdorf to study the technique. The R&D support unit has been established at the School of Biology of the UCR and is working well. Research included development of a model programme for the fight against the medfly, involving direct participation of the end user (small producer associations). The optimum dose for release of sterile flies was determined, and indicators for measuring results of the various strategies were also studied. The integrated project has established control of the medfly in some major fruit-producing areas and significantly reduced annual losses caused by medfly. For example, in the districts of Acosta and Mora annual losses decreased from 34% to 1% of the local fruit production.

**CUBA**

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**CUB/1/008                      CYCLOTRON LABORATORY**

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APPROVED: 1993

CANCELLED: 1994-04-19

TOTAL COST: \$ 0

To complete the installation of the cyclotron facility.

The Government requested the Agency to cancel the project as the authorities were unable to provide the cyclotron.

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**CUB/2/007                      METAL POLLUTION OF THE MARINE ECOSYSTEM**

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APPROVED: 1991

COMPLETED: 1994-12-19

TOTAL COST: \$ 163,424

To establish an adequate base to obtain precise and accurate data on the presence of trace metals in marine sediments, in order to formulate measures to prevent or decrease pollution in the marine ecosystem.

The Institute of Oceanography of the Cuban Academy of Sciences requested Agency assistance for the utilization of nuclear and related techniques to study metal pollution in the marine environment. A staff member from the IAEA Marine Environment Laboratory, Monaco, carried out a pre-project mission. The Agency provided equipment for X-ray fluorescence (XRF) analysis and atomic absorption spectrometry, with two expert missions to give training in its use. Two fellowships were awarded. An analytical base has been established for the use of XRF and atomic absorption spectrometry, the former for baseline sediment surveys and the latter for rapid surveys, bioavailability studies and measurement of marine organisms. A number of studies are being carried out, including the determination of contamination on coral reefs, the impact of contamination on certain rivers, and determination of the chemical composition of sediments in several areas of the marine platform.

**CUB/8/008                      NUCLEAR TECHNIQUES IN THE SUGAR INDUSTRY**

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APPROVED: **1989**COMPLETED: **1994-06-17**TOTAL COST: **\$ 127,683**

To complete the equipment and installation of laboratories for the application of nuclear techniques in the sugar industry.

The Cuban Sugar Research Institute (ICINAZ) requested Agency assistance to introduce nuclear techniques in the production of sugar from sugar cane. Two experts gave advice on tracers and the Agency provided the equipment necessary to complete the laboratory. Two fellowships were awarded. Tc-99m radiotracers were found to give more accurate results than radiocarbon, which had previously been used. The chemical composition of the processed mass, which is important in the sugar industry, was determined using X-ray fluorescence and neutron activation analysis. The mechanism of losses of sucrose during the different stages of the process is now better understood through the application of C-14 labelled sucrose, glucose and fructose molecules and, consequently, some parts of the plant were redesigned for optimum results. The project has had a strong impact on the sugar industry, which provides most of the income from exports.

**CUB/8/010                      DEVELOPMENT OF IRRADIATION TECHNIQUES**

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APPROVED: **1989**COMPLETED: **1994-05-27**TOTAL COST: **\$ 42,714**

To extend research and pilot studies on the application of irradiation techniques in industry to grain disinfestation and radio-sterilization.

The project assisted the Irradiation Techniques Laboratory of the National Centre for Animal and Plant Health, Havana. Two expert missions gave advice on irradiation processing and process control. Another expert lectured at a food irradiation conference and a training course. Three fellowships were awarded. Equipment was provided to improve dosimetry procedures and the accuracy of dosimetric measurements for industrial applications. The quality of the specialized irradiation services was improved and the irradiator used with greater efficiency.

**CUB/8/011                      NUCLEAR TECHNIQUES IN THE NICKEL INDUSTRY**

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APPROVED: **1991**COMPLETED: **1994-12-19**TOTAL COST: **\$ 122,298**

To optimize chemical processes in the different stages of exploitation and processing of nickel ores.

The Centre for Laterite Research requested Agency assistance for the application of nuclear techniques to improve the production processes of nickel, which is one of the main sources of hard currency for Cuba. Three expert missions advised on the design of a radioisotope laboratory, provided on-the-job training and set up experiments. The Agency supplied equipment to complete the laboratory and awarded three fellowships. Radiotracer techniques have improved the efficient use of raw materials, produced better end products and reduced the consumption of energy.

**CYPRUS****CYP/9/004                      THERMOLUMINESCENCE DOSIMETRY SERVICE (PHASE II)**

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APPROVED: **1993**COMPLETED: **1994-08-23**TOTAL COST: **\$ 86,984**

To expand radiological services through provision of monitoring equipment.

The Physics Department of the Nicosia General Hospital monitors 400 persons using radiation-monitoring films, but the accuracy of dose measurements in the low dose region was found to be unreliable. A thermoluminescence dosimetry (TLD) monitoring service was introduced to cover designated personnel and to improve the accuracy of low dose measurements. The Agency provided an automated TLD reader and a data processing system. During implementation it became clear that support was needed to establish radiation protection legislation in Cyprus, and an additional expert mission was undertaken and an organizational structure was agreed upon. The Physics Department has set up a complete calibration facility, below secondary standards dosimetric level, sufficient to calibrate personnel dosimeters and other radiation protection detectors. This facility has greatly improved the national radiation protection capabilities.

## **CZECH REPUBLIC**

### **CZR/9/002 ASSESSMENT OF ENVIRONMENTAL RISKS IN THE NORTH BOHEMIA**

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APPROVED: **1993**

COMPLETED: **1994-08-18**

TOTAL COST: **\$ 9,019**

To strengthen national expertise and institutional capability for upgrading and development of an area-wide strategy for risk reduction and hazard control in highly industrialized regions.

The federal Government had indicated its long term commitment to solve the serious health and environmental problems in the former Czechoslovakia. The North Bohemia area has the most urgent needs in this respect. The Agency provided assistance, in collaboration with France, under an interagency project (UNEP/WHO/IAEA/UNIDO) on risk management, to support the North Bohemia case study. Under this footnote-a/ project, supported by France, a computer system and software as well as expert advice on air/water pollution were provided. One scientific visit was awarded. The project has helped to establish the national capability for risk assessment and will contribute to the development of a strategy for risk reduction and hazard control in highly industrialized regions of the country.

## **DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA**

### **DRK/0/002 MANPOWER DEVELOPMENT**

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APPROVED: **1993**

CANCELLED: **1994-06-30**

TOTAL COST: **\$ 57,583**

To upgrade and strengthen the skills and capabilities of the human resources of the Democratic People's Republic of Korea within the broad spectrum of the applications of nuclear science and technology.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

### **DRK/3/003 URANIUM PROSPECTING**

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APPROVED: **1987**

COMPLETED: **1994-01-18**

TOTAL COST: **\$ 365,055**

To strengthen the local capability for assessing the nuclear raw material potential.

In view of the increasing commitment to nuclear power, and since some uranium deposits have been discovered, the Maebongsan Geoprospecting Expedition (MGE) of the Ministry of Atomic Energy sought Agency assistance to introduce efficient analysis and exploration methods in assessing the country's resources of nuclear raw materials. The Agency provided a considerable amount of exploration equipment as well as a microcomputer and software for data processing. Three fellowships were awarded. A uranium geological sample analysis laboratory has been established at the MGE. The staff is capable of operating the modern instruments installed to analyse geological samples (they have already analysed more than 1500) and of assessing the uranium resources in the country. Anomalies have been evaluated by gamma ray spectrometry, and for one promising anomaly three holes were drilled and logged. An experimental survey of black shales and metamorphic rocks is being carried out. The staff calibrated the radon detector and are using it for measurement of soil and water samples. Computerized geological maps have been produced. The work is being continued under the project DRK/3/004.

### **DRK/3/004 URANIUM EXPLORATION**

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APPROVED: **1993**

CANCELLED: **1994-06-30**

TOTAL COST: **\$ 30,822**

To provide support for the uranium exploration programme in the country.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

### **DRK/4/003 NUCLEAR INSTRUMENTATION**

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APPROVED: **1987**

COMPLETED: **1994-04-19**

TOTAL COST: **\$ 289,607**

To establish a system for prompt and efficient repair of nuclear instrumentation.

The project was designed to establish an electronics laboratory for maintenance and repair of nuclear instrumentation at the Institute for Radiation Protection (IRP) of the Ministry of Atomic Energy, Pyongyang. The Agency provided a computer system and software, testing equipment, and electronic spare parts. Seven expert missions gave guidance on use of the microcomputer system in nuclear experiments. A national training course on nuclear instrumentation and electronics was held at the IRP in 1992, with 18 participants. Four fellowships were awarded. An electronics

laboratory has now been established, with staff capable of providing routine services for calibration, maintenance and quality control of basic nuclear instruments both at the IRP and at other Institutions. The laboratory is also a training centre at which 45 local staff and university students have been trained. Since spare parts are not easily available, however, the repair of malfunctioning nuclear instruments still faces some difficulties. The work is being continued under the project DRK/4/006.

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**DRK/4/004            CYCLOTRON FOR NUCLEAR ANALYTICAL TECHNIQUES (PHASE II)**

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APPROVED: **1991**

COMPLETED: **1994-05-25**

TOTAL COST: \$ **122,197**

To assist in the installation of the cyclotron; to initiate proton-induced X-ray emission and charged particle analysis techniques; to train personnel to operate the cyclotron.

Under this project the 20 MeV MGC-20 cyclotron at the Institute of Atomic Energy (IAE), Pyongyang, was installed with Agency assistance and was commissioned in April 1992. The Agency also assisted in the installation of facilities for proton-induced X-ray emission (PIXE) and charged particle activation analysis for trace elements and provided some equipment. Agency experts assisted the staff to perform PIXE analysis of human hair, blood and minerals. The capability of the IAE in the use of PIXE has improved, but more work is required to initiate charged particle analysis techniques. The provision of routine PIXE analysis will benefit both research and industry.

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**DRK/4/005            CYCLOTRON PRODUCTION OF RADIONUCLIDES**

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APPROVED: **1993**

CANCELLED: **1994-06-30**

TOTAL COST: \$ **43,749**

To establish a radiochemistry laboratory for the local production of cyclotron-produced radionuclides to be used in nuclear medicine.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

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**DRK/4/006            NUCLEAR INSTRUMENTATION AND COMPUTER INTERFACING**

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APPROVED: **1993**

CANCELLED: **1994-06-30**

TOTAL COST: \$ **24,317**

To promote the local design and development of selected nuclear instruments and to train local staff in the use of nuclear instrumentation and in computer interfacing.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

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**DRK/5/004            ISOTOPE TECHNIQUES IN FERTILIZER STUDIES**

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APPROVED: **1993**

CANCELLED: **1994-06-30**

TOTAL COST: \$ **23,523**

To conduct phosphate fertilizer studies by using phosphorus-32 isotope techniques for increasing crop productivity.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

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**DRK/6/003            IMPROVEMENT OF RADIATION THERAPY**

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APPROVED: **1988**

CANCELLED: **1994-06-30**

TOTAL COST: \$ **381,806**

To upgrade and modernize the institute's radiotherapy facilities for improved treatment of cancer patients.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DRK/6/004      NUCLEAR MEDICINE**

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APPROVED: 1989

CANCELLED: 1994-06-30

TOTAL COST: \$ 299,016

To extend the diagnostic possibilities with a gamma camera and to realize automated radioimmunoassay to provide medical specialists with the patient information they need for improved treatment of cancer.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DRK/6/005      ESTABLISHMENT OF A RADIOIMMUNOASSAY CENTRE**

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APPROVED: 1993

CANCELLED: 1994-06-30

TOTAL COST: \$ 18,210

To introduce bulk-reagent-based radioimmunoassay (RIA) methodology and to upgrade the level of RIA practices, enabling the RIA laboratory service to function as a national centre for the development and propagation of such techniques.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DRK/6/006      NUCLEAR MEDICINE (PHASE II)**

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APPROVED: 1993

CANCELLED: 1994-06-30

TOTAL COST: \$ 11,638

To extend the diagnostic possibilities for an existing gamma camera and to train local medical specialists in improved techniques for cancer treatment.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DRK/8/002      UTILIZATION OF RADIATION AND RADIOISOTOPES IN INDUSTRY**

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APPROVED: 1991

CANCELLED: 1994-06-30

TOTAL COST: \$ 120,520

To develop an on-line X-ray fluorescence (XRF) system of analysis for control of the lead-zinc ore-dressing process.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DRK/8/003      NON-DESTRUCTIVE TESTING CENTRE**

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APPROVED: 1993

CANCELLED: 1994-06-30

TOTAL COST: \$ 70,373

To upgrade equipment and organize training programmes for non-destructive testing.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DRK/9/003      MONITORING OF MARINE RADIOACTIVITY**

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APPROVED: 1991

CANCELLED: 1994-06-30

TOTAL COST: \$ 144,555

To establish a national capability for carrying out a programme of marine radioactivity monitoring.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DRK/9/004 EXPANSION AND IMPROVEMENT OF PERSONNEL DOSIMETRY SERVICES**

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APPROVED: 1993

CANCELLED: 1994-06-30

TOTAL COST: \$ 9,439

To expand and improve the personnel dosimetry system by using thermoluminescence dosimetry and a computer system.

Following the withdrawal of the Democratic People's Republic of Korea from the IAEA in June 1994, this project was cancelled.

**DOMINICAN REPUBLIC****DOM/2/002 NUCLEAR ANALYTICAL TECHNIQUES (PHASE II)**

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APPROVED: 1989

COMPLETED: 1994-05-25

TOTAL COST: \$ 124,836

To upgrade X-ray fluorescence analytical services; to initiate the application of thermoluminescence dosimetry for dating.

This project was designed to assist the Department of Physics of the Universidad Nacional Pedro Henríquez Ureña (UNPHU) to improve and extend its analytical services. The Agency provided the necessary equipment and an expert assisted in obtaining dating measurements. A fellowship was awarded in analytical chemistry. Most of the thermoluminescence dosimetry activities were carried out under another project (DOM/9/002), while this project concentrated on improvement of the analytical capabilities in X-ray fluorescence (XRF) analysis. The reliability of XRF analytical measurements was considerably improved and they were extended to cover water pollution and food analysis, such as the determination of potassium and calcium in milk powder.

**DOM/8/005 SEDIMENTOLOGICAL STUDIES**

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APPROVED: 1991

COMPLETED: 1994-10-27

TOTAL COST: \$ 183,946

To obtain information through the use of isotope techniques on sediment transport and deposition in the Nizao River with a view to improving its potential, inter alia, as a source of hydroelectricity.

The project was mainly devoted to the quantification of the sediment load transported by the rivers Nizao and Mahomita and identification of the areas contributing a larger quantity of sediments due to higher erosion rate in their catchment area. The sediments are being accumulated in the Valdesia reservoir, limiting the storage capacity of the dam and affecting the production of electricity. Two automatic water samplers were installed along the two major streams, allowing the collection of samples for monitoring suspended sediments over periods of one week. A new infrared probe for measuring the concentration of suspended sediments was purchased and calibrated locally. Additional X-ray fluorescence analyses were carried out to determine the origin of the sediments. The sediment load from Nizao and Mahomita catchment areas was estimated. Some tracer experiments were undertaken in connection with leakage problems in other dams. Fluorescent dyes were used as a routine tool. A tritium enrichment line based on electrolysis of water samples was installed to allow the measurement of environmental tritium in surface water and groundwater.

**ECUADOR****ECU/8/012 ISOTOPE APPLICATIONS IN HYDROLOGY**

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APPROVED: 1989

COMPLETED: 1994-11-29

TOTAL COST: \$ 165,045

To introduce nuclear techniques in the study of problems affecting water resources management and sediments in dams.

Agency assistance was requested to develop nuclear techniques for the investigation of hydrological problems related to the management of water resources. This footnote-a/ project was made operational through an extrabudgetary contribution from Germany. Expert advice, training and equipment for field and laboratory measurement of radioactive and fluorescent tracers were provided. Transfer of the technology was achieved for the application of artificial tracers, both radioactive and fluorescent, in the determination of flowrate in open channel and interconnection experiments between surface and groundwater. The technology is particularly suitable for flowrate measurement in most rivers in Ecuador with torrential regime. The underground seepage at the Agoyan Dam was thoroughly investigated by means of artificial and environmental tracers (tritium, deuterium and O-18) as well as by analytical methods. The groundwater flow under the dam and the contribution of local aquifers to the flow emerging downstream from the dam were quantified. The results obtained will allow a better evaluation of the risks arising from the leakage.

## **EGYPT**

### **EGY/0/011      NUCLEAR INFORMATION NETWORK**

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APPROVED: **1991**

COMPLETED: **1994-05-25**

TOTAL COST: \$ **30,049**

To improve the information services at three laboratories by providing PC workstations suitable for information retrieval from INIS CD-ROMS.

The project was designed to assist the Atomic Energy Authority (AEA) of Egypt in the management and dissemination of nuclear information. The Agency provided complete sets of computer systems with CD-ROM drives to the AEA in Cairo and the research centres in Nasr and Inshas. An additional set of the INIS database on CD-ROM and expert services to train the staff of the AEA in search procedures were also provided. An expert mission assisted the AEA in planning the establishment of an information centre at Nasr. Improved nuclear information services are now being offered to scientists and engineers in Egypt, including regular bibliographic information in specific fields supplied to the appropriate institutions or research groups. The staff of the Nuclear Information Centre of the AEA in Cairo has been trained in the use of software for the preparation of input to the INIS database, resulting in an immediate significant increase in the number of items submitted and greater regularity in submission.

### **EGY/3/012      ISOTOPIC ANALYSIS OF URANIUM IN YELLOW CAKE**

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APPROVED: **1991**

COMPLETED: **1994-09-21**

TOTAL COST: \$ **51,560**

To upgrade the mass spectrometry laboratory by providing ancillary equipment and spares, and to provide training in mass spectrometry.

The Nuclear Materials Authority (NMA), Cairo, has been carrying out an exploration programme for radioactive ores for many years. The Agency assisted, under previous projects, in establishing a uranium information system, constructing pads and carrying out a feasibility study for the production of uranium concentrates. The NMA had established an analytical laboratory containing a mass spectrometer and ancillary measuring equipment. The mass spectrometer suffered many breakdowns owing to shortage of spare parts and inadequate maintenance, and Agency assistance was sought in upgrading the laboratory facilities. The Agency provided equipment and the services of an engineer to update and recommission the spectrometer. A functional and well equipped laboratory can now carry out routine analyses.

### **EGY/9/007      WASTE MANAGEMENT (LIQUID)**

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APPROVED: **1974**

COMPLETED: **1994-02-09**

TOTAL COST: \$ **4,099,082**

To establish a liquid radiation waste treatment plant.

A substantial rise in nuclear activities is expected in Egypt. The Agency has been assisting the Hot Laboratory and Waste Management Centre of the Egyptian Atomic Energy Authority since 1974 to design and construct an industrial scale plant for the treatment of radioactive liquid waste with design throughput of 10 cubic metres per day for low level waste and 2 cubic metres per day for intermediate level waste. The Agency assisted in the design and commissioning of the plant and provided the necessary equipment. 31 expert missions were fielded and 10 fellowships awarded. The plant consists of chemical precipitation, filtration, ion-exchange and evaporation facilities, integrated into one system, as well as a cementation facility for solidification of resulting sludges and concentrates. It now has sufficient capacity for the treatment and conditioning of all radioactive wastes currently arising and to be generated in the future. The work will continue under the project EGY/9/029.

### **EGY/9/022      RADIOLOGICAL EMERGENCY MOBILE LABORATORY**

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APPROVED: **1989**

COMPLETED: **1994-02-28**

TOTAL COST: \$ **128,663**

To establish a mobile laboratory for dealing with radiological emergencies on location.

In view of the increasing number and variety of activities using radioactive materials and radiation in Egypt, the potential for a radiological emergency has been steadily increasing. It became necessary to acquire a mobile laboratory able to respond to a radiological emergency anywhere in the country and capable of accurately characterizing and quantifying any on-site or off-site contamination resulting from such an emergency. The Agency supplied the sophisticated analytical and meteorological equipment needed for outfitting a mobile laboratory. An expert conducted two missions to advise on the installation, field testing and calibration of the equipment and on the operation and use of the vehicle. National preparedness for responding to radiological emergencies has been strengthened, to the benefit of public safety.

APPROVED: 1989

COMPLETED: 1994-01-20

TOTAL COST: \$ 32,070

To inspect the reactor and report on the degradation of parts and safety implications.

The Nuclear Research Centre (NRC), Inshas, has a 2 MW(th) research reactor that reached criticality in 1964. As the reactor had been taken out of operation for a long time, the Atomic Energy Authority requested the Agency to assist in performing in-service inspections (ISI) with regard to the degradation of the reactor caused by ageing. Seven expert missions were undertaken. The ISI concentrated primarily on ultrasonic and radiographic inspections of the entire reactor tank. Pictures obtained with underwater optical equipment during an inspection performed by Egyptian and Russian teams were evaluated and interpreted by the Agency experts. Following the earthquake of October 1992, an Agency staff member visited the NRC to provide guidance on the seismic hazard potential at the site and to assist in planning an assessment programme to check the capacity of safety-related structures, equipment and piping. In 1992 two experts evaluated the comprehensive Safety Analysis Report, which had been in preparation for several years, with emphasis on safety evaluation of several design modifications. Recommendations based on IAEA safety publications were communicated to the NRC.

**GHANA****GHA/5/016 GENETIC IMPROVEMENT OF COCOA AND COFFEE**

APPROVED: 1988

COMPLETED: 1994-10-28

TOTAL COST: \$ 157,314

To breed disease-resistant cocoa and high yielding coffee varieties.

This footnote-a/ project was implemented through an extrabudgetary contribution from the UK. The necessary equipment was provided for the establishment of a tissue culture laboratory at the Cocoa Research Institute (CRI), Tafo, using the Co-60 gamma irradiator available at the National Nuclear Research Institute in Accra for mutation induction. Eight expert missions assisted in setting up and planning the operation of the in-vitro tissue culture laboratory, diagnosing and indexing plant viruses, and establishing screening procedures and strategies for detecting resistance to the cocoa swollen shoot virus (CSSV). One fellowship and four scientific visits were awarded. As a result of irradiating the cocoa shoot tip and nodal bud explants, varieties with limited shoot proliferation and rooting were produced. In addition, the conventional mutation breeding programme led to CSSV-resistant mutants, which is no mean achievement because previous attempts, since the disease was first reported in 1937, have not been so successful. The facilities at the CRI can now sustain activities at local level.

**GHA/6/008 NUCLEAR MEDICINE (PHASE II)**

APPROVED: 1991

COMPLETED: 1994-10-27

TOTAL COST: \$ 199,686

To upgrade the nuclear medicine services.

The project was designed to revive the nuclear medicine services at the Korbe Bu Hospital of the University of Ghana Medical School and establish a self-sustaining radiopharmaceutical manufacturing facility, with the intention of reducing imports of radiopharmaceuticals routinely used in clinical practice. The Agency provided radioimmunoassay (RIA) counting, data processing and printing facilities. A small scale radiopharmaceutical manufacturing facility had already been established, with Agency assistance, at the National Nuclear Research Institute of the Ghana Atomic Energy Commission. Expert services were provided, mainly for commissioning the radiopharmaceuticals production facilities and training local staff. A medical electronics specialist, trained to provide maintenance and repair for the nuclear medicine equipment, is now functioning as a regional expert in the field. Diagnostic procedures and medical care have improved and are now available to low income patients. Low cost radiopharmaceuticals for clinical practice are being produced on a regular basis.

**GHA/8/004 GAMMA IRRADIATION FACILITY**

APPROVED: 1979

COMPLETED: 1994-09-21

TOTAL COST: \$ 429,229

To develop radiation technology for sterilizing medical products and for disinfecting food crops.

The project was approved in 1979 to assist the Ghana Atomic Energy Commission to establish a gamma irradiation facility at the National Nuclear Research Institute. Implementation was hampered at first by delays in construction of a suitable building to house the gamma irradiator. Consequently, the project was rephased several times and was resumed in 1984. The Agency supplied a 50 kCi multi-purpose gamma irradiator and related equipment. Experts advised on general layout and engineering design, installed the gamma irradiator, and advised on safety aspects and licensing of the irradiation facility and its optimal utilization. Fellowships totalling over 92 months were awarded.

The facility is now being used for research on sterilization of medical products and disinfection of food crops, while conforming to international radiation safety standards.

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**GHA/8/005      NON-DESTRUCTIVE TESTING (NDT)**

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APPROVED: **1988**

COMPLETED: **1994-11-29**

TOTAL COST: **\$ 134,760**

To promote non-destructive testing for inspection and quality control in industry.

Although approved in 1988, this footnote-a/ project did not become operational until 1990, through an extrabudgetary contribution from the USA. An industrial X-ray machine and non-destructive testing (NDT) equipment were provided. Expert missions assisted in setting up the NDT laboratory and trained local staff in the appropriate techniques. Four national training courses were organized and the project counterpart received intensive training in the USA. The laboratory is now well equipped and staffed and can provide NDT services to local industries.

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**GHA/8/006      EVALUATION OF GROUNDWATER RESOURCES**

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APPROVED: **1988**

COMPLETED: **1994-10-28**

TOTAL COST: **\$ 232,988**

To improve the assessment and management of groundwater resources in the upper region of Ghana and in the Lower Volta basin.

This footnote-a/ project was made operational through an extrabudgetary contribution from the UK and subsequently supported from the TACF. It was designed to equip a chemical laboratory for water analyses and to train the staff in analytical and sampling techniques to improve the assessment and management of groundwater resources in the drought-prone upper region of Ghana and in the Lower Volta basin. Equipment, including an atomic absorption spectrophotometer and an ion chromatograph, was provided to the Water Resources Research Institute of the Council for Scientific and Industrial Research. Two expert missions established a programme for water quality investigations in northern Ghana using isotope and geochemical techniques, installed the equipment, and trained the staff in its use. Two fellowships were awarded. The laboratory is now well equipped and staffed and can continue its activities independently.

**GREECE**

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**GRE/1/034      ION IMPLANTATION USING A TANDEM ACCELERATOR**

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APPROVED: **1989**

COMPLETED: **1994-09-26**

TOTAL COST: **\$ 266,791**

To embark on ion implementation research for modification of materials surfaces and to use the Rutherford backscattering technique to analyse the crystalline structure.

The "Democritus" Nuclear Research Centre wishes to carry out research on surface modification and analysis of materials using the existing 5.5 MeV tandem accelerator and to install a second injection leg with new ion sources suitable for industrial applications. Through an extrabudgetary contribution by the USA, sputter neutron source radioactive isotopes, a molecular turbopump, fluxmeter and a complete goniometer system were provided. Two expert missions advised on ion implantation using the tandem accelerator and on channelling Rutherford backscattering. The upgraded Research Centre can now provide direct support to industry.

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**GRE/2/022      ESTABLISHMENT OF A XRF LABORATORY**

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APPROVED: **1993**

COMPLETED: **1994-12-30**

TOTAL COST: **\$ 56,981**

To improve analytical capability through the establishment of an X-ray fluorescence laboratory and familiarization with modern radiochemical analytical techniques.

The Radiochemical Laboratory of the Department of Chemistry at the Aristotelian University, Thessaloniki, had acquired a gamma spectroscopy system which was used mainly for activation analysis. To improve its analytical capabilities, the Agency was requested to upgrade the X-ray fluorescence (XRF) measuring unit. The Agency provided the necessary equipment and radioisotopes. Two expert missions assisted in installing and testing the equipment and provided hands-on training. The analytical techniques for a number of environmental, biological, archeological and industrial samples have been improved and can now be extended to the analysis of samples from the mineral processing industries of northern Greece.

**GRE/2/023****CHEMILUMINESCENCE INDUCED BY INTERNAL RADIATION**

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APPROVED: **1993**COMPLETED: **1994-09-21**TOTAL COST: \$ **41,956**

To provide equipment for developing new analytical techniques for clinical tests, based on chemiluminescence induced by internal radiation.

Chemiluminescence (CL) is an accurate and versatile tool in analytical chemistry, particularly for clinical analysis, yet little work has been done on radiation-induced CL. The Institute of Physical Chemistry of the "Democritos" Nuclear Research Centre decided to investigate organized molecular assemblies using P-32 as an internal radiation source. The Agency provided a spectrophotometer and other equipment. The laboratory of the institute has been upgraded, a new field of research for clinical analysis has been opened up, and new analytical techniques for clinical tests developed.

**GRE/8/008****ISOTOPES IN GEOTHERMAL STUDIES**

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APPROVED: **1991**COMPLETED: **1994-09-16**TOTAL COST: \$ **94,070**

To assist in collecting data on geothermal fields and to develop capabilities for geothermal studies.

Greece possesses many potential geothermal fields, but investigations have so far been limited mainly to locating the fields. The Agency was requested to assist the "Democritos" Nuclear Research Centre and the Institute of Geology and Mineral Exploration in improving the infrastructure for applying geochemical and isotope techniques for in-depth investigations into the origins of geothermal heat and field recharge mechanisms. The Agency provided an ion-chromatograph and related equipment, two fellowships and three scientific visits. Three experts assisted in preparing a programme for geothermal field investigations and in interpreting the geochemical characteristics of the exploration areas. The project introduced isotope techniques as an additional tool to assess the characteristics of geothermal fields.

**GUATEMALA****GUA/5/008****MUTATION BREEDING**

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APPROVED: **1989**COMPLETED: **1994-06-30**TOTAL COST: \$ **147,840**

To develop techniques and a programme for the improvement of cereals and other crops through radiation-induced mutations.

The General Directorate of Nuclear Energy (DGEN) requested Agency assistance as a continuation of the project GUA/5/005. The Agency provided laboratory equipment and supplies. Six expert missions planned and organized the laboratory and advised on rice mutation breeding, rice anther culture, and wheat doubled haploids. Two fellowships and a scientific visit were awarded, and the staff participated in a number of regional training courses and workshops. A tissue culture laboratory was established at DGEN and, in spite of delays caused by lack of staff, is now being utilized to capacity. In close co-operation with the Institute of Agricultural Science and Technology (ICTA), a considerable number of rice mutants have been obtained, and their evaluation is continuing concurrently with conventional breeding programmes. Four agronomically superior mutants are being evaluated in field trials on farmers' fields. The M1 generation of irradiated wheat varieties is now growing at an ICTA experimental station. The work continues under the new project GUA/5/012.

**GUA/5/009****NUCLEAR TECHNIQUES IN SOIL SCIENCES**

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APPROVED: **1989**COMPLETED: **1994-06-17**TOTAL COST: \$ **141,050**

To use nuclear techniques to study the efficiency with which fertilizers and water are being utilized by cereals and fruit trees; to evaluate nitrogen fixation in soya and kidney beans; to extend studies to other crops.

Following the introduction of nuclear techniques in agriculture through the project GUA/5/005, the General Directorate of Nuclear Energy requested Agency assistance to carry out soil studies. The Agency provided laboratory equipment, isotopes and fertilizers. Two fellowships were awarded and some staff members participated in regional training courses and workshops. In spite of constant delays in implementation owing to shortage of staff and problems with the equipment, particularly the nitrogen analyser, the laboratory was completed and general studies were undertaken, in close co-operation with the Institute of Agricultural Science and Technology. Nine expert missions assisted in planning and conducting studies on water and fertilizers, soil physics and plant-water relationship, biological nitrogen fixation in basic crops and P-32 studies in rice. A basis has been established for determining research priorities and planning experiments and for the eventual transfer of the technology to research institutes throughout the country. The work continues under the new project GUA/5/011.

## HUNGARY

### HUN/4/009 IN-SERVICE INSPECTION

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APPROVED: 1989

COMPLETED: 1994-02-20

TOTAL COST: \$ 255,136

To train specialists in an up-to-date ultrasonic testing system for in-service inspection of the reactor pressure vessel.

The project was designed to improve the operational safety of WWER-type reactors at Paks NPP through improved in-service inspection (ISI) methods and technology. The principal component of the project was the provision, through subcontract, of a reliable and advanced ultrasonic non-destructive testing system consisting of ultrasonic probes, a positioning system, and fully programmable, computer-controlled data acquisition hardware and software. Training in the use of the equipment was provided to personnel from the NPP. Two expert missions visited Paks for consultation and assessment of requirements for the ISI programme, and a number of scientific visits were awarded to organizations in Finland and the USA. The operational testing of the new ultrasonic inspection system was carried out on Paks Unit-2 in September 1992. The comprehensive test on Unit-3 was completed in August 1993, followed shortly after by successful inspection of the unit's reactor pressure vessel. At about the same time, the first training course was held on ISI of WWER-type reactors at Paks, introducing the system to participants from other countries operating these reactors.

### HUN/4/010 SPENT FUEL STORAGE TECHNOLOGY

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APPROVED: 1992

COMPLETED: 1994-02-09

TOTAL COST: \$ 28,046

To advise on the principles and methods of safe storage of spent fuel, the behaviour of the assemblies during long term storage, and cladding integrity and temperature during storage.

Hungary has four WWER-440 type reactors in operation at Paks NPP and intermediate spent fuel facilities are to be constructed on the same site. The need to address storage problems and to develop a national capacity to receive the plant's own spent fuel has arisen because of uncertainties in backshipment to the supplier in Russia for reprocessing. The NPP operator, with assistance from the Agency, selected the type of spent fuel storage which best met the specific conditions. The pre-construction safety report of the storage facility was prepared. This Reserve Fund project was initiated at the request of the Government since no similar facility had hitherto been licensed in the country. Assistance was therefore requested in the principles of the licensing procedures. An Agency expert team carried out a one-week mission to advise on the safe methods and technologies available in the area of spent fuel storage. The experts provided the operators and representatives of the Hungarian regulatory authorities with current information, discussed the available technical data and reviewed the feasibility studies on spent fuel storage systems commissioned by Hungary from commercial sources. Consideration of the present storage capacity of the spent fuel pools of each reactor, the expected amount of fuel that can be returned for reprocessing and other technical and economic factors, required the Government to reach a decision on whether to approach countries offering spent fuel reprocessing services or to develop its own safe and reliable spent fuel storage capability. The expert services provided under the project produced valuable information to help the Hungarian authorities in determining the eventual direction of the country's spent fuel handling programme.

### HUN/9/010 MODERNIZATION OF PERSONNEL DOSIMETRY SYSTEM

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APPROVED: 1991

COMPLETED: 1994-02-09

TOTAL COST: \$ 133,791

To install a computer-assisted thermoluminescence dosimetry system to enable automatic evaluation and record-keeping of 15,000 radiation workers.

This project assisted the National Research Institute for Radiobiology and Radiohygiene, Budapest, to upgrade and improve the personnel dosimetry service it has been operating for the Ministry of Health since 1965. The Institute provides a dosimetry service for more than 15,000 radiation workers throughout the country. The previous film badge dosimetry has been superseded by a thermoluminescence dosimetry (TLD) system. The Agency provided and installed the system, including evaluation and data management software, 2000 TLD cards and accessories. The increased capacity for processing data from monitoring the large number of radiation workers covered by the service has led to an improvement in radiation safety standards.

### HUN/9/011 ENVIRONMENTAL RADIATION TELEMETRY

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APPROVED: 1991

COMPLETED: 1994-02-20

TOTAL COST: \$ 69,221

To establish an early warning environmental radiation monitoring system.

The Government requested Agency assistance in extending, on a nationwide basis, an environmental radiation

telemetry system. This system had been designed by the Health Physics Department of the Central Research Institute for Physics, Budapest, and was installed around Paks NPP. The radiation telemetry network, including the construction of a new radiation telemetry station, has been successfully implemented with the collaboration of the Hungarian Meteorological Service. The Agency provided computer equipment, modems and radiation detectors. One fellowship and two scientific visits were awarded. An Agency expert reviewed progress and discussed the requirements for the proposed countrywide radiation information database to be integrated into the network. A real-time radiation monitoring system with computer network connections to the competent organizations in Hungary has been established to receive early warning and reliable information in case of accidental release of radioactivity into the environment.

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**HUN/9/013      TRAINING IN MANAGEMENT AND ANALYSIS OF SEVERE ACCIDENTS**

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APPROVED: **1991**

COMPLETED: **1994-02-20**

TOTAL COST: **\$ 10,435**

To train specialists in accident management procedures and to elaborate emergency procedures for WWER-type reactors.

The original safety philosophy of WWER-type reactors did not accept the probabilistic approach to design and operation. Consequently, owing to the neglect of severe accident analysis, there was a lack of tools and knowledge in the countries operating these reactors. Under this footnote-a/ project, funded through an extrabudgetary contribution by France, a two-week training course was organized in Budapest in 1992 by Electricité de France and the IAEA, in co-operation with the Institute of Electrical Power Research, Budapest. Experts from France, Germany and the Agency lectured to 42 participants from eight Hungarian institutions, with observers from Bulgaria, the Czech Republic and the Slovak Republic. The participants were mostly qualified engineers involved in NPP operations, nuclear fuel and steam supply systems, safety analysis and regulation. Participants gained familiarity with the principles and practices adopted in France and elsewhere. Two fellowships were awarded in 1993. Expertise was transferred which has been utilized in the analytical work of research and development institutions in Hungary and in national safety practices. The results have helped to improve operational safety at Paks NPP.

**ICELAND**

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**ICE/9/003      ESTABLISHMENT OF EARLY WARNING SYSTEM**

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APPROVED: **1993**

COMPLETED: **1994-06-15**

TOTAL COST: **\$ 33,877**

To establish an early warning environmental radiation monitoring system (EWERMS).

The Agency assisted the National Institute of Radiation Protection (NIRP) in Reykjavik to establish a radiation protection service for personnel dosimetry and environmental monitoring through a previous project ICE/9/002. As the second phase of the project, the Government requested Agency assistance to set up an early warning system, conformable with the Early Notification Convention already established in the other Nordic countries. During implementation of the project, Iceland transferred US \$34,000 to the Agency as funds-in-trust for the procurement of a gamma spectrometric system, including a computerized data collector and analysis software. This equipment is being used for monitoring the dose to radiation workers, for environmental radiation measurements and control of imported and exported foodstuffs. The capability of the NIRP to alert the population to any radiological emergency is considerably improved.

**INDONESIA**

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**INS/0/007      ENERGY ECONOMICS CALCULATIONS WITH NUCLEAR OPTIONS**

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APPROVED: **1987**

COMPLETED: **1994-05-25**

TOTAL COST: **\$ 145,537**

To assist in energy and electricity planning studies using computer software planning tools.

The Government is embarking on a nuclear power programme for the generation of electricity. The Centre for Nuclear Energy Studies of the National Atomic Energy Agency (BATAN), in co-operation with other institutions, wished to study the various options by means of the Energy and Power Evaluation Program (ENPEP), with Agency assistance. This Reserve Fund project was supported by an extrabudgetary contribution from the USA in 1987-1988 and by TACF in 1991-1992. The Agency provided three computers and software and nine expert missions to assist in installation and application of ENPEP. Three fellowships were awarded. The options have now been studied, and the local ENPEP team has mastered the MACRO, DEMAND, ELECTRIC and MAED modules, and adapted the BALANCE and IMPACT codes. BATAN is applying ENPEP for energy planning, and the results are being used by energy policy makers. Phase II of the project is being carried out under INS/0/012.

APPROVED: 1985

COMPLETED: 1994-10-27

TOTAL COST: \$ 436,988

To establish a co-ordinated experimental programme on the use of the multi-purpose research reactor and ancillary facilities.

The National Atomic Energy Agency (BATAN) embarked on a large scale development programme to establish a new complex of nuclear research centres in Serpong. The programme comprises a group of facilities/laboratories including a 30 MW multi-purpose research reactor, installations for manufacturing fuel elements for research reactors and NPPs as well as for the production of radiolotopes and the treatment of radioactive wastes. This footnote-a/ project, made operational through an extrabudgetary contribution from Germany, provided a two-year expert mission and two short missions to assist in planning this development. Three fellowships and one scientific visit were awarded and some extra equipment was provided. The experimental capabilities for materials research of the multi-purpose research reactor centre at Serpong have been upgraded and its technical and managerial competence has been strengthened. Radiolotopes are being produced.

**INS/3/009****URANIUM EXPLORATION AND DEVELOPMENT**

APPROVED: 1989

COMPLETED: 1994-04-18

TOTAL COST: \$ 354,575

To develop the uranium prospect in Kalimantan for possible exploration.

The Nuclear Minerals Development Centre (NMDC) of the National Atomic Energy Agency (BATAN) sought Agency assistance to develop uranium prospect in Central Kalimantan and adjacent areas for possible exploration. This footnote-a/ project was made operational through an extrabudgetary contribution from France. Fifteen expert missions to assist in exploration, mining and ore processing technology were undertaken, and uranium exploration equipment was provided. Three fellowships and two scientific visits were awarded. Ores from Kalimantan were tested at Cogéma's facility in France. The staff now has the capability to develop the uranium deposit in Central Kalimantan. The most important success of the project is that of the ore sorting tests, through which it was found that the relatively low grade ore of 0.1% U of the deposit can be enriched to as high as 0.9% U. This means that an economic mining project may be realized. The NMDC is currently undertaking ore processing tests, and a feasibility study is being carried out by BATAN to determine the economic viability of the first uranium mine in Indonesia. This would be of interest in the national nuclear power programme.

**INS/4/023****RESEARCH REACTOR CALCULATIONS AND EXPERIMENTS**

APPROVED: 1989

COMPLETED: 1994-10-28

TOTAL COST: \$ 235,137

To gain expertise in reactor physics calculations with the MPR-30 reactor.

In order to utilize fully the integrated facilities at the 30 MW multi-purpose research reactor at Serpong and the 1 MW TRIGA Mark-II research reactor at Bandung, a good understanding of the reactor physics parameters is essential. The project was originally approved for the research reactor at Serpong and was later extended to include the reactor at Bandung. The Agency provided a signals analyser, a radiation detector, and related equipment, together with extensive expert advice on measurements, calculations and neutron noise analysis. Four fellowships and one scientific visit were awarded. The manpower and infrastructure at Serpong and Bandung have been strengthened to allow effective utilization of both research reactors.

**INS/4/024****CYCLOTRON PRODUCTION OF RADIONUCLIDES**

APPROVED: 1989

COMPLETED: 1994-11-07

TOTAL COST: \$ 146,408

To strengthen cyclotron facilities for the production of medically important radionuclides and to secure smooth operation of the cyclotron.

A Cs-30 cyclotron was commissioned at the nuclear research complex at Serpong in 1989 for use in physics and chemistry research and for the production of short lived radioisotopes for medical, biomedical and biological applications. Five hospitals are routine users of the diagnostic and radiopharmaceutical products produced. The Agency provided extensive expert services on the installation, commissioning and maintenance of the cyclotron as well as production of radionuclides. Five fellowships and five scientific visits were awarded. Staff skills have been upgraded for routine operation and maintenance of the cyclotron, for radiochemical and radioanalytical processing of cyclotron-produced radionuclides, and for safety aspects of the production process.

**INS/6/006                      RADIATION THERAPY**

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APPROVED: **1989**COMPLETED: **1994-11-07**TOTAL COST: \$ **189,007**

To develop a radiotherapy facility for the improvement of nuclear medicine services.

The demand for nuclear medicine services in Indonesia is growing, but in 1989 the national radiotherapy facilities and qualified manpower were found to be insufficient. The Agency provided a telecobalt therapy rotating unit for Persahabatan Hospital, Jakarta, including a gamma source. Two expert missions assisted in installing the equipment and training local radiotherapists in its use. One fellowship was awarded. The radiotherapy infrastructure of the Hospital has been upgraded and services to cancer patients have improved.

**INS/7/002                      RADIOBIOLOGICAL LABORATORY**

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APPROVED: **1988**COMPLETED: **1994-05-25**TOTAL COST: \$ **39,146**

To establish a radiobiological laboratory for tissue culture; to undertake studies on chromosomal changes in tissues and peripheral blood lymphocytes.

The Centre for Standardization and Radiation Safety Research of the National Atomic Energy Agency (BATAN), sought Agency assistance to establish a radiobiological laboratory for tissue culture in order to undertake studies on the effects of radiation on human health. This footnote-a/ project was made operational through an extrabudgetary contribution from the USA. The Agency provided an incubator, laboratory equipment and supplies. An expert assisted in setting up a laboratory for radiobiology research with emphasis on radiation cytogenetics for biological dosimetry. A fellowship was also awarded. The radiobiological laboratory has been set up and the staff is capable of using chromosome preparation and analysis techniques for induced aberrations and absorbed radiation dose estimation. They also use the blood cell technique in pre-employment medical examination. The laboratory now provides nationwide biological dosimetry services for radiation workers.

**INS/8/013                      RADIOCARBON DATING**

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APPROVED: **1985**COMPLETED: **1994-04-18**TOTAL COST: \$ **135,082**

To provide support for archaeological and geological investigations.

The project was designed to establish a radiocarbon dating laboratory at the Yogyakarta Nuclear Research Centre of the National Atomic Energy Agency (BATAN). This footnote-a/ project was made operational through an extrabudgetary contribution from the USA and was subsequently financed by the TACF. The Agency provided a low level liquid scintillation spectrometer and a sample preparation system based on the benzene synthesis method. Four expert missions were fielded and four fellowships awarded. The laboratory was established and the staff has mastered the techniques for sample collection, pre-treatment and benzene synthesis of (for example) bones, shells, wood, charcoal, carbonates, celluloses and sucroses. They are also capable of carrying out age calculations for such samples. The laboratory, in co-operation with the National Archaeological Centre and the Gadjah Mada University, Yogyakarta, is supporting archaeological and geological investigations.

**INS/9/016                      ENVIRONMENTAL RADIOACTIVITY MEASUREMENTS (PHASE II)**

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APPROVED: **1991**COMPLETED: **1994-05-25**TOTAL COST: \$ **83,663**

To upgrade the environmental radioactivity laboratory in order to improve the reliability of low level radioactivity measurements of environmental samples.

The project was designed to upgrade the Environmental Radioactivity Laboratory at the Centre for Standardization and Radiological Safety Research of the National Atomic Energy Agency (BATAN). The Agency provided four expert missions and a semiconductor detector. Measurements have been performed of the Cs-137, Sr-90 and Ra-226 concentrations in sea water at selected sites in the Java Sea and of Cs-137 and Sr-90 concentrations in water, soil, grass and foods at 28 locations. Radioactivity in environmental samples obtained around the 30 MW(th) research reactor at Serpong is also being monitored. The data derived could be used as baseline data in assessing national radiological safety. The Centre also provides radioactivity measurement services to exporters and issues radioactivity-free certificates for foods and other goods for export. The improvement in accuracy of measurements benefits the radiological safety of the population.

**INS/9/017****ESTABLISHMENT OF A DECONTAMINATION FACILITY**

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APPROVED: **1991**COMPLETED: **1994-05-25**TOTAL COST: **\$ 37,906**

To strengthen local capability for decontamination of nuclear facilities.

The Radioactive Waste Management Technology Centre of the National Atomic Energy Agency (BATAN), Serpong, sought Agency assistance in setting up a chemical decontamination facility and to advise on the technology. The Agency provided two expert missions and awarded two fellowships. BATAN provided the necessary equipment. The basic decontamination facility has now been established at the Centre, and the staff is capable of routine decontamination of small equipment. They are also undertaking R&D for the chemical and electro-chemical decontamination process.

**INTERREGIONAL****INT/5/099****NITROGEN FIXATION STUDIES**

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APPROVED: **1985**COMPLETED: **1994-02-09**TOTAL COST: **\$ 45,893**

To evaluate the conduct of nitrogen fixation studies.

In view of the poor soil nitrogen fertility and associated low crop yields, enhancing biological nitrogen fixation by legumes and improving fertilizer nitrogen use efficiency are of great importance to many developing countries. Nuclear techniques, particularly the isotope N-15, have been widely used to measure fertilizer nitrogen uptake, to develop improved fertilizer nitrogen practices and to enhance biological nitrogen fixation. Over the years the Agency has been providing assistance to many Member States in this field through regional and national TC projects and the Research Contract Programme. This interregional project was initiated in 1985 to promote the use of N-15 in soil fertility studies primarily at those institutions which were not yet involved in these Agency-supported activities. Under the project the Agency offered to supply isotope-labelled material for experimental purposes and to analyse experiment samples at the Seibersdorf Laboratory. During the project implementation, assistance was provided to 29 scientists from 22 Member States, 23 kg of N-15 labelled fertilizers were delivered and 6560 samples analysed. The project has significantly contributed to the introduction of this technology in recipient Member States and to strengthening scientific capabilities of local staff. Studies performed have been of excellent quality and highly relevant for increasing agricultural productivity. The adoption of these improved nitrogen management sources would imply significant savings in foreign currency, by reducing imports of expensive fertilizer nitrogen.

**INT/8/002****ELECTRON BEAM TECHNOLOGY FOR FLUE GAS PURIFICATION**

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APPROVED: **1988**COMPLETED: **1994-11-07**TOTAL COST: **\$ 179,964**

To promote transfer of electron beam technology for purification of flue gases.

In view of the need to control the release of toxic gases into the atmosphere, there is interest in many Member States in the development and application of effective purification technologies. In 1986, an Agency-sponsored consultants meeting on the electron beam purification of combustion flue gases recommended the promotion of this technology from the standpoint of environmental protection. Given the global nature of the problem, an interregional TC project was initiated in 1988 comprising expert services and group training. During the period 1988-94, four interregional workshops were organized (three in Poland, one in Spain) to exchange latest information on the technology development and set up further goals; seven national seminars for executives were carried out (in Argentina, Brazil, India, Mexico, Paraguay, Republic of Korea, Thailand); expert missions provided advice to six Member States. Partly as a result of these activities several national projects were initiated, the largest one in Poland, where a demonstration plant was constructed; and multilateral co-operation has been implemented within two regional arrangements - RCA and RLA. A Co-ordinated Research Programme was initiated and successfully completed in 1993.

**INT/8/026****ENVIRONMENTAL REHABILITATION OF LAKE MANZALA IN EGYPT**

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APPROVED: **1992**COMPLETED: **1994-07-27**TOTAL COST: **\$ 57,500**

To contribute data for an environmental impact assessment.

Lake Manzala is a vast coastal lagoon in the Nile Delta in Egypt which receives much of the domestic pollution from Cairo. This UNDP project was initiated as part of a new UNDP/UNEP programme to assess the feasibility for a Global Environment Facilities (GEF) project involving the construction of artificial wetlands for treatment of wastewaters entering the lake. The existing data for an environmental impact assessment (EIA) of the environmental quality of the lake was deemed insufficient. A sampling programme was carried out to obtain water, sediment and biota samples

from major sources of contamination through the drainage system, from main canals, and from various parts of the lake. Sample analysis included the determination of concentrations of petroleum hydrocarbons, chlorinated hydrocarbons, sterols (sewage pollution indicators), some second generation (organophosphorus) pesticides, and trace elements. The study led to the conclusion that the Lake Manzala environment is heavily influenced by municipal sewage from Cairo, which influences the geochemistry by creating anoxic conditions near the regions of discharge and by introducing anthropogenically derived contaminants. Severe human sewage pollution has been found near the drainage channels. Sediments were also found to be severely contaminated with oil. There is no evidence that chemical pollution presents a direct risk to human health from the consumption of fish. However, new forms of pollution, such as from organophosphorus compounds, have been revealed by the study and should be further investigated. The results also highlight the need to elucidate the cause of the stress experienced by the lake's fish by studying biochemical indicators, such as mixed-function hepatic oxidizers and cholinesterase, as well as physiological parameters. From the project outputs it appears that the construction of an artificial wetland would contribute considerably to limiting the further extension of the plume of pollution within the system and improving its assimilative capacity. However, a monitoring programme should be carefully planned in order to assess the effectiveness of the wetland and the overall status of the lake itself. Waste from Cairo city should also receive primary treatment before it is discharged to the lake.

## **IRAN, ISLAMIC REPUBLIC OF**

### **IRA/3/002 URANIUM EXPLORATION**

APPROVED: **1985**

COMPLETED: **1994-06-17**

TOTAL COST: **\$ 857,747**

To complete the evaluation of airborne data, the preparation of maps and integration of the data with the maps to facilitate follow-up exploration programmes.

In 1977-78 an airborne survey for uranium prospecting was carried out by foreign contractors on an area of about 600,000 square km. The survey was performed by planes and helicopters using gamma-ray spectral and magnetic methods. Under this project, the primary airborne data have been collected and processed in the form of digital radiometric and magnetic tapes, and a series of radiometric maps produced. The latter show distribution of U, Th and U/K, U/Th and Th/K ratios. Detailed radiometric and magnetic data have been compiled for an area of about 60,000 square km. For this area all flight path films have been indexed and transformed into flight path maps, a database of 200 megabytes prepared, and 70% of final contour maps on the 1:50,000 scale delivered. After over nine years of implementation, the project has achieved the technology transfer of airborne data processing and has the local capability to carry out computer processing of airborne and ground geophysical survey and the production of desired maps. High quality maps representing the updated airborne survey data have been produced which will be used for data integration in uranium resource assessment. The project has contributed to the flight path recovery, refinement in the use of computer software for airborne data interpretation, field verification of some areas of interest indicated by the airborne survey results, and installation and use of the borehole calibration facility.

### **IRA/3/003 ORE DRESSING AND LEACHING OF URANIUM ORES**

APPROVED: **1991**

COMPLETED: **1994-06-14**

TOTAL COST: **\$ 18,220**

To set up a well equipped dressing laboratory and to prepare a feed that permits the best balance of uranium recovery by optimized leaching conditions.

A pilot plant for ore dressing and leaching of uranium ore has been installed and put into trial operation by the Atomic Energy Organization of Iran (AEOI). Experimental work was initiated for treatment of the more refractory ore of the Saghand deposits. The Fuel Department of the AEOI has elaborated a flowsheet for processing the Saghand uranium ores. The Agency contributed to the project by providing expertise on uranium ore processing and some equipment.

### **IRA/9/008 ENVIRONMENTAL RADIOACTIVITY MONITORING**

APPROVED: **1985**

COMPLETED: **1994-05-25**

TOTAL COST: **\$ 172,277**

To facilitate the assessment of radium in drinking water and strengthen the capability for environmental radioactivity monitoring.

Agency assistance was requested to establish a laboratory infrastructure for environmental radioactivity monitoring, including assessment of radium in drinking water. The Agency supplied the National Radiation Protection Department (NRPD) of the Atomic Energy Organization of Iran (AEOI) with monitoring equipment and accessories. Two fellowships were awarded. Different procedures for measuring radium in drinking water were reviewed, and the emanation procedure was selected for determining Ra-226 in public water supplies. This is now standard procedure. A total of 282 samples from 178 villages and cities were analysed up to December 1992. Remedial actions were taken

where necessary. The Ra-226 level in hot mineral water springs in high level natural radiation areas such as Ramsar and in north-west Iran was also determined. An early warning national network system was created, consisting of SAPOS-90MS air radiation monitors, provided by the Agency. Ten systems have been installed in different cities, all of which are connected to the central control computer system installed at the NRPD. A system has also been designed at the NRPD for using meteorological data as a subsystem to early warning systems. These activities will be continued under the project IRA/9/012. An infrastructure has been established, and the national radiation monitoring system is considerably improved.

#### **IRA/9/011 REVIEW OF THE BUSHEHR NUCLEAR POWER PLANT**

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APPROVED: **1989**

COMPLETED: **1994-08-23**

TOTAL COST: **\$ 813,253**

To assist in an assessment of the status of the Bushehr NPP before resumption of construction; to advise on nuclear safety criteria for licensing; to assist in developing a national infrastructure for work on plant construction.

The Atomic Energy Organization of Iran requested Agency assistance in its long term programme for nuclear power development. In response, the Agency arranged for a report to be prepared in 1989/90 by Empresarios Agrupados (Spain) on the status of the Bushehr NPP and submitted it to the Government. Extensive expert missions were undertaken to advise on nuclear safety, licensing and regulatory procedures. A one-year post-graduate national training course on nuclear power engineering began in December 1991, with 21 lecturers provided by the Agency and 25 participants; another of ten months duration began in 1993 with 16 Agency lecturers and 23 participants. Twenty graduates of the first course received four months follow-up on-the-job training in Russia, starting in May 1993. The Agency provided advanced computer hardware and software for NPP design and for stress and thermohydraulic analyses. The project has made a valuable contribution to the establishment of an infrastructure for Iran's nuclear power programme.

#### **IRA/9/013 INSTALLATION OF INCINERATOR**

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APPROVED: **1991**

COMPLETED: **1994-07-11**

TOTAL COST: **\$ 19,403**

To re-establish the design and technological process of existing radioactive waste incinerator components and to install the facility.

Agency assistance was requested to re-establish the design and technology of existing incinerator components which had been purchased abroad about 15 years previously. The original design of the incinerator had been lost and the manufacturing firm no longer exists. A special project was created at the Isfahan Nuclear Research Centre to re-create the necessary information and install the equipment. The Agency provided expert advice on the technological process and on how to complete and install the incinerator.

#### **IRA/9/014 WASTE MANAGEMENT OF URANIUM TAILING**

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APPROVED: **1991**

COMPLETED: **1994-01-18**

TOTAL COST: **\$ 0**

To optimize effluent treatment conditions and design the liquid waste treatment and tailing disposal system for the uranium ore processing pilot plant.

In January 1992, at the Government's request, the project was postponed for one year and an expert mission was therefore cancelled. In February 1992, at the AEOI's request, activities recommenced, a team mission was prepared and scheduled for July 1993, then again postponed until September 1993, and subsequently cancelled by the AEOI. It is recommended to reconsider the project in a few years time if the objectives and local commitment to waste management are clearly defined by the Government.

### **IRAQ**

#### **IRA/9/005 DOSIMETRY AND NUCLEAR INSTRUMENTATION LABORATORY**

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APPROVED: **1985**

COMPLETED: **1994-05-27**

TOTAL COST: **\$ 376,720**

To upgrade and co-ordinate radiation protection services.

The project was operational until 1990. Substantial assistance had been provided until then to the Iraqi Atomic Energy Commission to strengthen the capability of the Nuclear Research Centre, Tuwalitha, for assuring radiation safety services, including nationwide personnel monitoring. Expert missions were fielded to establish a dosimetry programme and upgrade the secondary standards dosimetry laboratory. A training course was held on gamma spectroscopy

and internal dosimetry. However, following the UNSC resolutions of 1990 and the subsequent action by the IAEA Board of Governors, all activities under the project were suspended in 1990.

## **JAMAICA**

### **JAM/5/003 NUCLEAR AGRICULTURE DEVELOPMENT**

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APPROVED: **1990**

COMPLETED: **1994-02-21**

TOTAL COST: **\$ 25,077**

To assess requirements and to facilitate the co-ordination of efforts to prepare a large scale development programme in nuclear agriculture.

This Reserve Fund project was designed to carry out a detailed assessment of local capabilities to launch a development programme for the application of isotope techniques in agriculture. Six short term expert missions, in co-operation with the Ministry of Agriculture and the University of the West Indies, Kingston, undertook a comprehensive study of all practicable applications of nuclear techniques for the solution of agricultural problems in Jamaica. The report was delivered to the Government.

## **JORDAN**

### **JOR/0/005 NUCLEAR INFORMATION CENTRE**

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APPROVED: **1991**

COMPLETED: **1994-08-31**

TOTAL COST: **\$ 59,311**

To set up a nuclear information centre.

Owing to the extreme difficulty of obtaining literature on nuclear energy in Jordan, the Ministry of Energy and Mineral Resources decided to set up a Nuclear Information Centre within the Nuclear Energy Section for collection and dissemination of information related to nuclear science and technology. The Agency provided a computer system and related equipment as well as books and journals. Expert advice was given on INIS procedures and on organization and management. One fellowship and three scientific visits were awarded. The upgraded Centre is now able to provide nuclear information services and send inputs to the INIS nuclear database. However, the expert missions have indicated an urgent need to increase the space assigned to the Centre.

### **JOR/5/003 NUCLEAR TECHNIQUES IN AGRICULTURE**

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APPROVED: **1987**

COMPLETED: **1994-05-27**

TOTAL COST: **\$ 182,728**

To improve crop yields in a cereal-legumes rotation through better soil water management and N-fertilizer supply.

Wheat is the major cereal crop in Jordan; lentil and chickpeas are the most common leguminous crops rotated in the rain-fed highlands. Crop yields depend upon the nitrogen fixation from the rotation system, tillage practices, soil moisture conservation and the amount of fertilizer uptake. The project supported studies on the efficient use of water, the effect of nitrogen fixation and the application of chemical fertilizers, and was based at the Faculty of Agriculture at the University of Jordan. The Agency provided field and laboratory equipment and a large quantity of N-15 fertilizer. Four scientific visits were awarded. Eight expert missions were fielded to assist in setting up experiments as well as to advise on soil fertility and microbiology techniques and on interpretation of results. The plant samples collected during the experiments were analysed at the Syrian Atomic Energy Commission; intercomparisons of the measurements were performed at the Agency's Laboratory at Seibersdorf. The results of the experiments indicated that nitrogen fertilizers have low efficiency in Jordan owing to the rather high acidity of the soils, and that potassium fertilizers must be preferred but should be incorporated directly next to the plant instead of being broadcast, which has been the traditional practice. The results of the project were disseminated in seminars for agricultural officers and farmers. These activities will be continued under a regional project, RER/5/004.

### **JOR/5/005 NUCLEAR TECHNIQUES FOR ANIMAL PRODUCTION IMPROVEMENT**

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APPROVED: **1991**

COMPLETED: **1994-05-31**

TOTAL COST: **\$ 99,569**

To use radioimmunoassay to monitor reproductive efficiency of ruminants in order to identify major constraints limiting productivity and to design management approaches to alleviate these constraints.

The Government sought Agency assistance to establish a radioimmunoassay (RIA) laboratory at the Department of Animal Production of the University of Jordan to measure reproductive hormones in farm animals. The Agency provided a multi-well gamma counter and associated equipment including a desktop computer for on-line data analysis, together with equipment for on-farm studies and standardized RIA kits for measuring progesterone. Three experts carried out three training missions. Two fellowships and a scientific visit were awarded, and one counterpart

attended an Agency training course. The laboratory now performs RIA routinely and has conducted a study that has generated important information on differences in the ovarian follicular system and embryo viability in dairy cows during summer and winter seasons. Field studies on interactions between nutrition, heat stress and reproduction are also under way. The results from these studies will allow appropriate animal management systems to be designed to alleviate major constraints.

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**JOR/9/003                      RADIOLOGICAL ACCIDENTS RESPONSE TEAM**

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APPROVED: **1991**

COMPLETED: **1994-09-16**

TOTAL COST: **\$ 76,295**

To set up a radiological team and programme to cope with any radiological emergency arising from either the local use of highly radioactive sources or a nuclear accident in a neighbouring country.

The project was a follow-up to the establishment of Early Warning Environmental Radiation Monitoring Systems (EWERMS) in the Middle East countries. The Agency assisted the Ministry of Energy and Mineral Resources (MEMR) to develop capabilities to respond to a radiological emergency. Three expert missions advised on developing a national plan for emergency planning and preparedness. Training was provided to the Civil Defence Organization on emergency drills and the management of overexposed or contaminated individuals. Monitoring equipment for internal and external contamination measurements and for laboratory analysis of field samples was provided. A fellowship was awarded. The MEMR has now established routines to deal with a national or international radiological emergency.

**KENYA**

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**KEN/4/004                      NUCLEAR INSTRUMENT MAINTENANCE AND QUALITY CONTROL**

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APPROVED: **1986**

COMPLETED: **1994-08-23**

TOTAL COST: **\$ 198,731**

To develop a national repair and maintenance centre for nuclear instruments.

The Faculty of Engineering of the University of Nairobi wished to establish a national capability for repair and maintenance of nuclear instruments. The Agency provided the necessary electronic and laboratory equipment. Experts assisted in repair and maintenance, provided on-the-job training, and organized two national training courses. Two project-funded and two project-related fellowships were awarded. The Engineering Faculty can now carry out repair and maintenance of nuclear instruments and can provide services to other institutions in Kenya and to other countries in Africa. Training has already been provided to technicians from Nigeria and Tanzania.

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**KEN/6/009                      RADIOIMMUNOASSAY LABORATORY**

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APPROVED: **1991**

COMPLETED: **1994-10-28**

TOTAL COST: **\$ 108,720**

To establish a functional radioimmunoassay laboratory for diagnostic and teaching purposes.

The project was intended to make functional the radioimmunoassay (RIA) laboratory at the Kenyatta National Hospital, Nairobi, so that it could be used for diagnostic and teaching purposes. The laboratory had been in existence for some years but was in a rudimentary condition with outdated equipment and was unable to provide an adequate clinical diagnostic service. The Agency provided equipment including a multiple manual gamma counter with built-in computer and on-line data processing facility, together with ancillary equipment. Reagents, including radioactive tracers, were also regularly supplied. Expert missions introduced bulk reagent-based RIA methodology for analytes of the most common clinical importance and trained local staff. Two fellowships were awarded. The clinical service potential of the RIA laboratory has been upgraded and can now provide diagnostic tests for at least the more common endocrine and metabolic disorders. The work will continue under a regional project.

**KOREA, REPUBLIC OF**

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**ROK/0/006                      ENERGY AND NUCLEAR POWER PLANNING**

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APPROVED: **1989**

COMPLETED: **1994-03-21**

TOTAL COST: **\$ 82,156**

To develop expertise in integrated energy economic planning.

The project was designed to develop a computer program for integrated energy system planning, with particular emphasis on environmental impact, and to assess an environmentally clean, techno-economically optimizable, integrated energy system plan suitable for the national energy situation. The Agency organized a two-week workshop on the introduction of energy systems planning methodology and a demonstration of the Energy and Power Evaluation

Program (ENPEP). A seminar on energy and environment was held during the workshop. A one-week workshop was organized on MESAP energy and environmental analysis. Two fellowships and three scientific visits were awarded. MESAP has been introduced and is used as a local background methodology for various studies and as a base for the development of programs intended to keep a balance between energy sector growth and environmental impacts. The results of the project have been made available to decision makers.

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**ROK/4/019                    NUCLEAR POWER PLANT OPERATOR TRAINING**

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APPROVED: **1988**

COMPLETED: **1994-01-25**

TOTAL COST: **\$ 83,963**

To provide training activities for NPP operators, including refresher courses, qualification of operators and organization of personnel and management.

The Government requested Agency assistance in organizing seminars and workshops covering the principal aspects of NPP operator training. This footnote-a/ project was supported partly by an extrabudgetary contribution from the USA and partly from the TACF. Eight Agency experts took part in a two-week seminar organized by the Argonne National Laboratory, USA, on NPP operator training, with 32 participants. The programme covered all major problem areas and included a workshop on safe and reliable operation. The Agency organized a two-week workshop on accident management in NPPs. A project-related scientific visit was also awarded. These training activities have considerably strengthened the capabilities of the operating staff of all NPPs in the country. The work is continuing under the project ROK/0/005 (manpower development).

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**ROK/4/024                    ULTRASONIC SIGNAL ANALYSIS AND IMAGE PROCESSING SYSTEM**

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APPROVED: **1991**

COMPLETED: **1994-12-30**

TOTAL COST: **\$ 81,184**

To develop an automated image reconstruction system for ultrasonic signals obtained from defects in NPPs.

The Non-Destructive Testing (NDT) Department of the Korean Atomic Energy Research Institute, which had been carrying out in-service inspections manually, acquired an automated ultrasonic testing imaging system based on automatic data acquisition and signal processing. The Agency fielded five expert missions to advise on NDT technology and awarded a 16-month fellowship. The improved capability in ultrasonic signal analysis and imaging has contributed significantly to the safety and reliability of the NPPs in the Republic of Korea.

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**ROK/9/025                    NUCLEAR POWER PLANT SAFETY**

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APPROVED: **1984**

COMPLETED: **1994-05-25**

TOTAL COST: **\$ 313,559**

To strengthen capability in safety analysis, inspection and enforcement of regulations.

To meet the needs of the expanding national nuclear programme, the Korea Institute of Nuclear Safety (KINS), Taejeon, wishes to strengthen its capability to ensure adequate safety at all stages of NPP development, including site selection, construction, operation and maintenance. Nineteen expert missions were undertaken to provide advice on a wide variety of topics. In addition, eight experts undertook a three-week safety mission to assist KINS in a review of the probabilistic safety analysis of the Wolsong-2 NPP. One fellowship and three scientific visits were awarded under the project; five fellowships and three scientific visits were awarded under the regional manpower development project. KINS now has the capability to conduct safety analysis studies and promote greater operational safety at nuclear installations. The work is continuing under the project ROK/9/036.

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**ROK/9/030                    REGULATORY POLICY**

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APPROVED: **1989**

COMPLETED: **1994-01-25**

TOTAL COST: **\$ 9,210**

To improve planning capability for regulatory and safety aspects of the national nuclear power development programme.

An expert mission reviewed the methodology for the development of the safety parameter display system (SPDS) of the Kori NPP emergency response facility and conducted four seminars on USNRC experience in undertaking SPDS reviews. Another expert advised and assisted the Korean Institute of Nuclear Safety (KINS) in evaluating the emergency response facilities of Ulchin 3 and 4 and also conducted a comprehensive emergency response facility appraisal. Some of the basic knowledge required for regulatory and safety aspects of nuclear development has now been acquired by KINS, which will facilitate long term policy making and planning for the national nuclear programme.

## **LIBYAN ARAB JAMAHIRIYA**

### **LIB/4/007            NUCLEAR INSTRUMENTATION**

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APPROVED: **1991**

COMPLETED: **1994-09-22**

TOTAL COST: \$ **134,971**

To set up a laboratory facility for maintenance and repair of electronic equipment in support of research and development work.

The Tajoura Nuclear Research Centre (TNRC) wished to set up a laboratory in order to improve its capabilities for maintenance and repair of nuclear instrumentation to cope with the increasing demands. The Agency provided electronic equipment for troubleshooting and computer software. Expert advice was given on preventive and corrective maintenance procedures and microprocessor applications. An expert mission also assisted in assessing the status and feasibility of repairing a gamma camera at the Tripoli Hospital. Fifteen months of fellowship training were awarded. The Department of Electronics of TNRC is now able to provide maintenance and repair services for nuclear and nuclear research related instruments.

### **LIB/7/002            STUDY ON STERILIZATION OF MEDICAL SUPPLIES**

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APPROVED: **1991**

COMPLETED: **1994-08-23**

TOTAL COST: \$ **50,720**

To develop technical competence in radiation-sterilization of medical supplies for practical applications.

The project was intended to assist the Radioisotopes and Radiation Application Department of the Tajoura Nuclear Research Centre (TNRC) in improving radiation-sterilization practice for medical supplies, using a Co-60 gamma facility as an alternative to the previous method of sterilization by toxic ethylene oxide gas. The Agency supplied radiation monitoring and laboratory equipment. One expert mission identified and repaired the technical faults of the Co-60 irradiator; another assisted in redressing the lack of local support services for development and validation of the process; and a third established and calibrated routine dosimetry systems. Two project-related fellowships were awarded. The irradiation room was mapped to assess the extent of heterogeneity in radiation dose delivery and for remedial steps for uniform predictable dose deposition protocols including the use of computer programmes. The staff of the TNRC is now familiar with the Co-60 irradiation facility and its use for radiation-sterilization of medical supplies.

### **LIB/8/002            INDUSTRIAL TRACER APPLICATIONS**

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APPROVED: **1989**

COMPLETED: **1994-01-18**

TOTAL COST: \$ **71,221**

To develop radiotracer applications for the cement and oil industries and to develop a tracer team to provide services to other industries.

This project was designed to assist the Tajoura Nuclear Research Centre (TNRC) to develop the applications of radiotracer techniques in industry. The Agency provided equipment including a complete radiotracer detector-scaler ratemeter system, software for data processing, and expert services to assist in carrying out a radiotracer study at a soap factory. The TNRC now has the capacity to provide radiotracer services and undertake independently tracer applications for other industries.

## **MADAGASCAR**

### **MAG/1/005            APPLIED NUCLEAR PHYSICS**

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APPROVED: **1989**

COMPLETED: **1994-05-25**

TOTAL COST: \$ **170,264**

To develop X-ray spectroscopy for analysing geological, biological and aerosol samples on a national scale.

This project was a follow-up of MAG/1/004 and was designed to complete the X-ray fluorescence (XRF) analysis laboratory at the University of Madagascar. The Agency provided the necessary equipment, four expert missions and a fellowship. The laboratory has been set up; local staff have been trained in sample preparation techniques and quantitative trace element analysis and can operate and repair most of the equipment. The XRF equipment is being effectively used for training and for elemental analysis of geological and biomedical samples.

**MAG/3/007      A RADIOACTIVE MINERAL RESOURCE INVENTORY**

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APPROVED: 1991

COMPLETED: 1994-08-22

TOTAL COST: \$ 52,551

To upgrade the computerized geological and mining databank for radioactive minerals.

During 1979-1982 the National Military Office for Strategic Industries (OMNIS), assisted by a UNDP programme, carried out an extensive uranium exploration. Since 1986, the Agency has been assisting OMNIS in establishing a computerized databank for information on uranium mining and exploration. The Agency provided modern computer hardware and software as well as additional training. Two expert missions trained the staff in the use of the software, and two scientists attended training courses in Zambia and Canada. OMNIS has now acquired the necessary expertise and equipment to establish computerized databases for preservation of uranium exploration information. The relatively high level of expertise in database programming and geological data treatment in general was achieved in spite of insufficient communication and lack of mechanisms for exchange of technical information and expertise between the institution generating the information and the end user sector.

**MAG/4/003      MAINTENANCE OF NUCLEAR INSTRUMENTATION**

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APPROVED: 1988

COMPLETED: 1994-11-21

TOTAL COST: \$ 160,818

To upgrade local facilities for maintenance and repair of nuclear instruments.

The National Institute for Nuclear Science and Technology, Antananarivo, requested Agency assistance to upgrade its existing facilities for maintenance and repair services. The Agency provided test instruments, mechanical workshop tools, PC-controlled instruments and electronic components. Six expert missions gave on-the-job training and two national workshops were arranged. One fellowship was awarded. The Institute has now improved its capability to repair, maintain and calibrate nuclear instruments and provides services to national and private institutions and to local industry.

**MALAYSIA****MAL/9/007      RADIATION PROTECTION PROGRAMME**

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APPROVED: 1986

COMPLETED: 1994-05-30

TOTAL COST: \$ 163,145

To establish regulations, procedures and technical infrastructure for a nationwide radiation protection service.

The Atomic Energy Licensing Act was passed in 1985. Nine experts carried out twelve missions to assist the Atomic Energy Licensing Board in establishing regulations and codes of practice for a national radiation protection programme. A radon-thoron measurement system, air monitoring equipment and a computer system were provided by the Agency. Five counterpart staff received long term training abroad, including three fellowships funded under the Agency's general training programme. Regulations on radiation protection for industrial radiography were established. The project has contributed to the strengthening of radiation safety and to the establishment of a national radiation protection service.

**MALI****MLI/8/003      SEDIMENTOLOGY**

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APPROVED: 1984

COMPLETED: 1994-09-21

TOTAL COST: \$ 290,581

To conduct studies on the accumulation of sediments in reservoirs, rivers and lakes and to elucidate the mechanisms of sediment transport with a view to defining methods for the improved management of water resources.

The project was designed to assist the National Directorate of Hydraulics and Energy and the National Engineering School, Bamako, in conducting sedimentology studies. The Agency established a sedimentology laboratory equipped with several nuclear gauges for measuring sediment deposits, a radiation detector, sampling and navigation equipment. Experts installed the equipment, trained the staff in its use and assisted with the interpretation of results. The Agency also assisted in the sampling campaigns on rivers and dams by providing experts to supervise the field work, spare parts and supplies. One team of three hydrologists and four technicians was trained to carry out sampling, and another to interpret the results and to design improvements for navigation channels and the management of reservoirs. Both teams now perform these tasks regularly and report the results and the proposed solutions to the authorities in charge of the management of rivers and reservoirs. The work will be continued under the project MLI/8/004.

## **MEXICO**

### **MEX/1/015 PLASMA PHYSICS**

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APPROVED: **1989**

COMPLETED: **1994-02-21**

TOTAL COST: \$ **171,612**

To obtain a pure plasma in the vacuum chamber, to build up the circuits of the tokamak magnetic system and to carry out basic measurements of the plasma column.

The National Institute for Nuclear Research, Mexico City, requested Agency assistance to improve the performance of its small scale tokamak NOVILLO, in particular to produce a toroidal discharge in the tokamak. The Agency provided equipment, including an interferometer and a CAMAC module, and fielded four expert missions. Five project-funded and three project-related fellowships were awarded. A clean plasma discharge was produced in the vacuum chamber, the circuits of the tokamak magnetic system were developed, the plasma column's stable equilibrium was maintained, and the tokamak regime of operation was demonstrated. Startup and optimization of the discharge in NOVILLO have been achieved, and the tokamak is now ready for full scale physical experiments.

### **MEX/2/013 CYCLOTRON FOR MEDICAL PURPOSES**

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APPROVED: **1993**

COMPLETED: **1994-10-27**

TOTAL COST: \$ **9,399**

To assist in preparatory studies for the establishment of a cyclotron facility for production of radionuclides and radiopharmaceuticals.

An Agency expert mission was financed by the UNDP Sectoral Support Fund to assist the National Institute of Pediatrics and the National Institute for Nuclear Research in a feasibility study for a radionuclide production cyclotron facility. Three scientific visits were awarded by the Agency. The preliminary feasibility studies were reviewed, a clear definition of the scope of the project was established, and the layout of the facility designed. The basis for project cost analysis and guidelines for the general specifications for international bids were established. Action following the eventual approval of the project by the governmental authorities was outlined.

### **MEX/4/038 REACTOR FUEL FABRICATION AND PERFORMANCE**

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APPROVED: **1989**

COMPLETED: **1994-12-30**

TOTAL COST: \$ **177,622**

To fabricate eight prototype fuel assemblies for the Laguna Verde NPP, observing quality control procedures; to test assemblies under irradiation and analyse the fuel behaviour.

This footnote-a/ project, made operational in 1991 by an extrabudgetary contribution from Spain, provided expertise and part of the equipment for a BWR fuel pilot plant for the fabrication of part of the fuel for the Laguna Verde Nuclear Power Plant (LVNPP). This was a preliminary step in the construction of a full scale plant envisaged in the case of extension of the Mexican nuclear power programme. The Agency provided five expert missions and awarded five fellowships and five scientific visits. A table for assembly monitoring, with a computer, required to complete the plant equipment was also provided. The National Institute for Nuclear Research can now fabricate BWR assemblies for LVNPP in accordance with the quality assurance programme of the original NPP supplier. Four complete fuel element assemblies are ready to be delivered to the LVNPP.

### **MEX/5/017 IMPROVEMENT OF PLANT SPECIES**

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APPROVED: **1991**

COMPLETED: **1994-08-26**

TOTAL COST: \$ **208,205**

To induce mutants as a means of providing genetic variability in a search for improved commercial varieties of plants of economic importance.

The School of Agronomy and Animal Husbandry, University of Guanajuato, has been using ionizing radiation for mutation breeding for several years and intends to carry out research on economically important crops in the Bajío region. Under a previous project, conventional breeding of the more important crops in combination with applications of mutation techniques including in-vitro culture had been initiated. The present footnote-a/ project was made operational through an extrabudgetary contribution from the UK. An ELISA system, laboratory equipment and supplies as well as eight expert missions were provided. Four fellowships and two scientific visits were awarded. A phytopathology laboratory has been established under the project and is applying mutation strategies to endemic diseases, particularly white rot of garlic and onion. Anther culture has now become a routine technique for wheat improvement. Doubled haploids are undergoing yield trials in the field. Work to establish the new wheat x maize system for large scale doubled haploid production has been initiated. A programme for inducing white rot resistance in onion through radiation has been initiated. The School has successfully produced new and useful

genotypes/mutant lines of sorghum, garlic, wheat and beans by combining mutation and In-vitro strategies. Work on avocado and pepper has also begun.

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**MEX/7/005                      FEASIBILITY STUDY OF SLUDGE IRRADIATION**

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APPROVED: 1993

COMPLETED: 1994-11-29

TOTAL COST: \$ 30,621

To assist in the preparation of a feasibility study of an irradiation plant for sludge treatment and promotion of the relevant technology.

Three expert missions assisted the Mexican State Autonomous University, Toluca, and the National Nuclear Research Institute, Salazar, in the preparation of feasibility studies for the use of radiation processing in the treatment of municipal waste, by means of either electron beam accelerators or gamma radiation sources, with a view to safe utilization of the sludge as an agricultural fertilizer, while protecting the environment. The counterparts now have sufficient information to carry out a pre-feasibility study and a feasibility study for a pilot size irradiation plant.

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**MEX/9/043                      SAFETY REVIEW MISSIONS TO LAGUNA VERDE NUCLEAR POWER PLANT**

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APPROVED: 1993

CANCELLED: 1994-02-09

TOTAL COST: \$ 0

To review the operational safety of the Laguna Verde Nuclear Power Plant.

The Mexican authorities requested cancellation of this project.

**MONGOLIA**

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**MON/2/006                      RADIOCHEMISTRY TEACHING**

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APPROVED: 1991

COMPLETED: 1994-12-30

TOTAL COST: \$ 76,575

To establish facilities for teaching radiochemistry, with emphasis on practical applications.

The Nuclear Research Laboratory of the National University of Mongolia, Ulan Bator, established teaching and research in several areas of nuclear science and technology, but had no facilities for teaching radiochemistry. An Agency expert assisted in establishing a radiochemical laboratory for teaching purposes and designed courses on nuclear chemistry, nuclear medicine and pharmacy and on industrial and agricultural applications of radionuclides and radioanalytical chemistry. The Agency also supplied some laboratory equipment. One fellowship and one scientific visit were awarded. The new courses are now part of the curriculum for undergraduate and post-graduate students and also benefit specialists from medicine, industry, pharmacy and agriculture.

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**MON/7/004                      ESTABLISHMENT OF RADIOBIOLOGY LAB.**

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APPROVED: 1993

COMPLETED: 1994-12-30

TOTAL COST: \$ 92,424

To establish a radiobiology laboratory.

The Institute of Biotechnology of the Mongolian Academy of Sciences is carrying out a programme on radiobiological applications in biomedical fields and human health care services. A UNDP project (MON/87/002), initiated in 1987, on the development of hepatitis B vaccine and diagnostics is being implemented at the Institute with the co-operation of the State Institute of Hygiene Epidemiology and Microbiology. To complement the UNDP project, the Agency provided equipment for the establishment of a radiobiology laboratory, including a gamma counter and fermentation equipment. An expert mission advised on molecular biology/genetic techniques in health care. One fellowship and two scientific visits were awarded. The laboratory has developed its own monoclonal antibody against hepatitis B surface antigen (HBsAg). In 1994, more than 2000 individuals were tested for HBV infection by radioimmunoassay (RIA). The Institute is now in a position to establish a unit for RIA tests for HBV, HCV, AFP and serodia-HIV.

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**MON/8/003                      GAMMA RADIOGRAPHY TRAINING**

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APPROVED: 1991

COMPLETED: 1994-12-30

TOTAL COST: \$ 91,577

To establish a gamma radiography laboratory for training in non-destructive testing.

The Physics Department of the Mongolian Technical University (MTU), Ulan Bator, wished to establish a gamma radiography laboratory to train undergraduate and post-graduate students and other industrial personnel in the technology of non-destructive testing (NDT). The Agency provided expert advice on setting up the laboratory and

organized a national training course on radiographic testing, with nine participants from the aviation, thermal power, petroleum, metal work and building industries, as well as from the University. The MTU also participated in the regional project (RCA) on NDT. Two fellowships were awarded. An industrial X-ray machine and other NDT equipment were provided. The radiographic testing laboratory has been upgraded and is performing radiographic testing for local industries. The basis has been established for qualification and certification of NDT personnel.

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**MON/9/002 RADIATION PROTECTION AND DOSIMETRY LABORATORY**

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APPROVED: 1983

COMPLETED: 1994-01-20

TOTAL COST: \$ 117,655

To set up a radiation protection and dosimetry service.

In the early 1980s, dosimetry and radiation protection activities in Mongolia were carried out by the Nuclear Research Laboratory (NRL) of the Mongolian State University, Ulan Bator, and this project was designed to set up a radiation protection and dosimetry laboratory for monitoring and inspection at institutions using radiation sources or radioactive materials. In 1984 the responsibility for radiation protection was transferred to the State Institute of Public Health, Epidemiology and Microbiology (SIPHEM) of the Ministry of Health, and the NRL's activities under the project were confined to an environmental study and to mapping environmental gamma radiation. The Agency provided most of the equipment required to conduct personnel and area monitoring and to carry out small scale research work and simple environmental monitoring. Two experts provided training on operation of the equipment and on the basic principles of occupational and environmental monitoring. Two fellowships were awarded. A radiation monitoring laboratory has been established. Systematic measurement of radiation background is being carried out nationwide and personnel radiation protection services have been set up. These activities are continuing under the project MON/9/004. Closer co-operation in radiation protection methodology is being maintained between the NRL and SIPHEM, now the State Inspectorate for Hygiene and Epidemiology.

**MOROCCO**

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**MOR/0/003 NUCLEAR ENERGY RESEARCH CENTRE**

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APPROVED: 1986

COMPLETED: 1994-09-22

TOTAL COST: \$ 108,102

To assist in the establishment of a nuclear science and technology centre, including the installation and utilization of a research reactor.

The project was approved to assist the National Centre for Energy, Sciences and Nuclear Techniques (CNESTEN), Rabat, in establishing a nuclear research centre around the Triga Mark II research reactor. Experts assisted in the conceptual design of the centre, including the various laboratories to be associated with the research reactor, and in the potential utilization of the facility. Experts also assisted in checking the work done by contractors, advised on the preparation of the masterplan for the centre, the site study, and the establishment of the site radiological baseline. To establish this baseline, a radioactive source and accessories were provided. Substantial fellowship training and project-related scientific visits were awarded to nine CNESTEN staff members to prepare them to manage the establishment of the nuclear research centre and to provide training when the research laboratories become operational. This team is now playing a major role in the construction of the centre and in implementing co-operative projects with the Agency and other donors.

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**MOR/0/004 MANPOWER DEVELOPMENT**

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APPROVED: 1989

COMPLETED: 1994-12-30

TOTAL COST: \$ 232,218

To provide theoretical and on-the-job training to personnel from the utility and the regulatory body in order to strengthen their project management capabilities in respect of the first nuclear power plant.

The project was designed to train a team from the National Electricity Office (ONE), Casablanca, that can efficiently discharge functions connected with the first NPP. Fellowship training in France was provided to 14 staff members from ONE and the regulatory authority on all aspects of the management of nuclear power projects, including site evaluation, feasibility studies of nuclear power programmes, safety analysis and regulatory aspects. This included theoretical and on-the-job training at a number of French NPPs. Before going to France, the team received on-the-job training in conventional electricity plants in Morocco. Expert services were also provided to assist ONE in bid specifications for the NPP and in a review of the nuclear power programme.

**MOR/4/007 FEASIBILITY AND SITING STUDIES**

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APPROVED: 1985

COMPLETED: 1994-09-21

TOTAL COST: \$ 105,978

To carry out feasibility and siting studies in connection with the introduction of nuclear power for electricity generation.

The project was designed to assist the National Electricity Office (ONE), Casablanca, in conducting siting and techno-economic feasibility studies. A manpower training programme for a team of engineers and scientists from the ONE and the Regulatory Authority had already been prepared and implemented under the project MOR/0/004. Sixteen expert missions assisted the ONE in evaluating site selection studies undertaken by a foreign consultant and in reviewing the nuclear power programme and the requirements for manpower development. Four scientific visits and a project-related fellowship were awarded. A well trained team can now carry out all functions of nuclear power projects. Three potential sites have been selected.

**MOR/4/008 MAINTENANCE AND REPAIR OF SCIENTIFIC INSTRUMENTS**

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APPROVED: 1988

COMPLETED: 1994-12-30

TOTAL COST: \$ 154,332

To strengthen the maintenance and repair capability of the existing laboratory; to train technicians in maintenance methodology and in the management of spare parts.

The project was designed to strengthen the capability of the Scientific Instruments Laboratory, Rabat, to meet the increased demand for maintenance and repair of nuclear equipment provided by the IAEA. The project provided diagnostic equipment as well as four expert missions to introduce preventive maintenance concepts and nuclear interfacing. Two fellowships were awarded. The laboratory now provides two hospitals and one agronomic research centre with preventive maintenance, repair of defective equipment and assistance with bid specifications. It also undertakes commissioning and testing of new equipment.

**MOR/8/004 ISOTOPES IN HYDROLOGY**

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APPROVED: 1988

COMPLETED: 1994-09-21

TOTAL COST: \$ 173,260

To study mechanisms of dam sedimentation and to evaluate water resources to find methods of rational management of various types of reservoirs.

Under this footnote-a/ project, made operational through an extrabudgetary contribution from France, sampling and related equipment was provided to the Water Resources Administration, Rabat, and samples were analysed in France. Experts assisted in the interpretation of results and the elaboration of new practices for better maintenance of dams and improved management of water resources. Studies are now being carried out at selected harbours to identify sedimentation problems and reduce dredging costs. A large scale programme to study sediment deposits and siltation of navigation channels along the Atlantic coast of Morocco has been initiated in co-operation with the national harbour authority.

**MOR/9/005 RADIATION PROTECTION**

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APPROVED: 1985

COMPLETED: 1994-12-19

TOTAL COST: \$ 312,649

To improve and expand the existing radiation protection service.

The project was designed to assist the Central Radiation Protection Service of the Ministry of Public Health, Rabat, to upgrade and expand its radiation protection capability in order to provide monitoring services for all ionizing radiation workers, food contamination and the environment and to perform all functions relating to the import and use of radiation sources. The Agency provided equipment for upgrading the personnel monitoring services, including a thermoluminescence dosimetry (TLD) system, for establishing a food contamination laboratory (a gamma spectrometer and sampling equipment) and an environmental monitoring unit. Experts assisted in the installation and operation of the equipment and in the preparation of national radiation monitoring programmes. A fellowship was awarded. Assistance was also given in planning the expansion of the Service to cover calibration of radiation equipment and in designing a new building for the facilities, which is now under construction. The Service is currently monitoring 5000 workers and a large proportion of imported food. The calibration laboratory will be equipped under the project MOR/9/009.

**MOR/9/006 TECHNICAL REGULATIONS AND NUCLEAR SAFETY**

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APPROVED: 1991

COMPLETED: 1994-09-21

TOTAL COST: \$ 1,598

To assist the Regulatory Authority in assessing preliminary safety reports and in preparing regulations relating to safety criteria and standards for licensing nuclear facilities.

Agency experts assisted the Regulatory Authority and the Nuclear Research Centre (CNESTEN), Rabat, in assessing the research reactor safety report and provided training on the preparation of radiation safety regulations. A project-related fellowship was awarded. The capability of CNESTEN to assess safety reports has been strengthened. Assistance in commissioning the research reactor is being provided under the ongoing project MOR/9/010.

**NAMIBIA****NAM/0/002 NUCLEAR LAW AND RADIATION SAFETY**

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APPROVED: 1992

COMPLETED: 1994-09-22

TOTAL COST: \$ 33,638

To provide expert assistance for assessment of the radiological programme at the Roessing uranium mine and to provide expert assistance in drafting nuclear legislation.

The project was approved from the Reserve Fund to provide urgent assistance to the Ministry of Mines and Energy, Windhoek, for assessment of the radiological safety programme applied at the Roessing uranium mine. The Agency provided a multi-disciplinary mission to perform an independent assessment of radiological safety at the mine. Another mission dealt with specific radiation safety problems. Recommendations of the missions as well as the full report were submitted to the Government for consideration. Further assistance has been approved under NAM/9/002 to assist in the establishment of a radiation protection infrastructure and elaboration of legislation.

**NIGER****NER/8/004 ISOTOPE TECHNIQUES IN HYDROLOGY**

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APPROVED: 1991

COMPLETED: 1994-09-21

TOTAL COST: \$ 77,851

To use isotope techniques to perform hydrological and sedimentological investigations with the aim of collecting data for the Eastern Niger Basin.

The project was intended to assist the Directorate of Water Resources, Ministry of Hydrology and Environment, Niamey, in conducting hydrological studies on the Eastern Niger Basin to acquire the necessary data for establishing an aquifer simulation model to be used in the design of a rational exploitation programme of water resources in the region. The Agency provided equipment required for the use of tracing techniques and expert advice on sampling campaigns and interpretation of the results. A fellowship was awarded on aquifer modelling techniques. The results are reported in IAEA TECDOC/721. Additional expert services and training are being provided under the regional project RAF/8/012.

**NER/9/006 UPGRADING THE RADIATION PROTECTION INSPECTORATE**

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APPROVED: 1991

COMPLETED: 1994-09-26

TOTAL COST: \$ 104,927

To improve the effectiveness of the Radiation Protection Inspectorate in performing radiation monitoring related to uranium mining and milling.

This footnote-a/ project, made operational through an extrabudgetary contribution from France, was designed to upgrade the capability of the Radiation Protection Inspectorate at Arlit, which belongs to the Ministry of Mines and Energy. Radon detectors were provided, and experts assessed the comparability and consistency of the results of measurements made by the mining companies and the Inspectorate. Standardization of measuring methods has improved the effectiveness of the Inspectorate and simplified its daily workload. Further assistance is provided under the ongoing project NER/9/007.

## **NIGERIA**

### **NIR/2/004 TRACE-ELEMENT DETERMINATION**

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APPROVED: **1988**

COMPLETED: **1994-10-27**

TOTAL COST: **\$ 179,975**

To develop a trace element characterization laboratory for environmental pollution monitoring and for the petroleum industry.

The Physics Department of Obafemi Awolowo University, Ile-Ife, requested Agency assistance to establish a facility for local analysis of environmental samples. This footnote-a/ project was made operational through an extrabudgetary contribution from the UK. X-ray equipment, air sampling equipment and a computer system were provided. Experts assisted in installing equipment, sample preparation and analysis of environmental samples using the new equipment and provided on-the-job training. The laboratory is now well equipped and able to carry out experiments in trace element determination, for the benefit of environmental monitoring and the petroleum industry.

### **NIR/5/019 ANIMAL SCIENCE**

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APPROVED: **1989**

COMPLETED: **1994-09-26**

TOTAL COST: **\$ 51,918**

To diagnose and study rinderpest and "peste des petits ruminants" to support the national control and eradication programme.

The project was approved with footnote-a/ status and upgraded in 1990 through the TACF. It was designed to introduce nuclear techniques for animal disease diagnosis, in support of the national programme. The project at first introduced the FAO/IAEA rinderpest ELISA and later extended activities to other diseases affecting livestock production. The Agency provided laboratory equipment and supplies. Rinderpest ELISA is now established at the National Veterinary Research Institute (NVRI), Vom. The ELISA technique was used routinely during recent vaccination campaigns and the work has been reported in a number of publications. A research contract was awarded under the SIDA-funded CRP on sero-monitoring of rinderpest throughout Africa. Sero-monitoring has proved an indispensable epidemiological tool in evaluating the national vaccination results for rinderpest, and it was recommended at a conference that Nigeria should cease vaccination against rinderpest and enter into a surveillance phase to ensure that the virus is eradicated. However, field activities are making slow progress, mainly due to delayed implementation of the national PARC project and lack of local support. Epidemiological investigations of "peste des petits ruminants" and brucellosis were undertaken under the project, and an antigen capture ELISA for the direct diagnosis of rinderpest was successfully introduced and compared with the classic diagnostic tests.

### **NIR/5/020 MUTATION BREEDING**

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APPROVED: **1989**

COMPLETED: **1994-05-30**

TOTAL COST: **\$ 68,893**

To improve root and tuber crops through mutation breeding and in-vitro culture techniques.

The National Root Crops Research Institute, Umudike, specializes in breeding important tropical root and tuber crops such as cassava, sweet potato, yam and ginger, in close co-operation with the International Institute of Tropical Agriculture, Ibadan, where conventional cross-breeding and selection using existing genetic resources is carried out. Conventional breeding is slow and is limited by variations in the genetic resources. To break through the barrier of existing genetic resources and to improve the current varieties, this project introduced a breeding programme for the above vegetatively propagated crops, using in-vitro culture techniques in mutation breeding. The breeding programme is being carried out with the use of the new technology but, even so, the vegetatively propagated species will need a long time to develop new mutant varieties. The Agency supplied a laminar flow hood and laboratory equipment. Three expert missions provided advice and on-the-job training and three scientists participated in interregional training courses. The project has made a valuable and continuing contribution to the breeding programme.

### **NIR/6/008 RADIOLOGICAL PHYSICS LABORATORY**

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APPROVED: **1991**

COMPLETED: **1994-08-23**

TOTAL COST: **\$ 97,552**

To establish a medical physics laboratory for accurate determination of radiation dose delivered by radiotherapy machines.

The Radiotherapy Department, University College Hospital, Ibadan, had no adequate instruments for dose determination; the X-ray simulator was out of order, and there was no equipment for dose planning. In order to set up a medical physics laboratory at the Hospital the Agency provided equipment including a therapy dosimeter and a medical data processing system. Two expert missions checked the instruments and calibrations, advised on

improvements to procedures, and trained the staff in dose planning. Two fellowships were awarded. The Radiotherapy Department now provides better services to the community.

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**NIR/9/005                      STRENGTHENING THE FEDERAL RADIATION PROTECTION SERVICE**

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APPROVED: **1991**

COMPLETED: **1994-08-31**

TOTAL COST: **\$ 182,095**

To strengthen radiation protection capabilities of the Federal Radiation Protection Service, and extend its services to the whole of the country.

To assist the Federal Radiation Protection Service (FRPS) in strengthening its radiation protection infrastructure and to upgrade its laboratory, the Agency provided equipment including a thermoluminescence dosimetry system and a gamma spectrometry system. Experts surveyed radiation protection at X-ray diagnosis and therapy installations and performed quality control of equipment, established inspection and licensing procedures, installed equipment and provided training. The Service is now able to monitor more than 3000 people from all over the country, inspect and commission radiation-emitting installations, and conduct some routine environmental monitoring. The capabilities developed would be instrumental in enforcing the national radiation protection regulations when they are enacted. The work continues under the new project NIR/9/007.

**PAKISTAN**

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**PAK/4/030                      RESEARCH REACTOR CONVERSION DEVELOPMENT**

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APPROVED: **1987**

COMPLETED: **1994-01-20**

TOTAL COST: **\$ 127,790**

To ensure continued safe operation of the Pakistan Research Reactor with its newly converted core using low enriched uranium fuel.

Following the conversion of the Pakistan Research Reactor (PARR) core to commercially available low enriched uranium fuel and the upgrading of its power level to 10 MW(th), the Agency was requested to assist in ensuring its continued safe operation. The Agency provided a coaxial germanium detector and related equipment. Expert missions advised on reactor core physics and thermal hydraulics. Three fellowships and a scientific visit were awarded. Detailed reactor design calculations for core neutronics, thermal hydraulics and accident analysis were completed and the final plant safety analysis report was prepared. Full power tests were completed and the reactor has been operating for routine full power runs since July 1992.

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**PAK/4/032                      QUALITY ASSURANCE (PHASE II)**

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APPROVED: **1988**

COMPLETED: **1994-01-20**

TOTAL COST: **\$ 115,984**

To establish a fully equipped non-destructive examination laboratory with a view to performing in-service inspection of selected system pressure and nuclear reactor components.

Agency assistance was requested to establish a non-destructive examination laboratory at the Karachi Nuclear Power Plant (KANUPP). The Agency provided TV equipment from the TACF with the help of funds-in-trust. Six expert missions gave advice and on-the-job training. KANUPP staff are now able to carry out in-service inspection on selected plant components on a routine basis. Activities are continuing under the ongoing project PAK/9/010.

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**PAK/4/035                      UPGRADING OF NPP CONTROL AND INSTRUMENTATION SYSTEM**

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APPROVED: **1989**

COMPLETED: **1994-12-30**

TOTAL COST: **\$ 42,812**

To upgrade the control and instrumentation system of the Karachi Nuclear Power Plant.

The Pakistan Atomic Energy Commission requested expert services to upgrade the control and instrumentation (C&I) system of the Karachi Nuclear Power Plant (KANUPP), where a C&I applications laboratory had already been established under the project PAK/4/027. Six expert missions gave advice at different stages on tender preparation, bid evaluation, programming, engineering design, commissioning, testing, quality assurance, and the use of simulators. One fellowship was awarded. Expert assistance was also provided for the replacement of a number of components. The KANUPP Test Simulator (KTS) is now being used for testing the main control loops of the new C&I system and for basic training. The engineering design has been completed and supplied to the vendor for construction. This upgrading will enhance the safety of the NPP.

APPROVED: 1983

COMPLETED: 1994-05-27

TOTAL COST: \$ 191,709

To achieve integrated control of fruit fly and codling moth (using the sterile insect technique).

This project was designed to assist the Atomic Energy Agricultural Research Centre, Tandojam, in establishing integrated management of fruit fly, *Bactrocera zonatus*, through mass trapping followed by use of the sterile insect technique. The Agency provided a Cs-137 gamma irradiator but, since delivery was considerably delayed, gamma irradiation was not installed and made available until October 1994. Two Agency experts assisted in the establishment of a mass rearing facility and the optimum conditions were determined to obtain the required number of flies for releases in the target areas. A mass rearing laboratory, with adult and larval rearing, pupal holding and quality control rooms, was also established. Three fellowships (one project-related) and one scientific visit to rearing facilities were awarded. Very good results were obtained in developing control procedures for *Bactrocera zonatus*. Mass rearing, monitoring, population reduction and determination of the radiation dosages required to induce sterility have been completed. The work continues under the ongoing project PAK/5/027.

**PAK/5/025****MUTATION BREEDING OF SUGAR CANE**

APPROVED: 1989

COMPLETED: 1994-01-20

TOTAL COST: \$ 67,514

To isolate clones from irradiation/tissue or cell culture of sugar cane endowed with early maturity, high sugar, better yield and disease and drought resistance.

The project was first approved with footnote-a/ status and upgraded in 1990 from the TACF. Sugar cane is a major crop in Pakistan, but the yield per unit area is lower than the world average. Mutation breeding combined with in-vitro culture and other biotechnological methods is the most practical and promising means to improve the agronomic characters of the crop. To develop this technology in Pakistan, an in-vitro culture laboratory was set up at the Plant Genetics Division, Atomic Energy Agricultural Research Centre, Tandojam. The Agency provided the additional laboratory equipment required. Three experts carried out nine weeks training and assistance in mutation breeding techniques for the target crop, including protoplast culture. Three staff members received training at the Agency's laboratory at Seibersdorf (one attended an interregional training course). Certain sugar cane clones were used for mutation breeding. The callus and micropropagated plantlets were irradiated by gamma rays. The plants obtained were transplanted in the field for screening and evaluation of improved characteristics. The technology was also successfully used in an FAO/IAEA co-ordinated research programme for banana.

**PAK/6/013****UPGRADING OF A TELE THERAPY FACILITY**

APPROVED: 1989

COMPLETED: 1994-01-20

TOTAL COST: \$ 182,669

To replace an obsolete Co-60 teletherapy machine.

In 1968 the Atomic Energy Medical Centre, Jamshoro, installed a Co-60 teletherapy machine. The source had been replaced twice, with Agency assistance, in 1975 and 1981. In 1988 the Government again sought Agency assistance to replace the source as the supplier had recommended replacement of the obsolete unit with modern teletherapy equipment. The Agency provided a new teletherapy machine with a 4700 Ci Co-60 source, which became available for patient treatment in April 1992. It has been working satisfactorily so far, and the Centre has resumed effective radiation therapy for cancer patients.

**PAK/8/008****INVESTIGATION OF SEEPAGE FROM CANALS**

APPROVED: 1989

COMPLETED: 1994-01-28

TOTAL COST: \$ 150,333

To investigate seepage from irrigation canals with the use of radiotracers.

The project was intended to assist the Radiation and Isotope Applications Division of the Pakistan Institute of Nuclear Science and Technology (PINSTECH), Islamabad, to conduct groundwater studies using tracer techniques and to investigate certain problems including waterlogging and salination of land due to seepage from unlined irrigation canals. The Agency provided a complete borehole dilution system for measurement of groundwater velocity, with supporting equipment, and a computer for data processing. Measurements of groundwater flow were made in a few boreholes in the vicinity of a canal. A national expert attended an interregional workshop on tracers for sedimentology; two staff members received long term training at the Agency, and a long term fellowship was awarded. PINSTECH is now capable of conducting groundwater studies, including investigations of seepage from canals, in order to control waterlogging and salination and is thereby preserving valuable agricultural land. PINSTECH has also undertaken groundwater studies at the site of the Chasma NPP.

**PAK/9/008 MOBILE RADIATION MONITORING LABORATORY**

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APPROVED: 1987

COMPLETED: 1994-01-20

TOTAL COST: \$ 208,545

To strengthen preparedness for radiological emergencies by establishing a mobile radiation monitoring laboratory for the collection and analysis of environmental samples and for dose assessment in emergency conditions.

The Pakistan Institute of Nuclear Science and Technology (PINSTECH), Islamabad, needed to establish a mobile laboratory for radiation monitoring and dose assessment. The mobile laboratory was designed to be used for routine environmental monitoring around the research reactor as well as being a stand-by facility for emergencies. The Agency provided monitoring and meteorological equipment and supplies. The vehicle and power generator were supplied locally. An expert carried out two missions to assist in installing and testing the equipment provided by the Agency. Regular field exercises are being performed to establish background radiation levels at various sampling points around the research reactor. National preparedness for responding to radiological emergencies has been strengthened and public safety enhanced.

**PAK/9/009 AUTOMATIZATION OF A THERMOLUMINESCENCE DOSIMETRY SERVICE**

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APPROVED: 1989

COMPLETED: 1994-01-25

TOTAL COST: \$ 140,410

To provide facilities for an automated TLD service for personnel monitoring.

The project was intended to provide facilities for the automation of the thermoluminescence dosimetry (TLD) personnel monitoring service to cover about 10,000 individuals occupationally exposed to radiation. The Agency provided a TLD system, an automatic TLD reader and a computer with specialized software. An expert mission calibrated the system and trained the Radiation Dosimetry Group of the Health Physics Division of the Pakistan Institute of Nuclear Science and Technology, Rawalpindi, in its use. One fellowship was awarded. The Division is now self-sufficient in providing personnel monitoring services at a national level adequate for present and future needs.

**PAK/9/017 DESIGN AND SAFETY REVIEW OF CHASMA NUCLEAR POWER PLANT**

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APPROVED: 1993

COMPLETED: 1994-12-30

TOTAL COST: \$ 80,056

To make an independent assessment of selected aspects of the plant design and safety evaluation presented in the Preliminary Safety Analysis Report for the 300 MW(e) PWR for the Chasma Nuclear Power Project.

The Government has signed a contract with China for the supply of a 300 MW(e) PWR for the Chasma Nuclear Power Project (CHASNUPP), with commissioning scheduled for 1999. The plant is under construction and its Preliminary Safety Analysis Report (PSAR) has been submitted to the Pakistan regulatory authority (DNSRP). At the request of the Government, the Agency fielded a design and safety review mission (13 international experts from five countries and the IAEA), to review the design of the plant as presented in the PSAR and to formulate recommendations to the authorities on possible safety improvements. The first part of the review was conducted in China and continued in Islamabad with the Pakistan Atomic Energy Commission. The mission made recommendations on the management of the NPP and on the regulatory body, and some 100 technical recommendations were made on design aspects. The design and safety aspects of CHASNUPP have been considerably improved and some important follow-up actions recommended by the mission have already been implemented, including the review of design and manufacture of the reactor pressure vessel.

**PANAMA****PAN/6/006 USE OF DNA PROBES IN DIAGNOSIS OF TROPICAL DISEASES**

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APPROVED: 1990

COMPLETED: 1994-02-09

TOTAL COST: \$ 87,026

To introduce the use of DNA probes in the diagnosis of leishmaniasis and to extend the technique eventually to other tropical diseases.

The Government sought Agency assistance to improve diagnostic procedures for leishmaniasis, a disease that affects large numbers of people living in dense forests. Following recommendations of a pre-project mission in 1989, this project was designed to assist the Centre for Research and Diagnosis of Tropical Diseases (CIDEP) of the University of Panama to establish facilities for the use of DNA probes for the diagnosis of leishmaniasis and identification of *Leishmania*, since this influences the chemotherapy regime undergone by patients. The Agency provided an expert mission from the Oswaldo Cruz Foundation, Rio de Janeiro, and awarded fellowship training there to two CIDEP staff members. The Brazilian Foundation is a leading institution in the Latin America region specializing in tropical diseases. The Agency also supplied laboratory equipment and supplies. CIDEP is now operational and has been designated

by WHO as a reference centre in the region for leishmaniasis; professionals from other countries in the region are receiving training there.

## **PARAGUAY**

### **PAR/5/002 NUCLEAR TECHNIQUES IN AGRICULTURE**

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APPROVED: **1988**

COMPLETED: **1994-02-21**

TOTAL COST: \$ **143,772**

To train personnel in the use of isotope techniques in soil-plant relationships; to initiate and continue research on the use of labelled fertilizers in order to assess the effectiveness of fertilizer application on staple and export food crops and nitrogen fixation in legumes.

The National Agronomic Institute Experimental Station of the Ministry of Agriculture and Livestock Breeding at Caacupe requested Agency assistance to introduce isotope techniques for the study of soil-plant relationships in order to improve nitrogen fertilizer use efficiency in different crops. The Agency provided an N-15 analyser, laboratory equipment and supplies. Seven expert missions were fielded and three fellowships were awarded. The use of N-15 isotope techniques has improved nitrogen fertilizer management practices in cotton, maize and wheat. The Institute has developed a biological nitrogen fixation technology in soybean. Research work has been initiated to isolate and evaluate selected Bradyrhizobium japonicum strains for the production of local inoculants for the soybean crop.

## **PERU**

### **PER/4/012 COMPUTERIZED SYSTEM FOR SAFE OPERATION OF THE RP10 REACTOR**

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APPROVED: **1991**

COMPLETED: **1994-10-27**

TOTAL COST: \$ **53,745**

To introduce a new, parallel system for sensing and recording reactor parameters.

Agency assistance was requested to develop a data acquisition system for the RP-10 research reactor at the Peruvian Institute of Nuclear Energy. An expert mission and a follow-up mission established the system characteristics, operational logic and details of parameters to be monitored and trained the staff. A fellowship was awarded. The system can acquire, display and store routine operational data as well as information on abnormal conditions and on transients. The technology acquired will be useful for designing similar systems for experiments on the reactor and also for process control in non-nuclear applications.

### **PER/9/017 MONITORING OF INTERNAL CONTAMINATION**

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APPROVED: **1989**

COMPLETED: **1994-05-25**

TOTAL COST: \$ **136,673**

To establish monitoring for internal contamination, using standardized measurement and computational procedures.

The Agency assisted the Peruvian Institute of Nuclear Energy (IPEN) to establish adequate monitoring services for the increasing number of persons occupationally exposed to radiation. The Agency provided major equipment, including a low level alpha-beta counter, laboratory equipment and supplies. An Agency expert advised on quality control and interpretation of results, and provided training. Two fellowships were awarded. An in-vitro analysis laboratory was established and a continuous dosimetric evaluation of gamma emitters in the thyroids of radiation-exposed staff is being carried out. Changes and staff cuts (due to internal constraints at IPEN) have affected the work of the project. However, provided that sufficient professional staff are available, the laboratory should continue to be capable of adequately assessing the internal contamination of radiation workers.

## **PHILIPPINES**

### **PHI/1/015 NUCLEAR ANALYTICAL LABORATORY**

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APPROVED: **1988**

COMPLETED: **1994-01-25**

TOTAL COST: \$ **147,561**

To upgrade neutron activation analysis capabilities.

Following the conversion of the Philippine Research Reactor (PRR-1) from 1 MW to 3 MW, the Philippine Nuclear Research Institute (PNRI) sought Agency assistance to upgrade its neutron activation analysis capabilities. The Agency provided the necessary equipment including a gamma spectrometer. One fellowship was awarded. Since 1989, nearly 900 environmental samples have been analysed using the gamma counting system. Unfortunately, since most of the other activities planned for the project are research reactor dependent, they will have to be postponed until completion of repairs to PRR-1, which was shut down in 1988 owing to a leak in the reactor pool lining.

**PHI/4/020 RESEARCH REACTOR OPERATION**

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APPROVED: **1989**COMPLETED: **1994-04-05**TOTAL COST: \$ **68,330**

To improve research reactor operation and safety; to advise on operational problems and to retrain reactor operators.

The Philippine Research Reactor (PRR-1) was converted from 1 MW to 3 MW in 1988 and was expected to become operational in 1989. The Philippine Nuclear Research Institute (PNRI) requested Agency assistance to improve operation and safety and to retrain the operators. However, the PRR-1 has been shut down since 1988 when the reactor pool lining developed a leak. The project therefore focused on repair of the reactor. The Agency supplied air monitoring equipment, a computer system and reactor materials, and assisted in the assessment of graphite reflector defects. Three fellowships were awarded under this project and three under the regional manpower development project. The 30-year-old reactor was eventually found to need complete refurbishing. PNRI attempted to repair the reactor, and half the high power section of the reactor pool was relined in 1992 but, mainly due to financial constraints, progress has been slow. The repair work is continuing under the project PHI/4/021.

**PHI/5/020 MUTATION BREEDING**

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APPROVED: **1991**COMPLETED: **1994-01-18**TOTAL COST: \$ **128,672**

To improve existing varieties of agricultural crops by mutation breeding; to couple radiation-induced mutation breeding with tissue-culture techniques in order to accelerate progress in the genetic improvement of crops; to transfer the results to end users.

The Philippine Nuclear Research Institute (PNRI), in collaboration with the Philippine Rice Research Institute (PHILRICE), is attempting to evolve varieties of rice with higher yield and resistant to environmental stress. The Agency provided laboratory equipment and supplies. Two experts gave advice on in-vitro culture techniques and the production of doubled haploids in rice. Five fellowships were awarded. An in-vitro culture laboratory for mutation breeding has been established for research, mainly on rice anther cultures. PNRI has produced doubled haploid lines of rice mutants. PHILRICE has planted many mutant lines of rice in experimental fields and is assessing the performance of new varieties, which will eventually be handed over to the farmers. The two institutes are extending their work to some other vegetatively propagated crops such as banana and cassava.

**PHI/5/021 IMPACT OF PESTICIDES ON THE ECOSYSTEM**

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APPROVED: **1991**COMPLETED: **1994-05-25**TOTAL COST: \$ **88,978**

To strengthen the capability to utilize nuclear and associated technologies to identify and solve pesticide-related problems in agriculture.

The National Crop Protection Centre (NCPC) of the University of the Philippines sought Agency assistance to study the impact of pesticides on food and agriculture ecosystems, particularly on the rice paddy-fish system. This footnote-a/ project was made operational through an extrabudgetary contribution from the USA. Two expert missions were fielded; laboratory equipment and supplies were provided. One fellowship and one scientific visit were awarded. Pesticides commonly used in rice agrosystems were tested for residues in water, sediment, rice grain and fish. Studies are in progress to develop a controlled release formulation that is not toxic to fish. Commercial processes used in refining crude coconut oil were evaluated for their efficiency in removing pesticide residues. This will assist the food and agriculture authorities in choosing national pesticide practices. The dissipation and degradation of DDT were studied in the field for two years and it was concluded that its behaviour in a tropical environment may preclude the accumulation of residues. The NPC developed a simple method to measure the concentration of acaricides in cattle dips. The result of these studies have led to safer and more effective use of pesticides, with a consequent reduction of the health risk to the population.

**PHI/8/014 TRAINING CENTRE FOR NON-DESTRUCTIVE TESTING**

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APPROVED: **1991**COMPLETED: **1994-11-10**TOTAL COST: \$ **138,433**

To establish a non-destructive testing laboratory at the national training centre.

The Philippine Nuclear Research Institute (PNRI), in co-operation with the Philippine Society for Non-destructive Testing, is setting up a national non-destructive testing (NDT) training centre to carry out a certification programme. The Agency provided X-ray equipment and a computerized single-channel analyser, together with expert services on

qualification and certification of NDT personnel. Two national training courses on radiographic and ultrasonic testing were organized for nine participants and a fellowship was awarded. The PNRI has extended its NDT training activities and is undertaking the NDT certification programme as part of the national manpower training plan for industrial development. The work is continuing under the project PHI/8/019.

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**PHI/9/019                      OPERATIONAL SAFETY OF PNPP-1 AND REGULATORY ASPECTS**

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APPROVED: 1993

CANCELLED: 1994-08-12

TOTAL COST: \$ 0

To strengthen nuclear regulatory capabilities and to ensure the operational safety of the nuclear power plant PNPP-1.

This project was approved in anticipation of the Government's decision to revive the mothballed BATAAN Nuclear Power Plant (PNPP-1). Operation of the NPP is still under discussion and there is no possibility that the project could be implemented in the near future. The project has therefore been cancelled.

**POLAND**

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**POL/2/011                      ADVANCED X-RAY FLUORESCENCE METHODS OF TRACE ANALYSIS**

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APPROVED: 1991

COMPLETED: 1994-08-18

TOTAL COST: \$ 123,724

To upgrade an X-ray fluorescence spectroscopy laboratory for the analysis of aerosols, foodstuffs and biological samples.

The Institute of Physics and Nuclear Techniques, Krakow, has been using X-ray fluorescence (XRF) methods for on-stream analysis of mineral slurries and for multi-element analysis of geological and biological material and water. It was decided to upgrade the XRF spectrometry laboratory for the analysis of environmental and biological materials, particularly air particles and food samples. The Agency provided an XRF spectrometer system as well as expert services to install, commission and test it. Two fellowships and two scientific visits were awarded. The multi-functional system developed under the project has been applied, inter alia, for the analysis of potable water samples from southern Poland. The upgraded laboratory has enabled the Institute of Physics to enter the X-ray microanalysis field for analytical, research and training activities.

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**POL/8/007                      ELECTRON BEAM TECHNOLOGY FOR FLUE GAS PURIFICATION (PHASE 2)**

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APPROVED: 1988

COMPLETED: 1994-02-09

TOTAL COST: \$ 1,092,224

To develop further an electron beam purification system; to develop new advanced techniques to improve filtration efficiency.

The Institute of Nuclear Chemistry and Technology (INCT), Warsaw, began a long term research programme in 1988 to study the removal of environmental pollutants, mainly sulphur dioxide and nitrogen oxides, from flue gasses of coal fired power plants using a new electron beam dry scrubbing technology. The Agency assisted the INCT in the construction of two installations. A laboratory unit, with a gas treatment capacity of 400 cubic metres per hour, and equipped with a 600-1000 keV electron beam accelerator, was used for basic research. A much larger pilot scale test facility with 20,000 cubic metres per hour capacity was constructed at the coal fired thermal heating plant, Electro Power Station Kaweczyn. The irradiator components of the plant were successfully tested in 1991 and full operation was achieved in May 1992. The conceptual design was elaborated by INCT and the Polish design and engineering firms. Two electron accelerators of Russian design, analytical equipment, instrumentation and consumables were provided by the Agency. Close collaboration was established with US and German institutions, principally Ebara Environmental Corporation, which donated the continuous monitoring system for the installation, Badenwerk Utility, Karlsruhe, which provided parts of the bag filter system through the Agency, and Kernforschungszentrum Karlsruhe (KfK). The Institute of Atomic Energy and the Institute of Nuclear Studies, both in Swierk, were involved in developing the PC control system and analytical monitoring methods. Notable breakthroughs under the project were the use of double beam irradiation on this scale for improved dose distribution, reducing energy consumption by up to 20%, and an air curtain over the secondary beam window to prevent corrosion. Further work at the Kaweczyn plant and additional research at the INCT test unit is being made under project POL/8/013, funded partly by Japan. This project is investigating combined electron beam and microwave irradiation as well as research into by-product filtration to seek improvements in efficiency, energy use and costs. The results were used to establish the model project POL/8/014 to construct a much larger pre-industrial scale processing plant at Electro Power Station Pomorzany. The present project has effected the transfer of international experience to Poland as well as significant development of this technique in Poland itself. It has paved the way towards demonstrating a new, cost effective and straightforward nuclear-related technology, competitive with conventional methods, whilst possessing a number of distinct advantages.

## **PORTUGAL**

### **POR/1/005 NEUTRON SCATTERING SPECTROMETER**

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APPROVED: **1988**

COMPLETED: **1994-06-30**

TOTAL COST: \$ **119,212**

To upgrade the neutron physics facilities in order to carry out neutron scattering experiments in materials science.

The National Laboratory of Engineering and Industrial Technology (LNETI) requested Agency assistance to establish a small angle neutron scattering (SANS) project for studies on the characterization of ceramic glasses and glassy materials formed by sol-gel processes. This footnote-a/ project was made operational by an extrabudgetary contribution from the USA for the purchase of a small-area position-sensitive detector. The Agency fielded two expert missions. LNETI has installed the SANS equipment and is collaborating with other SANS groups, including one in Denmark, to study the formation, microstructure and optimum conditions for the preparation of polymer gels. These studies will provide information on a wide array of materials useful to industry.

### **POR/1/006 UPGRADING AND USE OF VAN DE GRAAFF ACCELERATOR**

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APPROVED: **1991**

COMPLETED: **1994-12-30**

TOTAL COST: \$ **461,812**

To upgrade a Van de Graaff accelerator to permit advanced analytical and materials research.

The National Laboratory for Engineering and Industrial Technology (LNETI) wished to upgrade its 2 MeV Van de Graaff accelerator in order to introduce advanced techniques for eventual industrial applications. Three research groups are using the accelerator for analyses and materials research. The Agency provided a new high voltage terminal and major equipment. Expert advice was given on installing and testing the new terminal and on ion beam analytical techniques. A scientific visit was awarded. The accelerator has been upgraded and is performing well. Proton-induced X-ray emission and Rutherford backscattering have begun.

### **POR/3/010 URANIUM EXPLORATION AND ENVIRONMENTAL MONITORING**

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APPROVED: **1991**

COMPLETED: **1994-06-17**

TOTAL COST: \$ **70,518**

To calibrate radiometric anomalies and natural background radioactivity levels; to map 8000 square km for uranium exploration.

Portugal has a long history of uranium exploration and production. The General Directorate of Geology and Mines (DGGM) has received Agency assistance for over ten years, covering ground and car-borne total-count scintillometer measurements of favourable areas for uranium deposits, and part of the country has been covered by airborne gamma ray surveys. In this follow-up project the Agency assisted the DGGM to produce coloured raster maps which could represent the baseline information on the natural radioactivity background of Portugal. A gamma ray sensor, transportable calibration pads and a portable radiometric survey instrument were provided. An expert assisted in setting up a programme of back-calibrating and in standardizing previous data into exposure rates, to be merged into the baseline map. The expert also advised on new calibration procedures. A fellowship was awarded. The local staff is now able to assess, calibrate and analyse radiometric data for use in uranium exploration, as well as in radiological emergencies, where the baseline map could provide valuable information on the level of radioactive contamination.

### **POR/3/011 ENVIRONMENTAL MONITORING AND URANIUM EXPLORATION**

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APPROVED: **1993**

COMPLETED: **1994-09-27**

TOTAL COST: \$ **39,522**

To map the natural background radioactivity for environmental monitoring and to assess the uranium potential.

The General Directorate for Geology and Mines has collected during decades of uranium exploration a considerable amount of scintillometric data on a large part of Portugal, and several areas have been surveyed by airborne gamma-ray spectrometry. Growing public concern has led to a need to produce maps of natural radioactivity, particularly in an 8000 square km area which is a potential uranium mining region. The Directorate decided to utilize previously collected data and to perform additional measurements of natural radioactivity. The Agency provided a car-borne gamma-ray spectrometer system as well as expertise in calibration and comparison of measurements using various instruments. During project-related fellowship training, part of this data was processed and the first maps produced. Production of a background radioactivity map of Portugal is well under way. The high quality maps being produced will be useful in other disciplines as well as to geologists.

**POR/6/003 RADIOIMMUNOASSAY TECHNIQUES FOR CLINICAL DIAGNOSTICS**

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APPROVED: 1991

COMPLETED: 1994-08-23

TOTAL COST: \$ 104,047

To assist in the production of radioimmunoassay kits frequently used in clinical diagnostic tests for hormones and drug measurements in biological fluids.

The National Laboratory of Engineering and Industrial Technology (LNETI) wished to produce the radioimmunoassay (RIA) kits most used in clinical diagnostics, particularly in thyroid function study and investigations on infertility and sterility. Three RIA kits (T4, T3 and cortisol) were already being locally produced. The Agency provided the necessary equipment for the production of the required kits, including laboratory supplies and a computer system. Three experts were fielded and two fellowships awarded. Production of reagents and RIA kits for clinical diagnostics has increased.

**POR/7/002 DIETARY STUDIES IN PORTUGAL**

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APPROVED: 1991

COMPLETED: 1994-09-21

TOTAL COST: \$ 141,318

To initiate the systematic production of analytical data on nutrition by analyses of food samples.

The Portuguese Food Tables published by the National Health Institute (INSA) in 1961 covered only a limited number of nutrients, and no comprehensive up-to-date information existed on the composition of food in Portugal. The National Laboratory for Engineering and Industrial Technology (LNETI), in collaboration with INSA, therefore decided to undertake a comprehensive dietary study in order to increase and update the available data. The Agency provided laboratory equipment and expert advice on dietary collection and awarded a fellowship. Systematic production of analytical nutrition data was initiated, with the consequent updating of the Portuguese Food Tables. This information will help to identify population groups whose health is at risk owing to inadequate nutrition or exposure to food additives or contaminants.

**POR/8/008 RADIATION POLYMER LABORATORY**

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APPROVED: 1993

COMPLETED: 1994-09-30

TOTAL COST: \$ 82,674

To upgrade a radiation polymer laboratory for the analysis of irradiated materials and other products.

Gamma radiation applications, e.g. radiation sterilization, have been introduced at the National Laboratory for Industrial Technology and Engineering (LNETI) following the installation of a semi-industrial Co-60 irradiation facility previously supplied by the Agency. LNETI wished to upgrade the Radiation Polymer Laboratory to solve analytical and technological problems for regular users of the irradiation facility and potential users of radiation technology. Agency experts gave advice on characterization of polymers, assisted in drawing up a plan for completing the laboratory's infrastructure and advised on the short and long term programme for fundamental and applied research. Accessories for the thermal analysis system were also provided. The Laboratory has been significantly upgraded, with increased capability of assistance to industry.

**POR/9/010 TRAINING ON RADIATION PROTECTION**

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APPROVED: 1991

COMPLETED: 1994-11-11

TOTAL COST: \$ 16,637

To train radiation workers in radiological protection and to establish a training programme.

Portugal has about 1700 installations containing radioactive sources, including a Nuclear Research Centre, hospitals and laboratories, representing some 8000 workers occupationally exposed to radiation risks. Under this footnote-a/ project, made operational through an extrabudgetary contribution from France, expert assistance was provided to the Radiological Protection and Safety Department of the National Laboratory of Engineering and Industrial Technology (renamed the General Directorate for Environmental Protection) to train manpower for the establishment of a national radiation protection programme. Emphasis was placed on modern teaching techniques, for which the Agency provided monitoring equipment and audio-visual aids.

## **REGIONAL AFRICA**

### **RAF/0/007 MANPOWER DEVELOPMENT IN THE AFRICA REGION**

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APPROVED: **1991**

COMPLETED: **1994-12-30**

TOTAL COST: **\$ 2,124,225**

To make funding available for fellowship training and scientific visits requested by a country in the Africa Region but which cannot be directly included as part of an approved project.

This project was a follow-up to RAF/0/003 to arrange for fellowship training and scientific visits deemed relevant to nuclear technology activities of countries in the region but which do not fall directly within the scope of operational individual TC projects. Under this project, about 1100 months of training were arranged for 226 fellows, including 28 scientific visits. 23.6% of the training concerned the applications of isotopes and radiation in medicine, followed by agriculture (19.3%), safety in nuclear energy (14.5%) and nuclear engineering and technology (14%). This project has proved to be an important mechanism in the Agency's efforts in the region to build critical capacity in nuclear science and technology. However, some countries have not yet taken full advantage of the opportunities offered by this framework. This is reflected by the fact that 73% of fellowships were granted to 8 countries, while the remaining 15 countries that benefitted from the project accounted for only 27% of the number of fellowships awarded. Efforts are being made under the ongoing similar project RAF/0/009 to ensure a more equitable share of training opportunities amongst the countries of the region.

### **RAF/8/012 ISOTOPE HYDROLOGY TECHNIQUES IN THE SAHELIAN COUNTRIES**

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APPROVED: **1987**

COMPLETED: **1994-09-26**

TOTAL COST: **\$ 1,030,800**

To provide further support and to facilitate the co-ordination of regional co-operation relating to groundwater investigations in the Sahelian countries in which isotope techniques are to be applied.

The project was designed to assist the Sahelian countries, Cameroon, Mali, Niger and Senegal, in conducting groundwater investigations, promoting exchange of information and reinforcing the sub-regional capability. The Agency provided equipment and expert services to enable the participating countries to make optimal use of the available laboratories (a radiocarbon laboratory in Niger, sedimentology and hydrology laboratories in Mali and a geochemical laboratory in Senegal). An Agency resident expert in Dakar supervised the implementation of all activities, and ran the five workshops and training courses arranged under the project. One fellowship and five scientific visits were awarded. Several joint studies were conducted on the relationship between surface water and groundwater, unsaturated zones, very old water and piezometric depressions. The studies were undertaken along the two rivers Niger and Senegal and in the north of Cameroon, near Lake Chad. Studies were also carried out on surface hydrology in Mali, on the origin of nitrates in Niger; an isotopic study of organic matter was performed in Senegal. The results were reported in IAEA TECDOC/721. One of the most visible achievements of the project is the development of manpower in the four countries and the exploitation of available local expertise. Under a scientific exchange programme, several scientists from the participating countries undertook expert missions and participated in project activities. The group training programme has trained 45 scientists, most of whom are trainers themselves.

## **REGIONAL MIDDLE EAST AND EUROPE**

### **RER/0/003 MANPOWER DEVELOPMENT IN THE EUROPE AND MIDDLE EAST REGION**

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APPROVED: **1989**

COMPLETED: **1994-08-23**

TOTAL COST: **\$ 1,418,642**

To make funding available for fellowship training and scientific visits that have been requested by a country in the region but which cannot be directly included as part of an approved project.

From 1988 to 1993 a total of 160 fellowships and 52 scientific visits were provided to nationals of 16 countries. This corresponds to a total of 870 months of training, 87% of which were hosted by countries of the region.

### **RER/0/005 MANPOWER DEVELOPMENT IN EUROPE AND THE MIDDLE EAST REGION**

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APPROVED: **1991**

COMPLETED: **1994-12-30**

TOTAL COST: **\$ 1,567,900**

To make funding available for fellowship training and scientific visits requested by a country in the Middle East and Europe Region but which cannot be directly included as part of an approved project.

This project provided funding for fellowships and scientific visits requested by Member States which could not be accommodated within approved national projects. From 1991 to 1994 the Agency provided 165 fellowships and 40 scientific visits to nationals of 18 countries, representing a total of 984 months of training, 72% of which were hosted by countries of the region.

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**RER/9/005      PROBABILISTIC SAFETY ASSESSMENT OF WWER-TYPE REACTORS**

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APPROVED: **1988**COMPLETED: **1994-11-11**TOTAL COST: **\$ 453,342**

To promote the direct use of probabilistic safety analysis in the safety assessment and optimization of operational tasks of the WWER-type reactor.

All Eastern European countries have recognized the value of probabilistic safety analysis (PSAs), and are making great efforts to use this technique to improve the safety level of NPPs. The Agency prepared an extensive programme for training/education of PSA practitioners and to assist in developing a plant-specific Level 1 and Level 2 PSA in each participating country (Bulgaria, Czech Republic, Hungary, Poland, Slovak Republic, Russia and Ukraine). Some 45 workshops, seminars, project review meetings and expert missions were organized in the participating countries. The first phase of the project emphasized methodology transfer, and inflated practical application of PSA methodology, making considerable advances in the use of procedural and methodological guides and computer software. In the second phase, reviews were performed on PSA for NPPs at Bohunice, Kozloduy, Dukovany, Paks, Kola and Rovno. Some of the studies are being extended to seismic, fire/flood and shutdown studies at a national level. Technical Reports on methodology and data were prepared, including IAEA TECDOCs 749 and 749R, "Generic Initiating events for WWERs".

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**RER/9/007      STRENGTHENING RADIATION PROTECTION IN THE MIDDLE EAST**

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APPROVED: **1989**COMPLETED: **1994-08-18**TOTAL COST: **\$ 240,747**

To upgrade and co-ordinate development of radiation protection infrastructures in the region.

As a result of RAPAT missions, it was considered desirable to strengthen the national regulatory body activities and radiation safety service capabilities in the Middle East region with regard to the practical aspects of occupational radiation protection. The Agency organized five regional workshops/training courses on radiation protection topics such as regulatory practices, industrial and medical applications and quality assurance in diagnostic radiology. Some training equipment and literature were provided. Several countries of the region have upgraded their radiation protection infrastructure and staff skills, thus improving radiation protection services.

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**RER/9/030      RADIATION PROTECTION & WASTE MANAGEMENT IN NUCLEAR MEDICINE**

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APPROVED: **1994**COMPLETED: **1994-10-27**TOTAL COST: **\$ 26,905**

To improve the basis for radiation protection and waste management in nuclear medicine through organization of workshops where appropriate.

This Reserve Fund project was undertaken in response to a request from Belarus, Estonia, Latvia and Lithuania. The Agency, in co-operation with the Swedish Radiation Protection Institute (SSI), organized a workshop on radiation protection and waste management in nuclear medicine in Tallin, Estonia, in April 1994, attended by 13 participants from Estonia, Latvia and Lithuania (ten medical doctors, two radiophysicists and one radiation protection chief officer). Although invited, no Belarus participants attended. Three International experts and three Agency staff members gave lectures and demonstrations. The participants recommended more practical sessions for future workshops.

**REGIONAL LATIN AMERICA**

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**RLA/0/013      HUMAN RESOURCE DEVELOPMENT IN LATIN AMERICA**

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APPROVED: **1989**COMPLETED: **1994-09-19**TOTAL COST: **\$ 79,060**

To provide training for fellows from Latin American countries at the Joint Research Centre, Ispra (Italy).

This project was an initiative of the European Union to collaborate with the Latin America Region in strengthening the manpower for research, development and practical applications of nuclear energy. Four fellows, nationals of two countries, received long term training for a total of 42 months at the Joint Research Centre, Ispra (Italy), in probabilistic safety analysis, reactor pressure vessels and chemical analysis.

APPROVED: 1991

COMPLETED: 1994-09-21

TOTAL COST: \$ 97,760

To foster the exchange of information and experience on all aspects of nuclear power programmes at regional level.

The project was implemented through managerial workshops and expert missions and proved effective in launching the exchange of information and establishing co-operation among the nuclear power organizations in the region. A key element was the direct interaction at plant superintendent and upper management level. More important, it helped Member States to learn about common problems in the region and encouraged them to adopt preventive measures based on proven experience and to optimize management decisions. The methods applied for the project can be used as a model for the Agency's promotion of nuclear power co-operation programmes in other regions of the world. In view of these satisfactory results, a regional project for 1995-96 for Latin America and the Caribbean was proposed in order to consolidate and further expand the benefits of mutual learning and collaboration.

APPROVED: 1989

COMPLETED: 1994-09-26

TOTAL COST: \$ 799,501

To use isotope techniques for static and dynamic studies of aquifers, lakes, reservoirs and other water systems.

The overexploitation of groundwater and improper management of water resources in the Latin America region have led in many cases to deterioration in water quality or to the exhaustion of aquifers. Salination and harmful substances in shallow aquifers are reported in several countries of the region. In the frame of the ARCAI Programme, this regional project was designed to promote the application of isotope techniques to the assessment of groundwater resources and contamination. Each of the 12 participating countries undertook the implementation of a national field hydrological project with isotope techniques. In Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Mexico, Peru, Uruguay and Venezuela, projects included studies of groundwater, aquifers, contamination processes, origin of water, and relation with surface water. Three Technical Meetings were held, in Brazil (1990), Cuba (1991) and Venezuela (1993), to report and discuss progress. Four national itinerant courses on the application of isotope techniques were held in 1989 in Costa Rica, Uruguay, Venezuela and Peru, and a regional course on the use of environmental isotopes in hydrology was held in Chile in 1990. The Agency fielded 51 expert missions and awarded six fellowships and a scientific visit. Equipment to upgrade supporting laboratories and to carry out field work, analysis of samples where necessary, and financial support for the field work were provided to all participating countries. The project was first approved with footnote-a/ status and made operational through an extrabudgetary contribution from Germany and through the TACF. Chile funded a training activity. The participating countries made great progress in the application of isotopic and geochemical techniques and in the interpretation of the results for assessment of water resources and their vulnerability.

## ROMANIA

APPROVED: 1985

COMPLETED: 1994-09-15

TOTAL COST: \$ 339,315

To upgrade research facilities through gamma and heavy ion detection systems with computerized data collection and analysis.

This project was approved with footnote-a/ status and made operational through the TACF. The main activities of the Institute of Nuclear Physics and Engineering, Bucharest, are concentrated around the tandem Van de Graaff accelerator. The Agency assisted in rebuilding the accelerator, which had been damaged by the earthquake of 1986. Semiconductor detectors and accelerator columns as well as expert services were provided. A one-year fellowship was awarded. The Institute is now able to continue its programme of basic nuclear physics and research on technological applications.

APPROVED: 1991

COMPLETED: 1994-05-31

TOTAL COST: \$ 150,833

To improve laboratory facilities for R&D work on multiwire proportional counters and phosphor detectors for dosimetry, medicine and nuclear physics research.

This project was designed to assist the Institute of Nuclear Physics and Engineering, Bucharest, in the development of modern nuclear detector technology. Three expert missions evaluated the existing environmental radioactivity



26 April to 14 May 1993 to review commissioning activities and preparations for operation and to exchange technical experience and knowledge between the experts and the NPP counterparts. At the time of the mission, Unit 1 of the NPP was about one and a half years from initial fuel load. The team made a number of proposals on industrial safety and the need for training.

## **SAUDI ARABIA**

### **SAU/1/002      LOW-LEVEL COUNTING LABORATORY**

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APPROVED: **1986**

COMPLETED: **1994-06-14**

TOTAL COST: **\$ 41,981**

To establish a low level counting laboratory.

Following the Chernobyl accident, the King Abdulaziz University, Jeddah, acquired a number of nuclear instruments for measurement of low level radioactivity in humans, food, biota samples and the environment. The Government later requested Agency assistance to establish a low level counting laboratory at the Nuclear Engineering Department of the University. Three expert missions were undertaken to provide training in techniques for measuring radioactivity in air, water, soil, vegetation and farm animals. One fellowship and a scientific visit were awarded. The laboratory continues to undertake routine measurements of low level radioactivity, particularly in environmental samples and for the control of imported food.

### **SAU/3/003      NUCLEAR TECHNIQUES IN MINING**

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APPROVED: **1986**

COMPLETED: **1994-06-30**

TOTAL COST: **\$ 55,473**

To provide training for the application of neutron capture techniques in in-situ mineral exploration.

Saudi Arabia contains abundant minerals and metals, in addition to the vast oil resources, which could make a valuable contribution to the economy. The project was designed to train manpower for the application of nuclear analytical techniques in in-situ mineral exploration and mining. Five expert missions were undertaken to advise on training programmes. They also assisted the Nuclear Engineering Department of the King Abdulaziz University, Jeddah, to design and set up laboratory experiments for prompt gamma neutron activation analysis of bulk materials and held seminars on nuclear analytical techniques, neutron capture techniques for in-situ applications, and the design and fabrication of an experimental rig. The Department was encouraged to expand contacts with local mining industries and other relevant sectors for collaboration in mineral exploration and is continuing to upgrade and expand teaching and applications programmes.

### **SAU/8/003      INDUSTRIAL RADIOGRAPHY**

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APPROVED: **1986**

COMPLETED: **1994-06-30**

TOTAL COST: **\$ 33,236**

To improve training in industrial radiography.

Agency assistance was requested in the establishment of a radiography laboratory at the Nuclear Engineering Department of the King Abdulaziz University, Jeddah, to provide training in industrial radiography and non-destructive testing (NDT) techniques. Agency experts undertook four missions to conduct training programmes on NDT methodology, industrial applications of radiography, inspections for materials defects and quality control testing in accordance with international standards and codes. An infrastructure for training and certification of NDT personnel for local industries has been set up, and periodical training courses and refresher programmes will continue at the University. The NDT laboratory is being used by local industries as well as by the University.

## **SENEGAL**

### **SEN/2/002      X-RAY FLUORESCENCE LABORATORY**

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APPROVED: **1990**

COMPLETED: **1994-07-28**

TOTAL COST: **\$ 47,586**

To strengthen the analytical capability of the existing laboratory through provision of spare parts and training.

Following the recommendations of a pre-project mission, the Agency assisted in the installation of an X-ray fluorescence (XRF) system at the Institute of Applied Nuclear Technology, University of Dakar, provided spare parts and trained the staff in the use of the system for chemical analysis. Maintenance and servicing capabilities have been improved. Optimal utilization of the XRF system is at present hampered by the shortage of staff trained in this technique.

**SEN/5/020 PLANT ROOTING SYSTEM STUDIES**

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APPROVED: **1991**COMPLETED: **1994-12-30**TOTAL COST: \$ **63,543**

To characterize and study the functioning of the root system of rain-fed crops in order to optimize the use of nitrogen, phosphorus and water.

This project was designed to assist the National Agronomy Research Centre, Bambey, in conducting isotope-aided studies of the influence of the root system on the uptake of nitrogen, phosphorus and water by cereals and legume crops, with a view to increasing crop yield. The Agency provided the necessary equipment and expert services. The project progressed satisfactorily at first, but difficulties were encountered later, mainly because some of the trained scientists left the Institute and the emission spectrometer provided under a previous project did not function properly.

**SEN/8/004 WATER RESOURCE ASSESSMENT**

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APPROVED: **1991**COMPLETED: **1994-12-30**TOTAL COST: \$ **64,446**

To improve the quality of existing information on groundwater and surface water in western Senegal in order to monitor their evolution.

The Agency provided the Directorate for Water Research, Dakar, with the necessary equipment and two expert missions to train the staff in water chemical analysis and field use of fluorescent tracers for surface water gauging. The Directorate is now monitoring programmes for quantitative and qualitative evolution of water resources and undertaking routine water analyses, for the eventual improvement of the water supply and the benefit of public health.

**SEN/9/002 RADIATION PROTECTION**

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APPROVED: **1990**COMPLETED: **1994-07-28**TOTAL COST: \$ **133,358**

To establish a personnel monitoring system to cover all radiation workers and to train the staff.

Following the recommendation of a RAPAT mission in 1988 and a pre-project mission, the Agency provided the Institute of Applied Nuclear Technology of the University of Dakar with a thermoluminescence dosimetry (TLD) system and related equipment. Expert missions advised on developing national radiation protection regulations, establishing new dosimetry facilities and conducting a national radiation protection training course. Two fellowships were awarded. Senegal now has adequate facilities to provide radiation protection and personnel monitoring services. However, these facilities are not being fully utilized owing to insufficient operational budget and personnel.

**SIERRA LEONE****SIL/6/004 RADIOISOTOPES IN MEDICINE (PHASE II)**

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APPROVED: **1989**COMPLETED: **1994-11-11**TOTAL COST: \$ **139,250**

To upgrade radiolotope diagnostic facilities.

The Government sought Agency assistance to upgrade the diagnostic capability of the nuclear medicine department of the Connaught Hospital for in-vivo and in-vitro nuclear medicine. A scintiscan scanner for in-vivo activities and radioimmunoassay (RIA) for the in-vitro laboratory was provided. Three expert missions were undertaken. An inexpensive bulk reagent-based method for RIA of thyroid-related hormones, together with standard practices, has been established, thus ensuring the reliability of assay results.

**SINGAPORE****SIN/1/007 NATIONAL CALIBRATION LABORATORY FOR IONIZING RADIATION**

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APPROVED: **1988**COMPLETED: **1994-03-22**TOTAL COST: \$ **169,987**

To provide facilities for neutron calibration and dosimetry with a view to initiating a neutron monitoring service for radiation workers.

The Agency provided the Radiation Protection Inspectorate with calibration and dosimetry equipment, including a gamma irradiator. Three expert missions assisted in installing the facilities and three fellowships were awarded. A

secondary standards dosimetry laboratory (SSDL) for monitoring radiation workers was set up and is now operational. Additional expert services were provided in 1993 to help relocate the SSDL to a new building.

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**SIN/8/011                      SEDIMENT TRANSPORT INVESTIGATIONS**

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APPROVED: **1991**

COMPLETED: **1994-04-19**

TOTAL COST: **\$ 54,881**

To support studies of sediment transport around the coastline and, in particular, to assess the probable effects of land reclamation projects.

Land reclamation in the Singapore Straits creates a serious navigation problem, and the channels have to be maintained by dredging. The Civil Engineering Department of the Housing and Development Board wished to investigate sediment transport patterns by means of radioactive tracer techniques. Four expert missions planned sediment tracing experiments. Two fellowships were awarded. The studies were successfully concluded, in co-operation with the National University of Singapore and the Port of Singapore Authority.

**SLOVAKIA**

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**SLR/9/003                      NUCLEAR SAFETY REVIEW MISSIONS**

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APPROVED: **1993**

COMPLETED: **1994-10-27**

TOTAL COST: **\$ 19,849**

To provide operational safety missions to advise on nuclear safety standards and practices at the Mochovce NPP.

An Agency Pre-Operational Safety Review Team (Pre-OSART) of international experts visited the Mochovce NPP in January 1993 to review commissioning activities and preparations for operation and to exchange technical experience and knowledge between the experts and the NPP counterparts. It followed five previous OSART missions to the Czech and Slovak Federal Republic including the Bohunice NPP. The team found significant upgrading and changes in a number of fundamental plant programmes including improvements in emergency planning and preparedness. The team made some recommendations concerning a formal safety policy, a nuclear safety committee and a self-audit programme.

**SLOVENIA**

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**SLO/4/002                      NUCLEAR POWER PLANT ANALYSIS**

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APPROVED: **1993**

COMPLETED: **1994-10-27**

TOTAL COST: **\$ 38,090**

To analyse the behaviour of Class I components of Krsko NPP.

The Jozef Stefan Institute, Ljubljana, carries out in-service inspection at the Krsko NPP. In view of the number of steam generators to be inspected and the effects of ageing on the reactor coolant system, immediate on-line data processing was considered necessary. This footnote-a/ project was made operational through an extrabudgetary contribution from the USA. A computer system was provided and the software was supplied locally. The capacity for data processing for probabilistic safety assessment during analysis of ageing and degradation phenomena at the Krsko NPP has been considerably strengthened.

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**SLO/9/006                      FOLLOW-UP OSART MISSION TO KRSKO NUCLEAR POWER PLANT**

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APPROVED: **1993**

COMPLETED: **1994-08-22**

TOTAL COST: **\$ 16,525**

To conduct an OSART follow-up mission to the Krsko NPP.

An Operational Safety Review Team (OSART) of international experts visited the Krsko NPP in July 1993. Under the Agency's ASSET services, a seminar on prevention of incidents was organized. The team made a number of recommendations on quality assurance audit, industrial safety and emergency planning and preparedness.

## **SRI LANKA**

### **SRL/4/010 NUCLEAR ENGINEERING (MORATUWA)**

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APPROVED: **1988**

COMPLETED: **1994-11-10**

TOTAL COST: **\$ 25,929**

To strengthen the teaching capability of nuclear engineering at the University of Moratuwa and to upgrade the radiation measurements laboratory.

Forty per cent of the post-graduate course in electrical engineering at the University of Moratuwa includes nuclear engineering subjects, but the radiation measurements laboratory is insufficiently equipped in view of the number of students using it. The Agency provided a desktop computer and other equipment together with expert advice on laboratory training. The laboratory has been upgraded and the tuition for the nuclear engineering course is much improved, which represents an important expansion of the national manpower development programme.

### **SRL/4/011 NUCLEAR INSTRUMENTATION**

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APPROVED: **1989**

COMPLETED: **1994-01-25**

TOTAL COST: **\$ 34,385**

To establish capability for advanced training in repair and maintenance of nuclear instruments.

The Atomic Energy Agency (AEA) requested Agency assistance in improving its capability for maintenance and repair of nuclear instruments. Test equipment and electronic parts were provided; two expert missions assisted the AEA and other institutions in calibration and repair of malfunctioning nuclear instruments and provided training in troubleshooting. The AEA conducted three national training courses on quality control and the use of nuclear instrumentation. The AEA is now capable of providing routine services for calibration, maintenance and quality control of basic nuclear equipment. The work is continuing under the project SRL/4/012.

### **SRL/5/024 NITROGEN-15 FERTILIZER STUDIES**

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APPROVED: **1989**

COMPLETED: **1994-11-07**

TOTAL COST: **\$ 104,213**

To set up a national N-15 analytical laboratory for studies of nitrogen uptake by plants.

The Atomic Energy Authority (AEA) wished to establish a National Centre for Nuclear Research in Agriculture and Environmental Sciences. The demand for fertilizer studies is growing and the AEA provides services to the Tea Research Institute, the Rubber Research Institute, the Coconut Research Institute, several Universities and the Department of Agriculture. The Agency had already provided the Radioisotope Centre at the University of Colombo with an all-metal vacuum line and an emission spectrometer under the project SRL/5/016, and this equipment was transferred to the Department of Chemistry. Under the present project the Agency supplied laboratory equipment and N-15 fertilizers. The Agency conducted a workshop on plant and soil preparation and related topics and on the operation and maintenance of the vacuum line and the spectrometer. The laboratory is now performing nitrogen fixation studies and determining nitrogen fertilizer use efficiency, which will lead to increased crop production.

### **SRL/5/025 SOIL MOISTURE AND CROP PRODUCTIVITY STUDIES**

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APPROVED: **1989**

COMPLETED: **1994-11-10**

TOTAL COST: **\$ 80,530**

To obtain data on soil moisture status and crop productivity under different agronomic practices for coffee and pepper with a view to developing improved agronomic practices leading to higher yield.

The Department of Minor Export Crops operates a research station to study plant-soil-water-air interrelationships for a series of economically important minor crops. High mortality rates and retarded growth in newly established coffee and pepper fields pose a serious threat to the planting programmes. An expert mission designed and initiated field experiments at the Research Station of the Department of Export Agriculture, Matale, identifying requirements for training and future research programmes. The Agency provided agricultural equipment and radioisotopes. A fellowship was also awarded. Soil management practices on sloping land have improved and understanding of the water regime has increased, which should lead to increased crop yield.

### **SRL/5/026 INCREASED COCONUT PRODUCTION THROUGH IMPROVED WATER USE**

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APPROVED: **1991**

COMPLETED: **1994-10-28**

TOTAL COST: **\$ 77,555**

To identify cultivars/genotypes of coconut for the national planting programme in low-rainfall areas that utilize water more efficiently.

Coconut is an important part of the national diet and 70% of the crop is consumed locally. It also represents 5.4% of total export earnings. Two thirds of the total area under coconut suffers from very low rainfall and very long dry periods. The Coconut Research Institute, Lunuwila, is therefore conducting a programme using isotope techniques to identify cultivars and genotypes of coconut palms with high water and nutrient use efficiency. The Agency provided a liquid scintillation counter, laboratory equipment and radioisotopes as well as two expert missions and a fellowship. This was the first study of water use efficiency in coconut palms. It was highly successful in selecting improved cultivars and genotypes of coconut that will be utilized to increase productivity in low rainfall areas, thereby substantially increasing export earnings.

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**SRL/6/010                      NUCLEAR MEDICINE**

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APPROVED: 1983

COMPLETED: 1994-11-10

TOTAL COST: \$ 267,006

To upgrade and modernize the existing nuclear medicine unit.

The Nuclear Medicine Unit of the Faculty of Medicine of the University of Peradeniya trains medical undergraduates and post-graduates in the use of radioisotopes in medical diagnosis and research, in addition to providing services for other departments at the University and to other hospitals. The Agency provided a reconditioned gamma camera and related equipment and a medical data processing system, together with expert advice on installation, acceptance tests and quality control. Five fellowships were awarded. The Nuclear Medicine Unit now offers improved diagnostic procedures to patients and provides better training facilities. The work continues under the project SRL/6/019.

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**SRL/6/014                      RADIATION THERAPY**

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APPROVED: 1984

COMPLETED: 1994-01-25

TOTAL COST: \$ 233,857

To improve cancer treatment by the introduction of remote controlled after-loading brachytherapy.

Uterine-cervical cancer is one of the most common malignancies affecting women in Sri Lanka. The Government Cancer Institute, Maharagama, sought Agency assistance to introduce remote controlled after-loading brachytherapy to improve radiation treatment. The project was approved with footnote-a/ status and upgraded in 1985 from TACF. The Agency provided a brachytherapy unit, a diagnostic X-ray unit, dosimeters and treatment planning software. Three expert missions were undertaken and a scientific visit was awarded. The Institute staff can now operate the high dose rate brachytherapy unit and have developed treatment planning for patients to obtain the desired radiation dose distribution. The Institute is now providing treatment to about 400 new cases annually. The three-year survival rate of more advanced cases of uterine-cervical cancer has increased to 70%, with less than 5% rectal reaction, compared with 28% three-year survival rate and 27% with rectal reaction in 1986. This represents a significant improvement in health care and reduction of human suffering.

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**SRL/6/017                      TISSUE TYPING AND PROCESSING FOR TISSUE BANKING**

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APPROVED: 1988

COMPLETED: 1994-05-25

TOTAL COST: \$ 40,201

To help set up a tissue typing laboratory to support kidney transplants.

The Central Blood Bank at the General Hospital, Colombo, wished to set up a tissue typing laboratory with facilities for mixed lymphocyte culture (MLC) using tritiated thymidine as an essential support for kidney transplants in order to increase survival rates. The Agency supplied a liquid scintillation counter and accessories. An expert mission was fielded and a fellowship awarded. The tissue typing laboratory has been established, and the staff is capable of using MLC tissue typing techniques involving radiotracer labelling and radioactivity counting. In 1992-1993 the hospital carried out MLC tests for 14 kidney transplant cases as well as HLA-ABC typing for kidney transplants and HLA-ABC typing for bone marrow transplants. The work is being continued under the project SRL/7/003.

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**SRL/6/018                      APPLICATION OF NUCLEAR TECHNIQUES IN MALARIA CONTROL**

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APPROVED: 1991

COMPLETED: 1994-11-07

TOTAL COST: \$ 135,399

To establish a working laboratory for nuclear techniques in biotechnology to study malaria; to develop diagnostic DNA probes; to collect essential information for design of malaria vaccines.

Malaria is common in Sri Lanka, and new approaches to malaria control based on the application of biotechnology and molecular vaccines are being developed at the Institute of Fundamental Studies (IFS), Colombo. The IFS requested Agency assistance in the use of nuclear techniques in biotechnology to develop a new diagnostic DNA probe for malaria. The Agency provided monitoring and laboratory equipment, together with expert advice on

nucleic acid probes in diagnosis and immunoprophylaxis. Three fellowships and one scientific visit were awarded. The laboratory was set up and is producing DNA probes using nuclear techniques, making a significant contribution to the fight against malaria.

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**SRL/8/010 RADIATION PROCESSING/VULCANIZATION OF NATURAL RUBBER LATEX**

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APPROVED: **1983**

COMPLETED: **1994-01-18**

TOTAL COST: \$ **99,391**

To establish the basic technology for the use of a small irradiator in research, development and training.

The technology of radiation vulcanization of natural rubber latex (RVNRL) in Sri Lanka was developed through a UNDP/IAEA/RCA regional project. The Rubber Research Institute (RRI), Ratmalana, in collaboration with the Radiisotope Centre (RIC) of the University of Colombo, wished to establish a facility for experiments to determine optimum conditions for RVNRL of local natural rubber. Under this footnote-a/ project, made operational through an extrabudgetary contribution from the USA, a self-shielded gamma irradiator with 5000 Ci Co-60 source was provided. An Agency expert advised on RVNRL technology and process control. Three staff members were trained on the irradiator operation in the USA by the manufacturer, and the counterparts installed the irradiator at RIC in 1988. Since then the facility has been used for experimental work on RVNRL and on other work such as food preservation and sterilization of medical products. In spite of some problems with the irradiation chamber in 1990, research is being carried out on RVNRL, and the technology has been transferred to local industry. A commercial scale factory for RVNRL of local natural rubber is under construction.

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**SRL/8/014 TRACER TECHNIQUES IN INDUSTRY**

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APPROVED: **1987**

COMPLETED: **1994-05-25**

TOTAL COST: \$ **53,578**

To establish a facility for the application of radiotracer techniques to industrial problems.

The Atomic Energy Authority (AEA), in collaboration with the Radiisotope Centre of the University of Colombo, wished to increase the application of radiotracer techniques in industry. This footnote-a/ project was made operational through an extrabudgetary contribution from the USA. The necessary equipment was provided. Two expert missions assisted in identifying suitable areas for the application of tracer techniques. Several areas were selected but only the experiments in the National Paper Mill for flowrate determination in effluent channels were carried out owing to lack of manpower and a suitable laboratory. The experiments conducted in the National Paper Mill helped to determine the fibre loss from the paper machine and the fresh water loss from the pulp and paper manufacturing processes, and helped to confirm the actual volume of effluent diverted to the settling ponds. The work is continuing under the project SRL/8/015.

**SUDAN**

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**SUD/4/005 SECONDARY STANDARDS DOSIMETRY LABORATORY**

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APPROVED: **1987**

COMPLETED: **1994-09-30**

TOTAL COST: \$ **157,890**

To improve safety in the use of sources of ionizing radiation by establishing an adequate SSDL facility.

The Agency assisted the Radiation and Isotopes Centre, Khartoum, to establish a secondary standards dosimetry laboratory (DSSL) in order to improve the national radiation protection service, particularly for food contamination and environmental monitoring. Equipment, including a gamma spectrometer, a semiconductor detector and X-ray equipment for dosimetry, was provided. Agency experts assisted in the installation and commissioning of the gamma spectrometer and provided on-the-job training. A fellowship was awarded. Owing to delay in construction of the necessary building, the project could not be completed as planned. However, Agency assistance is continuing under SUD/9/005 and when the laboratory is completed, it will provide energy calibration of the TLD and environmental monitoring systems, calibration of portable irradiation survey meters, and performance of clinical dosimetry.

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**SUD/4/004 NUCLEAR INSTRUMENTATION (PHASE II)**

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APPROVED: **1991**

COMPLETED: **1994-08-23**

TOTAL COST: \$ **113,699**

To upgrade the existing laboratory for maintenance and repair of nuclear instruments to enable it to service larger equipment and construct specific equipment modules; to provide training in nuclear instrument maintenance and repair.

Under this project, which is a continuation of SUD/4/003, the Agency provided the Sudan Atomic Energy Commission (SAEC) with various test instruments. An expert mission trained the staff in advanced methods of repair and assisted in planning a long term national programme for nuclear instrumentation maintenance. A fellowship was also

awarded. The SAEC now produces small scale nuclear instruments, provides maintenance and repair services, and hosted a national training course on nuclear electronics and instrumentation.

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**SUD/6/012                      USE OF GAMMA CAMERA**

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APPROVED: 1984

COMPLETED: 1994-05-27

TOTAL COST: \$ 288,823

To provide a gamma camera and computer system to improve services in radiation therapy and nuclear medicine.

This footnote-a/ project, designed to improve nuclear medicine services at the Research and Isotope Centre, Khartoum, was supported for the first three years by an extrabudgetary contribution from the USA and thereafter from the TACF. A gamma camera was provided and installed in 1986 and a medical data processing system was supplied in 1992. An expert trained the staff in quality control of the gamma camera. Six project-related fellowships (four of them for more than one year) were awarded to medical physicists and nuclear medicine physicians, and a scientific visit was awarded to an electronics engineer. Gamma camera studies for patient investigations have been established for the study of brain, bone, liver, haepatobiliary system, kidney and lungs. Patient studies using the scanner and radioimmunoassay are being performed at a rate of about 9000 studies per six months. A regional training course on basic nuclear medicine was organized at the Centre.

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**SUD/6/014                      NUCLEAR MEDICINE (GEZIRA UNIVERSITY)**

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APPROVED: 1988

COMPLETED: 1994-05-30

TOTAL COST: \$ 48,322

To set up a nuclear medicine unit for in-vitro studies for therapeutic applications of radioisotopes.

This footnote-a/ project, upgraded in 1991 through the TACF, was designed to establish a radioimmunoassay (RIA) laboratory at the Faculty of Medicine, Gezira University, mainly for clinical diagnostic services. All necessary equipment was provided including a multiple manual gamma counter and bulk reagents. An expert mission assisted in setting up the laboratory and introducing RIA techniques. The assays are being performed regularly, with due attention to quality control and data processing procedures. The RIA laboratory is now carrying out the most common diagnostic tests and is in a position to expand its activities to include other hormones and biological substances of common clinical importance, particularly in the area of iodine deficiency disorders.

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**SUD/6/017                      NUCLEAR MEDICINE (PHASE II)**

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APPROVED: 1991

COMPLETED: 1994-10-28

TOTAL COST: \$ 84,989

To improve in-vivo and in-vitro radionuclide diagnostic services.

The project was designed to assist the Radiation and Isotope Centre, Khartoum, (RICK) to strengthen the in-house radiopharmacy facility for local preparation of the most commonly used radiopharmaceuticals for diagnostic purposes. The Agency provided laboratory equipment and supplies and fielded two expert missions. Nuclear medical services at RICK have improved and the imports of radiopharmaceuticals have decreased, with consequent savings of foreign exchange.

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**SYRIAN ARAB REPUBLIC**

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**SYR/2/002                      RADIOPHARMACEUTICAL PRODUCTION**

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APPROVED: 1988

COMPLETED: 1994-05-25

TOTAL COST: \$ 89,357

To establish a laboratory for the production of radiopharmaceuticals and labelled compounds.

The Atomic Energy Commission of Syria wished to establish a laboratory for the indigenous production and systematic quality control of the most widely used radiopharmaceuticals: about ten Tc-99m and I-131 labelled products. The Agency provided essential equipment and laboratory supplies for initiating the production of Tc-99m in-vivo kits and their quality control. Two expert missions provided training in basic and current techniques in radiopharmaceutical preparation, in readiness for a regular production programme. Equipment and expertise have been transferred to the AEC and the objectives will be continued under the ongoing project SYR/6/008.

## **THAILAND**

### **THA/2/009 RADIOCHEMISTRY TRAINING**

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APPROVED: **1986**

COMPLETED: **1994-01-19**

TOTAL COST: **\$ 269,950**

To provide training in nuclear chemistry and radiochemistry.

The project, originally approved with footnote-a/ status, was made operational through an extrabudgetary contribution from Germany. The Department of Chemistry of Chiang Mai University, with Agency assistance, hosted three national training courses: one on radiochemistry from 18 Jan. to 6 Feb. 1988, one on radioanalytical chemistry from 23 Jan. to 10 Feb. 1989, and one on application of nuclear and radiochemical techniques to environmental sample analysis from 21 Jan. to 8 Feb. 1991. Each training course had about 20 participants from research institutes, universities and organizations connected with agriculture, medicine, geology, chemistry and physics. Two participants from Myanmar participated in the third training course. The Agency also provided a liquid scintillation counter and X-ray equipment, with related instruments, and supplies. One fellowship was awarded under this project and one under the Agency's fellowship programme. A modern radiochemistry laboratory is now established at Chiang Mai University for advanced training and research work. The improved radiochemistry and related courses are benefitting other research institutions and will facilitate further applications of nuclear technology.

## **TUNISIA**

### **TUN/5/010 PRODUCTIVITY OF SHEEP**

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APPROVED: **1987**

COMPLETED: **1994-12-30**

TOTAL COST: **\$ 123,093**

To establish a radioimmunoassay laboratory for the determination of progesterone in sheep with a view to the development of methods for increasing production.

This project was designed to establish a radioimmunoassay (RIA) laboratory at the National Institute of Agronomic Research of Tunisia in order to develop methods to increase the productivity of sheep. The Agency provided two multi-well gamma counters and associated equipment. Ten expert missions trained the staff and assisted in the design and implementation of field studies on reproduction and nutrition. The Institute conducted a number of studies and generated useful information on the reproductive and productive performance of local breeds of sheep maintained under traditional systems of management. The information was communicated to the Department of Animal Production and Pasture Development for extension to sheepfarmers.

## **TURKEY**

### **TUR/2/009 RADIOISOTOPE AND RADIOPHARMACEUTICAL PRODUCTION**

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APPROVED: **1987**

COMPLETED: **1994-08-23**

TOTAL COST: **\$ 514,086**

To establish a laboratory for the production of isotopes and radiopharmaceuticals.

The Cekmece Nuclear Research and Training Centre, Istanbul, wished to strengthen its capability, using its 5 MW research reactor, for the production of Tc-99m, Ir-192 and I-131 in order to meet the existing demand. The Agency provided laboratory equipment, expert services and nine fellowships. The Centre has now established facilities for production and quality control of first generation Tc-99m kits and I-131 labelled hippuran with sufficient capacity to supply most of the existing hospital demand for 10,000 vials/year. It also equipped for the production of I-131, Ir-192 and Tc-99m generators.

### **TUR/2/010 EXPERT SERVICES FOR CYCLOTRON FACILITY**

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APPROVED: **1991**

COMPLETED: **1994-08-23**

TOTAL COST: **\$ 28,432**

To advise on the establishment of a cyclotron facility in order to strengthen fundamental and applied research.

The level of advanced research in atomic and nuclear physics in Turkey and the availability of radioisotopes for medicine and industry has been unsatisfactory, mainly due to the lack of an adequate accelerator. The Agency carried out a pre-project mission to assess the feasibility of a cyclotron project. Two experts advised the Atomic Energy Authority (AEA) on the construction of a facility based on a medium energy, multiple particle, and multi-purpose cyclotron. A national seminar on cyclotron applications in science and technology was organized in Ankara for the institutions involved. Recommendations were made that should assist the AEA to decide whether or not to construct a cyclotron facility.

**TUR/5/016****SOIL FERTILITY AND PLANT NUTRITION**

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APPROVED: **1991**COMPLETED: **1994-12-19**TOTAL COST: \$ **117,047**

To consolidate research on fertilization of main crops and on soil-plant-water relationships; to determine the efficiency of the fertilizer-water use of genotypes and N-fertilizer management practices.

The Soil Fertility and Plant Nutrition Department of the Nuclear Agriculture Research Centre in Ankara intended to study the fate of fertilizers in soil and the nitrogen fixation capacity of legumes, in an effort to extend the use of nuclear techniques to all research institutes in the country. The Agency provided expert advice and training on soil, fertility, water management and crop productivity, as well as laboratory equipment and N-15 fertilizers. One fellowship and a scientific visit were awarded. The N-15 laboratory has been upgraded. Co-operative research projects were initiated with four research institutes in the field of soil fertility using isotopes and related techniques. The Research Centre has increased its support for research work on soil-plant-water relationships. Fertilizer and water management practices for grain crops have been improved and the use of fertilizer and water reduced, thus reducing costs to the farmers.

**UGANDA****UGA/5/014****GRAIN LEGUME PRODUCTION THROUGH BIOLOGICAL NITROGEN FIXATION**

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APPROVED: **1991**COMPLETED: **1994-11-21**TOTAL COST: \$ **189,207**

To identify and exploit cultivars of legumes and symbiotic strains of rhizobium capable of improving atmospheric nitrogen fixation for increased crop yields.

The project was designed to assist the Kawanda Agricultural Research Institute of the Ministry of Agriculture, Animal Industry and Fisheries in building up the local capacity for the use of isotopes in soil-plant studies, and in initiating research addressing practical problems in exploiting biological nitrogen fixation in grain legumes, mainly the common bean and soybean. The Agency provided laboratory equipment and supplies for N-15 aided studies. An expert mission assisted in planning and setting up the experiments and trained a multi-disciplinary research team. Research work concentrated on N-15 isotope dilution technique for selection and testing of rhizobial strains and crop varieties, and determining ways of enhancing nitrogen fixation in the field. Several rhizobial strains were collected, evaluated and preserved. Rhizobial strains and soybean and bean cultivars supporting high levels of nitrogen fixation have been identified as well as some of the fertility factors that limit biological nitrogen fixation in the field. The results should lead to increased crop yields and the popularization of legume inoculation technology, and thus to less dependence on chemical nitrogenous fertilizers. The work continues under the project UGA/5/019.

**UKRAINE****UKR/0/002****ESTABLISHING A NATIONAL INIS CENTRE**

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APPROVED: **1993**COMPLETED: **1994-12-30**TOTAL COST: \$ **88,887**

To upgrade the INIS Database Centre.

The National INIS Centre, at the Institute for Nuclear Research of the Ukrainian Academy of Sciences, Kiev, needed to be upgraded since, after 1991, it was no longer organized centrally through Atominform, Moscow. The Agency supplied the National INIS Centre, Kiev, and the INIS Branch at the Physico-Technical Institute, Kharkov, with the necessary computer systems, including a multi-disc CD-ROM tower and software, related equipment, books and journals. A fellowship and four scientific visits were awarded. Four expert missions were undertaken to advise on the operation of INIS centres and the use of the equipment. The National INIS Centre, Kiev, and the Branch in Kharkov are now providing worldwide scientific and technical information to scientists and decision makers in Ukraine. The increased coverage of Ukrainian scientific literature in INIS benefits all users of the database. Both the National INIS Centre and the Branch are now sufficiently well equipped to be able to connect to the wide-area network planned by the UNDP that will allow access to United Nations and global databases as soon as they become available. The success of this project has encouraged other former states of the USSR to set up their own INIS database centres.

**UKR/9/003****OPERATIONAL SAFETY MISSIONS TO NUCLEAR POWER PLANTS**

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APPROVED: **1992**COMPLETED: **1994-02-21**TOTAL COST: \$ **46,452**

To provide operational safety missions; to advise on nuclear safety standards and procedures in NPPs.

This Reserve Fund project was initiated at the request of the Government. The first ASSET mission to the Chernobyl NPP was undertaken to review the root causes of a safety significant event at Unit-2 of the plant. On the evening of 11

October 1991, turbogenerator No. 4 was switched off for minor maintenance. Undetected mechanical damage to a control cable caused a 330 kV air breaker to switch on spontaneously, connecting the turbogenerator to the grid. The generator began to operate as an electric motor and the resulting high rotation speed caused mechanical damage and severe heating and combustion. An oil and hydrogen fire broke out, causing extensive damage to the turbine hall and the failure of both the emergency and main feedwater systems. The fire was later brought under control and a manual shutdown of Unit-2 could be carried out. The event rated 2 on the International Nuclear Event Scale (INES). There was no off-site impact, but analysis of on-site consequences showed degradation of plant safety function performance and of in-depth defence as well as significant structural damage. The team of eleven international experts carried out a detailed root cause analysis in accordance with standard ASSET methodology, and a series of detailed recommendations were made to the operating organization and to the Government. An ASSET seminar on safety culture was conducted under the project near the Khmelniysky NPP for operators from all NPPs in Ukraine, as well as representatives of the regulatory body. Observers from Lithuania and Russia were also present. The seminar covered reporting criteria, the INES event rating and ASSET root cause analysis, as well as a special lecture on the Incident Reporting System (IRS). Further nuclear safety review missions to Ukraine have been undertaken or planned under project UKR/9/004.

## **UNITED REPUBLIC OF TANZANIA**

### **URT/1/005 NUCLEAR PHYSICS (PHASE II)**

APPROVED: **1991**

COMPLETED: **1994-05-31**

TOTAL COST: \$ **123,486**

To strengthen the nuclear physics programme at the University of Dar es Salaam.

This project is a follow-up of activities supported by the Agency since 1980 and was designed to consolidate and upgrade the facilities for X-ray fluorescence (XRF) analysis and Moessbauer spectroscopy at the Physics Department of the University of Dar es Salaam. The Agency provided the necessary equipment. Five expert missions trained the staff in the use of the equipment and repaired the liquid nitrogen plant. Two fellowships and two scientific visits were awarded. The XRF system and the Moessbauer spectrometer are now being used in training undergraduate and post-graduate students and for elemental analysis of biological and mineral samples.

## **VENEZUELA**

### **VEN/4/008 RESEARCH REACTOR UPGRADING**

APPROVED: **1986**

COMPLETED: **1994-12-19**

TOTAL COST: \$ **75,471**

To improve the operational safety of the RV-1 reactor by upgrading the reactor console and reactor control instrumentation.

The Venezuelan Institute of Scientific Research had been operating a 3 MW swimming pool type reactor since 1963. When a new reactor with LEU fuel was installed in 1984, it was considered necessary to upgrade the reactor console and its control instrumentation. The Agency provided technical expertise and some equipment. However, an Agency INSARR mission in 1988 indicated that the facility and its operation did not conform to the Agency's safety standards, and the reactor was shut down. Recommendations were made regarding operational safety, most of which had been met by 1991, when an Agency mission reviewed the safety situation. A cost estimate for the reactor modernization was provided to the Venezuelan authorities and additional, more detailed, studies were carried out locally. Unfortunately, the economic situation of the country made it impossible to meet the financial requirements of modernization, increased staffing and operational costs.

### **VEN/5/011 CENTRE FOR NUCLEAR AGRICULTURE**

APPROVED: **1987**

COMPLETED: **1994-11-16**

TOTAL COST: \$ **261,349**

To establish nuclear and biotechnology techniques and practices in order to increase agriculture and livestock productivity and to transfer this technology to farmers.

This is an integral part of a previous project, VEN/5/009, with the same objectives, which were to be achieved by means of the establishment of a Centre for Nuclear Agriculture in Maracay. This project was created as a multidisciplinary programme in 1984, funded by the UNDP (1987-91) and the Agency (1984-91) with a Government counterpart contribution in cash from Venezuela. The project supported many activities that are also part of VEN/5/009, but it focussed mainly on training courses and co-ordination visits. Communication was very difficult, and the original Co-ordinator was replaced by three area representatives, co-ordinated by the Agency and the Ministry of Energy and Mines. Under the project, six national training courses and an in-service training course in Maracay on nitrogen-15 utilization were organized as well as five expert missions, numerous visits to co-ordinate the widely diverse activities covered by the project, six fellowships and four scientific visits. Laboratory equipment and supplies were also provided.

**VEN/5/012****IMPROVEMENT OF TROPICAL CROPS BY INDUCED MUTATIONS**

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APPROVED: **1991**COMPLETED: **1994-02-03**TOTAL COST: \$ **107,684**

To develop disease-resistant sugar cane, obtain desired mutations in sesame and produce genetic variability to facilitate the domestication of canavalla.

This project was intended to assist the Faculty of Agronomy of the Central University of Venezuela and the National Centre for Agriculture and Livestock Research (FONAIAP-CENIAP), both at Maracay. Four expert missions were fielded and a fellowship awarded. The Agency provided agricultural and laboratory equipment. In sesame, gamma ray doses for seed irradiation were established for different varieties. Several mutants have been detected which can be of agricultural value or can be used as genetic markers in molecular genetics. Canavalla seeds were treated with gamma rays and chemical mutagens (EMS). The first selection for nutritional values has begun, and determinate growth will be looked for, although the optimum dose for the mutagens has still to be determined. In sugar cane, a radiation treatment and chemical mutagens treatment protocol for callus produced in vitro from some good producing varieties was established. In the course of efforts to find resistance to the sugar cane mosaic virus, some virus-resistant clones were observed. The work continues under the project VEN/5/015 (Phase II).

**VEN/5/013****IMMUNOASSAY METHODS IN LIVESTOCK PRODUCTIVITY AND HEALTH**

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APPROVED: **1991**COMPLETED: **1994-11-07**TOTAL COST: \$ **131,222**

To study the potential of promising supplements to traditional feeds; to study the effects of different feeds on cattle and goat productivity; to gain a better understanding of the nutrition/reproduction interaction in livestock; to estimate the current status of cattle babesiosis.

Six institutions participated in this project: the Faculty of Veterinary Sciences and the Faculty of Agronomy, Universidad del Zulia, Maracaibo (LUZ); the Faculty of Veterinary Sciences of the Universidad Centro Occidental (UCLA), Barquisimeto; the Faculty of Science and the Faculty of Agronomy, Universidad Central de Venezuela, Maracay (UCV); and the Veterinary Research Institute (CENIAP-FONAIAP), Maracay. Six expert missions provided advice and training, and one fellowship was awarded. Some laboratory equipment was supplied. The reproduction research teams of LUZ (Maracaibo) conducted experiments related to reproductive efficiency of dual-purpose cattle, haired sheep and goats, and helped local farmers in the Zulia region to improve livestock productivity. In UCLA, research work improved reproductive performance of native and cross-bred goats in semi-arid zones, studied the reproductive behaviour of the Carora cattle and promoted the use of this Venezuelan breed in other parts of the country. Sound results were obtained in spite of limited staff and facilities for field activities. UCV provided training to several Agency trainees from other countries. One project leader has undertaken expert missions in the region. UCV conducted research studies on feed supplementation strategies and nutritional values of some regional agro-industrial by-products as well as on the effects of nutrition on reproductive performance. The use of urea-molasses blocks, by-pass protein and forage trees was evaluated. The animal health component of the project was conducted by the CENIAP-FONAIAP in Maracay to validate the FAO/IAEA ELISA kit for monitoring babesiosis and to establish a serum bank. A sero-epidemiological survey was initiated at a later stage. Although there was little interaction between participating institutions, most of the research work was completed and more sustainable livestock practices were developed, tested and validated under smallholder farmer conditions.

**VEN/6/003****INTRACAVITARY THERAPY**

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APPROVED: **1989**COMPLETED: **1994-12-19**TOTAL COST: \$ **239,203**

To improve post-graduate training and to expand intracavitary treatment of cancer patients.

The project was designed to assist the expansion of intracavitary treatment facilities for cervical cancer at the School of Medicine of the Central University of Venezuela, Caracas. The Agency provided a remote afterloading brachytherapy machine, ancillary equipment and a radiotherapy treatment planning system. An Agency expert trained three staff members in the use of the equipment. The University Hospital can now provide brachytherapy treatment to its own cervical cancer patients and to those from other hospitals.

**VIET NAM****VIE/1/008****NUCLEAR ANALYTICAL SERVICES**

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APPROVED: **1989**COMPLETED: **1994-01-28**TOTAL COST: \$ **72,685**

To improve operation of research facilities.

This project was a follow-up of VIE/0/002 and was designed to improve the analytical capabilities of the Dalat Nuclear

Research Institute through the introduction of fast neutron activation analysis. However, owing to a change in national priorities a neutron generator was not available and the objectives were modified to create the necessary infrastructure and to train personnel in the analytical determination of trace and minor elements in a variety of samples. The Agency provided equipment including a computer system. Under the project, a pneumatic transfer system for neutron activation analysis was constructed and the spectroscopy system was improved through the use of advanced data processing methods. The Institute can now provide analytical services to geologists and biologists.

**VIE/4/009                      DESIGN AND PRODUCTION OF NUCLEAR INSTRUMENTS**

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APPROVED: **1989**

COMPLETED: **1994-05-25**

TOTAL COST: **\$ 145,095**

To develop a capability for local manufacture of nuclear instruments.

With Agency assistance since 1983 under the project VIE/4/003, a well equipped laboratory was established at the Dalat Nuclear Research Institute (DNRI). The present project was intended to extend its activities to the design and production of nuclear instruments. The Agency provided a computer system, electronic components and laboratory supplies. An expert trained the staff in interfacing. Two fellowships and two scientific visits were awarded. DNRI is now capable of providing repair and preventive maintenance service required in southern Viet Nam. Since the Institute can now supply radioisotopes for medical diagnosis, five other hospitals have been able to establish their own nuclear medicine laboratories. Several low cost nuclear instruments, including nuclear spectrometers, renographs and surface contamination monitors, have been manufactured, and an X-ray fluorescence spectrometer, designed and fabricated at DNRI, was sold to a bank.

**YUGOSLAVIA**

**YUG/2/009                      RADIOPHARMACEUTICALS DEVELOPMENT**

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APPROVED: **1991**

CANCELLED: **1994-11-09**

TOTAL COST: **\$ 1,057**

To upgrade the local capabilities by provision of high pressure liquid chromatograph for radiopharmaceutical production in Yugoslavia.

This project was cancelled in compliance with the United Nations Security Council Resolution 757 (1992) and other related resolutions. Apart from a consultant mission by an IAEA staff member, no activities had been carried out prior to cancellation.

**YUG/9/028                      RADIOACTIVE WASTE TREATMENT**

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APPROVED: **1991**

CANCELLED: **1994-08-18**

TOTAL COST: **\$ 1,119**

To advise on the treatment and conditioning of existing and newly arising liquid waste and the volume reduction and immobilization of solid waste.

This project was cancelled in compliance with the United Nations Security Council Resolution 757 (1992) and other related resolutions.

**ZAIRE**

**ZAI/6/006                      UPGRADING THE NUCLEAR MEDICINE SERVICE**

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APPROVED: **1991**

COMPLETED: **1994-11-10**

TOTAL COST: **\$ 39,235**

To improve the range of in-vitro diagnostic tests through upgrading the equipment of the nuclear medicine unit.

Owing to the situation in the country, only certain components of this project could be implemented. The Agency provided the Department of Nuclear Medicine of the Kinshasa Regional Nuclear Research Centre with laboratory equipment and supplies but was unable to field the expert missions which were planned to assist in the production of reagents. Some of the planned activities which could not be further implemented will continue under the new project ZAI/6/008, starting in 1995.

**ZAI/6/007            UPGRADING RADIOIMMUNOASSAY CAPABILITY**

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APPROVED: **1991**CANCELLED: **1994-11-10**TOTAL COST: **\$ 0**

To upgrade the national radioimmunoassay capability; to produce locally a wider range of reagents and to promote their application at a national level.

This project has been cancelled because no expert missions could be fielded owing to the situation in the country. Some of the planned activities will be implemented under the new project ZAI/6/008, scheduled to start in 1995.

**ZAI/6/009            ISOTOPES IN WATER RESOURCE ASSESSMENT**

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APPROVED: **1988**COMPLETED: **1994-09-22**TOTAL COST: **\$ 161,462**

To study the principal basins draining the city of Kinshasa; to measure water course discharge; to determine and characterize liquid and solid constituents in rivers.

The project was designed to assist the Kinshasa Regional Nuclear Research Centre in carrying out hydrological studies for prediction and simulation of water distribution in the unsaturated zones for agronomic and hydrological purposes. In spite of unfavourable local conditions and the slow progress of implementation, the project succeeded in achieving some of its primary objectives. The Agency provided all necessary equipment and fielded two expert missions. Two fellowships were awarded. With the assistance of the experts, the counterparts applied tracer and nuclear techniques to measure the solid and liquid transport of the rivers crossing the city of Kinshasa. This information was particularly important as these rivers periodically overflow and cause serious damage to the region. The Soil Physics and Hydrology Laboratory is now sufficiently well equipped to utilize artificial radioactive tracers for flowrate measurement, to measure humidity profiles using a neutron probe, and to determine soil suction values at different depths through the utilization of tensiometers.

**ZAMBIA****ZAM/5/014            INDUCED MUTATION BREEDING**

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APPROVED: **1985**COMPLETED: **1994-05-25**TOTAL COST: **\$ 210,270**

To obtain improved varieties of indigenous trees by means of induced mutation and in-vitro culture.

The project was designed to assist the Tree Improvement Research Centre, Kitwe, to develop means of mutation breeding in arboreal crops, particularly for indigenous fruit trees and other useful tree species in combination with in-vitro culture. The Agency provided laboratory equipment and supplies. Eleven expert missions advised on the development of an in-vitro culture laboratory and trained the staff. Three project-related fellowships and one scientific visit were awarded. A well equipped in-vitro culture laboratory has been established and the technology has been transferred. A mutation breeding programme on *Uapaca kirkiana*, an indigenous fruit tree, is being carried out in the laboratory. The work continues under the new project ZAM/5/020.

**ZIMBABWE****ZIM/5/005            ANIMAL SCIENCE**

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APPROVED: **1989**COMPLETED: **1994-08-22**TOTAL COST: **\$ 148,320**

To support a problem-oriented research programme to improve the reproductive performance and health of indigenous cattle under traditional management with the aid of nuclear-related techniques.

The Agency assisted the Faculty of Veterinary Science of the University of Zimbabwe in a research programme and provided the necessary equipment and supplies for nutritional studies as well as standardized radioimmunoassay kits for measuring progesterone. Six expert missions were fielded and one fellowship was awarded. The Faculty conducted studies that generated useful baseline data on the productivity of indigenous cattle maintained under traditional management systems. The results of the studies carried out so far should facilitate the introduction of supplementary feeding and management strategies to improve the productivity of indigenous cattle.

APPROVED: **1991**COMPLETED: **1994-11-21**TOTAL COST: \$ **132,054**

To determine the nitrogen fixing potential of different legumes and the effect of legume crop residues on productivity.

The project was designed to assist the Chemistry and Soil Research Institute, Marondera, in the use of isotopes and nuclear techniques to assess the benefits of crop rotations involving legumes and cereals, and to measure the release of nutrients from decomposing litter. The Agency provided laboratory equipment and supplies for N-15 aided studies and trained a multi-disciplinary research team. The experts also assisted in planning studies and provided on-the-job training. The project demonstrated the great benefits from growing legumes followed by maize or cereals and from applying legume residues as a source of nutrient for cereals. Preliminary analysis showed that there were genetic differences in the nitrogen fixing abilities of different legume genotypes, and that bambara was ranked as better than groundnut, which was better than soybean. The work will continue under the project ZIM/5/008.

# LIST OF ABBREVIATIONS

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<b>ACC</b>	Administrative Committee on Co-ordination
<b>AFRA</b>	African Regional Co-operative Agreement for Research, Development and Training
<b>ARCAL</b>	Regional Co-operative Arrangements for the Promotion of Nuclear Science and Technology in Latin America
<b>ASSET</b>	Assessment of Significant Safety Events Team
<b>CD-ROM</b>	Compact disk - read only memory
<b>CIDA</b>	Canadian International Development Agency
<b>ECOSOC</b>	Economic and Social Council
<b>ELISA</b>	Enzyme-linked immunosorbent assay
<b>ENPEP</b>	Energy and power evaluation package
<b>EWERMS</b>	Early warning environmental radiation monitoring system
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>GEF</b>	Global Environment Facility
<b>IAEA</b>	International Atomic Energy Agency
<b>ICRP</b>	International Commission on Radiological Protection
<b>ILO</b>	International Labour Organization
<b>IMF</b>	International Monetary Fund
<b>INIS</b>	International Nuclear Information System
<b>INSARR</b>	Integrated Safety Assessment of Research Reactors
<b>IPEN</b>	Inst. for Nuclear Energy and Research (Brazil)
<b>IPERS</b>	International Peer Review Service
<b>ISO</b>	International Organization for Standardization
<b>LDC</b>	Least developed country
<b>MELSIM</b>	Computer Model for Reactor Core Meltdown Simulation
<b>MESAP</b>	Microcomputer Based Energy Sector Analysis & Planning
<b>MTR</b>	Materials testing reactor
<b>NEA</b>	Nuclear Energy Agency of the OECD
<b>NDT</b>	Non-destructive testing

<b>NENF</b>	Division of Nuclear Fuel Cycle and Waste Management, IAEA
<b>NENP</b>	Division of Nuclear Power, IAEA
<b>NENS</b>	Division of Nuclear Safety, IAEA
<b>NESI</b>	Division of Scientific and Technical Information, IAEA
<b>NPP</b>	Nuclear power plant
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>OSART</b>	Operational Safety Review Team
<b>PAHO</b>	Pan-American Health Organization
<b>PC</b>	Personal Computer
<b>PSA</b>	Probabilistic Safety Analysis
<b>PWR</b>	Pressurized water reactor
<b>RAPAT</b>	Radiation Protection Advisory Team
<b>RCA</b>	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (for Asian & Pacific countries)
<b>RIA</b>	Radioimmunoassay
<b>RIAL</b>	Agency Laboratory, Seibersdorf, IAEA
<b>RIFA</b>	Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture
<b>RIHU</b>	Division of Human Health, IAEA
<b>RIML</b>	Marine Environment Laboratory, IAEA, Monaco
<b>RIPC</b>	Division of Physical and Chemical Sciences, IAEA
<b>RPFI</b>	The Asian Regional Co-operative Project on Food Irradiation
<b>SIDA</b>	Swedish International Development Authority
<b>SPECT</b>	Single-photon-emission computerized tomography
<b>TACC</b>	Technical Assistance and Co-operation Committee
<b>TACF</b>	Technical Assistance and Co-operation Fund
<b>TC</b>	Department of Technical Co-operation, IAEA
<b>TCIM</b>	Division of Technical Co-operation Implementation, IAEA
<b>TCPM</b>	Division of Technical Co-operation Programmes, IAEA
<b>TECDOC</b>	Technical Document
<b>TSH</b>	Thyroid-stimulating hormone
<b>UNCED</b>	United Nations Conference on Environment and Development

<b>UNCTF</b>	United Nations Chernobyl Trust Fund
<b>UNDP</b>	United Nations Development Programme
<b>UNEP</b>	United Nations Environment Programme
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNIDO</b>	United Nations Industrial Development Organization
<b>UNU</b>	United Nations University
<b>USAID</b>	United States Agency for International Development
<b>USNRC</b>	United States Nuclear Regulatory Commission
<b>WWER</b>	Pressurized water-cooled and water-moderated power reactor
<b>WAMAP</b>	Waste Management Advisory Programme
<b>XRF</b>	X-ray fluorescence

## PROGRAMME CODES

<b>A</b>	=	Nuclear Power
<b>B</b>	=	Nuclear Fuel Cycle
<b>C</b>	=	Radioactive Waste Management
<b>D</b>	=	Food and Agriculture
<b>E</b>	=	Human Health
<b>F</b>	=	Industry and Earth Sciences
<b>G</b>	=	Physical and Chemical Sciences
<b>H</b>	=	Radiation Protection
<b>I</b>	=	Safety of Nuclear Installations
<b>J</b>	=	Safeguards
<b>S</b>	=	Direction and Support
<b>X</b>	=	Comparative Assessment

# GLOSSARY

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**Adjusted programme** - the total value of all technical co-operation activities approved for a given calendar year plus all approved assistance brought forward from previous years but not yet implemented. It is against this figure - which is not identical with resources actually available - that the implementation rate is measured.

**Disbursements** - actual cash outlays for goods provided and services rendered.

**Dynamic programming** - the process whereby funds released through rephasing and reprogramming are used to meet requirements of developing Member States through the implementation of approved projects for which funds would otherwise not be available; it serves to keep project planning realistic.

**Earmarkings** - amounts allotted for funding approved assistance awaiting implementation.

**Extrabudgetary funds** - funds provided by Member States for financing specific projects or activities. These funds are separate from voluntary contributions to the Technical Assistance and Co-operation Fund.

**Footnote-a/ projects** - projects approved by the Board for which no immediate funds are available.

**Funds in trust** - funds received from Member States to finance assistance for themselves.

**Implementation** - the volume of funds obligated (new obligations) in a given period.

**Implementation rate** - a ratio obtained by dividing implementation by the adjusted programme (expressed as a percentage), reflecting the financial rate of implementation.

**Model Projects** - projects responding to a real need with significant economic or social impact for the end user. These projects feature a competitive nuclear technique and require a local environment conducive to sustainable success.

**New obligations** - the sum of disbursements during the year plus year-end unliquidated obligations minus unliquidated obligations carried over from the previous year.

**New resources** - the total value of funds received in a calendar year not previously reported.

**Overprogramming** - the establishment of annual programming levels which exceed available resources.

**Programme year** - the year for which an activity is planned.

**Rephasing** - a temporary release of funds approved for inputs which were planned for a given programme year and which cannot be implemented as scheduled. Rephasing does not change total inputs approved for a project; rather, it serves to keep project planning realistic.

**Reserve Fund** - an amount set aside by the Board each year for financing assistance of an urgent nature requested after the Board has approved the Regular Programme for the year in question.

**Technical Assistance and Co-operation Fund** - at present, the main fund for the financing of the Agency's technical co-operation activities; it is supported by voluntary contributions from Member States, 8% assessed programme costs paid by Member States over assistance received and miscellaneous income.

**Type II fellowship** - fellowships provided by Member States at little or no cost to the Agency.

**UNDP Programme** - projects executed by the Agency on behalf of UNDP and its associated funds.

**Unliquidated obligations** - obligations incurred for which no cash outlays have yet been made.

**Unobligated balance** - total funds available less disbursements and less unliquidated obligations against the current year.

**Upstream work** - discussions, analysis, and negotiations for the purpose of identification and preliminary design of projects.

