

# THE AGENCY'S TECHNICAL CO-OPERATION ACTIVITIES IN 1993

REPORT BY THE DIRECTOR GENERAL

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## **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 1993: 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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# LIST OF ABBREVIATIONS

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<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>CANDU</b>	Canada deuterium-uranium (reactor)
<b>CC</b>	Convertible currency
<b>CD-ROM</b>	Compact disk - read only memory
<b>CEC</b>	Commission of the European Communities
<b>CIS</b>	Commonwealth of Independent States
<b>CWS</b>	Church World Service
<b>ELISA</b>	Enzyme-linked immunosorbent assay
<b>ECOSOC</b>	Economic and Social Council
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>HSA</b>	High specific activity
<b>HTGR</b>	High-temperature gas-cooled reactor
<b>IAEA</b>	International Atomic Energy Agency
<b>IAN</b>	Institute of Nuclear Affairs (Colombia)
<b>ICRP</b>	International Commission on Radiological Protection
<b>IMF</b>	International Monetary Fund
<b>INSARR</b>	Integrated Safety Assessment of Research Reactors
<b>INIS</b>	International Nuclear Information System
<b>ISO</b>	International Organization for Standardization
<b>KWU</b>	Kraftwerk Union AG
<b>LDAC</b>	Least-developed Arab country
<b>NCC</b>	Non-convertible currency
<b>NDT</b>	Non-destructive testing

<b>NENS</b>	Division of Nuclear Safety, IAEA
<b>NPP</b>	Nuclear power plant
<b>OPS</b>	Office for Project Services
<b>OSART</b>	Operational Safety Review Team
<b>PAHO</b>	Pan-American Health Organization
<b>PSA</b>	Probabilistic Safety Analysis
<b>PRIS</b>	Power Reactor Information System
<b>PWR</b>	Pressurized water reactor
<b>QA</b>	Quality assurance
<b>QC</b>	Quality control
<b>R &amp; D</b>	Research and development
<b>RAPAT</b>	Radiation Protection Advisory Team
<b>RCM</b>	Regional Co-ordination Meeting
<b>RIA</b>	Radioimmunoassay
<b>RI</b>	Research and Isotopes
<b>RIHU</b>	Division of Human Health, IAEA
<b>RIML</b>	Marine Environment Laboratory Monaco, IAEA
<b>RPFI</b>	Regional Project on Food Irradiation
<b>SPECT</b>	Single-photon-emission computerized tomography
<b>TACF</b>	Technical Assistance and Co-operation Fund
<b>TC</b>	Department of Technical Co-operation, IAEA
<b>TECDOC</b>	Technical Document
<b>TSH</b>	Thyroid-stimulating hormone
<b>UNCTF</b>	United Nations Chernobyl Trust Fund
<b>UNDP</b>	United Nations Development Programme
<b>UN/DTCD</b>	United Nations Department of Technical Co-operation for Development
<b>UNEP</b>	United Nations Environment Programme
<b>UNFSTD</b>	United Nations Fund for Science and Technology for Development
<b>UNIDO</b>	United Nations Industrial Development Organization

**WAMAP** Waste Management Advisory Programme

**XRF** X-ray fluorescence

## PROGRAMME CODES

- 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

**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).

**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.

**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.

# INTRODUCTION

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This report follows the format used last year to provide detailed data on the utilization of the various funds made available for technical co-operation activities in a particular year and to give an impression of the results achieved.

Following a description of overall developments, several detailed review categories provide quantitative data, expressed in both financial and non-financial terms, complementing the standard implementation summaries, tables, figures and annexes in a manner which facilitates comparison with previous years.

The presentation of the narrative part of the report has been streamlined in that the regional profile section describing the activities carried out in the past five years has been discontinued. The current year's activities for a particular region are described as usual in Part C - Review by Area. The section reporting the accomplishments of each completed project during 1993 has been placed at the end of the report as Annex XII.

All sums of money are expressed in US dollars and have in most instances been rounded to the nearest hundred or thousand dollars. Percentages have also been rounded in statistical tables and figures.

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.

- New resources for the Technical Co-operation Programme totalled \$52.9 million, a sharp increase over the \$40.3 million received in 1992. All categories of funding increased and income for the TACF, as a percentage of target, reached 79.3%, the highest since 1989. **para 14  
Figure 1  
Table 2**
  
- Overall implementation reached 65.9%, one of the highest totals ever attained, with total new obligations reaching \$47.6 million, an increase of more than \$12.2 million over the amount recorded in 1992. **para 16  
Implementation  
Summary I**
  
- All components of the TC Programme showed increased delivery; there were considerably more expert assignments, equipment purchase orders, fellowships, visiting scientists and training courses than in 1992. **para 17, 111, 115  
118, 123  
Tables 3A, 3C, 6B**
  
- The Model Project concept was launched and by December 1993 twelve such projects were approved by the Board of Governors to start in 1994. **para 1-4**
  
- In the context of dynamic programming, the timetables for implementing many projects were adjusted to permit more realistic implementation. **para 6**
  
- A comprehensive study was undertaken by TCPM to increase implementation. One of the results was the Board's approval of overprogramming by 15-20%. **para 5-6**
  
- A special study was made of the lessons learned from evaluation reviews completed during the ten-year period 1983 to mid-1993, and the resulting actions taken. It was concluded that the Department has, in most cases, responded promptly to needs for corrective action. **para 32**
  
- The TC information system infrastructure was greatly enhanced by the replacement of the local area network servers and the installation of new network software. **para 8**
  
- Food and agriculture had the highest proportion of the disbursements (over 20%), followed by radiation protection and safety (19.7%) and the physical and chemical sciences (over 18%). **para 33, 37  
Figure 2**

- The largest share of the TC programme (24.6%) was allocated to Africa, followed by Asia and the Pacific (23.7%), Latin America (22.7%), and Middle East and Europe (22.2%). Interregional and global activities accounted for 6.8% of the adjusted programme. **Implementation Summary I**
  
- The Regional Programme for Asia and the Pacific continued to attract substantial levels of extrabudgetary and UNDP support. Nearly \$6.5 million is expected to be available for activities under the project to strengthen radioisotope technology in support of environmentally sustainable development in the region. **para 65 and 140**
  
- The Agency has maintained close contact with other United Nations bodies with the view to integrating its programmes into the global sustainable development agenda. IAEA project proposals on specific environmental issues have been submitted to the Global Environment Facility and to Capacity 21. **para 9**



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

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## A. Overview

### 1. General Issues

#### **In-house developments**

1. The most significant new development in the Agency's Technical Co-operation Programme in 1993 was the launching of the Model Project concept. Model Projects must fulfil certain criteria:

- They must respond to real needs;
- They must result in a specific socioeconomic impact on end users;
- They must utilize nuclear technology;
- They must be cost effective.

2. Model Projects are developed in close connection with the governments concerned, which must also be willing to commit substantial resources and provide adequate infrastructure to ensure sustainable success.

3. A great deal of preparatory work has been carried out on this new project concept, and the Board as well as individual Member States were kept informed at all stages. Preliminary information was provided in a "Note by the Secretariat" issued on 3 June 1993. During the General Conference most of the Model Projects to be proposed for 1994 were documented and discussed with Member States in individual consultations, and a special presentation was made to Missions in Vienna in November 1993. At the Technical Assistance and Co-operation Committee Meeting (TACC) the twelve Model Projects to be included in the 1994 programme were presented in the form of comprehensive write-ups, including a project plan for each. The TACC recommended their inclusion in the TC programme and the Board approved them in December 1993.

4. These first few Model Projects have already led to a new approach to the entire TC programme. A concentrated effort is being made to identify TC activities which are more end user and impact oriented. A change of attitude was also noted in many countries visited in 1993, and it is expected that the project requests for the 1994-95 programme will be influenced by this new approach.

5. During 1993, the Division of Technical Co-operation Programmes carried out a comprehensive review of all operational projects in order to bring as many as possible to completion and to adjust the budgets of remaining projects for more realistic implementation.

6. In the context of dynamic programming many projects were rephased. This was done in two directions. Where implementation could be accelerated, funds budgeted for future years were rephased into 1993, and where implementation had slowed down for various reasons, 1993 budgets were rephased to future years. The Division also presented a detailed paper to the Board on the reasons for delays in implementation. Eight major categories of factors leading to delays were identified, and the Agency continued to strive for improvements in those factors which are under its control. However, the study showed that almost 30% of the obstacles to progress could be categorized as "factors related to recipient countries and counterparts". Understandably, most of the efforts to improve implementation for projects falling into these categories must be made by the recipient countries concerned, especially in the case of non-fulfilment of financial obligations as committed by the project counterparts when a project was requested. It was also pointed out in the paper that an increased programme meant an increased volume of TC delivery. This was discussed by TACC and the Board and a 15-20% overprogramming was subsequently approved. (However, this level of overprogramming will only be possible for the 1995-96 programme.)

7. Preparatory work was initiated during 1993 for the TC Policy Review Seminar to be held in September 1994, and the Technical Assistance Committee received suggestions for a number of topics to be discussed. Broad consensus to focus the Seminar on a few major issues was reached and subsequently approved by the Board.

8. The Information Systems Unit (TCSIS), created in 1991, continued to provide valuable support for the Department in 1993. In the first half of the year the reliability of the local area network (LAN) was greatly enhanced by the replacement of all production servers and the installation of MS LAN Manager, the software necessary to run the network. This software conforms to the Agency's Standard Technology Architecture Plan (STAP) and allows TC staff easy access to many in-house systems. Towards the end of the year, TCSIS established a help line. TCSIS has special knowledge of the TC systems and is capable of solving problems quickly and efficiently. At the end of the year the last mainframe connected terminals were phased out.

## **External developments**

9. During 1993, the UN system continued to pay considerable attention to follow-up activities related to the United Nations Conference on Environment and Development (UNCED) Rio de Janeiro. The co-ordination of these activities figured prominently on the agendas of such bodies as ECOSOC, the ACC and its subsidiary machinery, and the Governing Council of UNDP. The Agency participated in several systemwide consultations on these matters and was represented at the first two meetings of the new ACC Subsidiary Committee on Sustainable Development (IACSD). The development of new funding mechanisms for the environment was closely monitored. IAEA proposals have now been submitted to the Global Environment Facility and to Capacity 21. Although the Agency maintains intensive contacts with key officials at UNDP Headquarters on these matters, concrete results in the form of allocations from these funds for activities in the Agency's field of competence have not yet materialized. Nevertheless the discernible shift in emphasis in the international community towards environmentally sustainable development presents new and interesting opportunities for the Agency's TC activities which are in many areas directly supporting objectives identified in Agenda 21, the final document of UNCED.

10. Within the UN co-operative system the subsidiary machinery of the Administrative Committee on Co-ordination (ACC) was streamlined: the Consultative Committee for Substantive Questions - Operational Activities (CCSQ(OPS)) and the CCSQ(Prog) on programming, were merged to form the Consultative Committee on Programme and Operational Questions (CCPOQ), which will convene semi-annually to deal with both operational and programming in order to advise ACC on these issues. At the same time, the annual Inter-Agency Consultative Meeting with UNDP will continue.

11. In its triennial policy review of operational UN activities in December 1992, the General Assembly adopted Resolution 47/199, reaffirming and further developing previous guidelines regarding, inter alia, standardization of UN procedures, implementation of the programming approach, national project execution and field level co-ordination. This resolution, which was a main focus for inter-agency deliberations throughout the year, introduced the concept of the Country Strategy Note, aimed at the integration of UN assistance with national planning. Agencies without field representation will be invited by the UN Resident Co-ordinator to submit written inputs to the document. Governing bodies of UN agencies have been called upon to take appropriate action for implementation of this resolution.

12. Inter-agency meetings held in 1993 also dealt with the future relations between agencies, UNDP and the Bretton Wood institutions (World Bank, IMF) in view of growing concern about shrinking official development assistance (ODA) resources. Increasingly heavy demands are being made on the international community to provide resources for peacekeeping operations and for humanitarian relief. Additional needs have arisen in countries in Eastern Europe and Central Asia. These developments, coupled with weak economic performance in many industrialized countries, cannot but have an effect on resource flows available for traditional TC activities.

13. The smaller technical agencies of the UN system are affected by the trend towards more national execution of UNDP financed projects as well as by an apparent gradual reorientation of UNDP from its traditional role as the central funding mechanism of the UN development system towards more direct support to governments through its own executing mechanism (OPS). This is leading to a shortfall in UNDP support costs which hitherto had been the main source of financing the backstopping of TC activities in some of these agencies. There is particular concern that, owing to this situation, it will become extremely difficult for these agencies to play a role in the upstream work necessary in connection with project and programme planning. The smaller agencies have repeatedly expressed this concern to UNDP and have stressed the importance of preserving the unique features of the UN system and of ensuring that the expertise available remain accessible to developing countries. Since, from the inception of the Agency's own TC activities, the cost of implementing this programme has been borne by the Regular Budget, the Agency does not face these problems to the same extent. While it is regrettable that the UNDP part of its TC activities remains at very modest levels, this has not impeded its ability to deliver and support a growing TC programme.

## 2. Resources and Delivery

<b>New resources</b>	<b>\$ 52.9 million</b>
<b>Adjusted programme</b>	<b>\$ 69.4 million</b>
<b>New obligations</b>	<b>\$ 45.7 million</b>
<b>Implementation rate</b>	<b>65.9%</b>
<b>Disbursements</b>	<b>\$ 45.3 million</b>

14. Total new resources available to the Agency's TC programme rose sharply to \$52.9 million in 1993 from \$40.3 million in 1992. This increase of 31.3% came after the decline of 17.9% in 1992 compared to 1991. The total of \$52.9 million represents the highest amount ever received. As can be seen in Table 1, the \$50 million mark was exceeded only once before, in 1989. Not only were contributions to the TACF significantly higher in 1993, but all other categories also showed increases.

15. The relative weight of the various funding sources has changed very little since 1992. TACF still holds an 82.9% share of total resources, followed by extrabudgetary 12%, in kind 3.1%, and UNDP 2%.

16. The total of all technical co-operation approved for a given calendar year, plus the value of all approved but as yet unimplemented assistance from previous years (and adjusted during the year owing to cancellations, rephasings, and additions), constitutes the "adjusted programme". By the end of 1993 the total adjusted programme was \$69,375,000, an increase of \$10,038,000 or 16.9% over the adjusted programme recorded for 1992. It is against this significantly higher adjusted programme that implementation is measured. The implementation, i.e. the new funds obligated, reached a record height in 1993 of \$45.7 million, or \$10.5 million more than in 1992. In addition, \$1.8 million of future year obligations were also placed in 1993. With these included, the total increase in dollars implemented was \$12.2 million, or 34.5% more than in 1992.

17. TCIM's success in increasing implementation was mainly due to improved co-ordination and communications and to the review of operational systems, identification of needed improvements together with the successful integration of improved work procedures. The outcome of all this was that the four Implementation Sections had a higher output with the same level of human resources as in the previous year.

18. 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 1993 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**

Year	TACF	Funds in trust	Extrabudgetary funds	UNDP	Total
	(%)	(%)	(%)	(%)	(%)
1989	58.0	44.1	46.7	70.2	56.5
1990	71.3	35.6	50.4	88.6	67.8
1991	67.6	45.0	52.2	47.1	63.6
1992	61.9	77.7	45.6	48.8	59.3
1993	68.5	51.6	52.4	76.9	65.9

19. At the end of 1992 there were 860 operational projects. Since 1993 was the first year of the biennial cycle, 412 new operational projects were introduced at the beginning of 1993. During the year, 58 additional projects were included, namely 44 training courses, 11 Reserve Fund projects and three UNDP projects. In addition, a large number of footnote-g/ projects - 43 in all - were upgraded to operational status with the receipt of extrabudgetary contributions and with funds released through dynamic programming. The total operational projects during the year was therefore 1,373.

20. During the year, 244 projects were completed, and the achievements (with the exception of the 44 training courses) are reported in Annex XII. During the year, 15 projects were cancelled, two of them training courses. Of these 15 cancellations, six were due to territorial changes of Member States (Czechoslovakia, Yugoslavia), and follow-up projects in the new states were initiated. The reasons for the remaining seven cancellations are given in Annex XII. At the end of the year there remained 1,114 operational projects.

21. Annex III lists 22 country programme reviews and seven other reports from the Evaluation Section, as well as 12 published expert reports. Most of the reports of expert missions are not formally published; in 1993 TC received 763 of these reports which were distributed to the respective governments and counterparts. This is a significant increase over 1992, when 645 reports were received.

### **3. Evaluation**

22. Evaluation activities in 1993 followed established plans and, in addition to continuous review of the operational programme through routine monitoring systems introduced several years ago, included in-depth Project Desk Reviews (for the first time also covering two projects that had been completed some time ago), as well as evaluations of broader programme issues of concern to the Department of Technical Co-operation.

23. One of the Department's routine monitoring activities, the Interim Project Implementation Report (IPIR) system, supplies national counterparts with the latest project information available at Agency Headquarters and, in turn, provides Agency project and technical staff with the necessary feedback for continued implementation of projects and for any corrective action that may be required. In 1993, a total of 257 IPIRs were sent out to counterparts, and 177 were returned from the field. While the high quality of the information

provided was maintained, there was a slight decrease in the average return rate. Of the reports returned in 1993, 55% showed that progress was as planned or better and required no special action; 38% reported that, while progress was as planned, additional action was being initiated or recommended to meet the difficulties encountered; and only 7% stated that progress was less than planned and appropriate action has been initiated or recommended.

24. Routine follow-ups of Agency interregional and AFRA training courses are sent to all participants in the form of questionnaires six to nine months after the completion of a course. These provide the Secretariat and course organizers with a systematic review of the quality and impact of the training. The quality of these training activities was, as in the past years, rated high by most of the participants.

25. Country programme summaries were prepared for 22 countries: three for Asia and the Pacific, nine for Latin America, and ten for the Middle East and Europe. These summaries provide a comprehensive picture of the Agency's co-operation with Member States in a manner particularly useful for programming decisions.

26. An evaluation was conducted on a four-year agricultural project completed in 1989 in a country in the Middle East and Europe region providing assistance in improving mutation breeding efforts and in developing new and higher yielding crop varieties. The evaluation found that the short term objectives of the project had been achieved and that the volume and momentum of the work at the recipient institutions had increased. However, the evaluation concluded that full achievement of the long term objective of increasing agricultural production as a whole will require over a decade of further research and field trials.

27. A second evaluation was carried out on an industrial project completed in 1991 in another country in the Middle East and Europe region to introduce the technology for sterilizing medical supplies by radiation as an alternative to the previous practice of using ethylene oxide. Two major issues of concern emerged from the evaluation: (1) excessive delays in setting up the equipment, caused by delayed local construction work and by difficulties in shipping the source; and (2) a grievous lack of information on the progress and impact of the implementation. The evaluation concluded that the socio-economic impact of the project could only be properly assessed through a field mission in 1994.

28. Desk Reviews were conducted on two on-going projects nearing completion. The first, in the Asia and the Pacific region, was approved in 1983 to demonstrate on a semi-commercial scale the efficacy and profitability of food irradiation and to transfer the technology to relevant industries. Damage inflicted by a cyclone and tidal bore delayed the inauguration of the facility until 1993. The evaluation concluded that in spite of excellent technical progress, an effective transfer of technology, and the establishment of well-trained staff, the project objectives had been only partially achieved.

29. The second on-going project reviewed was initiated in 1984 to assist a country in the Africa region to develop the technical infrastructure capable of mounting a tsetse eradication effort on an island, using the sterile insect technique. The evaluation concluded that most of the objectives had been achieved and that, on the whole, the country was ready to launch a full-scale effort to eradicate the tsetse fly from the island, only needing enlarged facilities and additional inputs of equipment and staff.

30. A Special Evaluation was conducted (a) to review the overall situation with regard to the Agency's technical co-operation with Least Developed Countries (LDCs), including specific conditions in nuclear related activities prevailing in these countries, the approaches and practices used by the Agency in providing assistance to LDCs, and the main results of the co-operation in question; and (b) to identify any adjustments to technical co-operation with LDC Member States that may strengthen this activity. The evaluation concluded that, for most of these countries, the Agency's TC programme had been the principal source of external assistance in nuclear research and applications, playing an essential catalytic role and contributing significantly to the development of nuclear related activities. In agriculture, health care, water resources and other sectors involving basic human needs, the principal factor limiting the assistance which the Agency can provide to LDCs continues, with very few exceptions, to be a lack of sufficiently qualified local manpower. Other limiting factors are institutional and infrastructural weaknesses, including the absence or inadequacy of radiation safety regulations and controls, a lack of adequate physical facilities for nuclear research and application, a very limited ability to maintain and repair nuclear and related non-nuclear equipment and instruments, and severe shortage of foreign exchange for purchasing spare parts and supplies. Furthermore, there is insufficient awareness, particularly among the authorities responsible for planning and financing national economic and technological development, of the specific nuclear techniques that might efficiently assist and complement national efforts under way. The evaluation recommended that increased use be made by LDCs of the opportunities offered through the existing regional co-operative agreements in the Africa, Latin America, and Asia and the Pacific regions. The Agency should continue to pay special attention to its LDC Member States through country programme reviews, comprehensive and systematized information to LDCs on nuclear techniques considered to be the most promising for application in various sectors of the national economy, standardized or package projects to assist in formulating TC requests, and increased emphasis on manpower development.

31. A Special Evaluation of the Agency's RAPAT and WAMAP Programmes in Asia and the Pacific over the past ten years concluded that these programmes had contributed considerably to the development of radiation protection and waste management infrastructures in the countries of the region. Through national TC projects which largely evolved from RAPAT and WAMAP recommendations, essential assistance had been provided by the IAEA to recipient Member States in support of their own considerable efforts to strengthen the national capability in radiation protection and radioactive waste management. At the same time, a number of factors were identified which, in some Member States, were still impeding further development in this sector, including weakness of national radiation protection and waste management infrastructures (legislation, standards, enforcement authorities).

32. As a follow-up to evaluation, an in-depth analysis was made of the lessons learned from the evaluation reviews completed during the period 1983 to mid-1993, and the Agency's response to them, covering procedures and components of the programme in general, as well as the findings specific to individual projects or groups of projects. In the past ten years the TC Evaluation Section has reviewed a representative cross section of the Agency's TC programme, including Desk Reviews of 351 projects, field evaluation reviews of 39 projects, 29 process evaluations, five ten-year country programme evaluations, over 70 ten-year country programme summaries, and four sectoral evaluations involving 275 projects. The results and conclusions of these evaluations, together with recommendations for improving on-going and future activities, have provided a valuable continuous feedback. While some recommendations could not immediately be implemented, owing either to circumstances beyond the control of the Agency or to internal financial and

manpower constraints, the Department has in general responded promptly and efficiently to emerging needs for corrective action. Numerous measures were introduced for improving programme planning, design and implementation and for streamlining existing processes and procedures, including: the two-year TC programming cycle; country programme reviews; interregional projects for pre-project assistance; increased share of regional activities and interaction with co-ordinated research programmes; revision of the project request form, including the provision for formal agreement by the national regulatory body to apply the IAEA's health and safety measures; regional and national workshops on project design, management and evaluation techniques; training at Agency Headquarters for national liaison officers; Interim Project Implementation Reports; increased interaction between Agency divisions involved in TC activities; in-house workshops for Technical Officers; increased use of regional experts and new procedures for expert reporting; instrument maintenance training; regional manpower development projects; routine surveys of all interregional and AFRA training courses six to nine months after completion; establishment of RAPAT and WAMAP programmes; inclusion of radiation protection and waste management as a topic for the TC Policy Review Seminar in 1994; two new interregional Model Projects in 1994 on upgrading radiation protection and radioactive waste management infrastructures and programmes in selected Member States. The review concluded that evaluation has become an integral part of the Agency's TC programme, providing senior management with the information required to respond to the changing needs of a dynamic programme.

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

### **1. Agency Programmes**

33. In 1993 the continued importance of safety related activities in the TC programme was reflected in the breakdown of disbursements. An amount of \$8,942,900, or 19.7% of total disbursements of \$45,298,000, was spent on activities in programmes in radioactive waste management, radiation protection and the safety of nuclear installations. Other major fields included agriculture, accounting for \$9,136,600, or 20.2% of the total, and physical and chemical sciences, representing disbursements of \$8,206,500 or 18.1% of the total.

34. While these three major fields play an important role throughout the programme, their relative importance in various regions reflects the degree to which the TC programme responds to the needs of individual regions. In Africa and Latin America, disbursements in the field of agriculture accounted for 31.9% and 23.6% respectively, while safety related activities represented 14.3% and 15.3%. Physical and chemical sciences accounted for 17.9% in Africa and 16.7% in Latin America.

35. On the other hand, disbursements for safety related activities in Europe accounted for 38.1% of total disbursements (\$2,479,000 out of \$6,501,600). Physical and chemical sciences still represented a significant 17.6% of regional disbursements, but disbursements for agricultural activities accounted for a mere 6.1% (\$393,900).

36. Comparing the 1993 programme shares with those of five years ago tells another part of the story. In 1989 safety related activities represented 16.5% of total disbursements while physical and chemical sciences accounted for 20.0% of disbursements, and agriculture ranked a close third with 19.9%. At that time activities in industry and earth sciences accounted for 17.2% of the

programme, and 10.6% of disbursements were related to nuclear power projects. In 1993, disbursements for nuclear power projects dropped to just over 6% of the programme, with human health (14.4%) and industry and earth sciences (14.5%) absorbing some of the programme share.

37. The table below shows 1993 disbursements by Agency programme and region. A graphic representation of this information can also be found in Figure 8.

PROGRAMME	Inter-regional	Africa	Latin America	Asia & Pacific	Europe	Middle East	TOTAL
A. Nuclear Power	475.2	131.7	273.5	1,026.1	878.9	13.5	2,798.9
B. Nuclear Fuel Cycle	164.9	369.5	161.0	662.0	89.4	8.0	1,454.8
C. Radioactive Waste Management	174.4	199.4	145.3	307.7	185.1	3.8	1,015.7
D. Food and Agriculture	520.8	3,421.0	2,348.2	2,292.2	393.9	160.5	9,136.6
E. Human Health	213.9	2,307.5	1,633.7	1,950.9	376.3	38.1	6,520.4
F. Industry and Earth Sciences	128.6	1,015.9	2,242.9	2,001.1	995.0	174.8	6,558.3
G. Physical and Chemical Sciences	451.3	1,919.4	1,667.5	2,442.5	1,144.9	580.9	8,206.5
H. Radiation Protection	246.6	1,259.2	1,058.6	841.8	827.1	211.5	4,444.8
I. Safety of Nuclear Installations	744.4	71.2	318.0	882.0	1,466.8	0.0	3,482.4
J. Safeguards	0.0	0.0	0.0	17.3	0.0	0.0	17.3
S. Direction and Support	1,041.8	38.6	110.8	301.2	78.4	25.7	1,596.5
X. Comparative Assessment	0.0	0.0	0.0	0.0	65.8	0.0	65.8
TOTAL	4,161.9	10,733.4	9,959.5	12,724.8	6,501.6	1,216.8	45,298.0

## 2. Technical Divisions

38. The technical support provided by the Technical Divisions is an essential part of the success of the TC programme. Without the continued support of Technical Officers in the Department of Research and Isotopes and the Department of Nuclear Energy, the level and quality of assistance provided to Member States would be drastically reduced. As 1993 was the first year of a new biennial programme, the number of operational projects stood at 1,373, an increase of some 25% over the 1992 figures. As shown in the table below, these projects were managed by 183 Technical Officers, representing an average of 7.5 projects per Technical Officer, although, of course, the work required for each project varies widely. Such variations can be easily seen in the table below, which indicates that twenty Technical Officers in the Division of Physical and Chemical Sciences handled the same number of projects as 92 Technical Officers in the Department of Nuclear Energy.

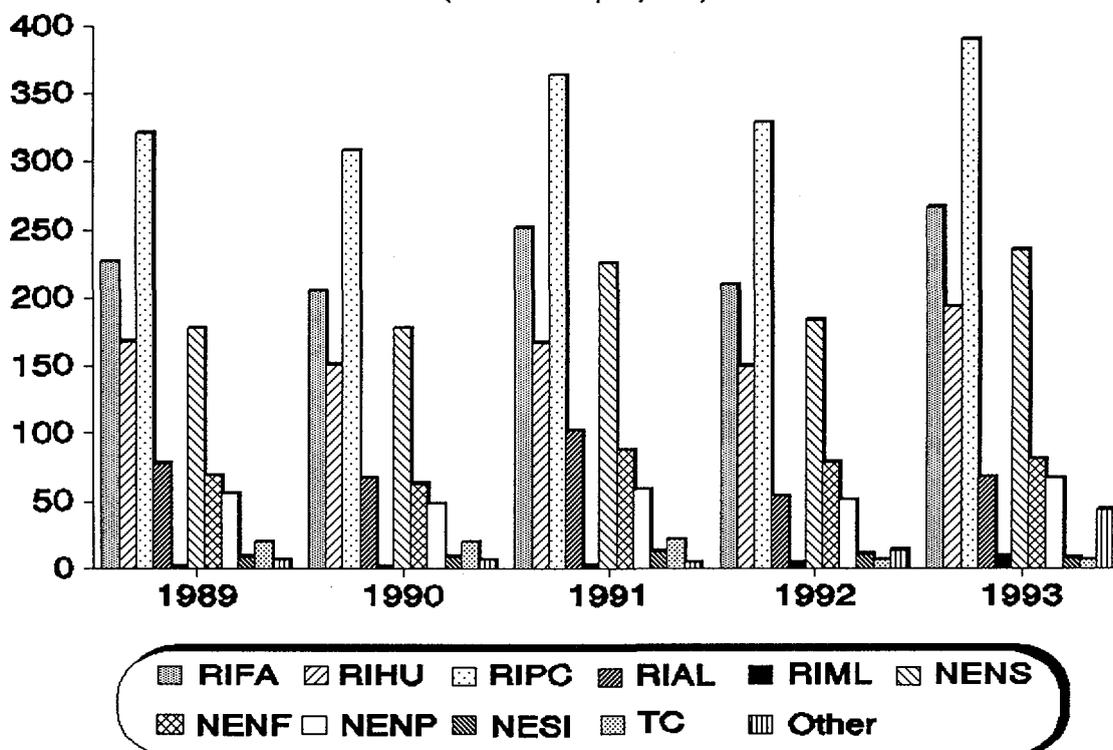
39. In addition to the increased workload caused by the new biennial programme, a significant increase was seen in the number of fellowship applications evaluated by staff throughout the house. A total of 1,447 applications were evaluated in 1993, an increase of nearly 70% over the 1992 total of 854.

40. Finally, Agency staff also serve as experts and lecturers for TC activities. In 1993, 649 such assignments were carried out for a total of just over 173 months. This represents an increase of approximately 20% over the same figures for 1992. A detailed analysis of the contribution of the Technical Divisions to the success of the TC programme is given in the table and graphs below.

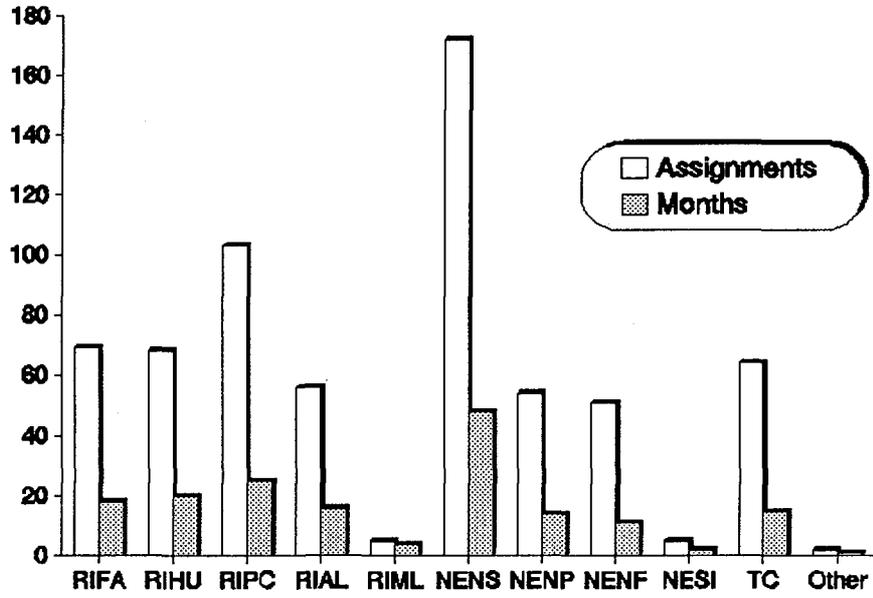
### TECHNICAL SUPPORT FOR TC PROGRAMME: 1993

Department/ Division	Number of Technical Officers	Number of projects supported	Number of fellowship applications evaluated	Number of expert/lecturer assignments	Number of months
<b>Research and Isotopes</b>					
RIFA	28	267	279	69	17/17
RIHU	15	194	199	68	20/14
RIPC	20	392	348	103	25/02
RIAL	13	68	123	56	15/19
RIML	8	9	14	5	3/22
Sub-total	84	930	963	301	82/14
<b>Nuclear Energy</b>					
NENS	48	236	224	172	48/02
NENP	16	67	102	54	14/02
NENF	23	81	108	51	11/08
NESI	5	8	26	5	1/18
Sub-total	92	392	460	282	75/00
TC	6	7	20	64	14/16
Other	1	44	4	2	1/03
<b>Total</b>	<b>183</b>	<b>1,373</b>	<b>1,447</b>	<b>649</b>	<b>173/03</b>

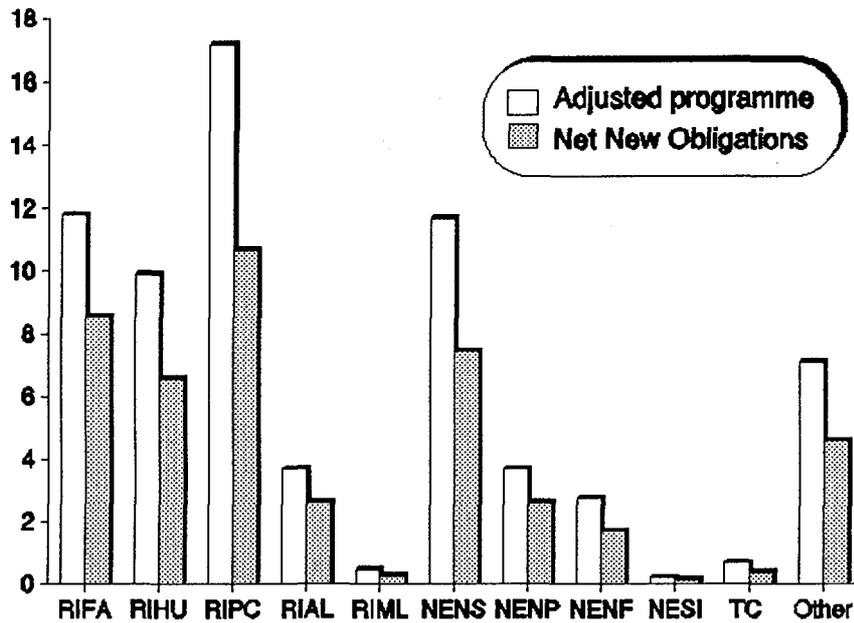
**PROJECT WORKLOAD BY DIVISION: 1989 - 1993**  
(number of projects)



**TECHNICAL SUPPORT FOR PROJECTS: 1993  
EXPERT AND LECTURER ASSIGNMENTS**



**IMPLEMENTATION BY DIVISION: 1993**  
(in millions of dollars)



## **C. Review by Area**

### **1. Africa**

41. When all sources of financing are taken into account, Africa's share in the total adjusted programme remains the largest (24.6%), amounting to about \$17 million. Overall, a high implementation rate (over 66%) has been achieved, in spite of the difficulties encountered in many projects owing to socioeconomic conditions. In most cases the major factors that hindered the timely delivery of technical assistance were identified as delays in building construction, particularly for projects pertaining to human health and radiation safety, and to inadequate manpower aggravated by frequent personnel turnover. In some countries, inadequate local support, in addition to understaffing, severely impeded the timely achievement of project objectives.

42. Special emphasis was placed on enhancing consultations with Member States and strengthening the Agency's programming in Least Developed Countries (LDCs). Review and programming missions were undertaken to five countries (Cameroon, Senegal, Sudan, Uganda and Zambia) of which four are LDCs, with a view to assessing the local infrastructure and identifying priority areas where Agency-supported projects could be integrated into national development efforts and provide an appropriate framework for future technical co-operation.

43. To strengthen local capabilities and to ensure sustainability of Agency-supported activities in the diverse fields of nuclear applications, manpower development continued to be emphasized. About 107 fellowships were awarded in 1993 within the framework of the regional project on manpower development, amounting to 449 months of training in addition to 155 individual fellowships for a total duration of 568 months. Regional and national training courses and workshops were held in the fields of nuclear medicine, radiotherapy dosimetry, radioimmunoassay (RIA) and radiopharmaceuticals, human nutrition, animal disease diagnosis and control, sterile insect technique, water resources assessment, mineral exploration and development, nuclear analytical techniques and nuclear instrumentation.

44. As in previous years, particular attention was given to the establishment of adequate radiation protection infrastructure. Assistance was provided to Cameroon, Madagascar and Sudan on radiation protection legislation and enforcement regulations. The Agency also organized a regional training course for radiation protection officers in Ghana, and assisted in organizing a national workshop for radiation protection officers in Libya and a national workshop on quality control in diagnostic radiology in Zambia. In total, 42 country projects in the field of radiation protection and nuclear safety were under implementation in the region. A RAPAT mission and a follow-up radiation protection mission were undertaken to Mauritius and Tanzania respectively. A WAMAP mission was fielded to Morocco.

45. Applications of radiation and radioisotopes in food and agriculture still represent the largest segment of the TC programme in Africa. In soil science, application of isotope techniques was focussed on two areas: (a) measuring nutrient uptake by crop plants in fertilizer management studies aimed at ensuring maximum yields with minimum nutrient losses to the environment, and (b) exploiting natural and cheap sources of nutrients (mainly biological nitrogen fixation and phosphate rocks) as alternatives to manufactured fertilizers. Efforts to improve nitrogen fixation in order to increase and sustain crop productivity and improve soil fertility continued at national levels and through regional collaboration.

46. Multi-year projects dealing with mutation breeding associated with biotechnological methods continued to be implemented in eight countries in order to obtain improved varieties of cereals and legumes. Further support was provided to transfer in-vitro micropropagation techniques for mutation breeding of vegetatively propagating crops.

47. As an important subsector of agriculture in Africa, livestock benefitted from substantial Agency assistance during 1993. The programme, consisting of 28 country projects and five regional projects, was mainly concerned with improving livestock production. Studies on (a) assessing the reproductive performance of indigenous breeds of cattle and sheep by means of RIA techniques, (b) identifying nutritional constraints to improve reproductive cyclicity and (c) improving health by establishing appropriate systems of animal diagnosis and control based on immuno-enzymatic methods, with particular reference to rinderpest and trypanosomiasis.

48. Several countries in the region have pest control projects at various stages of development. Of particular importance were the activities carried out in Tanzania on the application of the sterile insect technique to control the tsetse fly. Special efforts have been devoted to upgrade the local infrastructure and to prepare the work plan for future activities within the framework of a Model Project aiming at eradication of the tsetse fly from Zanzibar island.

49. TC activities pertaining to the application of isotope techniques in the water sector continued to be carried out in several countries. In Algeria, assistance was initiated to establish local capabilities to study sediment transport in port structures by means of tracer techniques. In Mali, further support was provided to study siltation of reservoirs. A project was initiated in Niger to study the multi-layer aquifer by hydrogeochemical and isotopic investigations. Similar activities were in progress in Senegal with a view to refining the existing information on groundwater and surface water in the western part of the country for management purposes. Assistance was also provided to Ethiopia to study geothermal fluids in the Rift Valley. In Mauritius, work was carried out on the introduction of isotopes and geochemical methods to assess the risk of pollution of groundwater resources. A regional planning seminar on water resources assessment was held in Morocco. This seminar led to a regional project on the practical use of isotope techniques in water resources development with the aim of applying isotope techniques in combination with other hydrological investigations to practical problems existing in the participating countries (Algeria, Egypt, Ethiopia, Libya, Mali, Morocco, Niger, Senegal and Sudan).

50. In the human health sector, support for activities related to nuclear medicine and radiotherapy continued in many countries. Assistance was provided to Egypt, Morocco and Tunisia to optimize the utilization of linear accelerators and to provide on-the-job training in dose treatment planning, quality assurance, dosimetry and preventive maintenance. Projects for upgrading existing radiotherapy facilities were implemented in Libya, Nigeria and Tanzania. Arrangements were made to establish teletherapy facilities in Ethiopia and Uganda. However, the project for developing intracavitary brachytherapy for the treatment of cervical cancer in Cameroon was hampered by lack of appropriate radiation protection. Support was provided to seven countries in the field of nuclear medicine to upgrade the infrastructure and to widen the scope of clinical investigations (Ethiopia, Ghana, Mali, Morocco) and to establish new facilities to introduce in-vivo investigation techniques (Kenya, Uganda and Tanzania).

51. The programme to develop local capabilities for production and quality control of RIA reagents for thyroid related hormones was operative in 15 laboratories in 11 African countries. The bulk reagent-based methodology has

been established and found fully acceptable in all the participants' laboratories. Standard RIA practice with due attention to quality control procedures is being promoted. As a result, clinical diagnostic services are being offered to patients at lower cost and therefore on a potentially wider scale.

52. The year under review saw an increase in AFRA membership to 17 with Ethiopia and Zambia acceding to the agreement. The programme consisted of 10 co-operative projects dealing with various nuclear applications in agriculture, human health, animal reproduction and nutrition, industry and environmental monitoring. As in previous years, training of scientists and technicians from the region has been the major component of the programme. Two regional training courses on food irradiation technology and production of primary reagents for the RIA of thyroid related hormones were hosted by Algeria and Morocco. Under the project on environmental radiation measurement and harmonization, a workshop was held in Cairo to review the results of the intercomparison exercise and to plan future activities with respect to selection, pretreatment and analysis of samples. Two workshops, one on the harmonization of national schemes for certification and qualification of non-destructive testing (NDT) personnel and the other on radioactive waste management techniques, took place in Nairobi. In addition, co-ordination meetings on waste management, irradiation processing, environmental monitoring and NDT were held in Arusha, Nairobi and Tunis.

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

53. Of the four geographical regions, Asia and the Pacific, with 23.7% of the total adjusted programme, accounted for the second largest share of the TC programme in 1993.

54. A total of 315 country projects and 41 regional projects were operational, including nine UNDP projects and 49 footnote-a/ projects. A new UNDP project, "Manpower Development for Safe Operation of Nuclear Power Plants", was launched in China. A total of 53 projects, including three UNDP projects were closed after achievement of their objectives.

55. Most of the operational country projects focussed on five areas: food and agriculture, human health, industry and earth sciences, physical and chemical sciences, and nuclear safety. Growing interest in nuclear power in the region has led to a significant programme increase in the areas of nuclear power, its fuel cycle, and safety of nuclear installations. Specifically, industrial applications involving the use of radiation and radioactive sources, including NDT, radiation processing, and tracer technology, continued to receive the greatest emphasis, followed by nuclear medicine, particle accelerators (including neutron generators) and research reactors, production of radiopharmaceuticals, and repair and maintenance of nuclear instruments. In the agriculture sector, 56 projects were operational, including two multi-disciplinary UNDP projects. These were more or less equally distributed among six specialized areas, but with stronger emphasis on soil fertility, irrigation, crop production, and animal production and health.

56. In view of plans for the introduction of additional nuclear power plants in the region, safe operation and safety of nuclear power plants were important areas of Agency assistance. Ten projects on the safe operation of nuclear power plants, including emergency planning and preparedness, were ongoing in China, the Republic of Korea, and Pakistan. Site evaluation missions were carried out in Indonesia, Pakistan and Thailand --- the latter for a research reactor. Assistance was also provided on severe accident management and

probabilistic safety analysis (PSA) of proposed and operational plants. A three-week OSART mission was conducted to review the startup preparations of the Guangdong nuclear power plant and to provide objective assessment of the status of essential items for its safe operation. A comprehensive design review mission was fielded to Pakistan and China to review design aspects of the nuclear power plant being constructed by the Chinese at Chasma, in Pakistan.

57. Activities relating to research reactors and their operation increased in intensity. Major projects on repair/upgrading of research reactors and/or their instrumentation were operational in Indonesia, Malaysia, Philippines and Viet Nam. A large multi-disciplinary project on establishing a new Nuclear Research Centre, including a research reactor for radioisotope production, and waste management facilities, was operational in Thailand.

58. Nine projects on various aspects of uranium exploration, ore processing and purification were operational in various Member States.

59. In July 1993, the President of the Philippines ordered a comprehensive feasibility plan for nuclear power in the country. A mission was fielded to assist in a comparative economic analysis of nuclear power plants in the national power development programme. Two other expert missions advised on the legal framework and assisted in the creation of a regulatory body to oversee licensing and operation of nuclear power plants. A third mission assisted in the preparation of a document on emergency planning and preparedness, and advised on spent fuel repository and disposal.

60. A RAPAT mission was fielded to Myanmar in November 1993. Assistance had previously been provided, under a project operational since 1991, in establishing some very basic infrastructure. Two missions, one on strategy for radiation protection, and the other on regulatory aspects, had already been carried out with the aim of enabling the country to make some progress in establishing a proper infrastructure prior to the RAPAT mission. Following continued efforts by the Bangladesh Atomic Energy Commission, supported by the Agency, the Nuclear Safety and Radiation Control Bill was passed by the Bangladesh Parliament in July 1993. A Nuclear Safety and Radiation Control Directorate was established to enforce the act. Following the WAMAP mission to Viet Nam in 1992 which had identified a serious waste management problem, a subsequent mission was fielded to assist the national authorities in rectifying the situation. An expert mission assessed the medical and radiological implications of an over-exposure accident at an institute in Hanoi. The injured person received medical treatment in France. A workshop on radiation protection in X-ray examination was organized in Ulan Bator, and a national training course on licensing and inspections was organized in Hanoi. Eleven projects on radiation protection and seven on waste management, including the establishment of a decontamination facility in Indonesia, were operational in the Member States of the region.

61. Following the introduction of the Model Project concept, the Project Officers, during their duty travel, made special efforts to explain this new approach in technical co-operation. The concept was also discussed with UNDP Resident Co-ordinators to solicit their support in identifying suitable projects. Efforts continued to effectively interface the Agency's TC programmes with those of other UN Agencies in general and UNDP in particular. The Resident Co-ordinators were requested to send documentation on national development plans, as well as any recent sectoral reviews in areas of interest to the IAEA which may have been conducted by the UNDP or other UN Agencies. These documents will form part of country files and be used wherever possible to establish Agency-assisted TC activities consistent with national development plans. Country programme review missions were fielded to two LDCs: Bangladesh and Myanmar, during which past and present TC activities were reviewed in depth and medium term priorities established.

62. A new UNDP project for China on manpower development for safe operation of nuclear power plants was launched. The project was formulated by a mission which carried out an in-depth evaluation of two terminating UNDP projects. Two other Agency projects, both relating to silt movement, one in Myanmar and the other in Viet Nam, were carried out in conjunction with large UNDP projects executed by other UN Agencies. Efforts were initiated to solicit assistance from UNDP Capacity 21 funds to support a project on radioactive waste management in China.

63. UNDP sectoral support missions were fielded to Mongolia (animal production and health), Myanmar (radiation protection and country programme review) and Viet Nam (radiation technology) to assist in formulating national programmes.

64. At the request of the national authorities in Viet Nam, a national workshop on TC project design, management and evaluation was organized in Hanoi, the fourth such workshop in the region during the last four years. In view of the new TC policy directions, the workshop included coverage of Model Projects. The workshop once again served as a forum for free and frank discussions on TC practices and procedures, and provided an explanation of the Agency's TC policy. It also strengthened the communication channels between project counterparts and the Agency. These workshops are expected to improve programme quality and stimulate the introduction of the Model Project concept into the entire TC programme during the coming years. Continuous efforts by the Project Officers, combined with the Secretariat's request to all Member States to limit the number of project requests for 1995-96 to ten, resulted in a reduction in the number received: 144, compared with 184 for 1993-94. Since Mongolia and Myanmar joined RCA in 1993, all but one country in the region are participants in this Regional Co-operative Agreement which should lead to much stronger TCDC in the Asia and Pacific region in the years to come.

65. The RCA programme again showed a high level of extrabudgetary support, with the agreement of UNDP in April 1993 to provide almost \$3 million for the period 1993 to 1996 to support the joint UNDP/RCA/IAEA project proposal on the use of isotopes and radiation to strengthen technology and support environmentally sustainable development. Co-financing is expected to bring the total cash budget of this joint project to \$6.48 million, with \$1.6 million from Japan, \$1 million from Australia, \$50,000 from Malaysia and \$840,000 from the Agency.

66. Four National Co-ordinator Meetings were held to prepare detailed amplification of the project activities, covering the five areas of technology concerned. During the year this project carried out four regional training events as well as national training events and expert assignments.

67. Fifteen RCA TC projects were listed in the 1993-94 Action Plan, four of which had associated co-ordinated research programmes (CRPs). Two additional CRPs were not associated with a TC project. Two projects, one on energy and nuclear power planning and the other on research reactor utilization, finished their first phase in 1993, and project formulation meetings (PFMs) were held to evaluate progress and assess the requirements for extension. It was proposed that both enter a second five-year phase. Most Member States sent representatives to the PFMs and the decisions on content and design of the future programmes were made on a collective consensus basis.

68. There was strong extrabudgetary support from Australia and Japan for the RCA programme with additional cash inputs from Malaysia and the Philippines. In addition, India funded two regional training events, China funded two and

the Republic of Korea funded one. A total of 23 regional Asia and RCA training events were held during the year.

### 3. Latin America

69. Structural adjustment of the public sector as well as the economic situation in most Latin American countries continue to impede the timely implementation of TC projects since they cause a rapid turnover of counterparts and limit local operational support.

70. Major institutional measures favouring the development of nuclear activities have been taken in two countries of the region. In Nicaragua, the National Atomic Energy Commission has been created to co-ordinate and regulate the use of radioactive materials and radiation. In the Dominican Republic, the newly created National Council for Radiation Protection has produced a considerable improvement in radiation protection.

71. Technical co-operation in Haiti continued to be frozen in view of the political situation there and the United Nations embargo.

72. A gradual reorientation towards more applied activities has been observed in the atomic energy organizations of many Latin American countries, together with a greater involvement of the end users in TC projects. In some countries with limited applications of nuclear technology, like Costa Rica and the Dominican Republic, a concentration of efforts on promotion and co-ordination activities by the local nuclear energy bodies has been successful in awakening the interest of new potential users.

73. Agency support in nuclear medicine and radiotherapy continued in 1993. A refurbished gamma-camera was provided to the Santa Barbara Hospital in Sucre, as a contribution to a national programme for strengthening nuclear medicine in Bolivia. A state of the art Co-60 teletherapy unit has been ordered for the Oncological Centre of the Bertha Calderon Hospital in Managua, using funds in trust from Nicaragua as well as Agency funds. To increase local production of radiopharmaceuticals and improve their quality, support to radiopharmacy has continued through projects in several countries. To improve the standard practice of nuclear medicine, radiodiagnosis and radiotherapy in the region, training and expert services have been provided in the field of medical physics in many countries and, through an extrabudgetary contribution from the USA, the foundation has been laid for a medical physics education curriculum in Mexico. A project to introduce the use of DNA probes in the diagnosis of leishmaniasis was successfully concluded at the Centre for Research and Diagnostics of Tropical Diseases in Panama City. The Centre is now used by WHO as a reference laboratory and provides training for personnel from neighbouring countries, where many people suffer from the disease.

74. In those countries of the region with a nuclear power programme, TC activities concentrated on the transfer of relevant technology. Assistance included PSA applied to nuclear power plant operation, emergency planning, production of nuclear fuels, and the behaviour and integrity of large power plant components.

75. In the field of agriculture and animal husbandry several projects continued to be operational in many Latin American countries.

76. A project, initiated in 1993 to support Argentina's national programme, led to the approval of a Model Project at the end of the year that will contribute

to the eradication of the medfly in large areas of the country by using the sterile insect technique in association with other methods. Continuing the transfer of technology for the diagnosis of animal diseases, ten new projects were initiated in 1993 to complete a network of immunoassay laboratories for diagnosis and the control/eradication of animal diseases in 19 countries of the region. Co-ordination and co-operation with international organizations such as OIE (Office International des Epizooties), PAHO (Pan American Health Organization), IICA (Inter-American Institute for Co-operation on Agriculture), and OIRSA (Regional International Organization for Plant Protection and Animal Health) have been established to improve and increase the use of immunoassay in national and international animal health programmes in the region. The validation of the FAO/IAEA kits for diagnosis of foot-and-mouth disease, brucellosis, leukosis and babesiosis was initiated to standardize immunoassay techniques as a support to the official control/eradication programmes in Latin American countries.

77. In the field of environmental studies a project on safe disposal of radioactive wastes in Brazil was prepared for submission to the UNDP under the Capacity 21 programme. This project would improve the existing radioactive waste disposal system by integrating the activities of all the institutions involved.

78. Nuclear analytical and instrumentation techniques used in environmental studies have been supported by TC projects in several countries.

79. Efforts to improve radiation protection in the region have been enhanced by supporting radiation protection activities in many countries, mainly through expert services and fellowship training. In addition, assistance has been provided in drafting legislation and enforcement regulations for countries without a legal framework to regulate the use of radiation.

80. Considerable effort has been made by the counterparts in the ARCAL Programme to support regional activities. During the tenth technical co-ordination meeting of ARCAL, national co-ordinators identified areas where regional activities are of mutual interest and drew up a strategy for activities that should be carried out under the regional co-operative effort.

81. Two ARCAL projects were completed in 1993. A project on radiation protection contributed to strengthening national infrastructures and to harmonizing radiation approaches and procedures in the region. This project stimulated further co-operation on radiation safety, demonstrating that objectives had been achieved. A second project, dealing with the application of isotope techniques in hydrology, transferred the technology required to define the characteristics of various types of groundwater and has improved the management of a scarce resource. It is expected that the participating institutions will be able to carry out further studies, continuing co-operation among the Latin American countries on the basis established by this project.

82. A regional project, funded by the USA and the Agency, was initiated to strengthen national infrastructures for radiological safety in Central America and the Caribbean countries, mainly in the area of medical applications of ionizing radiation. This project is supported by the Pan American Health Organization (PAHO), which assists countries in the same region that are not members of the Agency and thus contributes to the improvement of radiation protection activities in ten Central American and Caribbean countries.

83. A regional project designed to introduce the concept of quality control and assurance as an integral part of industrial production and construction activities using NDT methods continued in 1993 with the participation of 18 countries of the region. Important progress in the development of NDT and

quality assurance programmes and their applications to industrial activities was made in the participating countries.

84. Regional co-operation in nuclear power management resulted in the successful launch of an effective exchange of information and co-operation among the management of nuclear power plants in the region. The establishment of direct interaction at plant superintendent and upper management levels was one of the most important objectives achieved.

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

85. The main developments during the 1992-93 period for the Middle East and Europe region were affected by events in the former Soviet Union, former Yugoslavia, and Iraq. TC projects were being dealt with from Armenia to Afghanistan in Central Asia, and from Yemen, near the Horn of Africa, to Estonia on the Baltic Sea. By the end of the year, 34 Member States in the region were in one way or another involved in the Agency's TC programme. For greater efficiency, and in order to be able to respond better to the needs of Member States, the region could be divided into two groups; one composed of countries in the Middle East and Central Asia, and the other of countries in Eastern Europe and the European part of the former Soviet Union.

86. During 1993, the two sub-groups continued to focus on different priorities and interests in the peaceful applications of atomic energy. In the Middle Eastern countries emphasis was placed on applications of atomic and isotope techniques in such diverse fields as medicine, hydrology, agriculture and industry. Radioisotopes and radiation techniques were applied to improve crop production, to determine and manage groundwater resources, for the sterilization of medical products, RIA, NDT techniques, quality control of industrial products, and to study environmental pollution. Activities in the installation of early warning environmental monitoring systems (EWERMS) continued in the participating Member States. In the Eastern European sub-region, marked emphasis was placed on nuclear safety, regulatory aspects, radioactive waste and spent fuel management, and reactor maintenance, including in-service inspection and quality assurance. Particular attention was paid to on-going nuclear power programmes in Bulgaria, Croatia, the Czech Republic, Hungary, Romania, the Slovak Republic, Slovenia and Ukraine.

87. The improvement of the operational safety of nuclear reactors in Eastern European Member States continued to have high priority. Nuclear safety review missions under the Agency's OSART and ASSET programmes and other related activities continued to be supported during 1993 under various TC projects, with a total of seven ASSET seminars and review missions, three of which were conducted at Ukrainian nuclear power plants, and two pre-OSART missions to the sub-region.

88. The optimization of maintenance and in-service inspection (ISI) of nuclear power plants was one of the most important tasks in Eastern Europe. Efforts by Member States operating WWER-type reactors continued to receive support. Under the regional programme on ISI design, a training course was held in Kozloduy, Bulgaria, on WWER-440 ISI of reactor pressure vessels. A second training course on ISI was hosted by the Paks nuclear power plant in Hungary. As a result, several countries have now developed relatively adequate national infrastructures and systems for proper maintenance and ISI. In addition, a Model Project for Hungary was approved by the Board at the end of the year with the objective of further improving operational safety and the general safety culture at Paks. It is expected that successful completion of this project will set an achievable safety standard for all WWER-type power plants in Eastern Europe.

89. Increased emphasis was given to the development of adequate nuclear regulatory and licensing infrastructures. Bulgarian authorities continued to receive assistance for the elaboration of nuclear safety and radiation protection standards, including evaluation of the licensing procedures for nuclear power plant operators and upgrading of a mobile dosimetry laboratory. An expert mission visited Romania to review the nuclear safety activities of the Romanian regulatory body, the National Commission on Nuclear Activities Control (CNCAN), and attention was paid to improvements related to the Cernavoda nuclear power plant. Similarly, a Model Project was prepared for the Slovak Republic to strengthen nuclear safety and regulatory capabilities and enable it to fulfil most of its established nuclear regulatory tasks to the level of good international practice.

90. The need for Eastern European Member States operating WWER-type reactors to define adequate spent fuel storage programmes continued to be a matter of urgency. Close attention continued to be paid to radioactive waste management and spent fuel storage in Ukraine. Bulgaria received continuing assistance to put into operation a radioactive waste treatment system. Hungary requested additional services connected with the technical evaluation of nuclear power plant spent fuel storage facility. Poland received further assistance for the safety assessment of the Rozan radioactive waste depository and the construction of a radioactive waste treatment facility.

91. Work continued under regional TC projects related to safety assessment of the WWER-type reactors. Safety re-assessment was carried out and three TECDOCs were prepared, mainly concerning the Bohunice reference plant. Work is in progress on five further TECDOCs. On the basis of experience with regional co-operation on WWER-440, a new regional TC project was launched in 1993 for safety assessment of WWER-1000/320 reactors, in response to a request from Bulgaria, the Czech Republic and Ukraine. Another product of regional co-operation is the MELSIM trainer/simulator which has been installed at Bohunice nuclear power plant. It is to be used as a tool for severe accident simulation to evaluate accident management strategies, to assess complex interfaces between emergency operating procedures, and to provide accident management guidelines. Promising experience with the simulator has aroused the interest of other countries of the region. A programme of activities on PSA of WWER-type reactors was carried out, with the active participation of Bulgaria, the Czech Republic, the Slovak Republic, Hungary, Russia and Ukraine. In 1993 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 the Slovak Republic and Ukraine. A reference technical report on generic initiating events (IE) for WWER reactors was finalized for publication. A database was developed using plant specific data input from eight WWER sites in all participating countries. Five TECDOCs were also prepared relating to these activities.

92. Another regional project for WWER-type nuclear power plants on radioactive waste management made good progress in 1993, and a TECDOC on radioactive waste management at WWER-type reactors was published. On the basis of its recommendations, two groups of tasks have been formulated which addressed: (a) evaluation of existing policies, strategies, legislation, organization and the structure of regulatory bodies in respect of radioactive waste management, and (b) comparative evaluation of the radioactive waste management systems of WWER-type NPPs.

93. In 1993 a regional TC project on the application of low energy particle accelerators was launched involving more than 20 countries.

94. Many institutions in the Middle East continued their programmes on the peaceful applications of nuclear techniques in such diverse fields as monitoring food and environment, medicine, hydrology, agriculture and industry. Radioisotopes and radiation techniques are being used to improve crops, determine groundwater resources, sterilize medical supplies, analyse hormones, check for weak spots in pipelines, control the quality of industrial products, and monitor environmental pollution and radiation levels. Early warning environmental radiation monitoring systems have also been expanded, to deal with a local or international radiation accident. Regional collaboration 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 the regional projects, while Lebanon was the latest country to join the on-going programmes in 1993. Indeed, two national Reserve Fund projects in the areas of radiation protection and isotope hydrology were approved for Lebanon in 1993, following visits by the Director General and other Agency officials. Afghanistan could not take part in the regional activities owing to the political situation in the country. Qatar is still in the process of building up its infrastructure and manpower to enable it to participate fully in regional activities. Yemen is set to join in the regional activities soon; the Director General and other Agency officials visited the country to discuss technical co-operation.

95. Under the regional project on nitrogen fixation and water balance studies, a co-ordination meeting and a training workshop were organized in Amman. Participants from Cyprus, Jordan, Saudi Arabia, Syria, 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 has promoted regional collaboration in agricultural practices towards increased food production, and also strengthened existing national projects in fertigation and biological nitrogen fixation in grains and legumes.

96. Efforts to strengthen capabilities in the Middle East for monitoring food and environmental contamination by natural and man-made radionuclides are already well in place. The establishment of food and environmental contamination laboratories was and is an element in a large number of national TC projects, as well as in the regional project on environmental monitoring in the Middle East. These projects have also considerable relevance to other inorganic and organic pollutants whose monitoring generally follows similar strategies and which require similar services from the analytical chemistry laboratories. A co-ordination meeting on quality assurance and harmonization of analytical measurements in the Middle East was organized in 1993; the preconditions, requirements and modes of implementation of a regional quality assurance and harmonization effort for analytical measurement of food and environmental contamination were discussed and agreed upon at the meeting.

97. Under the project on environmental radiation monitoring in the Middle East, which began in 1987, the project on early warning environmental radiation monitoring systems (EWERMS) continued to be a focal point in environmental monitoring. The EWERMS stations have been established in most countries in the region to alert the population to higher than normal levels of radiation, such as in the event of a nuclear accident. A second working group meeting on the development of EWERMS in the Middle East was organized in Tehran for counterparts from the region. The operational status of the network in the Member States was reviewed and recommendations were made to improve both hardware and software related problems on the EWERMS, and to finalize a TECDOC on the project.

98. The main objective of the TC project on radiopharmaceuticals in the Middle East, which began in 1988, is to provide experts to lecture at regional workshops, where participants receive training geared to improving the quality control of radiopharmaceuticals. Six workshops have thus far been organized; the latest one being a regional workshop on synthesis, kit preparation and quality control of new functional  $^{99m}\text{Tc}$  radiopharmaceuticals for single photon computerized emission tomography (SPECT) imaging, held in Istanbul.

99. Through the regional project on isotope hydrology in the Middle East, the Agency has been promoting environmental isotope studies to estimate the recharge rates of aquifers from rain and surface waters, the age of groundwater, and the interconnections between surface and groundwater. Such studies have made enormous contributions to hydrological knowledge in the arid and semi-arid countries of the region. Several expert missions were fielded to the participating countries to advise on sampling, sample preparation and analytical and data interpretation techniques. Emphasis has so far been on improving the capabilities of the counterparts for undertaking isotopic analysis of water and interpreting the experimental data. A regional workshop on isotope hydrology in the Middle East was held in Damascus for counterparts from participating Member States. Five regional workshops were organized at which results of on-going well-water sampling programmes in the participating countries were discussed and linked to the general hydrogeological problems in the region. 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.

100. A regional project for strengthening radiation protection in the Middle East has been in operation since 1989. Practical aspects of radiation protection with regard to regulatory guides and specific codes of practice for the safe use of radioactive and ionizing sources in nuclear medicine, radiotherapy and industry, have been emphasized. Eight training events, including five workshops, were organized, the last one being a workshop on radiation protection and quality assurance in diagnostic radiology, held in Nicosia.

101. Another regional project aims at the promotion and utilization of radiation technology in industrial establishments in the region. Workshops were organized on the use of ionizing beams in medicine, materials research, environmental and related studies. The Agency provided assistance to some countries in the region towards the construction of and/or preparation for the construction of a cyclotron and in the development of industrial sterilization facilities.

102. In support of environmental protection activities in Member States, the Agency continued to assist Poland with the development of electron beam technology towards a cost effective and efficient method of pollution control by the removal of toxic pollutant gases such as  $\text{SO}_2$  and  $\text{NO}_x$  from industrial flue gases. In 1993 the Department of Technical Co-operation organized a meeting in Vienna in which Agency experts were joined by experts from Austria, Japan and the USA, as well as by Polish counterparts, to review a feasibility study prepared for a more ambitious industrial scale demonstration plant. As a result of this meeting, and of the success of the Agency-assisted project which developed the Kaweczyn test facility, the Board approved a Model Project to assist the Polish authorities to construct the first industrial scale plant at the Pomorzany electric power station in Szczecin. In terms of financial resources, this will be the largest project to be implemented by the Department of Technical Co-operation. The broad application of the technology in many countries is expected to lead to a significant reduction of  $\text{SO}_2$  and  $\text{NO}_x$  emissions and therefore reduce the environmental damage caused by these gases, which are associated with the formation of acid rain and ozone depletion.

<sup>103.</sup> During 1993, the regular regional training course programme for the Middle East and Europe addressed the priority interests of its Member States. Most of the courses were related to radiation and nuclear safety. A workshop was held under the project on environmental restoration to assist Member States in Central and Eastern Europe, including newly independent states of the former Soviet Union, to assess the extent of damage from the large number of nuclear facilities and sites that were left in a condition inadequate to protect the population and environment. A workshop attended by nationals from countries in the region, as well as by experts from Western Europe, the USA and Canada, was organized in Budapest for identification and characterization of radioactively contaminated sites. In Ukraine, the Agency provided experts in radioecology and environmental radioactivity monitoring to provide lectures and share their experience post-Chernobyl, within a programme of several conferences organized by the Faculty of Radiometry and Radioecology of Kiev University. The conference addressed the main issues concerning Ukraine's national programme for assessment and mitigation of the consequences of the Chernobyl accident and the resulting contamination of the environment by radionuclides.

<sup>104.</sup> During 1993 several new countries joined the Agency and became interested in the Agency's TC programme. A Reserve Fund TC project on nuclear safety was approved for Armenia, following a fact finding mission which identified high priority issues. The project will advise the local authorities on licensing and regulatory aspects of the re-start of the Medzamoor nuclear power plant, with emphasis on seismic safety.

## **5. Interregional**

<sup>105.</sup> In addition to TC projects carried out at national and regional levels, significant assistance was provided to Member States in 1993 through interregional activities. These included nine multi-year advisory and promotional projects and 18 interregional training courses covering a range of nuclear technologies of common interest to a large number of developing countries throughout the world.

<sup>106.</sup> Under multi-year interregional projects, assistance continued to be provided to Member States in planning their technical co-operation with the Agency. Nine countries were visited in 1993 (as against only one in 1992) by country programme review missions which resulted in recommendations assisting national authorities in harmonizing such co-operation with national development programmes. Five pre-project missions went to Member States to assist in identifying appropriate nuclear activities and in designing TC projects in a way which would ensure effective implementation.

<sup>107.</sup> Substantial interregional TC activities were carried out during the year in the fields of radiation protection and waste management. Six countries were visited by RAPAT missions and three by WAMAP missions which assessed national infrastructures and practices leading to recommendations for measures which will strengthen national efforts in these fields.

<sup>108.</sup> A variety of advisory and promotional services were provided through interregional projects dealing with the application of nuclear techniques in agriculture and industry.

<sup>109.</sup> Nearly 40% of the interregional training courses in 1993 were devoted to nuclear safety, followed by courses on the application of nuclear techniques in agriculture (17%). General atomic energy development, nuclear engineering and technology, and the application of nuclear techniques in industry and hydrology each accounted for 11% of this training activity.

110. A total of 1,543 applications were received for participation in interregional training courses, 434 of which were approved, including 163 participants (37%) from Middle East and Europe, 126 (29%) from Asia and the Pacific, 86 (20%) from Latin America and 59 (14%) from Africa.

## D. Review by Component

### 1. Experts

111. The delivery of expert services attained a new level in 1993. The implementation rate for this component reached 60.8%, the highest ever, and new obligations increased by \$2.4 million over 1992. As can be seen in the tables below, the number of persons, assignments and months worked were all significantly higher than the corresponding numbers in 1992. The large total of 2,978 assignments, nearly 32% more than in 1992, should be particularly noted. For each of them, numerous administrative steps must be taken and such a steep increase in workload could not have been accomplished without the exceptional dedication of the staff. Productivity was also increased through the computerized LAN-based Expert Post Control System.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings
	\$ millions	\$ millions	%	\$ millions
1989	16.1	7.8	48.2	8.3
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

Year	Number of persons	Number of assignments	Number of months	Months per assignment
1989	1337	2144	1246	0.58
1990	1414	2221	1217	0.55
1991	1463	2306	1160	0.50
1992	1460	2258	1009	0.45
1993	1861	2978	1172	0.39
Increase over five years(%)	39.2	38.9	(6.0)	

112. The high rate of delivery was also due to a 47% increase in recruitment requests from Project Officers over 1992. As can be seen in Table 3A, in addition to international experts (1,842 assignments) two other categories of expertise accounted for nearly all other assignments: national experts (615) and lecturers (509). The number of national experts has increased considerably in recent years. There were 84 in 1989; 125 in 1990; 423 in 1991; and 501 in 1992. This development shows that national experts are playing an increasingly important role in technology transfer.

113. The expert roster was completed in 1993, and a keyword list was finalized and used to classify all experts in it. The roster comprised 4,826 entries of which 280 (6%) were women. The following table shows the composition of the roster by major field and gender.

### Expert roster

Main field code	Main field name	Total	Men	Women
0	General atomic energy development	248	232	16
1	Nuclear physics	414	398	16
2	Nuclear chemistry	275	249	26
3	Prospecting, mining and processing of nuclear materials	165	160	5
4	Nuclear engineering and technology	895	877	18
5	Application of isotopes and radiation in agriculture	890	821	69
6	Application of isotopes and radiation in medicine	396	344	52
7	Application of radiation and isotopes in biology	82	76	6
8	Application of radiation and isotopes in industry and hydrology	365	353	12
9	Safety in nuclear energy	1096	1036	60
Total		4826	4546	280

114. The Expert Section encourages submission of personal history forms from prospective experts for inclusion in the roster. They are particularly interested in receiving applications from experts from developing countries and from women.

## 2. Equipment

115. Equipment, which is the largest single component of the programme, increased its share marginally in 1993 to 39.8%. As shown in the table below, the implementation rate increased to 69.3%, which is the highest rate ever recorded for this component. New obligations reached over \$19 million, an increase of 35.9% over the \$14 million figure for 1992. The high rate of implementation was the more remarkable as normal activities in several countries were interrupted owing to unstable political situations.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings	Disbursements	Number of purchase orders <sup>a)</sup>
	\$ millions	\$ millions	%	\$ millions	\$ millions	
1989	30.5	17.6	57.7	12.9	18.7	3,894
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

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

116. Equipment disbursements broken down by area can be found in Figure 5. There was little change in purchases compared with 1992. There was a small percentage increase in equipment purchased from Latin America and Asia (1% each) with a corresponding decrease in equipment from Europe (2%). On the recipient side, significant changes can be observed. Africa, which received slightly more than 25% of the total equipment delivered in 1992, increased its share to 30% in 1993. Asia also increased its share by over 3% to some 25%. However, Europe and Latin America each decreased their share by some 4%. Equipment disbursements by country of origin can be found in Table 3C and the listing by recipient country in Table 7.

117. The Field Procurement Section continued to update and expand its computerized database of vendors and potential suppliers. With the help of this system, it is intended to increase the number of suppliers from developing countries as well as from those based in under-utilized major donor countries. The number of entries in the supplier file increased from 3,620 in 1990 to 5,125 in 1993. Firms which are not yet registered with the IAEA are invited to provide a list of their products in the Agency's field of competence.

### 3. Fellowships

118. The number of fellowships and visiting scientists reached a total of 1,054, an increase of over 10% from 1992. The overall implementation rate for this component also increased, reaching 55.5% in 1993, and total obligations increased to over \$7 million. The average cost for a fellowship month has risen only marginally since 1989, from \$2,307 per month to \$2,542 in 1993, and for visiting scientists from \$7,202 in 1989 to \$7,965 in 1993. This was significantly lower than inflation rates during the last five years, and can be attributed to negotiations for either lower training fees or none at all, to the emergence of new host countries, especially among developing countries, and to savings due to group fellowships.

119. The average duration of a fellowship is decreasing from year to year. Whereas the average fellowship lasted 4.00 months in 1990, it declined to 3.75 months in 1992 and reached 3.26 months in 1993. As can be expected, the average duration of a visiting scientist's stay has stabilized at 0.6 months, or about 18 days, over the last four years.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings	Number of fellows	Number of fellowship months	Number of visiting scientists	Number of visiting scientists months
	\$ millions	\$ millions	%	\$ millions				
1989	9.6	6.0	62.4	3.6	732	2,713	192	129
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
Increase over five years (%)					13	(1)	18	5

120. A further improvement was made in the "in-house" review time, which is now down to 2 or 3 months. However, owing to the sometimes considerable delays in receiving confirmation from host countries, the overall placement time remains at 8 to 10 months after receipt of the nominations. Meetings were held in 1993 with key host countries (France, Germany, Hungary, India, Japan, Russia and USA) in an attempt to reduce this time.

121. In an effort to improve the quality and efficiency of the training programme, representatives from more than 65 nominating countries were briefed, and country liaison officers from 12 countries were trained in the operation of the IAEA fellowship system.

122. As in previous years, the most important factors affecting the implementation of fellowships are the number and the timeliness of applications received. While the number of fellowship applications increased to 1,400 in 1993, due in part to efforts by Technical Officers and Area Officers, the total was still short of the numbers needed to fully implement the 1993 programme.

#### 4. Training Courses

123. In 1993, the Training Courses Section organized 100 interregional and regional training courses as well as 72 national courses. The total of 172 was well above the number of courses handled in recent years, i.e. 128 in 1992 and 149 in 1991. There was also an increase in the implementation rate to 80.4% and an increase in participants in regional and interregional courses from 1,199 in 1992 to 1,450 in 1993 (more than 20%).

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings	Number of courses	Number of participants	Number of months
	\$ millions	\$ millions	%	\$ millions			
1989	8.3	5.0	60.2	3.3	106	1,265	1,090
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

124. Most of the regional courses continued to be implemented within the framework of the various regional agreements: 13 under RCA (Asia and the Pacific), 19 under ARCAL (Latin America) and 11 under the AFRA programme (Africa).

## 5. Sub-contracts and Miscellaneous

125. A small portion of the TC programme is allocated to sub-contract and miscellaneous components. In 1993, the sub-contract component remained constant with an adjusted programme of \$1.2 million. However, implementation improved significantly from 1992. New obligations amounted to \$800,000, increasing from \$500,000 in 1992. This represented an implementation rate of 70% in 1993 as compared with only 39% in 1992. Sub-contracts are a means of providing project assistance which does not fall precisely into any of the major components (expert services, equipment, fellowships or training courses). In 1993, for example, several contracts were issued to firms or individuals for the preparation of training course materials and implementation of the courses.

126. In 1993 just under \$635,000 was necessary to cover miscellaneous expenses which were not directly attributable to individual projects. Such expenses include costs of radiation protection services (42% of total disbursements), insurance premiums (35%) 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 4%. In a 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

<b>New resources</b>	<b>\$43.8 million (82.9% of total)</b>
<b>Adjusted programme</b>	<b>\$56.3 million (81.1% of total)</b>
<b>New obligations</b>	<b>\$38.5 million (84.3% of total)</b>
<b>Implementation rate</b>	<b>68.5%</b>
<b>Disbursements</b>	<b>\$36.7 million (81.1% of total)</b>

127. The Technical Assistance and Co-operation Fund (TACF) resources rose significantly in 1993, reaching \$43.8 million (see Table 1). This increase, over 31% more than for the previous year, stands in marked contrast to the situation in 1992, when a decline of 14% was registered. This increase was due to several factors, mainly substantially higher pledges and fewer losses on currency exchange. The individual factors are analysed below.

128. The pledges in convertible currency (CC) rose to \$41.8 million, an increase of 14.4%, so that the percentage of CC pledges against that portion of the target reached 86.4%, the highest percentage in several years. The decision

of Canada to pledge and pay a much larger amount (\$3,081,261) than its target (\$1,714,950) contributed significantly to this positive result. The pledges in non-convertible currency (NCC) stabilized, and only a slight decline was registered since 1992. Details of the pledging of both currency components are shown below.

**CC and NCC pledging comparison**  
(in thousands of dollars)

Pro-gramme year	CC target	CC pledges	% of CC target	NCC target	NCC pledges	% of NCC target
1989	35,352	29,275	82.8	6,648	6,458	97.1
1990	38,607	32,213	83.4	6,893	6,291	91.3
1991	42,071	33,669	80.0	6,929	4,148	59.9
1992	45,077	36,548	81.1	7,423	1,067	14.4
1993	48,384	41,803	86.4	7,116	1,053	14.2

129. Currency exchange losses were again significant in 1993. In CC there was a loss of \$2,655,000 and in NCC a small loss of \$122,000. In spite of sharply declining interest rates, the Agency was able to generate a sizeable income from short-term investments and other income in 1993 so that \$1,930,000 flowed into the TACF from this source. In addition, assessed programme costs received rose to \$1,828,000. While this is a positive development, it should be noted that the assessed programme costs are obligatory and that a number of countries have large amounts outstanding. The Agency accounts (Schedule D.1) showed that 47 countries had a total of \$5.8 million still to pay at the end of 1993. The table below shows how the net miscellaneous income of \$981,000 in 1993 was derived.

**Miscellaneous and other income**  
(in thousands of dollars)

Type	Convertible	Selected Non-convertible	Total
Interest and other income	1,930	0	1,930
Assessed programme costs	1,513	315	1,828
Exchange losses (realized)	(161)	5	(156)
Exchange losses (unrealized)	(2,494)	(127)	(2,621)
Total	788	193	981

130. Higher pledges and higher miscellaneous income resulted in resources higher than expected. In addition, a record number of projects (244) were completed, some with sizeable savings, i.e. the entire budgeted amount was not needed to accomplish the objectives. Slowly moving projects with 1993 budget provisions which would not be needed until 1994 or beyond were appropriately rephased. In some cases projects had to be cancelled. As a

result, there was a \$5.4 million reserve at year-end, as can be seen in the table below.

**Resources available and programme commitments by year-end**  
(in thousands of dollars)

Year	Available financial resources			Programme commitments			Balance		
	CC	NCC	Total	CC	NCC	Total	CC	NCC	Total
1984	19,240	3,274	22,514	19,583	3,782	23,365	(343)	(508)	(851)
1985	18,975	5,663	24,638	21,392	5,536	26,928	(2,417)	127	(2,290)
1986	14,002	8,813	22,815	18,146	7,706	25,852	(4,144)	1,107	(3,037)
1987	10,164	7,345	17,509	16,758	8,753	25,511	(6,594)	(1,408)	(8,002)
1988	13,833	11,376	25,209	18,590	11,456	30,046	(4,757)	(80)	(4,837)
1989	19,274	13,982	33,256	21,435	15,146	36,581	(2,161)	(1,164)	(3,325)
1990	23,879	7,332	31,211	22,688	6,511	29,199	1,191	821	2,012
1991	24,208	10,084	34,292	25,352	7,614	32,966	(1,144)	2,470	1,326
1992	26,460	2,609	29,069	26,217	2,273	28,490	243	336	579
1993	33,076	3,111	36,187	29,022	1,729	30,751	4,054	1,382	5,436

131. The resources and programme commitments in NCC have been declining sharply. At the end of 1993 the programme yet to be delivered with NCC was down to \$1,729,000 or less than 6% of the total programme commitments. For this reason, and as approved by the Board, no currency category distinctions will be made from 1994 onwards.

132. Implementation in financial terms rose sharply in 1993. The 68.5% rate achieved was the third highest since 1983 when the present method of calculating implementation rates was first used. New obligations (technical assistance on the way) against the current programme increased from \$29.4 million to \$38.5 million. As can be seen in the following table, the total new obligations, including those in respect of future years programmes, exceeded \$40.3 million - a sharp increase from the \$29.5 million registered in 1992.

**Current and future year new obligations**

Year	New obligations current year	New obligations future year	Total new obligations
1989	28,320,331	3,102,057	31,422,388
1990	33,422,585	1,211,835	34,634,420
1991	35,093,180	3,834,615	38,927,795
1992	29,393,068	154,272	29,547,340
1993	38,523,853	1,831,823	40,355,676

133. In 1993, 16 projects were financed from the Reserve Fund. The value of these projects exceeded \$526,000 or 62% of the amount approved. The trend

noted in earlier 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

Year	No. 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%

## 2. Extrabudgetary Resources (including Funds in Trust)

<b>New resources</b>	<b>\$ 6.4 million (12.0% of total)</b>
<b>Adjusted programme</b>	<b>\$11.7 million (16.9% of total)</b>
<b>New obligations</b>	<b>\$ 6.1 million (13.4% of total)</b>
<b>Implementation rate</b>	<b>52.3%</b>
<b>Disbursements</b>	<b>\$ 5.6 million (12.3% of total)</b>

<sup>134</sup>. An increase of 28% (\$1.4 million) over the 1992 level brought the extrabudgetary resources to \$6.4 million in 1993. Included in this figure is the Funds in Trust category (\$1.2 million), which showed an increase mainly due to a contribution of \$600,000 from Colombia for upgrading their Research Reactor IAN-R1.

<sup>135</sup>. As shown in the table below, over \$4.5 million were allocated to fund part of the 1993 approvals for footnote-a/ projects. It should be noted that approvals of footnote-a/ projects for previous years worth over \$1 million also drew on available extrabudgetary resources in 1993. The Secretariat was therefore in a position to fully or partly fund 64 projects of which 43 were made operational for the first time.

**Footnote-g/ approvals and upgrading summary**

Year	Approved footnote-g/ projects	Footnote -g/ projects and components made operational	Share of footnote-g/ projects made operational
	\$	\$	%
1989	9,933,900	5,332,606	53.7
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

136. The overall implementation rate for extrabudgetary funds increased from 49.1% to 52.3% in 1993, which brings the percentage up to the highest attained in the last five years. Implementation rates in this part of the programme vary among individual donors as the funds provided are subject to a number of constraints which do not apply to the TACF. Close collaboration with donors is required in order to find solutions whenever impediments to the execution of this part of the programme occur.

137. The United States of America, followed by the United Kingdom and France, were the largest single contributors, as can be seen in Table 5. In addition to contributions from Japan and Australia, the RCA programme welcomed inputs from Malaysia and the Philippines.

### 3. UNDP

<b>New resources</b>	<b>\$ 1.1 million (2.0% of total)</b>
<b>Adjusted programme</b>	<b>\$ 1.4 million (2.0% of total)</b>
<b>New obligations</b>	<b>\$ 1.1 million (2.3% of total)</b>
<b>Implementation rate</b>	<b>76.9%</b>
<b>Disbursements</b>	<b>\$ 1.4 million (3.0% of total)</b>

138. Since UNDP funding equals the amounts needed to finance project activities within approved budgets, "new resources" are equal to the total expenditure recorded under "new obligations". The figure recorded under "adjusted programme" is the sum of approved 1993 budgets at the end of the year.

139. The implementation rate returned to more typical levels after being depressed for several years owing to the impasse over the project concerning the establishment of a research reactor in Albania. This project was eventually cancelled and operationally closed by the Government of Albania after pressure from UNDP. Unused provisions have now been returned to UNDP, decreasing the UNDP programme by \$1.8 million. The Agency's assistance to Albania is being reviewed.

140. Although the 1993 expenditure represents a 71% increase over 1992, the level of UNDP-funded assistance remains well below that prevailing in the 1980s. Nevertheless, three major new projects have now become operational,

representing the varying needs for nuclear-related assistance in various parts of the world. The RCA Member States were successful in obtaining UNDP support for continued collaboration in the use of isotopes for technology and environmentally sustainable development. 1993 saw the inception of RAS/92/073, a major endeavour covering over \$6 million of assistance by Australia, Japan, UNDP and the IAEA over four years, where UNDP contributes about half of the necessary funding. Of the total 1993 implementation, 51% emanated from this and other projects in the Asia and Pacific Region.

**UNDP Fund comparative summary**

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings
	\$	\$	%	\$
1989	4,427,249	3,105,808	70.2	1,321,440
1990	3,223,083	2,855,764	88.6	367,319
1991	3,210,360	1,513,194	47.1	1,697,166
1992	1,270,164	620,102	48.8	650,062
1993	1,377,143	1,059,234	76.9	317,909

141. Another ambitious programme, specifically concerned with nuclear and radiation safety, was launched in countries which had been part of the former USSR (RER/93/006). This initiative by the Division of Nuclear Safety, monitored by a joint UNDP/IAEA Secretariat, began with an international forum meeting in Vienna in May 1993, where an exchange of information took place between CIS countries, donors, UN organizations and other interested parties. Fact-finding missions are being carried out to establish country priorities for further implementation. At the request of the Government of China, UNDP also provides funding for a new \$1 million project: "Manpower development for safe operation of nuclear plants" (CPR/91/221), a continuation of UNDP support of China's nuclear energy programme. In sum, there has been a concentration on fewer and larger projects, as eight projects were completed and the three projects mentioned above were initiated during 1993.

142. In addition to funds made available for TC projects, sectoral support provisions from UNDP amounted to \$107,000 in 1993, enabling the Area Offices of Africa and of Asia and the Pacific to field multi-sectoral advisory missions on nuclear applications to Uganda and Zambia, as well as country programme review missions to Mongolia, Myanmar and Viet Nam. One follow-up mission to Mexico was also fielded. In addition, the IAEA provided inputs to some projects executed by governments and other UN Agencies. For instance, the IAEA Marine Environment Laboratory, Monaco, has been taking part in the Global Environmental Facility programme for rehabilitation of Lake Manzala in Egypt since July 1992.

143. In spite of a dramatic decline in worldwide UNDP resources of up to 30% in 1993, on-going assistance, expected budget increases and the fact that four projects are currently in the pipeline or under development, give reason to hope that UNDP-funded IAEA activities may continue to increase. On-going UNDP-funded technical assistance projects are listed in Annex VI.

#### 4. Assistance in kind

<b>New resources</b>	<b>\$1.6 million (3.1% of total)</b>
<b>Disbursements</b>	<b>\$1.6 million (3.6% of total)</b>

144. The volume of assistance in kind made available in 1993 increased by \$300,000 against 1992 (\$1.6 million against \$1.3 million). Assistance in kind is only recorded at year-end and the new resources are automatically calculated to be equivalent to the disbursements. The concepts of "adjusted programme", "new obligations" and "implementation rate" do not apply.

145. Assistance in kind is recorded according to strict criteria: such assistance is only reported for equipment if it has actually been shipped from one country to another. In the case of experts, credit is given to donor countries when individuals 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. Although this category represents only about 3% of total resources, it remains a valuable feature of the TC programme, particularly in the training component. It was possible to provide 308 months of fellowship training in nine countries. In addition, 292 experts and lecturers were provided by 43 countries and one international organization either cost-free or part-free.

146. Five countries and two international organizations provided stipends and travel costs for 60 regional training course participants (73% from Asia and Pacific and 27% from Latin America). No projects benefitted from equipment donations. A five year comparison of in-kind contributions is given below.

#### Comparative summary of in-kind contributions

(in thousands of dollars)

Year	Experts	Equipment	Fellowships	Group Training	Total
1989	313.9	18.0	1,450.6	512.1	2,294.6
1990	318.1	125.0	1,333.9	436.8	2,213.8
1991	310.5	0.0	1,115.8	275.2	1,701.5
1992	272.9	0.0	792.5	236.3	1,301.7
1993	448.1	0.0	901.7	292.5	1,642.3

147. The USA, Spain and France, as reflected in Annex I, were the largest contributors. Member States who are themselves recipients of technical co-operation donated 19% of these resources.

# 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	17,057,470	24.6%	11,272,804	66.1%	5,784,666
Asia & Pacific	16,459,823	23.7%	10,940,292	66.5%	5,519,531
Latin America	15,714,613	22.7%	10,662,064	67.8%	5,052,549
Middle East & Europe	15,420,436	22.2%	8,853,092	57.4%	6,567,344
Interregional	3,841,092	5.5%	3,311,130	86.2%	529,962
Global	881,605	1.3%	688,184	78.1%	193,421
<b>Total</b>	<b>69,375,039</b>	<b>100.0%</b>	<b>45,727,566</b>	<b>65.9%</b>	<b>23,647,473</b>
<b>Component breakdown</b>					
Experts	18,691,901	26.9%	11,371,665	60.8%	7,320,236
Equipment	27,591,351	39.8%	19,121,886	69.3%	8,469,465
Fellowships	12,752,186	18.4%	7,079,991	55.5%	5,672,195
Training Courses	8,166,876	11.8%	6,568,909	80.4%	1,597,967
Sub-contracts	1,255,646	1.8%	878,471	70.0%	377,175
Miscellaneous	917,079	1.3%	706,644	77.1%	210,435
<b>Total</b>	<b>69,375,039</b>	<b>100.0%</b>	<b>45,727,566</b>	<b>65.9%</b>	<b>23,647,473</b>
<b>Fund breakdown</b>					
TACF	56,251,046	81.1%	38,523,853	68.5%	17,727,193
UNDP	1,377,143	2.0%	1,059,234	76.9%	317,909
Extrabudgetary	10,273,354	14.8%	5,384,663	52.4%	4,888,691
Funds-in-Trust	1,473,496	2.1%	759,816	51.6%	713,680
<b>Total</b>	<b>69,375,039</b>	<b>100.0%</b>	<b>45,727,566</b>	<b>65.9%</b>	<b>23,647,473</b>
<b>Current and future years</b>					
Current	69,375,039	55.7%	45,727,566	65.9%	23,647,473
Future	55,165,712	44.3%	1,831,823	3.3%	53,333,889
<b>GRAND TOTAL</b>	<b>124,540,751</b>	<b>100.0%</b>	<b>47,559,389</b>		<b>76,981,362</b>

\* As at 31 December 1993

**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	14,381,578	25.6%	9,747,693	67.8%	4,633,885
Asia & Pacific	12,865,464	22.9%	8,931,479	69.4%	3,933,985
Latin America	12,075,033	21.4%	9,055,327	75.0%	3,019,706
Middle East & Europe	12,380,224	22.0%	6,943,763	56.1%	5,436,461
Interregional	3,667,142	6.5%	3,157,407	86.1%	509,735
Global	881,605	1.6%	688,184	78.1%	193,421
<b>Total</b>	<b>56,251,046</b>	<b>100.0%</b>	<b>38,523,853</b>	<b>68.5%</b>	<b>17,727,193</b>
<b>Component breakdown</b>					
Experts	14,544,830	25.9%	9,657,522	66.4%	4,887,308
Equipment	21,485,330	38.2%	15,215,831	70.8%	6,269,499
Fellowships	12,252,468	21.8%	6,931,691	56.6%	5,320,777
Training Courses	6,838,283	12.1%	5,852,146	85.6%	986,137
Sub-contracts	233,079	0.4%	173,206	74.3%	59,873
Miscellaneous	897,056	1.6%	693,457	77.3%	203,599
<b>Total</b>	<b>56,251,046</b>	<b>100.0%</b>	<b>38,523,853</b>	<b>68.5%</b>	<b>17,727,193</b>
<b>Currency breakdown</b>					
Convertible	54,513,540	96.9%	38,035,496	69.8%	16,478,044
Non-convertible	1,737,506	3.1%	488,357	28.1%	1,249,149
<b>Total</b>	<b>56,251,046</b>	<b>100.0%</b>	<b>38,523,853</b>	<b>68.5%</b>	<b>17,727,193</b>
<b>Current and future years</b>					
Current	56,251,046	50.5%	38,523,853	68.5%	17,727,193
Future	55,165,712	49.5%	1,831,823	3.3%	53,333,889
<b>GRAND TOTAL</b>	<b>111,416,758</b>	<b>100.0%</b>	<b>40,355,676</b>		<b>71,061,082</b>

\* As at 31 December 1993

**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	11,820,236	17.0%	8,553,202	72.4%	3,267,034
Division of Human Health	9,893,928	14.3%	6,573,202	66.4%	3,320,726
Division of Physical and Chemical Sciences	17,216,337	24.8%	10,724,984	62.3%	6,491,353
The Agency's Laboratories	3,731,914	5.4%	2,624,347	70.3%	1,107,567
Marine Environment Laboratory, Monaco	472,176	0.7%	267,299	56.6%	204,877
<b>Total</b>	<b>43,134,591</b>	<b>62.2%</b>	<b>28,743,034</b>	<b>66.6%</b>	<b>14,391,557</b>
<b>DEPARTMENT OF NUCLEAR ENERGY AND SAFETY</b>					
Division of Nuclear Safety	11,726,688	16.9%	7,451,779	63.5%	4,274,909
Division of Nuclear Power	3,692,172	5.3%	2,627,148	71.2%	1,065,024
Division of Scientific and Technical Information	205,622	0.3%	151,138	73.5%	54,484
Division of Nuclear Fuel Cycle and Waste Management	2,775,423	4.0%	1,719,933	62.0%	1,055,490
<b>Total</b>	<b>18,399,905</b>	<b>26.5%</b>	<b>11,949,998</b>	<b>64.9%</b>	<b>6,449,907</b>
<b>DEPARTMENT OF TECHNICAL CO-OPERATION</b>	<b>724,675</b>	<b>1.0%</b>	<b>418,435</b>	<b>57.7%</b>	<b>306,240</b>
<b>GLOBAL</b> (not distributed by Department)	<b>7,115,868</b>	<b>10.3%</b>	<b>4,616,099</b>	<b>64.9%</b>	<b>2,499,769</b>
<b>GRAND TOTAL</b>	<b>69,375,039</b>	<b>100.0%</b>	<b>45,727,566</b>	<b>65.9%</b>	<b>23,647,473</b>

\* As at 31 December 1993

## Explanatory Notes to Figures

### **Figure 1. Resources available for Agency technical co-operation programmes: 1987-1993**

This figure shows all resources made available to the Agency for technical co-operation activities from all funds for the programme years 1987-1993. 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 1987-1993 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 Agency programme: 1993**

This figure shows, by component and by Agency programme, the distribution of all assistance provided in 1993, irrespective of the source of funds. It should be noted that fellowships under the manpower training projects have been individually assigned to an Agency programme and their costs are accounted for accordingly.

### **Figure 3. Disbursements by component: 1984-1993**

The total assistance provided during the ten year period 1984-1993 (\$419,212,700) is broken down by year and type of input (training, experts and equipment), irrespective of the source of funds.

### **Figure 4. Technical co-operation personnel services by region: 1993**

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 5. Distribution of equipment disbursements by region: 1993**

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 6. Summary data on training programmes: 1993**

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 7. Technical Assistance and Co-operation Fund disbursements by type of currency and region: 1993**

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This figure, which refers only to the Technical Assistance and Co-operation Fund, gives total disbursements for 1993 broken down by region and for convertible and non-convertible currencies.

**Figure 8. Technical assistance and co-operation disbursements by programme and region: 1993**

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At the top, the overall expenditures by Agency Programme are shown in a summary bar chart. The bar charts at the bottom illustrate the different emphasis to the various Agency Programmes in each region. (Please note that the scales are different for each region.)

**Figure 9. Distribution of technical co-operation disbursements by source and region: 1993**

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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.

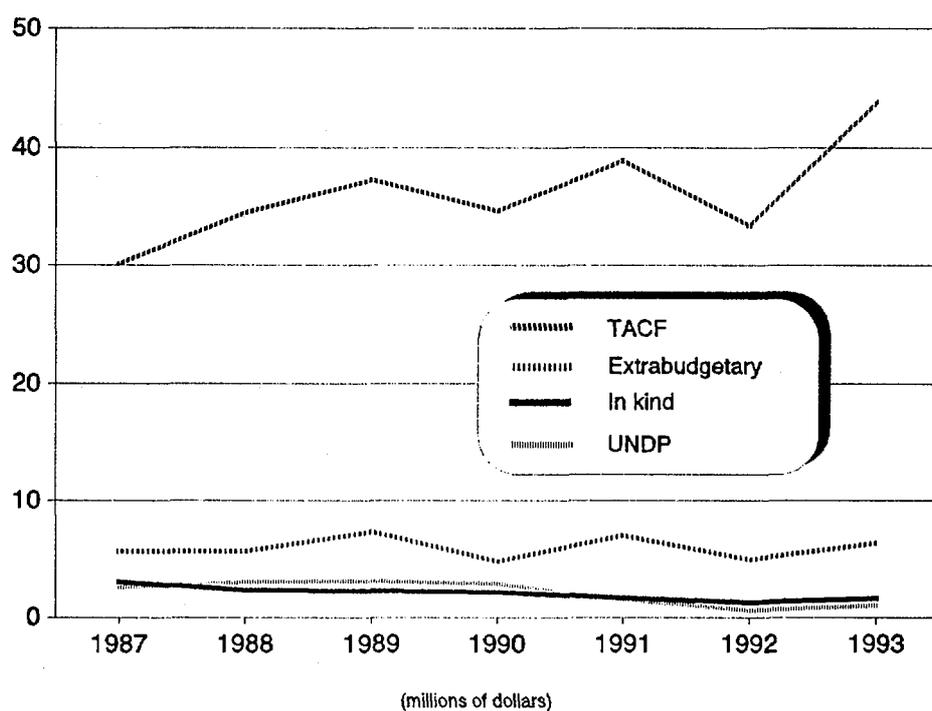
**Figure 10. Utilization of the Technical Assistance and Co-operation Fund**

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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 1993. The graph 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**



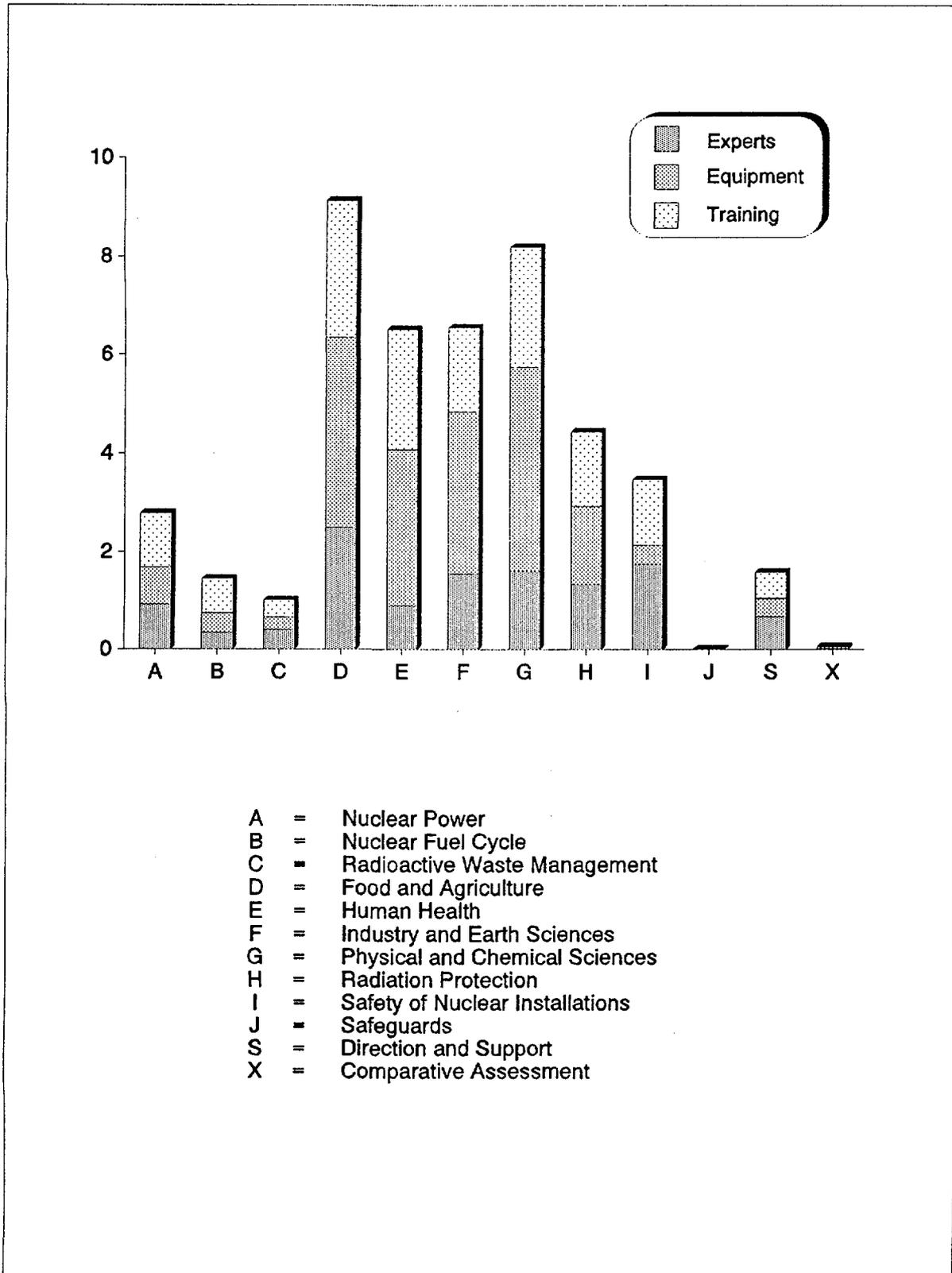
	1987	1988	1989	1990	1991	1992	1993
TACF	30,153	34,510	37,312	34,660	38,882	33,411	43,837
Extra-budgetary funds	5,700	5,710	7,375	4,820	7,018	4,975	6,367
Assistance in kind	3,066	2,322	2,295	2,214	1,702	1,302	1,642
UNDP	2,568	3,051	3,106	2,856	1,513	620	1,059
<b>TOTAL</b>	<b>41,487</b>	<b>45,593</b>	<b>50,088</b>	<b>44,550</b>	<b>49,115</b>	<b>40,308</b>	<b>52,905</b>

(thousands of dollars)

**FIGURE 2**

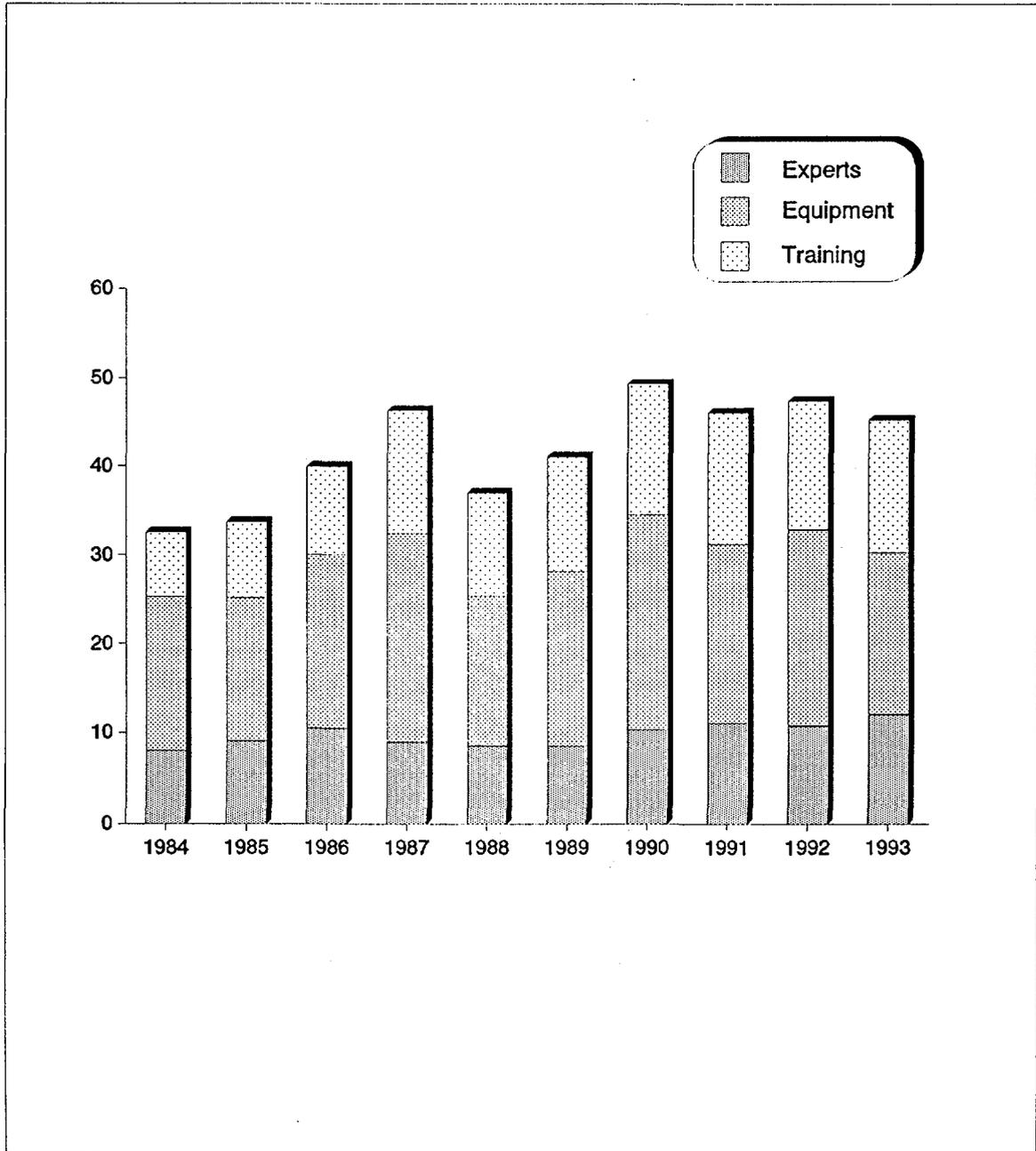
**DISBURSEMENTS BY PROGRAMME: 1993**

(in millions of dollars)



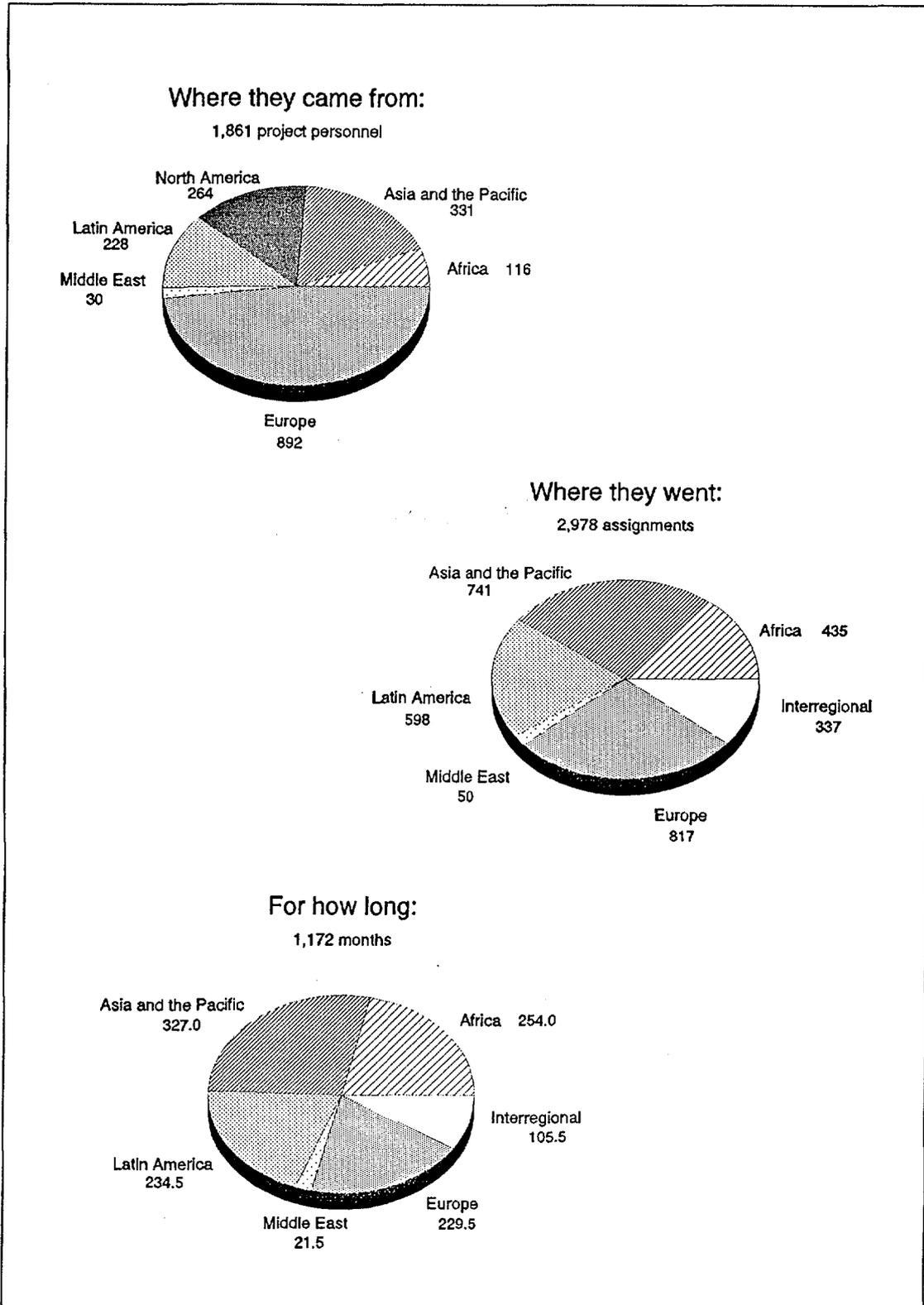
**FIGURE 3**

**DISBURSEMENTS BY COMPONENT: 1984 - 1993**  
(in millions of dollars)



**FIGURE 4**

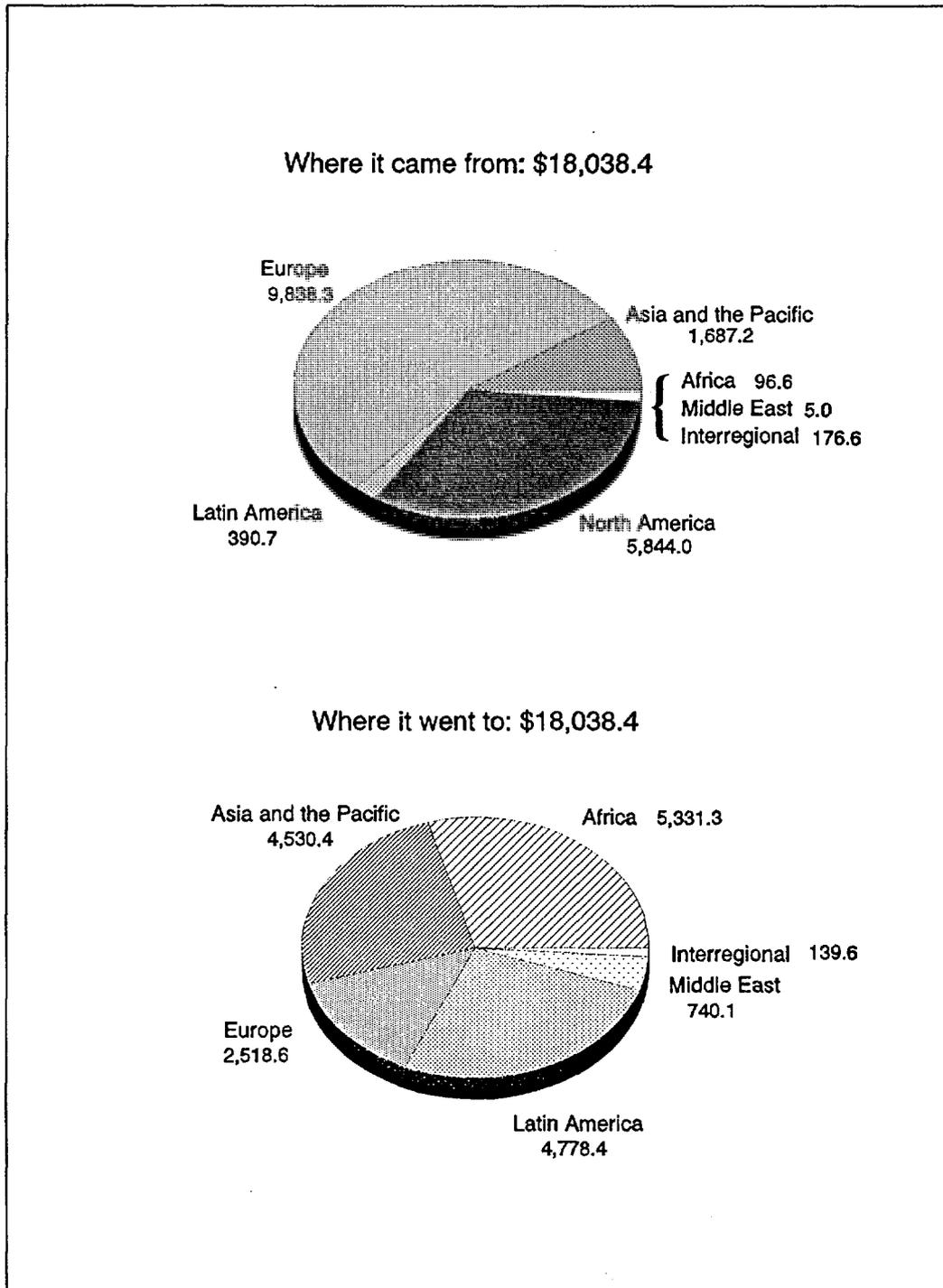
**TECHNICAL CO-OPERATION  
PERSONNEL SERVICES BY REGION: 1993**



**FIGURE 5**

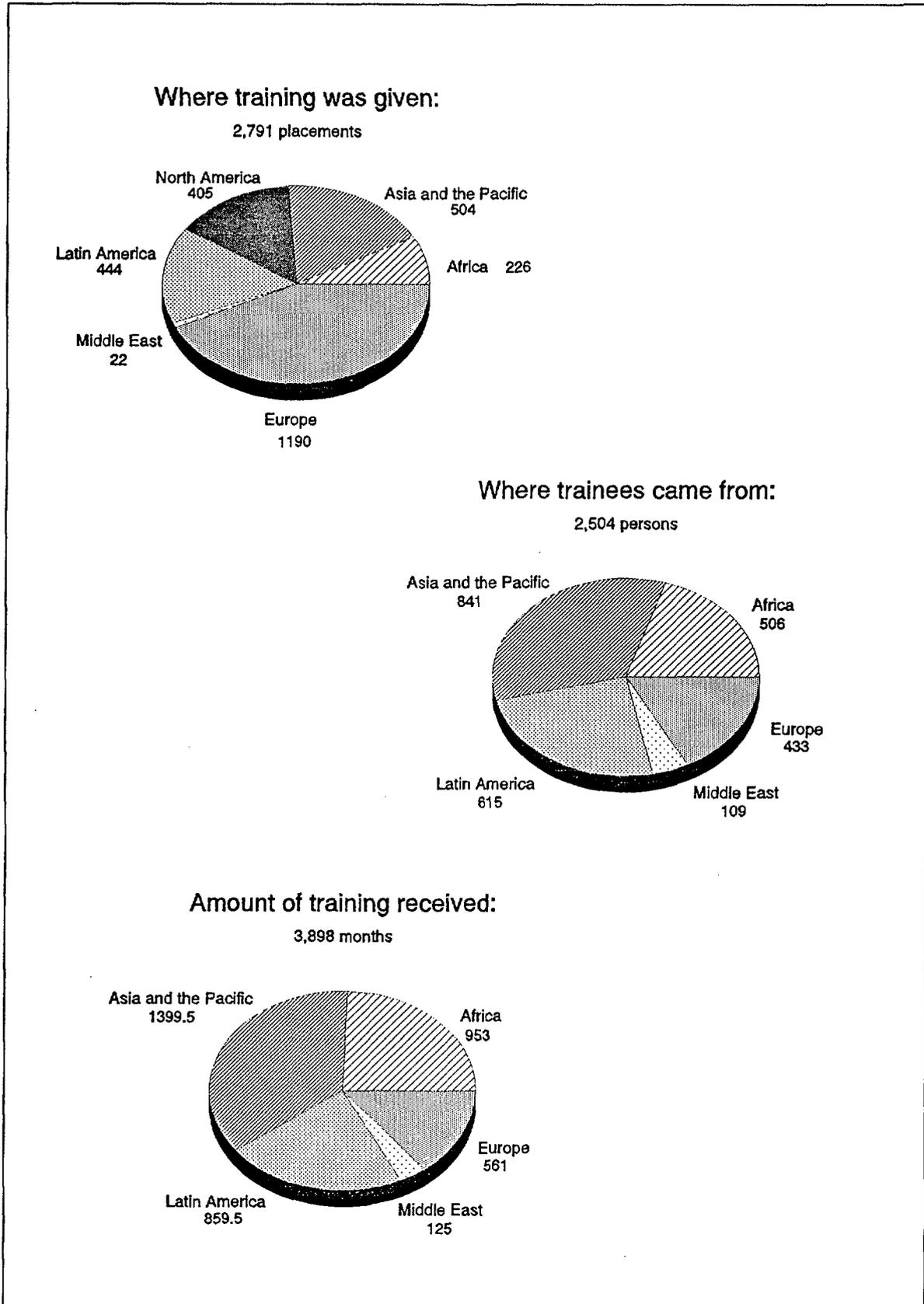
**DISTRIBUTION OF EQUIPMENT DISBURSEMENTS  
BY REGION: 1993**

(in thousands of dollars)



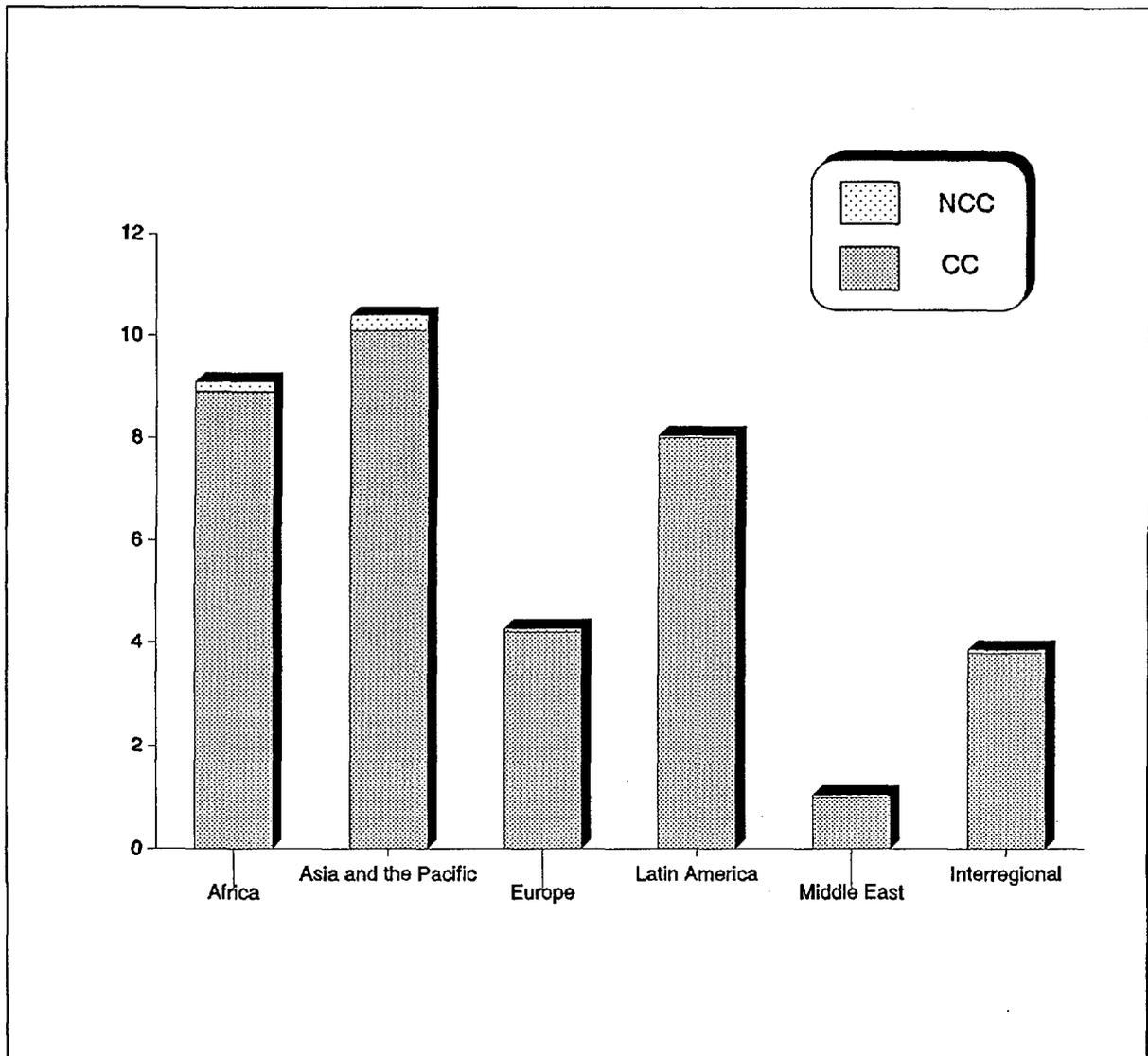
**FIGURE 6**

**SUMMARY DATA ON TRAINING PROGRAMMES: 1993**



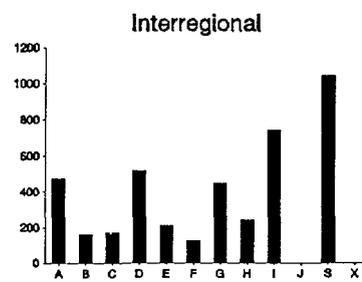
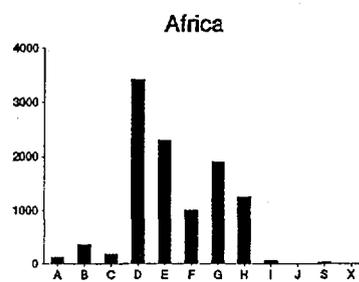
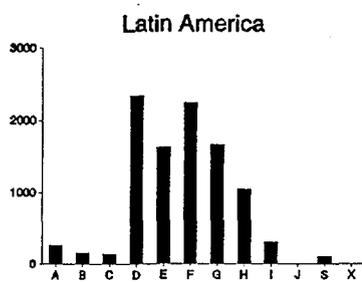
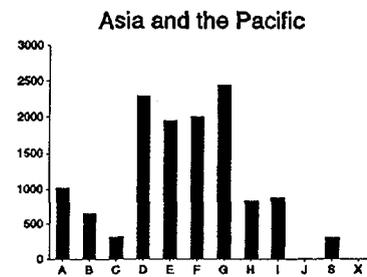
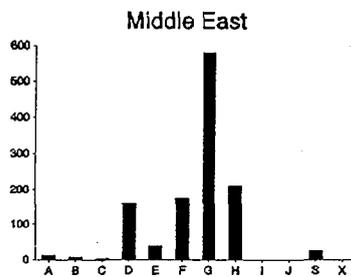
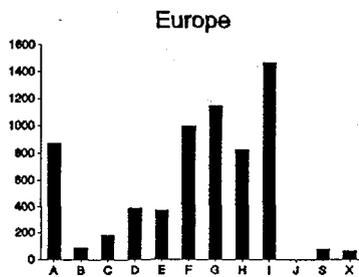
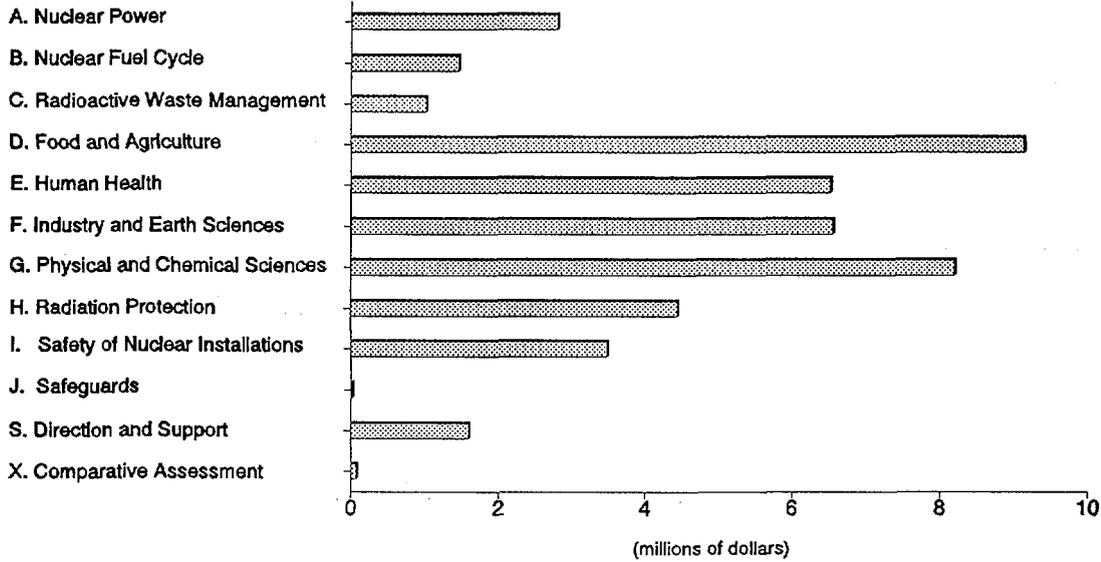
**FIGURE 7**

**TECHNICAL ASSISTANCE AND CO-OPERATION FUND  
DISBURSEMENTS BY TYPE OF CURRENCY AND REGION: 1993**  
(in millions of dollars)



**FIGURE 8**

**TECHNICAL ASSISTANCE AND CO-OPERATION DISBURSEMENTS  
BY PROGRAMME AND REGION: 1993**

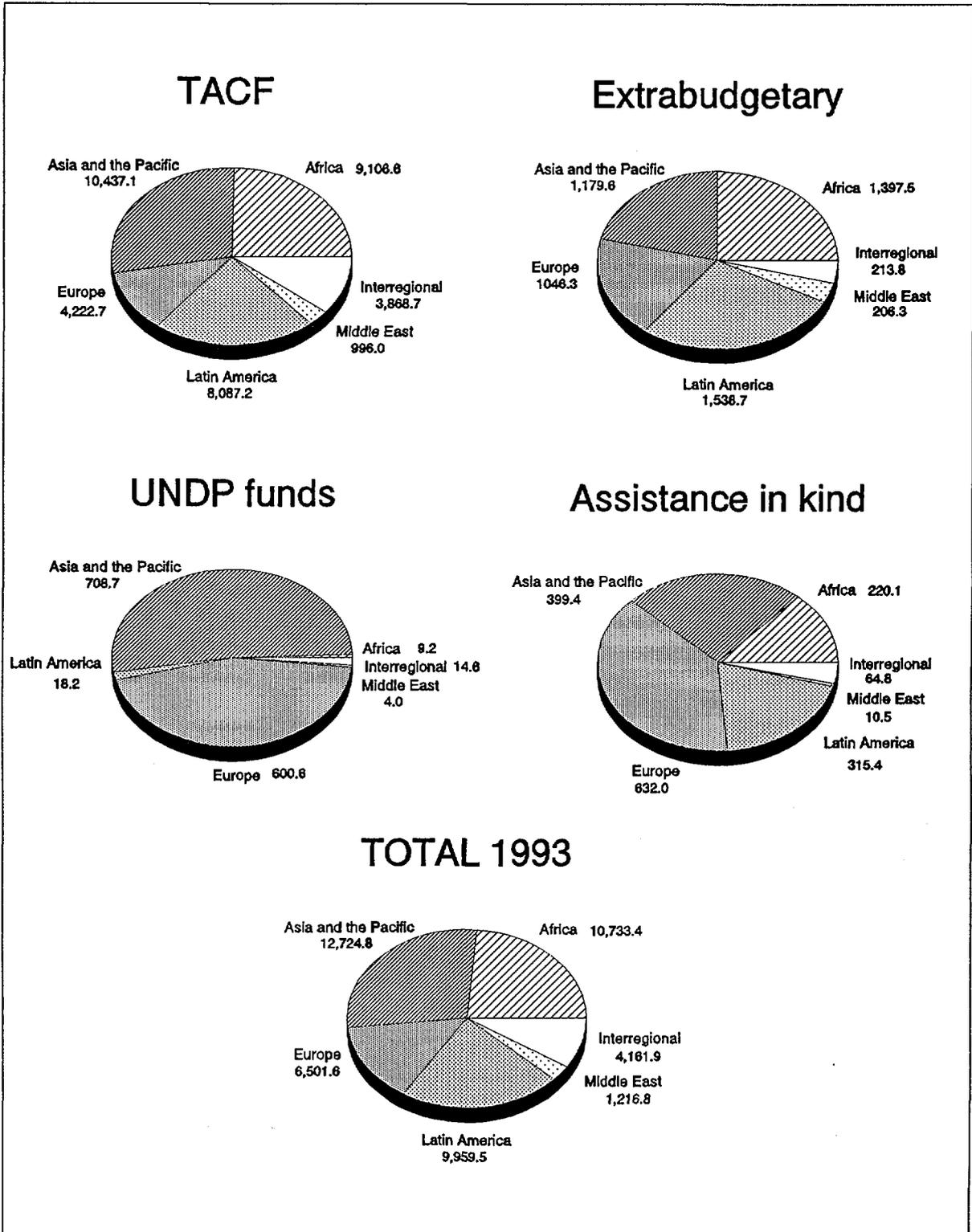


(thousands of dollars)

**FIGURE 9**

**DISTRIBUTION OF TECHNICAL CO-OPERATION  
DISBURSEMENTS BY SOURCE AND REGION: 1993**

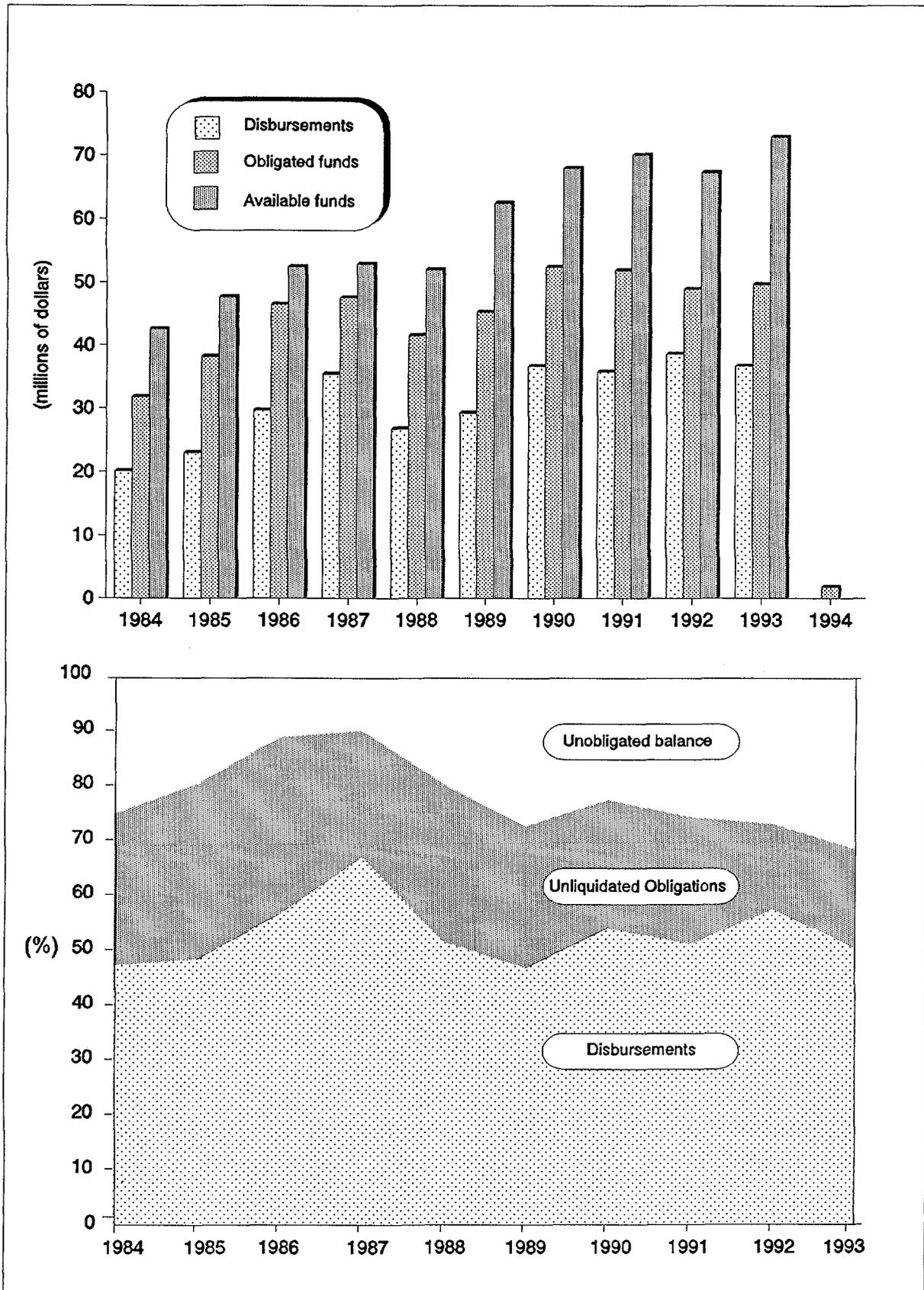
(in thousands of dollars)



**FIGURE 10**

**UTILIZATION OF THE TECHNICAL ASSISTANCE  
AND CO-OPERATION FUND**

(status at year end)



## Explanatory Notes to Tables

### **Table 1. Available resources: 1984-1993**

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 1993, please see text section E.1.

### **Table 2. Technical Assistance and Co-operation Fund: 1984-1993**

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 1993). It should be noted that, in this table, voluntary contributions are shown not by the year in which they become available but for the programme year for which they are 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: 1993**

This table shows the number of individuals, who undertook technical co-operation assignments during 1993. They came from 102 countries. Information on the number of assignments is also provided. 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: 1993**

A breakdown is given for trainees (fellows, training course participants and visiting scientists) based on the place of study. There were 77 places of study involved.

### **Table 3C. Equipment by country of origin: 1993**

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.

**Table 4. Distribution of technical co-operation disbursements by type: 1989-1993**

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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 1993 for fellows who had already started their studies in 1993. "Miscellaneous" refers to disbursements in all components for telex charges, health insurance, copying fees and for other minor items or services. In 1993, it also included a charge for radiation protection services.

**Table 5. Extrabudgetary funds for technical co-operation activities by donor as at 31 December 1993**

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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 e and f are not recorded as income in the Agency's Accounts as these are receivables.

**Table 6A. Technical co-operation personnel services: 1993**

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A list is given of 78 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: 1993**

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The list shows the 112 recipient countries, number of trainees and the total months of training received in 1993.

**Table 7. Financial Summary: 1993**

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This major table shows, by type of assistance and by source, the total technical assistance furnished to 86 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: 1958-1993**

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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**

---

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 1992 and 1993. The total number of women involved reached 1,065 of which 929 or 87.2% were from developing countries.

**TABLE 1****AVAILABLE RESOURCES: 1984-1993**

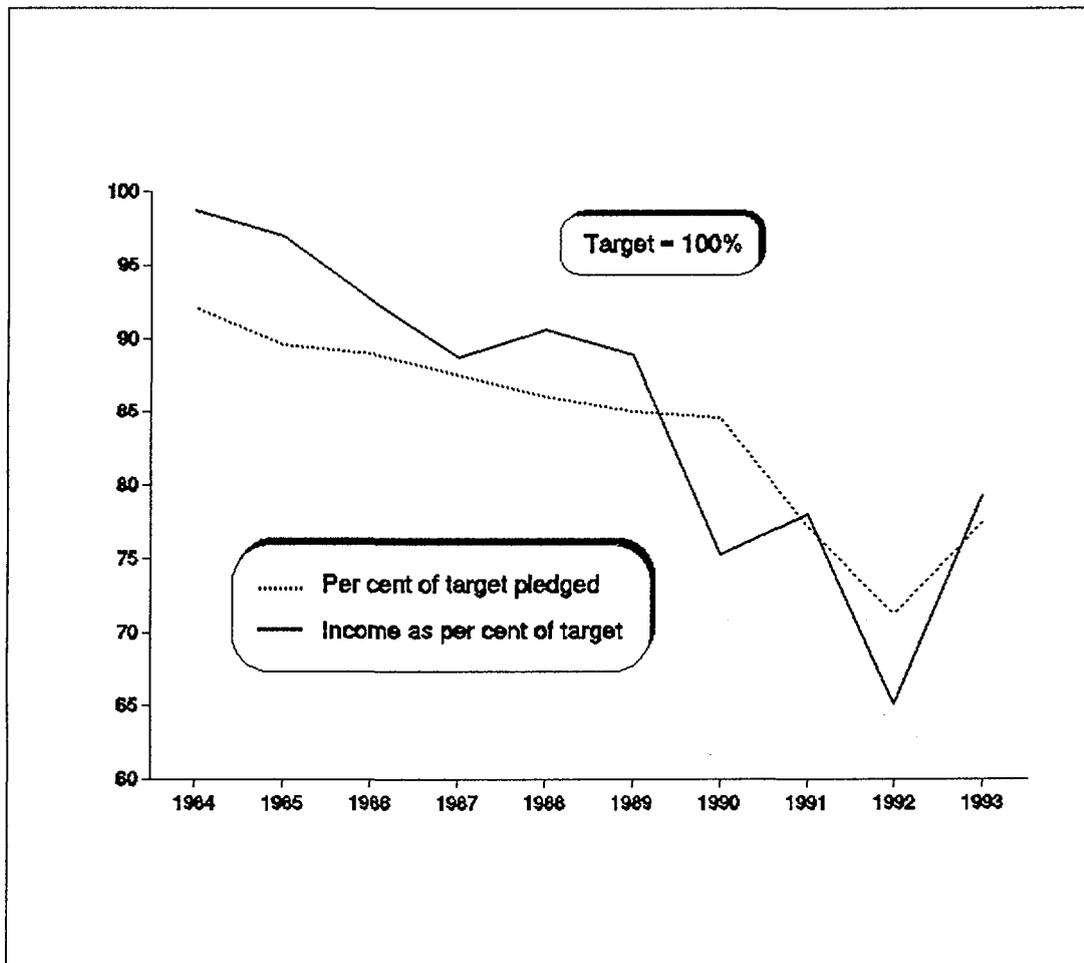
(in thousands of dollars)

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	
	CC	NCC							
	(1a)	(1b)	(1c)	(1)	(2)	(3)	(4)	(5)	
<b>1984</b>	17,213	3,524	1,495	22,232	5,964	2,066	2,541	10,571	32,803
<b>1985</b>	19,282	3,976	1,939	25,197	5,484	2,765	2,654	10,903	36,100
<b>1986</b>	21,348	5,431	1,081	27,860	5,702	2,282	3,480	11,464	39,324
<b>1987</b>	24,571	5,178	404	30,153	5,700	3,066	2,568	11,334	41,487
<b>1988</b>	26,889	5,854	1,767	34,510	5,710	2,322	3,051	11,083	45,593
<b>1989</b>	29,223	6,458	1,631	37,312	7,375	2,295	3,106	12,776	50,088
<b>1990</b>	32,251	6,598	(4,189)	34,660	4,820	2,214	2,856	9,890	44,550
<b>1991</b>	33,688	4,756	438	38,882	7,018	1,702	1,513	10,233	49,115
<b>1992</b>	36,549	1,067	(4,205)	33,411	4,975	1,302	620	6,897	40,308
<b>1993</b>	41,803	1,053	981	43,837	6,367	1,642	1,059	9,068	52,905
<b>1984-1993</b>	282,817	43,895	1,342	328,054	59,115	21,656	23,448	104,219	432,273

**TABLE 2**

**TECHNICAL ASSISTANCE AND CO-OPERATION FUND: 1984-1993**

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
1984	22,500,000	20,735,931	92.2	22,231,347	98.8
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	43,017,893	77.5	43,998,859	79.3



**TABLE 3A**

**PROJECT PERSONNEL BY PLACE OF ORIGIN: 1993**

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	2	0	2	0	0	2
Algeria	13	7	12	0	0	19
Argentina	56	51	16	32	0	99
Australia	45	59	0	17	0	76
Austria	33	61	0	9	4	74
Bangladesh	10	6	7	2	0	15
Belarus, Republic of	4	1	3	0	0	4
Belgium	25	29	0	6	0	35
Bolivia	4	10	2	2	0	14
Brazil	57	27	13	38	2	80
Bulgaria	30	9	40	2	0	51
Cameroon	1	0	1	0	0	1
Canada	64	64	0	20	0	84
Chile	20	14	6	4	0	24
China	26	23	14	3	0	40
Colombia	10	9	4	2	0	15
Costa Rica	6	4	4	0	0	8
Cote d'Ivoire	1	1	0	1	0	2
Croatia	15	28	9	8	0	45
Cuba	9	3	6	3	0	12
Cyprus	4	1	3	0	0	4
Czech Republic	47	24	52	5	0	81
Denmark	3	9	0	1	0	10
Dominican Republic	1	0	1	0	0	1
Ecuador	9	3	5	1	0	9
Egypt	13	3	10	5	0	18
Estonia, Republic of	1	0	1	0	0	1
Ethiopia	3	0	3	0	0	3
Finland	19	19	0	6	0	25
France	95	99	0	37	0	136
Georgia	2	0	2	0	0	2
Germany	88	101	0	35	0	136
Ghana	11	9	8	2	0	19
Greece	5	2	2	2	0	6
Guatemala	6	2	4	2	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	
Hungary	50	41	40	8	0	89
India	60	66	12	20	0	98
Indonesia	14	6	11	2	0	19
Iran, Islamic Rep.	8	7	5	0	1	13
Iraq	2	3	0	1	0	4
Ireland	1	2	0	0	0	2
Israel	9	6	0	6	0	12
Italy	34	53	0	10	0	63
Jamaica	1	0	0	1	0	1
Japan	38	51	0	6	0	57
Jordan	5	0	5	0	0	5
Kazakhstan	1	0	1	0	0	1
Kenya	8	1	5	3	0	9
Korea, Republic of	18	9	9	1	0	19
Kyrgyzstan	1	0	1	0	0	1
Lebanon	1	1	0	0	0	1
Libyan Arab J.	7	0	8	0	0	8
Macedonia (former YUG)	1	1	0	0	0	1
Malaysia	16	9	9	1	0	19
Mali	4	1	2	1	2	6
Mauritius	3	3	2	0	0	5
Mexico	20	15	8	4	0	27
Moldova, Republic of	1	1	0	0	0	1
Mongolia	7	0	8	0	0	8
Morocco	10	4	8	1	0	13
Myanmar	1	3	0	1	0	4
Netherlands	25	32	0	9	0	41
New Zealand	3	1	0	2	0	3
Niger	1	0	1	0	0	1
Nigeria	7	5	4	1	0	10
Norway	2	2	0	0	0	2
Pakistan	27	14	18	2	0	34
Panama	4	1	3	1	0	5
Paraguay	3	0	3	0	0	3
Peru	8	15	5	0	0	20
Philippines	13	3	8	1	3	15
Poland	48	60	34	4	0	98
Portugal	7	2	1	4	0	7

Place of origin	Total individuals <sup>a)</sup>	Assignments				Total
		International experts <sup>b)</sup>	National experts	Lecturers <sup>c)</sup>	Other project personnel	
Romania	11	9	5	2	0	16
Russian Federation	49	57	14	14	0	85
Saudi Arabia	6	1	7	0	0	8
Senegal	4	0	3	1	0	4
Singapore	3	0	3	0	0	3
Slovak Republic	20	8	23	0	0	31
Slovenia	17	23	3	10	0	36
South Africa	2	2	0	0	0	2
Spain	43	62	0	13	0	75
Sri Lanka	15	23	10	6	0	39
Sudan	6	1	7	0	0	8
Sweden	28	58	0	21	0	79
Switzerland	9	14	0	1	0	15
Syrian Arab Rep.	6	2	8	0	0	10
Thailand	15	6	9	1	0	16
Tunisia	10	8	9	0	0	17
Turkey	12	21	5	5	0	31
Uganda	1	0	1	0	0	1
Ukraine	27	7	38	1	0	46
United Arab Emirates	1	0	1	0	0	1
UK	126	153	0	40	0	193
United Rep. Tanzania	6	2	6	0	0	8
USA	200	253	1	45	0	299
Uruguay	9	4	4	3	0	11
Venezuela	5	7	4	2	0	13
Viet Nam	12	3	10	0	0	13
Yugoslavia	6	19	0	8	0	27
Zaire	3	3	2	0	0	5
Zambia	2	0	1	1	0	2
<b>TOTAL</b>	<b>1,861</b>	<b>1,842</b>	<b>615</b>	<b>509</b>	<b>12</b>	<b>2,978</b>

<sup>a)</sup> Includes 200 IAEA staff members and 4 other international organization members. <sup>b)</sup> Includes 506 assignments of IAEA staff members and 2 assignments of other international organization members as International experts. <sup>c)</sup> Includes 143 assignments of IAEA staff members and 2 assignments of international organization members as lecturers.

**TABLE 3B**

**TRAINEES IN THE FIELD BY PLACE OF STUDY: 1993**

Place of Study	Fellows	Visiting scientists	Training course participants	Total <sup>a</sup>
Algeria	0	2	37	39
Argentina	18	1	30	49
Australia	16	7	62	85
Austria	15	11	0	26
Bangladesh	0	1	0	1
Belgium	12	6	0	18
Brazil	18	2	17	37
Bulgaria	1	0	0	1
Burkina Faso	1	0	0	1
Canada	40	24	25	89
Chile	6	2	35	43
China	13	11	78	102
Colombia	3	1	20	24
Costa Rica	4	1	6	11
Cote d'Ivoire	1	0	0	1
Croatia	0	0	18	18
Cuba	1	0	31	32
Cyprus	0	0	11	11
Czech Republic	0	0	12	12
Denmark	4	8	0	12
Dominican Republic	0	0	16	16
Ecuador	1	0	35	36
Egypt	7	4	24	35
Ethiopia	0	0	19	19
Finland	1	5	0	6
France	43	27	62	132
Germany	36	22	80	138
Ghana	2	0	33	35
Greece	5	1	19	25
Guatemala	6	1	13	20
Hungary	51	12	40	103
Iceland	0	2	0	2
India	23	15	41	79
Indonesia	3	2	25	30
Ireland	0	1	0	1
Israel	1	0	0	1
Italy	12	3	0	15
Japan	10	13	38	61
Jordan	0	0	10	10

Place of Study	Fellows	Visiting scientists	Training course participants	Total <sup>a</sup>
Kenya	0	0	19	19
Korea, Republic of	0	4	28	32
Malaysia	4	9	12	25
Mexico	25	8	107	140
Morocco	0	0	24	24
Myanmar	0	1	0	1
Netherlands	13	9	0	22
New Zealand	1	0	0	1
Norway	2	3	0	5
Pakistan	6	2	0	8
Paraguay	0	0	14	14
Peru	1	0	0	1
Philippines	2	0	0	2
Poland	21	5	0	26
Romania	1	0	0	1
Russian Federation	44	0	14	58
Singapore	1	1	0	2
Slovak Republic	1	5	0	6
Slovenia, Republic of	2	5	0	7
South Africa	1	2	0	3
Spain	27	5	25	57
Sri Lanka	1	0	17	18
Sweden	2	20	0	22
Switzerland	2	3	0	5
Syrian A.R.	0	0	11	11
Thailand	15	5	20	40
Tunisia	1	0	0	1
Turkey	1	1	41	43
UK	82	36	0	118
U.R. Tanzania	1	0	24	25
USA	104	47	165	316
Uruguay	4	0	0	4
Venezuela	3	1	13	17
Viet Nam	0	0	17	17
Zambia	0	0	12	12
Zimbabwe	0	0	12	12
IAEA	122	38	135	295
European Nuclear Research Center	5	0	0	5
<b>TOTAL</b>	<b>849</b>	<b>395</b>	<b>1,547</b>	<b>2,791</b>

<sup>a</sup> The difference between the number of trainees (2,504 see Table 68) and the number of places of study (2,791) 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: 1993

Country	Disbursements (\$ thousand)	New purchase orders placed
ARGENTINA	196.7	4
AUSTRALIA	136.6	11
AUSTRIA	1,932.7	674
BANGLADESH	13.5	1
BELGIUM	107.8	16
BOLIVIA	3.6	1
BRAZIL	72.1	14
BULGARIA	3.9	1
CAMEROON	1.8	0
CANADA	156.4	34
CHILE	42.5	19
CHINA	677.6	33
COLOMBIA	5.8	3
COSTA RICA	10.8	5
COTE D'IVOIRE	0.0	1
CUBA	22.3	7
CZECH REPUBLIC	29.0	10
DENMARK	154.3	35
ECUADOR	4.4	1
EL SALVADOR	2.0	0
ETHIOPIA	2.1	1
FINLAND	125.9	12
FRANCE	990.0	141
GERMANY	1,847.8	322
GHANA	4.7	1
GUATEMALA	7.3	2
HONDURAS	2.2	3
HUNGARY	579.3	24
INDIA	185.5	13
INDONESIA	4.8	1
ISRAEL	5.0	5
ITALY	121.6	16
JAPAN	508.7	53
KENYA	1.7	1
MADAGASCAR	4.1	2
MALAYSIA	4.4	0
MALI	22.4	3
MEXICO	4.6	7
MOROCCO	8.5	2
MYANMAR	0.1	1

Country	Disbursements (\$ thousand)	New purchase orders placed
NAMIBIA	9.4	5
NETHERLANDS	370.3	69
NEW ZEALAND	18.3	4
NICARAGUA	0.5	1
NIGERIA	11.1	1
NORWAY	0.6	2
PANAMA	2.0	2
PARAGUAY	6.7	3
PHILIPPINES	29.3	6
POLAND	183.3	22
RUSSIAN FEDERATION	390.8	19
SENEGAL	(0.8)	0
SIERRA LEONE	1.0	2
SINGAPORE	0.1	2
SLOVAK REPUBLIC	0.6	1
SLOVENIA, REPUBLIC OF	1.9	2
SOUTH AFRICA	1.0	1
SPAIN	50.4	0
SRI LANKA	2.8	4
SUDAN	1.0	0
SWEDEN	203.1	43
SWITZERLAND	99.5	47
TAIWAN, CHINA	2.9	3
THAILAND	3.1	3
TUNISIA	0.0	2
UGANDA	0.0	5
UK (HONG KONG)	84.0	30
U.A.EMIRATES	0.0	2
UNITED KINGDOM	2,645.5	543
UNITED REPUBLIC OF TANZANIA	28.1	5
UNITED STATES OF AMERICA	5,687.6	932
URUGUAY	3.1	2
VENEZUELA	4.1	3
VIET NAM	15.5	0
ZAIRE	0.0	1
ZAMBIA	0.5	1
<b>TOTAL COUNTRIES</b>	<b>17,861.8</b>	<b>3248</b>
<b>LOCAL COSTS</b>	<b>176.6</b>	
<b>TOTAL</b>	<b>18,038.4</b>	

**TABLE 4**  
**DISTRIBUTION OF TECHNICAL CO-OPERATION DISBURSEMENTS**  
**BY TYPE: 1989 - 1993**  
(in thousands of dollars)

Year	Source	Experts		Equipment		Fellowships		Visiting scientists		Training courses		Sub-contracts		Miscellaneous		TOTAL		Unliquidated obligations	In-kind balance	TOTAL
		\$	%	\$	%	\$	%	\$	%	\$	%	\$	%	\$	%	\$	%			
1989	UNDP funds	828.6	30.0	823.3	29.8	657.5	23.8	105.8	3.8	307.6	11.1	16.3	0.6	24.7	0.9	2,743.8	100.0	0.0	0.0	2,743.8
	Agency funds	5,994.8	20.5	14,064.0	48.1	3,946.2	13.5	771.4	2.6	3,712.5	12.7	292.1	1.0	483.4	1.6	29,264.4	100.0	0.0	0.0	29,264.4
	Extrabudgetary funds	1,220.9	18.1	3,818.2	56.6	220.1	3.3	38.0	0.6	1,079.1	16.0	363.9	5.4	0.0	0.0	6,740.2	100.0	0.0	0.0	6,740.2
	Assistance in kind	313.9	13.7	18.0	0.8	1,436.8	62.6	13.8	0.6	512.1	22.3	0.0	0.0	0.0	0.0	2,294.6	100.0	0.0	0.0	2,294.6
	Total	8,358.2	20.4	18,723.5	45.6	6,260.6	15.2	929.0	2.3	5,611.3	13.7	672.3	1.6	508.1	1.2	41,063.0	100.0	0.0	0.0	41,063.0
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	331.6	0.0	1,686.9
	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	14,855.9	0.0	51,574.2
	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	2,804.9	0.0	8,387.1
	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	152.0	1,794.2
	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	17,992.4	152.0	63,442.4
1989-1993	UNDP funds	3,183.2	30.8	3,115.2	30.1	1,605.3	14.5	319.8	3.1	1,519.9	14.7	624.9	6.0	85.1	0.8	10,353.4	100.0	331.6	0.0	10,685.0
	Agency funds	38,784.7	21.9	78,550.8	44.4	26,092.1	14.7	4,473.2	2.5	25,142.5	14.2	1,301.5	0.7	2,777.7	1.6	177,122.5	100.0	14,855.9	0.0	191,978.4
	Extrabudgetary funds	6,626.2	20.3	18,952.1	58.2	874.1	2.7	175.4	0.5	3,857.8	11.9	2,090.4	6.4	2.6	0.0	32,578.6	100.0	2,804.9	0.0	35,383.5
	Assistance in kind	1,653.4	18.2	143.0	1.5	5,489.0	60.0	105.5	1.1	1,752.9	19.2	0.0	0.0	0.0	0.0	9,153.8	100.0	0.0	152.0	9,305.8
	Total	50,257.5	21.9	100,761.1	44.0	33,960.5	14.8	5,073.9	2.2	32,273.1	14.1	4,016.8	1.8	2,865.4	1.2	229,208.3	100.0	17,992.4	152.0	247,352.7

TABLE 5

## EXTRABUDGETARY FUNDS FOR TECHNICAL CO-OPERATION ACTIVITIES BY DONOR

(as at 31 December 1993)

Donor	Funds available 1 January 1993	New funds in 1993	Total funds available	Disbursements in 1993	Unliquidated obligations at year-end	Unobligated balance
Part A: Funds for activities where donor is not recipient						
Australia	190,130	354,610	544,740	157,101	79,090	308,549
Belgium	304,421	61,538	365,959	115,948	15,254	234,757
Canada	0	189,394 <sup>a</sup>	189,394	0	0	189,394
Chile	4,000	11,000	15,000	8,950	6,050	0
Colombia	2,863	9,985	12,848	9,985	0	2,863
CEC	141,377	(74,017)	37,360	37,360	0	0
Finland	10,806	0	10,806	0	0	10,806
France	761,952	618,715	1,380,667	503,505	171,848	705,314
Germany, F.R.	307,379	342,749	650,128	263,112	151,861	235,155
Italy	123,573	(31,000)	92,573	34,329	0	58,244
Japan	493,564	407,319 <sup>b</sup>	900,883	298,267	72,228	530,388
Korea, Rep. of	256,108	37,500	293,608	0	0	293,608
Malaysia	0	10,000	10,000	0	0	10,000
Philippines	0	2,520 <sup>c</sup>	2,520	0	0	2,520
Russian Federation	263	(207) <sup>d</sup>	56	56	0	0
Spain	173,674	374,584	548,258	211,240	41,858	295,160
Sweden	80,826	56,365	137,191	68,918	28,747	39,526
UK	1,730,734 <sup>e</sup>	741,050 <sup>f</sup>	2,471,784	766,170	442,905	1,262,709
UNCTF	0	200,000	200,000	1,440	198,560	0
USA	3,275,898	2,029,000	5,304,898	2,525,055	760,118	2,019,725
<b>sub-total</b>	<b>7,827,568</b>	<b>5,341,105</b>	<b>13,168,673</b>	<b>5,001,436</b>	<b>1,968,519</b>	<b>6,198,718</b>
Part B: Funds for activities where donor is recipient						
Bulgaria	0	78,000	78,000	0	73,500	4,500
Chile	130,436	0	130,436	98,094	31,320	1,022
China	50,975	25,000	75,975	4,995	15,995	54,985
Colombia	143,362	622,852	766,214	111,407	0	654,807
Ecuador	2,301	0	2,301	2,162	0	139
Ghana	119,401	0	119,401	40	118,300	1,061
Iceland	32,707	0	32,707	32,707	0	0
Iran, Islamic Rep.	555	200,000	200,555	450	0	200,105
Nicaragua	293,041	0	293,041	0	293,000	41
Nigeria	75	0	75	0	0	75
Pakistan	76,842	84,700	161,542	156,876	0	4,666
Portugal	2,312	0	2,312	1,762	447	103
Saudi Arabia	14,309	0	14,309	11,200	0	3,109
Syrian Arab Rep.	372,095	4,797	376,892	134,555	202,150	40,187
U.A. Emirates	73,395	200,000	273,395	26,534	101,686	145,175
<b>sub-total</b>	<b>1,311,806</b>	<b>1,215,349</b>	<b>2,527,155</b>	<b>580,782</b>	<b>836,398</b>	<b>1,109,975</b>
<b>TOTAL</b>	<b>9,139,374</b>	<b>6,556,454</b>	<b>15,695,828</b>	<b>5,582,218</b>	<b>2,804,917</b>	<b>7,308,693</b>

<sup>a</sup> Represents future-year project provisions. <sup>b</sup> Additional funds provided under non-TC programme for the RCA project in Asia. <sup>c</sup> Included in Miscellaneous Income of the TACF in the Agency's Accounts. <sup>d</sup> Represents \$153 loss on exchange for funds received in earlier years and \$54 reduction of income.

<sup>e</sup> Includes receivable of \$364,073. <sup>f</sup> Represents receivable of \$741,050

TABLE 6A

## TECHNICAL CO-OPERATION PERSONNEL SERVICES: 1993

Recipient	Number of assignments	Number of months	Recipient	Number of assignments	Number of months
Albania	10	2.0	Morocco	27	9.0
Algeria	13	6.5	Myanmar	16	14.0
Argentina	28	11.0	Namibia	2	4.5
Armenia	8	2.5	Nicaragua	14	5.5
Bangladesh	13	5.5	Niger	2	2.0
Bolivia	6	2.0	Nigeria	9	6.0
Brazil	33	15.0	Pakistan	61	24.0
Bulgaria	34	10.0	Panama	7	3.0
Belarus, Republic of	3	1.0	Paraguay	7	3.0
Cameroon	4	4.0	Peru	20	6.5
Chile	30	13.5	Philippines	12	8.0
China	57	25.5	Poland	31	11.0
Colombia	18	9.0	Portugal	4	2.0
Costa Rica	16	7.0	Romania	48	20.5
Cote d'Ivoire	2	1.0	Saudi Arabia	12	5.0
Croatia	15	3.5	Senegal	6	4.5
Cuba	15	8.0	Sierra Leone	6	4.5
Cyprus	3	1.0	Singapore	4	3.0
Czech Republic	33	10.5	Slovak Republic	33	12.0
Dem. P.R. Korea	7	8.0	Slovenia, Rep. of	29	14.0
Dominican Republic	10	4.5	Sri Lanka	16	9.0
Ecuador	16	6.0	Sudan	6	6.0
Egypt	36	18.0	Syrian Arab Rep.	18	9.0
El Salvador	7	3.0	Thailand	31	21.0
Ethiopia	6	3.5	Tunisia	13	3.0
Ghana	12	6.0	Turkey	23	6.0
Greece	10	4.0	Ukraine	33	11.0
Guatemala	13	5.0	United Arab Emirates	7	2.5
Hungary	26	6.5	UK (Hong Kong)	6	2.0
Indonesia	82	41.0	U.R. Tanzania	23	28.0
Iran, Islamic Rep.	42	17.0	Uganda	8	5.0
Jamaica	5	4.0	Uruguay	7	4.0
Jordan	13	5.0	Venezuela	15	6.0
Kenya	13	7.0	Viet Nam	19	13.5
Korea, Rep. of	26	12.0	Zambia	7	5.5
Libyan Arab J.	10	7.0	Zimbabwe	4	3.0
Madagascar	5	3.0	<b>Sub-total</b>	<b>1,366</b>	<b>644.0</b>
Malaysia	27	13.5	Intercountry Projects	1,103	419.5
Mali	3	2.0	Training Courses	509	108.5
Mauritius	4	3.0	<b>Sub-total</b>	<b>1,612</b>	<b>528.0</b>
Mexico	49	19.5	<b>TOTAL</b>	<b>2,978</b>	<b>1,172.0</b>
Mongolia	17	10.5			

TABLE 6B

## RECIPIENTS OF TRAINING ABROAD: 1993

Recipient	Fellows		Visiting Scientists		Training Course Participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Afghanistan	6	24.0	0	0.0	0	0.0	6	24.0
Albania	10	29.0	5	4.0	9	7.5	24	40.5
Algeria	12	30.5	5	3.0	27	22.5	44	56.0
Argentina	21	53.5	13	7.0	31	16.0	65	76.5
Armenia	0	0.0	0	0.0	3	0.5	3	0.5
Azerbaijan	0	0.0	0	0.0	3	0.5	3	0.5
Bangladesh	16	54.0	6	4.0	35	25.0	57	83.0
Barbados	0	0.0	0	0.0	2	1.0	2	1.0
Belarus, Republic of	3	3.5	0	0.0	9	5.0	12	8.5
Bolivia	10	24.5	2	1.5	15	15.0	27	41.0
Brazil	19	59.5	7	4.0	65	47.5	91	111.0
Bulgaria	16	71.5	8	6.0	24	16.0	48	93.5
Burkina-Faso	0	0.0	0	0.0	2	2.0	2	2.0
Burundi	0	0.0	0	0.0	1	0.5	1	0.5
Cambodia	0	0.0	0	0.0	1	1.0	1	1.0
Cameroon	10	35.0	2	0.5	6	4.5	18	40.0
Chad	0	0.0	0	0.0	1	0.5	1	0.5
Chile	17	29.0	1	0.5	29	30.0	47	59.5
China	34	110.0	30	22.0	57	41.0	121	173.0
Colombia	6	31.0	1	1.0	23	31.5	30	63.5
Congo	0	0.0	0	0.0	2	1.5	2	1.5
Costa Rica	7	12.0	1	1.0	15	7.0	23	20.0
Cote d'Ivoire	2	7.5	0	0.0	4	3.5	6	11.0
Croatia	1	3.0	2	1.5	9	6.0	12	10.5
Cuba	22	65.0	4	2.5	33	37.0	59	104.5
Cyprus	1	3.0	1	0.5	6	4.0	8	7.5
Czech Republic	9	36.0	1	0.5	23	14.5	33	51.0
Dem. P.R. Korea	9	16.0	0	0.0	2	2.0	11	18.0
Dominican Rep.	4	11.0	1	0.5	4	3.5	9	15.0
Ecuador	8	23.0	1	0.5	14	15.5	23	39.0
Egypt	26	99.5	4	2.0	25	17.0	55	118.5
El Salvador	3	6.0	0	0.0	14	11.5	17	17.5
Estonia, Republic of	0	0.0	0	0.0	6	5.0	6	5.0
Ethiopia	12	54.0	3	2.0	11	8.0	26	64.0
Gambia	0	0.0	0	0.0	2	1.5	2	1.5
Georgia	0	0.0	0	0.0	3	0.5	3	0.5
Ghana	16	40.0	1	0.5	20	12.0	37	52.5
Greece	3	18.5	0	0.0	8	6.0	11	24.5
Guatemala	10	37.0	1	1.0	19	10.5	30	48.5
Guinea	0	0.0	0	0.0	2	2.0	2	2.0

Recipient	Fellows		Visiting Scientists		Training Course Participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Guyana	0	0.0	0	0.0	2	1.5	2	1.5
Hungary	10	40.5	11	6.5	16	12.0	37	59.0
India	0	0.0	0	0.0	33	18.5	33	18.5
Indonesia	35	122.5	12	8.0	39	25.0	86	155.5
Iran, I.R.	41	147.0	5	2.0	19	11.5	65	160.5
Jamaica	0	0.0	0	0.0	6	3.0	6	3.0
Jordan	9	18.0	1	0.5	23	17.5	33	36.0
Kazakhstan	0	0.0	0	0.0	4	1.0	4	1.0
Kenya	13	53.0	1	0.5	16	10.0	30	63.5
Korea, Republic of	16	63.0	3	1.0	23	16.0	42	80.0
Kuwait	0	0.0	0	0.0	1	0.5	1	0.5
Kyrgyzstan	0	0.0	0	0.0	2	0.5	2	0.5
Lao P.D.R.	0	0.0	0	0.0	2	1.5	2	1.5
Latvia	0	0.0	0	0.0	3	1.0	3	1.0
Lebanon	1	3.0	0	0.0	4	1.5	5	4.5
Libyan Arab J.	14	52.0	0	0.0	8	5.5	22	57.5
Lithuania	0	0.0	0	0.0	4	1.0	4	1.0
Macedonia (former YUG)	0	0.0	1	0.5	0	0.0	1	0.5
Madagascar	4	9.5	1	0.5	6	3.5	11	13.5
Malawi	0	0.0	0	0.0	2	2.0	2	2.0
Malaysia	20	60.0	9	5.5	30	22.0	59	87.5
Mali	6	18.0	0	0.0	3	2.0	9	20.0
Mauritania	0	0.0	0	0.0	1	0.5	1	0.5
Mauritius	0	0.0	0	0.0	3	1.5	3	1.5
Mexico	10	28.5	2	1.0	32	23.0	44	52.5
Moldova	0	0.0	0	0.0	3	0.5	3	0.5
Mongolia	16	48.5	6	5.0	8	6.5	30	60.0
Morocco	17	39.0	0	0.0	15	9.0	32	48.0
Myanmar	15	54.5	1	0.5	9	9.0	25	64.0
Namibia	2	6.0	0	0.0	3	2.5	5	8.5
Nicaragua	5	21.0	1	0.5	5	3.0	11	24.5
Niger	7	26.5	0	0.0	5	3.5	12	30.0
Nigeria	13	54.5	2	1.0	9	6.0	24	61.5
Oman	0	0.0	0	0.0	2	1.5	2	1.5
Pakistan	19	62.5	9	4.0	39	26.5	67	93.0
Panama	4	5.5	0	0.0	10	6.5	14	12.0
Papua New Guinea	0	0.0	0	0.0	1	1.0	1	1.0
Paraguay	3	11.0	0	0.0	9	4.5	12	15.5
Peru	14	45.0	4	2.0	26	24.5	44	71.5
Philippines	14	48.0	2	1.5	40	34.5	56	84.0
Poland	11	31.0	7	3.5	11	6.5	29	41.0
Portugal	2	2.0	2	0.5	3	2.0	7	4.5
Qatar	0	0.0	0	0.0	1	1.0	1	1.0
Romania	27	72.0	8	4.5	26	21.5	61	98.0

Recipient	Fellows		Visiting Scientists		Training Course Participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Russian Federation	0	0.0	0	0.0	12	10.5	12	10.5
Rwanda	0	0.0	0	0.0	2	2.0	2	2.0
Saudi Arabia	6	10.0	3	1.5	9	5.5	18	17.0
Senegal	2	2.0	0	0.0	5	3.5	7	5.5
Sierra Leone	6	21.0	0	0.0	8	7.0	14	28.0
Singapore	1	9.0	0	0.0	6	3.0	7	12.0
Slovak Republic	4	12.5	3	1.0	19	11.0	26	24.5
Slovenia, Republic of	3	9.0	0	0.0	14	9.0	17	18.0
Sri Lanka	11	38.5	2	1.0	22	13.0	35	52.5
Sudan	12	61.5	0	0.0	17	15.0	29	76.5
Swaziland	0	0.0	0	0.0	1	0.5	1	0.5
Syrian A.R.	19	47.0	2	0.5	24	15.0	45	62.5
Thailand	21	82.0	6	5.0	38	24.5	65	111.5
Trinidad and Tobago	0	0.0	0	0.0	1	0.5	1	0.5
Tunisia	2	7.0	2	1.0	15	7.5	19	15.5
Turkey	8	22.0	2	1.0	18	12.0	28	35.0
Uganda	7	35.0	1	1.0	11	7.5	19	43.5
UK (Hong Kong)	0	0.0	1	0.5	1	0.5	2	1.0
Ukraine	3	5.0	6	3.0	23	14.5	32	22.5
U.A. Emirates	0	0.0	0	0.0	4	2.0	4	2.0
U.R. Tanzania	12	45.5	2	1.0	9	6.5	23	53.0
Uruguay	4	8.5	1	1.0	23	26.5	28	36.0
Uzbekistan	0	0.0	0	0.0	4	1.0	4	1.0
Venezuela	4	12.0	0	0.0	26	33.5	30	45.5
Viet Nam	26	91.0	6	3.0	38	24.0	70	118.0
Zaire	5	20.0	1	0.5	8	6.5	14	27.0
Zambia	7	16.0	0	0.0	13	10.5	20	26.5
Zimbabwe	4	13.0	0	0.0	7	5.5	11	18.5
TOTAL	828	2,696.0	226	136.0	1,450	1,066.0	2,504	3,898.0

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

TABLE 7

## FINANCIAL SUMMARY: 1993

(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 CC	TACF NCC	Extra-bud.	In kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)		
AFGHANISTAN	0.0	7.6	50.3	0.0	0.0	57.9	0.0	40.9	17.0	0.0	0.0	57.9	14.1	72.0
ALBANIA	20.3	98.0	96.0	0.0	0.0	214.3	9.2	188.1	3.4	0.0	13.6	214.3	87.3	301.6
ALGERIA	71.3	351.6	104.1	0.0	0.0	527.0	0.0	510.9	16.1	0.0	0.0	527.0	156.1	683.1
ARGENTINA	160.0	108.4	206.5	0.0	0.0	474.9	2.1	467.6	0.0	0.0	5.2	474.9	260.5	735.4
ARMENIA	23.2	0.0	0.0	0.0	0.0	23.2	0.0	23.2	0.0	0.0	0.0	23.2	3.2	26.4
BANGLADESH	62.6	550.2	157.6	0.0	0.0	770.4	0.0	600.8	0.1	166.2	3.3	770.4	188.9	959.3
BELARUS, REP. OF	6.4	0.0	9.0	0.0	0.0	15.4	0.0	14.0	0.0	1.4	0.0	15.4	208.4	223.8
BOLIVIA	30.8	159.7	57.1	0.0	0.0	247.6	0.0	237.7	0.0	9.9	0.0	247.6	232.2	479.8
BRAZIL	231.7	362.6	210.3	0.0	0.0	804.6	0.0	690.6	0.0	95.5	18.5	804.6	145.5	950.1
BULGARIA	108.7	401.1	226.0	0.0	0.0	735.8	0.0	371.6	14.2	246.6	103.4	735.8	170.9	906.7
CAMEROON	44.5	98.6	106.9	0.0	0.0	250.0	0.0	250.0	0.0	0.0	0.0	250.0	54.0	304.0
CHILE	189.1	365.3	78.6	0.0	0.0	633.0	0.0	514.2	0.0	103.6	15.2	633.0	196.6	829.6
CHINA	320.8	334.7	432.8	3.4	0.0	1,091.7	130.2	888.3	8.2	31.3	33.7	1,091.7	400.0	1,491.7
COLOMBIA	111.0	566.1	77.1	0.0	0.0	754.2	0.0	488.9	0.0	265.3	0.0	754.2	186.7	940.9
COSTA RICA	81.0	268.1	53.9	0.0	0.0	403.0	0.0	351.8	0.0	46.3	4.9	403.0	128.1	531.1
COTE D'IVOIRE	19.8	108.9	23.2	0.0	0.0	151.9	0.0	151.9	0.0	0.0	0.0	151.9	11.7	163.6
CROATIA	33.1	169.7	15.9	0.0	0.0	218.7	0.0	211.9	0.0	0.0	6.8	218.7	24.5	243.2
CUBA	72.0	336.7	152.1	0.0	0.0	560.8	0.0	526.9	20.4	0.0	13.5	560.8	515.2	1,076.0
CYPRUS	11.4	38.5	3.3	0.0	0.0	53.2	0.0	52.3	0.0	0.9	0.0	53.2	82.5	135.7
CZECH REPUBLIC	85.2	0.1	91.3	0.0	0.0	176.6	0.0	69.9	0.0	9.0	97.7	176.6	9.0	185.6
DEM. P.R. KOREA	77.4	113.3	76.1	0.0	0.0	266.8	0.0	266.8	0.0	0.0	0.0	266.8	162.2	429.0
DOMINICAN REP.	47.8	135.3	41.1	0.0	0.0	224.2	0.0	224.2	0.0	0.0	0.0	224.2	36.1	260.3
ECUADOR	69.8	301.4	58.4	0.0	0.0	429.6	0.0	381.6	0.0	45.4	2.6	429.6	144.0	573.6
EGYPT	226.0	441.6	237.7	0.0	0.0	905.3	9.2	697.3	4.9	159.7	34.2	905.3	336.1	1,241.4
EL SALVADOR	35.1	107.2	15.2	0.0	0.0	157.5	0.0	126.6	0.0	30.9	0.0	157.5	50.4	207.9
ETHIOPIA	35.3	212.2	136.9	0.0	0.0	384.4	0.0	305.5	52.2	3.4	23.3	384.4	280.5	664.9
GHANA	87.9	315.2	150.8	0.0	0.0	553.9	0.0	396.5	0.0	132.4	25.0	553.9	833.7	1,387.6
GREECE	39.0	224.3	55.1	0.0	0.0	318.4	0.0	153.9	0.0	128.3	36.2	318.4	161.5	479.9
GUATEMALA	60.2	128.0	77.5	0.0	0.0	265.7	0.0	230.8	0.0	34.9	0.0	265.7	100.7	366.4
HAITI	0.0	5.4	0.0	0.0	0.0	5.4	0.0	5.4	0.0	0.0	0.0	5.4	0.0	5.4
HUNGARY	42.0	100.0	131.7	0.0	0.0	273.7	0.0	53.1	0.0	100.5	120.1	273.7	61.7	335.4
ICELAND	0.0	33.9	0.0	0.0	0.0	33.9	0.0	1.2	0.0	32.7	0.0	33.9	0.0	33.9
INDONESIA	646.6	285.2	351.6	0.0	2.5	1,285.9	6.8	1,029.9	10.6	147.4	91.2	1,285.9	180.4	1,466.3
IRAN, I.R.	215.2	350.1	244.8	0.0	0.0	810.1	0.0	679.7	127.7	0.5	2.2	810.1	460.4	1,270.5
IRAQ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7
JAMAICA	32.5	76.5	0.3	0.0	0.0	109.3	0.0	109.3	0.0	0.0	0.0	109.3	22.1	131.4
JORDAN	62.7	158.6	39.9	0.0	0.0	261.2	0.0	227.2	0.0	34.0	0.0	261.2	112.9	374.1
KENYA	93.7	200.7	105.4	0.0	0.0	399.8	0.0	248.1	0.0	109.6	42.1	399.8	229.2	629.0
KOREA, REP. OF	200.7	34.1	208.1	0.0	0.0	442.9	0.0	405.6	0.0	14.7	22.6	442.9	68.4	511.3
LEBANON	0.0	40.5	9.0	0.0	0.0	49.5	0.0	49.5	0.0	0.0	0.0	49.5	0.0	49.5
LIBYAN A.J.	105.3	139.9	96.4	0.0	0.0	341.6	0.0	292.7	35.3	13.6	0.0	341.6	188.4	530.0
MACEDONIA (FORMER YUG)	0.0	0.0	2.9	0.0	0.0	2.9	0.0	2.9	0.0	0.0	0.0	2.9	0.0	2.9

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 CC	TACF NCC	Extra-bud.	In kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)		
MADAGASCAR	35.5	113.1	49.4	0.0	0.0	198.0	0.0	198.0	0.0	0.0	0.0	198.0	107.5	305.5
MALAYSIA	209.2	265.9	245.2	0.0	0.0	720.3	0.0	615.3	0.0	95.6	9.4	720.3	105.5	825.8
MALI	22.7	137.9	51.5	0.0	0.0	212.1	0.0	212.1	0.0	0.0	0.0	212.1	59.3	271.4
MAURITIUS	46.3	74.6	0.0	0.0	0.0	120.9	0.0	120.9	0.0	0.0	0.0	120.9	66.6	187.5
MEXICO	259.9	316.6	115.3	0.0	0.0	691.8	0.0	408.8	0.0	258.3	24.7	691.8	381.0	1,072.8
MONGOLIA	131.6	255.6	186.2	0.0	0.0	573.4	0.0	543.8	29.6	0.0	0.0	573.4	156.5	729.9
MOROCCO	82.9	370.9	174.4	0.0	0.0	628.2	0.0	463.8	0.0	138.5	25.9	628.2	197.9	826.1
MYANMAR	138.8	203.7	93.5	0.0	0.0	436.0	0.0	436.0	0.0	0.0	0.0	436.0	100.1	536.1
NAMIBIA	49.0	35.0	18.9	0.0	0.0	102.9	0.0	102.9	0.0	0.0	0.0	102.9	18.3	121.2
NICARAGUA	65.4	69.6	54.9	0.0	0.0	189.9	0.0	183.2	0.0	0.0	6.7	189.9	558.4	748.3
NIGER	45.7	129.2	72.8	0.0	0.0	247.7	0.0	237.4	0.0	0.0	10.3	247.7	148.6	396.3
NIGERIA	47.9	410.6	144.0	0.0	40.4	642.9	0.0	451.9	0.0	150.7	40.3	642.9	282.2	925.1
PAKISTAN	291.9	519.8	197.9	2.6	0.0	1,012.2	0.0	819.2	28.4	156.9	7.7	1,012.2	205.5	1,217.7
PANAMA	31.4	127.4	15.9	0.0	0.0	174.7	0.0	174.7	0.0	0.0	0.0	174.7	58.2	232.9
PARAGUAY	39.0	166.5	27.5	0.0	0.0	233.0	0.0	229.2	0.0	3.8	0.0	233.0	36.5	269.5
PERU	95.5	396.6	150.3	0.0	0.0	642.4	0.0	420.0	2.2	159.1	61.1	642.4	495.9	1,138.3
PHILIPPINES	82.2	375.0	120.8	0.0	0.0	578.0	0.0	464.9	0.0	87.2	25.9	578.0	102.7	680.7
POLAND	116.0	233.3	94.4	5.6	0.0	449.3	0.0	309.3	24.4	85.0	30.6	449.3	353.6	802.9
PORTUGAL	18.5	318.4	14.0	0.0	0.0	350.9	0.0	231.4	0.0	119.5	0.0	350.9	146.2	497.1
ROMANIA	211.7	153.1	275.6	0.0	60.0	700.4	16.4	528.3	0.9	97.3	57.5	700.4	202.6	903.0
SAUDI ARABIA	57.4	11.6	46.4	0.0	0.0	115.4	0.0	95.1	0.0	11.2	9.1	115.4	14.6	130.0
SENEGAL	31.4	55.2	10.0	0.0	0.0	96.6	0.0	96.6	0.0	0.0	0.0	96.6	38.8	135.4
SIERRA LEONE	56.6	219.2	53.4	0.0	0.0	329.2	0.0	288.0	41.2	0.0	0.0	329.2	134.2	463.4
SINGAPORE	20.2	11.7	27.3	0.0	0.0	59.2	0.0	59.2	0.0	0.0	0.0	59.2	31.6	90.8
SLOVAK REPUBLIC	72.5	34.6	37.1	0.0	0.0	144.2	0.0	86.7	0.0	2.0	55.5	144.2	55.6	199.8
SLOVENIA, REP. OF	120.7	39.2	27.2	0.0	0.0	187.1	0.0	95.8	0.0	57.1	34.2	187.1	91.4	278.5
SRI LANKA	73.5	259.9	107.6	0.0	0.0	441.0	0.0	436.8	0.0	3.8	0.4	441.0	151.7	592.7
SUDAN	31.4	216.4	129.9	0.0	0.0	377.7	0.0	370.6	7.1	0.0	0.0	377.7	138.7	516.4
SYRIAN A.R.	85.6	442.8	139.7	0.0	0.0	668.1	0.0	476.7	56.9	134.5	0.0	668.1	908.6	1,576.7
THAILAND	220.2	280.2	292.7	0.0	0.0	793.1	5.7	711.6	9.9	31.3	34.6	793.1	297.1	1,090.2
TUNISIA	36.8	152.3	29.2	0.0	0.0	218.3	0.0	155.0	0.0	60.0	3.3	218.3	268.9	487.2
TURKEY	89.8	471.0	80.3	0.0	57.1	698.2	332.1	355.9	10.2	0.0	0.0	698.2	155.3	853.5
UGANDA	62.9	185.0	51.3	0.0	0.0	299.2	0.0	299.2	0.0	0.0	0.0	299.2	248.6	547.8
UK (HONG KONG)	24.5	0.0	4.4	0.0	0.0	28.9	0.0	28.9	0.0	0.0	0.0	28.9	2.1	31.0
UKRAINE	117.3	57.2	37.4	0.0	0.0	211.9	0.0	181.3	0.2	0.0	30.4	211.9	53.4	265.3
URUGUAY	42.8	174.1	33.2	0.0	0.0	250.1	0.0	209.3	0.0	40.8	0.0	250.1	198.5	448.6
U. A. EMIRATES	32.0	86.6	0.0	0.0	0.0	118.6	0.0	90.6	0.0	26.6	1.4	118.6	141.2	259.8
U. R. TANZANIA	236.8	384.1	129.6	0.0	0.0	750.5	0.0	433.4	0.0	317.1	0.0	750.5	389.9	1,140.4
VENEZUELA	77.1	54.8	40.9	0.0	0.0	172.8	0.0	158.1	4.5	0.0	10.2	172.8	140.0	312.8
VIET NAM	138.6	358.7	187.9	23.1	0.0	708.3	0.0	705.3	3.0	0.0	0.0	708.3	204.7	913.0
YUGOSLAVIA	0.0	25.0	0.5	0.0	0.0	25.5	0.0	19.7	0.0	5.8	0.0	25.5	54.9	80.4
ZAIRE	0.0	121.3	46.1	0.0	0.0	167.4	0.0	167.4	0.0	0.0	0.0	167.4	111.7	279.1
ZAMBIA	68.8	166.0	52.7	0.0	0.0	287.5	0.0	287.5	0.0	0.0	0.0	287.5	55.3	342.8
ZIMBABWE	48.8	102.0	19.4	0.0	0.0	170.2	0.0	152.6	0.0	17.6	0.0	170.2	65.4	235.6
<b>SUB-TOTAL</b>	<b>7,526.9</b>	<b>16,311.0</b>	<b>7,877.6</b>	<b>34.7</b>	<b>160.0</b>	<b>31,910.2</b>	<b>511.7</b>	<b>25,651.7</b>	<b>528.6</b>	<b>4,023.7</b>	<b>1,194.5</b>	<b>31,910.2</b>	<b>14,240.1</b>	<b>46,150.3</b>

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 CC	TACF NCC	Extra-bud.	In-kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)		
<b>Intercountry Projects</b>														
INTERREGIONAL	866.5	9.9	0.0	2,610.8	40.0	3,527.2	14.6	3,162.7	71.3	213.8	64.8	3,527.2	724.9	4,252.1
REGIONAL AFRICA	1,007.7	501.8	0.0	859.9	0.8	2,370.2	0.0	2,030.8	28.8	294.9	15.7	2,370.2	816.9	3,187.1
REGIONAL ARAB STATES	4.0	0.0	0.0	0.0	0.0	4.0	4.0	0.0	0.0	0.0	0.0	4.0	0.0	4.0
REGIONAL EUROPE	774.9	120.9	0.0	581.5	190.7	1,668.0	242.9	1,204.9	14.0	160.2	46.0	1,668.0	531.0	2,199.0
REG. ASIA & PACIFIC	881.8	278.9	33.3	1,323.9	130.8	2,648.7	566.0	1,398.4	71.2	444.7	168.4	2,648.7	732.1	3,380.8
REG. LATIN AMERICA	580.9	445.7	26.5	1,424.7	57.2	2,535.0	16.1	1,892.6	28.6	444.9	152.8	2,535.0	880.6	3,415.6
<b>SUB-TOTAL</b>	<b>4,115.8</b>	<b>1,357.2</b>	<b>59.8</b>	<b>6,800.8</b>	<b>419.5</b>	<b>12,753.1</b>	<b>843.6</b>	<b>9,689.4</b>	<b>213.9</b>	<b>1,558.5</b>	<b>447.7</b>	<b>12,753.1</b>	<b>3,685.5</b>	<b>16,438.6</b>
<b>MISCELLANEOUS</b>	<b>166.6</b>	<b>243.6</b>	<b>121.0</b>	<b>101.4</b>	<b>2.1</b>	<b>634.7</b>	<b>0.0</b>	<b>634.7</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>634.7</b>	<b>66.8</b>	<b>701.5</b>
<b>GRAND TOTAL</b>	<b>11,809.3</b>	<b>17,911.8</b>	<b>8,058.4</b>	<b>6,936.9</b>	<b>581.6</b>	<b>45,298.0</b>	<b>1,355.3</b>	<b>35,975.8</b>	<b>742.5</b>	<b>5,582.2</b>	<b>1,642.2</b>	<b>45,298.0</b>	<b>17,992.4</b>	<b>63,290.4</b>

**TABLE 8**  
**FINANCIAL SUMMARY: 1958-1993**  
(in thousands of dollars)

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)
AFGHANISTAN	394.6	471.9	201.6	0.0	0.0	1,068.1	92.9	893.4	0.0	81.8	1,068.1
ALBANIA	277.8	2,020.4	511.2	38.5	0.0	2,847.9	270.7	2,513.6	0.0	63.6	2,847.9
ALGERIA	754.9	3,182.3	752.7	0.0	0.0	4,689.9	21.7	4,517.1	0.0	151.1	4,689.9
ARGENTINA	3,821.6	2,919.2	1,874.7	0.0	0.0	8,615.5	5,148.9	2,899.0	17.5	550.1	8,615.5
ARMENIA	23.2	0.0	0.0	0.0	0.0	23.2	0.0	23.2	0.0	0.0	23.2
BANGLADESH	1,462.1	6,660.2	3,647.1	0.0	0.0	11,769.4	63.8	8,313.1	1,777.9	1,614.6	11,769.4
BELARUS, REP. OF	6.4	48.8	12.0	0.0	0.0	67.2	0.0	65.8	1.4	0.0	67.2
BOLIVIA	793.1	2,801.5	553.1	27.1	0.0	4,174.8	159.5	3,200.9	636.8	177.6	4,174.8
BRAZIL	7,064.3	8,272.6	3,204.5	0.0	0.0	18,541.4	5,674.9	8,673.1	3,305.3	888.1	18,541.4
BULGARIA	651.5	5,275.7	3,518.3	0.0	474.8	9,920.3	543.9	7,758.0	730.6	887.8	9,920.3
CAMEROON	608.0	861.0	308.8	0.0	0.0	1,777.8	297.3	1,373.2	88.3	19.0	1,777.8
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	3,347.8	4,972.6	2,108.2	0.0	0.0	10,428.6	3,615.1	6,064.1	219.7	529.7	10,428.6
CHINA	2,495.1	3,365.6	4,108.8	6.3	8.1	9,983.9	2,772.6	6,243.5	563.5	404.3	9,983.9
COLOMBIA	1,824.2	4,890.0	1,392.9	0.0	0.0	8,107.1	1,693.6	4,623.7	1,042.9	746.9	8,107.1
COSTA RICA	1,147.0	1,903.1	415.6	0.0	7.0	3,472.7	618.1	2,282.9	374.2	197.5	3,472.7
COTE D'IVOIRE	594.8	1,168.6	261.4	0.0	0.0	2,024.8	73.4	1,801.4	119.8	30.2	2,024.8
CROATIA	33.1	169.7	15.9	0.0	0.0	218.7	0.0	211.9	0.0	6.8	218.7
CUBA	972.7	7,353.5	1,129.3	0.0	0.0	9,455.5	2,259.5	6,985.3	39.2	171.5	9,455.5
CYPRUS	212.6	1,112.4	269.5	0.0	31.0	1,625.5	24.1	1,228.4	205.9	167.1	1,625.5
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	85.2	0.1	91.3	0.0	0.0	176.6	0.0	69.9	9.0	97.7	176.6
DEM. P.R. KOREA	481.4	4,949.8	1,007.9	0.0	0.0	6,439.1	0.0	5,908.1	52.6	478.4	6,439.1
DOMINICAN REP.	332.6	1,241.2	333.9	0.0	0.0	1,907.7	0.0	1,871.6	3.9	32.2	1,907.7
ECUADOR	1,757.4	5,485.6	1,115.8	0.0	16.9	8,375.7	547.5	6,037.9	1,294.6	495.7	8,375.7
EGYPT	4,266.9	13,826.9	5,259.7	99.6	1,260.8	24,713.9	2,129.0	11,549.2	8,256.0	2,779.7	24,713.9
EL SALVADOR	393.0	1,285.5	254.4	0.0	0.0	1,932.9	14.1	1,384.1	356.9	177.8	1,932.9
ETHIOPIA	750.7	1,562.4	815.2	0.0	0.0	3,128.3	437.5	2,457.6	48.8	184.4	3,128.3
GABON	89.6	90.7	29.3	0.0	0.0	209.6	0.0	197.0	0.0	12.6	209.6
GHANA	1,085.7	3,851.2	3,011.1	0.0	0.0	7,948.0	354.5	5,081.1	1,011.6	1,500.8	7,948.0
GREECE	2,074.3	2,800.7	1,450.6	0.0	0.0	6,325.6	1,561.9	3,285.0	752.7	726.0	6,325.6
GUATEMALA	582.7	2,508.3	548.2	0.0	224.9	3,864.1	56.2	2,782.0	903.8	122.1	3,864.1
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	321.5	8,594.5	2,255.9	0.0	0.0	11,171.9	720.3	8,796.8	1,054.9	599.9	11,171.9
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	5,696.2	5,781.8	3,488.6	7.2	38.0	15,011.8	2,511.9	8,814.1	2,355.0	1,330.8	15,011.8
IRAN, I.R.	2,099.5	4,038.3	1,885.7	0.0	211.7	8,235.2	2,122.8	5,274.3	445.0	393.1	8,235.2
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	383.4	993.9	76.2	0.0	55.0	1,508.5	15.3	1,314.1	108.3	70.8	1,508.5
JORDAN	899.0	1,713.7	523.6	0.0	0.0	3,136.3	89.3	2,661.1	272.1	113.8	3,136.3
KENYA	1,120.1	2,061.3	1,435.3	0.0	0.0	4,616.7	97.2	2,986.5	906.6	626.4	4,616.7

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)
KOREA, REP. OF	4,507.8	2,230.1	4,983.1	0 0	0.0	11,721.0	1,206.8	6,512.2	1,551.4	2,450.6	11,721.0
LEBANON	248.5	338.9	138.7	0.0	0.0	726.1	139.3	532.2	31.4	23.2	726.1
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.	1,029.3	1,053.0	1,395.6	0.0	0.0	3,477.9	7.3	2,814.6	563.6	92.4	3,477.9
MACEDONIA (FORMER YUG)	0.0	0.0	2.9	0.0	0.0	2.9	0.0	2.9	0.0	0.0	2.9
MADAGASCAR	1,473.7	1,989.5	393.8	0.0	0.0	3,857.0	1,436.6	2,108.9	244.2	67.3	3,857.0
MALAWI	5.1	0.0	0.0	0.0	0.0	5.1	5.1	0.0	0.0	0.0	5.1
MALAYSIA	2,508.5	4,479.4	2,002.9	0.0	0.0	8,990.8	1.6	7,016.2	1,349.9	623.1	8,990.8
MALI	921.7	1,684.4	510.4	0.0	0.0	3,116.5	13.4	2,837.1	143.4	122.6	3,116.5
MAURITIUS	195.2	431.2	75.5	0.0	0.0	701.9	0.0	698.1	3.8	0.0	701.9
MEXICO	3,725.0	3,128.4	2,079.6	0.0	564.8	9,497.8	419.3	5,925.4	2,122.6	1,030.5	9,497.8
MONGOLIA	854.2	2,522.8	602.2	0.0	0.0	3,979.2	0.0	3,943.8	10.6	24.8	3,979.2
MOROCCO	2,197.1	2,705.6	1,082.6	0.0	18.0	6,003.3	909.6	4,080.4	664.9	348.4	6,003.3
MYANMAR	1,097.4	2,092.0	447.7	0.0	0.0	3,637.1	537.0	2,996.5	0.0	103.6	3,637.1
NAMIBIA	85.0	35.0	18.9	0.0	0.0	138.9	0.0	135.1	0.0	3.8	138.9
NICARAGUA	273.9	1,067.4	227.5	0.0	0.0	1,568.8	0.0	1,562.1	0.0	6.7	1,568.8
NIGER	508.4	1,184.8	282.6	0.0	0.0	1,975.8	0.0	1,836.7	56.9	82.2	1,975.8
NIGERIA	3,411.2	4,582.7	2,658.0	0.0	297.5	10,949.4	980.9	4,550.4	4,206.4	1,211.7	10,949.4
PAKISTAN	2,597.5	5,264.3	4,640.6	45.0	112.0	12,659.4	1,842.0	8,963.2	422.6	1,431.6	12,659.4
PANAMA	552.2	1,645.2	350.6	0.0	0.0	2,548.0	4.1	2,190.5	212.3	141.1	2,548.0
PARAGUAY	394.1	1,520.0	394.4	0.0	0.0	2,308.5	0.0	2,034.2	149.7	124.6	2,308.5
PERU	4,068.4	7,830.9	1,811.4	2.7	58.6	13,772.0	3,907.6	5,890.1	3,059.6	914.7	13,772.0
PHILIPPINES	2,829.0	5,186.0	4,317.1	0.0	90.8	12,422.9	1,964.4	6,656.3	1,460.1	2,342.1	12,422.9
POLAND	426.9	7,212.6	3,675.0	5.6	0.0	11,320.1	202.9	8,820.1	1,457.2	839.9	11,320.1
PORTUGAL	591.6	4,604.6	500.5	0.0	0.0	5,696.7	0.0	4,339.4	1,167.5	189.8	5,696.7
ROMANIA	1,780.5	6,086.2	1,770.7	0.0	224.5	9,861.9	3,223.1	5,913.7	276.4	448.7	9,861.9
SAUDI ARABIA	265.6	49.9	94.5	0.0	0.0	410.0	0.0	382.7	11.2	16.1	410.0
SENEGAL	585.4	1,560.4	310.2	0.0	0.0	2,456.0	345.8	1,883.2	154.7	72.3	2,456.0
SIERRA LEONE	561.8	710.9	352.1	0.0	0.0	1,624.8	174.5	1,314.8	12.4	123.1	1,624.8
SINGAPORE	518.6	1,256.8	232.8	0.0	0.0	2,008.2	0.0	1,838.4	103.3	66.5	2,008.2
SLOVAK REPUBLIC	72.5	34.6	37.1	0.0	0.0	144.2	0.0	86.7	2.0	55.5	144.2
SLOVENIA, REP. OF	120.7	39.2	27.2	0.0	0.0	187.1	0.0	95.8	57.1	34.2	187.1
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	1,370.5	4,024.3	2,173.3	0.0	0.0	7,568.1	307.9	5,833.3	752.4	674.5	7,568.1
SUDAN	1,020.4	2,848.7	2,555.2	0.0	13.4	6,437.7	296.7	4,858.2	580.2	702.6	6,437.7
SYRIAN A.R.	1,081.4	3,351.4	1,070.0	0.0	255.5	5,758.3	693.2	4,189.4	765.4	110.3	5,758.3
THAILAND	3,801.6	6,038.6	6,262.1	19.0	3.8	16,125.1	2,025.3	8,517.3	2,654.6	2,927.9	16,125.1
TUNISIA	909.7	2,069.9	511.5	0.0	0.0	3,491.1	141.2	2,630.3	534.3	185.3	3,491.1
TURKEY	2,637.4	4,224.6	3,801.1	0.0	278.7	10,941.8	2,563.6	6,275.6	130.8	1,971.8	10,941.8
UGANDA	542.3	1,058.6	568.8	0.0	0.0	2,169.7	131.0	1,983.5	0.0	55.2	2,169.7
UK (HONG KONG)	191.9	213.0	62.7	0.0	0.0	467.6	0.0	458.6	0.0	9.0	467.6
UKRAINE	199.9	131.8	48.6	0.0	0.0	380.3	0.0	334.1	0.0	46.2	380.3
URUGUAY	1,002.5	3,156.3	663.2	0.0	0.0	4,822.0	193.1	3,347.5	958.6	322.8	4,822.0
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	141.9	999.7	28.1	0.0	0.0	1,169.7	0.0	472.2	696.1	1.4	1,169.7
U.R. TANZANIA	1,061.1	2,202.0	1,191.7	0.0	0.0	4,454.8	9.6	3,823.2	415.0	207.0	4,454.8
VENEZUELA	1,591.0	2,225.4	677.9	24.7	0.0	4,519.0	396.5	3,719.0	191.0	212.5	4,519.0

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)
VIET NAM	938.3	6,096.1	2,840.8	23.7	0.0	9,898.9	31.4	8,908.2	139.5	819.8	9,898.9
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	2,384.9	1,059.8	0.0	0.0	4,279.6	578.8	3,044.0	206.5	450.3	4,279.6
ZAMBIA	1,726.9	3,297.5	1,007.2	0.0	0.0	6,031.6	152.5	5,422.5	180.9	275.7	6,031.6
ZIMBABWE	257.2	457.4	161.5	0.0	0.0	876.1	0.0	834.8	17.6	23.7	876.1
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>111,750.5</b>	<b>250,413.8</b>	<b>118,230.7</b>	<b>299.4</b>	<b>4,302.3</b>	<b>484,996.7</b>	<b>65,861.4</b>	<b>317,223.1</b>	<b>59,006.6</b>	<b>42,905.6</b>	<b>484,996.7</b>
INTERREGIONAL	14,577.6	5,259.4	17,041.9	18,674.8	563.8	56,117.5	1,845.2	46,660.6	4,568.0	3,043.7	56,117.5
REGIONAL AFRICA	5,076.7	3,240.9	353.7	3,586.5	129.7	12,387.5	332.8	11,254.4	676.9	123.4	12,387.5
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	8,973.1	4,997.5	2,737.0	9,040.9	619.0	26,367.5	9,793.9	9,046.9	5,355.5	2,171.2	26,367.5
REG. EUROPE	2,511.4	1,339.6	113.5	2,035.6	1,764.2	7,764.3	302.4	6,718.6	538.6	204.7	7,764.3
REG. LATIN AMERICA	7,784.9	7,017.7	1,659.9	8,103.6	998.5	25,564.6	3,042.5	13,907.9	6,179.2	2,435.0	25,564.6
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>38,965.8</b>	<b>21,867.6</b>	<b>21,950.3</b>	<b>41,448.4</b>	<b>4,075.2</b>	<b>128,307.3</b>	<b>15,422.7</b>	<b>87,588.4</b>	<b>17,318.2</b>	<b>7,978.0</b>	<b>128,307.3</b>
MISCELLANEOUS	1,061.5	1,858.4	737.5	472.8	36.5	4,166.7	23.2	4,143.5	0.0	0.0	4,166.7
<b>GRAND TOTAL</b>	<b>151,777.8</b>	<b>274,139.8</b>	<b>140,918.5</b>	<b>42,220.6</b>	<b>8,414.0</b>	<b>617,470.7</b>	<b>81,307.3</b>	<b>408,955.0</b>	<b>76,324.8</b>	<b>50,883.6</b>	<b>617,470.7</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			1992			1993		
	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	764	186	24.3	828	181	21.9
<b>Visiting scientists</b>	65	7	10.8	191	33	17.3	226	42	18.6
<b>Training course participants</b>	511	46	9.0	1199	282	23.5	1450	331	22.8
<b>Project counterparts</b>	519	64	12.3	1314	184	14.0	1605	231	14.4
<b>International experts</b>	319	7	2.2	861	56	6.5	1124	80	7.1
<b>National experts</b>	12	0	0.0	380	54	14.2	488	59	12.1
<b>Lecturers</b>	119	2	1.7	320	24	7.5	395	43	10.9
<b>Other project personnel</b>	11	9	81.8	5	4	80.0	7	5	71.4
<b>TC Professional staff<sup>a</sup></b>	34	5	14.7	49	10	20.4	48	12	25.0
<b>TC General Service staff<sup>a</sup></b>	54	48	88.9	91	81	89.0	88	81	92.0

<sup>a</sup> Excluding the staff of Printing Section and Publishing Section

## Explanatory Notes to Annexes

### **Annex I. Disbursements of extrabudgetary and in-kind contributions: 1993**

Related to Table 5, this Annex shows, by donor and by type, the technical co-operation disbursements made during 1993 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: 1993**

The courses organized by the Agency in 1993 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 60 courses conducted for individual Member States are not included.

### **Annex III. Published reports: 1993**

Technical co-operation project reports published in 1993 are listed by country.

### **Annex IV. Voluntary contributions pledged and paid to the Technical Assistance and Co-operation Fund for 1993**

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 1993. This Annex shows a grand total of \$55,816,350; however, all other tables in this report refer to the target of \$55,500,000 approved by the Board. The difference represents the contributions expected from new Member States since they were not included in the 1993 scale of assessment.

### **Annex V. Cost-free fellowships offered and awarded: 1993**

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 1993 and the duration in months (1993 and beyond) of their assignment. Columns 5 and 6 show information on all cost-free fellows receiving training in the calendar year 1993 regardless of when their assignment started.

### **Annex VI. Approved and on-going UNDP projects as at 31 December 1993**

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

### **Annex VII. Footnote-a/ projects made operational or extended during 1993**

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 1993**

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

### **Annex IX. Net programme changes by recipient: 1993**

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In accordance with the Revised Guiding Principles information on changes to approved projects is provided. As 1,244 changes were involved, the list only shows the net changes that took place in each country. The amounts given in the existing approval column refer to those projects which were affected by programme changes. Detailed data by project are available on request.

### **Annex X. Net rephasings undertaken during 1993**

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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 1993.

### **Annex XI. Extrabudgetary contributions for activities relating to technical co-operation which are not included in the technical co-operation programme: 1993**

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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 1993: Achievements**

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Brief accomplishment summaries are given for projects - excluding training courses - which were "operationally" completed during 1993. For the project cancelled during this period, the reasons leading to its 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 printed in capitals.

# ANNEX I

## DISBURSEMENTS OF EXTRABUDGETARY AND IN-KIND CONTRIBUTIONS: 1993

### 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	Fellow-ships	Training courses	Sub-total	
<b>Countries</b>											
ARGENTINA	0.0	0.0	0.0	0.0	0.0	0.0	17.2	0.0	33.2	50.4	50.4
AUSTRALIA	0.0	0.0	5.1	78.7	73.3	157.1	5.0	0.0	0.0	5.0	162.1
AUSTRIA	0.0	0.0	0.0	0.0	0.0	0.0	2.8	6.8	0.0	9.6	9.6
BELGIUM	111.1	4.8	0.0	0.0	0.0	115.9	10.5	0.0	0.0	10.5	126.4
BRAZIL	0.0	0.0	0.0	0.0	0.0	0.0	20.5	0.0	28.6	49.1	49.1
BULGARIA	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	3.0	3.0
CANADA	0.0	0.0	0.0	0.0	0.0	0.0	22.2	0.0	7.9	30.1	30.1
CHILE	0.0	0.0	0.0	9.0	0.0	9.0	4.0	0.0	3.4	7.4	16.4
COLOMBIA	0.0	0.0	0.0	10.0	0.0	10.0	0.0	0.0	2.6	2.6	12.6
CHINA	0.0	0.0	0.0	0.0	0.0	0.0	1.2	16.5	38.0	55.7	55.7
CROATIA	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	1.4	1.4
CZECH REPUBLIC	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2	1.2
CUBA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0	18.0	18.0
DENMARK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.6	0.0	22.6	22.6
FINLAND	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0	0.0	9.8	9.8
FRANCE	77.3	325.1	18.1	83.0	0.0	503.5	20.8	79.0	1.3	101.1	604.6
GERMANY	78.9	124.2	0.0	48.1	11.9	263.1	30.0	67.9	0.0	97.9	361.0
GHANA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.8	4.8
GUATEMALA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.8	4.8
HUNGARY	0.0	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0	16.8	16.8
INDIA	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	28.7	29.9	29.9
INDONESIA	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	1.4	1.4
ISRAEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.6	0.0	13.6	13.6
ITALY	0.0	32.8	0.0	0.0	1.5	34.3	1.4	0.0	0.0	1.4	35.7
JAPAN	194.7	0.0	0.0	103.6	0.0	298.3	33.0	0.0	0.0	33.0	331.3
KOREA, REPUBLIC OF	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	52.7	53.9	53.9
MALAYSIA	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	3.4	3.4
MALI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	2.8
MEXICO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.8	17.8	17.8
NETHERLANDS	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0	6.8	6.8
PAKISTAN	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	4.8	4.8
PANAMA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
POLAND	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	4.6	4.6
RUSSIAN FED.	0.0	0.1	0.0	0.0	0.0	0.1	24.0	0.0	1.2	25.2	25.3
SENEGAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.1	3.1
SLOVAK REPUBLIC	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	3.4	3.4
SPAIN	22.4	0.0	6.2	5.4	177.2	211.2	13.6	121.7	6.1	141.4	352.6
SUDAN	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.8	0.8
SWEDEN	66.3	0.1	2.5	0.0	0.0	68.9	7.0	0.0	7.2	14.2	83.1
SWITZERLAND	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2	1.2
TURKEY	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	1.4	1.4
UNITED KINGDOM	152.4	534.4	38.9	0.0	40.5	766.2	45.5	42.3	1.3	89.1	855.3
UKRAINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0
URUGUAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
USA	415.7	1,857.4	0.0	208.9	43.0	2,525.0	127.0	531.3	11.0	669.3	3,194.3
SUB-TOTAL	1,118.8	2,878.9	70.8	546.7	347.4	4,962.6	448.1	901.7	281.5	1,631.3	6,593.9

Donor	Extrabudgetary						In-kind				Total
	Experts	Equip-ment	Fellow-ships	Training courses	Sub-con-tracts	Sub-total	Experts	Fellow-ships	Training courses	Sub-total	
<b>International Organizations</b>											
CWS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	4.0
CEC	0.0	0.0	37.4	0.0	0.0	37.4	0.0	0.0	0.0	0.0	37.4
FAO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4
PAHO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	6.5	6.5
UNCTF	1.4	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	1.4
SUB-TOTAL	1.4	0.0	37.4	0.0	0.0	38.8	0.0	0.0	10.9	10.9	49.7
<b>GRAND TOTAL</b>	<b>1,120.2</b>	<b>2,878.9</b>	<b>108.2</b>	<b>546.7</b>	<b>347.4</b>	<b>5,001.4</b>	<b>448.1</b>	<b>901.7</b>	<b>292.4</b>	<b>1,642.2</b>	<b>6,643.6</b>

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

Donor	Project Title	Project	Experts	Equipment	Total
CHILE	IMPURITIES IN URANIUM COMPOUNDS	CHI/3/008	0.0	2.1	2.1
	MEDITERRANEAN FRUIT FLY ERADICATION	CHI/5/015	0.0	96.0	96.0
CHINA	IN-CORE PWR FUEL MANAGEMENT	CPR/4/009	0.0	5.0	5.0
COLOMBIA	USE OF RADIOISOTOPES IN INDUSTRY	COL/8/016	0.0	111.4	111.4
ECUADOR	NUCLEAR MEDICINE SERVICES	ECU/6/009	0.0	2.2	2.2
ICELAND	ESTABLISHMENT OF EARLY WARNING SYSTEM	ICE/9/003	0.0	32.7	32.7
IRAN, I.R.	REVIEW OF THE BUSHEHR NUCLEAR POWER PLANT	IRA/9/011	0.0	0.4	0.4
PAKISTAN	DEVELOPMENT OF URANIUM RESOURCES	PAK/3/008	0.0	44.7	44.7
	CORROSION FATIGUE TESTING	PAK/4/037	0.0	72.7	72.7
	DESIGN AND SAFETY REVIEW OF CHASMA NUCLEAR POWER PLANT	PAK/9/017	39.5	0.0	39.5
PORTUGAL	NEUTRON SCATTERING SPECTROMETER	POR/1/005	0.0	1.8	1.8
SAUDI ARABIA	APPLICATION OF NUCLEAR TECHNIQUES	SAU/8/002	0.0	11.2	11.2
SYRIAN A.R.	PROCUREMENT ASSISTANCE	SYR/0/005	0.0	3.1	3.1
	MINIATURE NEUTRON SOURCE REACTOR	SYR/4/004	0.0	128.8	128.8
	RADIATION PROTECTION (PHASE II)	SYR/9/007	0.0	2.7	2.7
U.A. EMIRATES	RADIOACTIVE ENVIRONMENTAL AND FOOD CONTAMINATION	UAE/9/003	2.0	24.5	26.5
<b>TOTAL</b>			<b>41.5</b>	<b>539.3</b>	<b>580.8</b>

## ANNEX II

## TRAINING COURSES: 1993

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/0/055/001	ARGONNE, IL,USA 20 SEPTEMBER - 12 NOVEMBER	AGENCY	30	0	0	248,682 (CC)
INTERREGIONAL TRAINING COURSE ON STRENGTHENING PROJECT MANAGEMENT, INT/0/056/001	BOMBAY,INDIA 1 NOVEMBER - 3 DECEMBER	AGENCY	21	0	0	144,941 (CC)
INTERREGIONAL TRAINING COURSE ON NUCLEAR ANALYTICAL TECHNIQUES APPLIED TO ENVIRONMENTAL POLLUTION STUDIES AND MONITORING, INT/2/008/001	KARLSRUHE,GERMANY 27 SEPTEMBER - 9 OCTOBER 17 OCTOBER - 22 OCTOBER SEIBERSDORF,AUSTRIA 10 OCTOBER - 16 OCTOBER	AGENCY	21	0	0	114,816 (CC)
INTERREGIONAL TRAINING COURSE ON NUCLEAR POWER PLANT CONTROL AND INSTRUMENTATION, INT/4/114/001	KARLSRUHE,GERMANY 19 APRIL - 19 MAY	AGENCY	32	0	0	149,144 (CC)
ADVANCED INTERREGIONAL TRAINING COURSE ON NUCLEAR ELECTRONICS, INT/4/115/001	XIAN, SN,CHINA 8 MARCH - 4 JUNE	AGENCY	16	0	3	156,943 (CC) 71,031 (NCC)
INTERREGIONAL TRAINING COURSE ON USE OF ISOTOPE AND RADIATION TECHNIQUES IN STUDIES ON SOIL/PLANT RELATIONSHIPS WITH EMPHASIS ON SOIL-WATER MANAGEMENT PRACTICES, INT/5/127/001	SEIBERSDORF,AUSTRIA 1 JUNE - 9 JULY	AGENCY	22	0	0	175,757 (CC)
INTERREGIONAL TRAINING COURSE ON INDUCTION AND USE OF MUTATIONS IN PLANT BREEDING, INT/5/128/001	SEIBERSDORF,AUSTRIA 20 APRIL - 28 MAY	AGENCY	24	0	0	195,163 (CC)
INTERREGIONAL TRAINING COURSE ON RADIOTRACER AND CONVENTIONAL TECHNIQUES FOR STUDIES OF PESTICIDES IN FOOD AND THE ENVIRONMENT, INT/5/129/001	SEIBERSDORF,AUSTRIA 1 MARCH - 27 MARCH	AGENCY	19	0	0	106,033 (CC)
INTERREGIONAL TRAINING COURSE ON NUCLEAR MEDICINE, INT/6/043/001	BERLIN,GERMANY 20 SEPTEMBER - 15 OCTOBER	AGENCY	27	0	0	88,676 (CC)
INTERREGIONAL TRAINING COURSE ON NUCLEAR METHODS IN MATERIALS RESEARCH, INT/8/027/001	GRENOBLE,FRANCE 10 MAY - 22 MAY ZAGREB,CROATIA 23 MAY - 4 JUNE	AGENCY	18	0	0	117,301 (CC)
INTERREGIONAL TRAINING COURSE ON NUCLEAR AND RELATED ANALYTICAL TECHNIQUES IN AIR POLLUTION MONITORING AND RESEARCH, INT/8/028/001	ARGONNE, IL,USA 26 APRIL - 28 MAY	AGENCY	21	0	0	105,079 (CC)
INTERREGIONAL TRAINING COURSE ON SAFETY AND RELIABILITY ASPECTS OF MAINTENANCE IN NUCLEAR POWER PLANT OPERATION, INT/9/131/001	ARGONNE, IL,USA 1 MARCH - 19 MARCH	AGENCY	26	4	0	103,749 (CC)
INTERREGIONAL TRAINING COURSE ON OPERATIONAL SAFETY ASSESSMENT TECHNIQUES, INT/9/132/001	MADRID,SPAIN 12 APRIL - 30 APRIL	AGENCY	25	3	0	120,147 (CC)
INTERREGIONAL TRAINING COURSE ON EXPERT SYSTEMS AND THEIR APPLICATIONS IN NUCLEAR POWER PLANTS, INT/9/133/001	GIF-SUR-YVETTE,FRANCE 18 OCTOBER - 5 NOVEMBER	AGENCY	21	2	0	100,600 (CC)
INTERREGIONAL TRAINING COURSE ON MANAGEMENT OF OCCUPATIONAL EXPOSURE TO IONIZING RADIATION, INT/9/134/001	ARGONNE, IL,USA 29 MARCH - 16 APRIL	AGENCY	30	0	0	126,497 (CC)
INTERREGIONAL TRAINING COURSE ON PHYSICAL PROTECTION OF NUCLEAR FACILITIES AND MATERIALS, INT/9/135/001	ALBUQUERQUE, NM,USA 12 APRIL - 30 APRIL	AGENCY USA	33	5	0	20,000 (CC) 149,840 (CC)
INTERREGIONAL TRAINING COURSE ON MANAGEMENT OF RADIOACTIVE WASTE FROM NUCLEAR POWER PLANTS, INT/9/136/001	ARGONNE, IL,USA 23 AUGUST - 8 SEPTEMBER PINAWA, MANITOBA, CANADA 9 SEPTEMBER - 17 SEPTEMBER	AGENCY	25	1	0	131,225 (CC)
INTERREGIONAL TRAINING COURSE ON INTERIM STORAGE OF SPENT FUEL FROM NUCLEAR POWER PLANTS AND RESEARCH REACTORS, INT/9/137/001	GIF-SUR-YVETTE,FRANCE 7 JUNE - 25 JUNE	AGENCY	23	0	0	100,869 (CC)
REGIONAL TRAINING COURSE ON COMPUTERIZED DATABASES IN MINERAL EXPLORATION AND DEVELOPMENT, IN PARTICULAR FOR URANIUM, RAF/3/003/001	LUSAKA,ZAMBIA 10 MAY - 28 MAY	AGENCY	12	0	4	92,822 (CC)
REGIONAL TRAINING COURSE ON THE OPERATION, MAINTENANCE AND REPAIR OF LIQUID NITROGEN PLANTS, RAF/4/004/002	DAR ES SALAAM,U R.TANZANIA 19 APRIL - 14 MAY	AGENCY	10	0	1	28,732 (CC)
REGIONAL TRAINING COURSE ON SELECTED TOPICS IN MAINTENANCE OF NUCLEAR INSTRUMENTS, RAF/4/004/003	CAIRO,EGYPT 4 SEPTEMBER - 1 OCTOBER	AGENCY	9	2	5	25,530 (CC)

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 THE MAINTENANCE AND EVALUATION OF POWER CONDITIONING DEVICES OF TYPICAL NUCLEAR AND NON-NUCLEAR INSTRUMENTS, RAF/4/004/004	SEIBERSDORF,AUSTRIA 14 JUNE - 25 JUNE	AGENCY	7	0	0	18,225 (CC)
REGIONAL WORKSHOP ON THE ASSESSMENT OF NUCLEAR ENERGY FOR SEAWATER DESALINATION, RAF/4/010/001	VIENNA,AUSTRIA 16 NOVEMBER - 18 NOVEMBER	AGENCY	2	0	0	8,189 (CC)
REGIONAL WORKSHOP ON PHYTOSANITARY INSPECTION AGAINST FRUIT FLIES, RAF/5/013/006	RABAT,MOROCCO 29 NOVEMBER - 10 DECEMBER	AGENCY	9	0	6	15,404 (CC)
REGIONAL TRAINING COURSE ON FOOD IRRADIATION, RAF/5/021/002	ALGIERS,ALGERIA 15 MAY - 26 MAY	AGENCY	8	0	4	28,577 (CC)
REGIONAL TRAINING COURSE ON USE OF IMMUNOASSAY AND DNA PROBE METHODS FOR ANIMAL DISEASE DIAGNOSIS AND CONTROL, RAF/5/024/001	ACCRA,GHANA 6 SEPTEMBER - 24 SEPTEMBER	AGENCY	21	0	4	102,641 (CC)
REGIONAL TRAINING COURSE ON THE USE OF THE STERILE INSECT TECHNIQUE IN COMBATTING TSETSE FLIES, RAF/5/025/001	TANGA,U.R TANZANIA 23 AUGUST - 17 SEPTEMBER	AGENCY	14	1	7	77,451 (CC)
REGIONAL TRAINING COURSE ON THE PREPARATION OF BASIC REAGENTS FOR THE RADIOIMMUNOASSAY (RIA) OF THYROID RELATED HORMONES, RAF/6/007/004	CASABLANCA,MOROCCO 6 SEPTEMBER - 17 SEPTEMBER	AGENCY FRANCE	15	0	3	18,867 (CC) 17,990 (CC)
REGIONAL TRAINING COURSE ON NUCLEAR MEDICINE, RAF/6/008/001	CAIRO,EGYPT 15 FEBRUARY - 4 MARCH	AGENCY	15	0	0	61,981 (CC)
REGIONAL TRAINING COURSE ON DOSIMETRY IN RADIOTHERAPY, RAF/6/009/001	ALGIERS,ALGERIA 4 OCTOBER - 20 OCTOBER	AGENCY	13	0	8	55,187 (CC)
REGIONAL TRAINING COURSE ON PREPARATION AND CONTROL OF RADIOPHARMACEUTICALS, RAF/6/010/001	ALGIERS,ALGERIA 26 JUNE - 14 JULY	AGENCY	9	0	5	50,283 (CC)
REGIONAL TRAINING COURSE ON ISOTOPE TECHNIQUES IN HUMAN NUTRITION RESEARCH, RAF/7/002/001	ADDIS ABABA,ETHIOPIA 1 NOVEMBER - 19 NOVEMBER	AGENCY	19	0	6	74,663 (CC)
REGIONAL WORKSHOP ON TRACE ELEMENT MOBILIZATION AND DETERMINATION BY X-RAY FLUORESCENCE, RAF/8/015/002	ALGIERS,ALGERIA 6 NOVEMBER - 10 NOVEMBER	AGENCY	7	0	3	22,335 (CC)
REGIONAL WORKSHOP ON QUALIFICATION AND CERTIFICATION OF NDT PERSONNEL, RAF/8/017/001	NAIROBI,KENYA 22 NOVEMBER - 26 NOVEMBER	AGENCY SPAIN	6	0	4	4,718 (CC) 6,717 (CC)
REGIONAL TRAINING COURSE ON THE USE OF ISOTOPE TECHNIQUES IN WATER RESOURCES ASSESSMENT, RAF/8/018/001	HARARE,ZIMBABWE 18 JANUARY - 12 FEBRUARY	AGENCY	12	0	0	75,696 (CC)
REGIONAL TRAINING COURSE FOR RADIATION PROTECTION OFFICERS, RAF/9/005/009	LEGON-ACCRA,GHANA 8 MARCH - 31 MARCH	AGENCY	12	0	0	31,280 (CC)
REGIONAL WORKSHOP ON STORAGE AND DISPOSAL OF SPENT RADIATION SOURCES AND SOLID WASTES (UNDER AFRA 1 WASTE MANAGEMENT), RAF/9/007/001	NAIROBI,KENYA 15 NOVEMBER - 26 NOVEMBER	AGENCY	13	5	4	52,928 (CC)
REGIONAL WORKSHOP ON APPLIED ASPECTS OF NEUTRON SCATTERING, RAS/0/015/015	BOMBAY,INDIA 22 NOVEMBER - 10 DECEMBER	AGENCY	8	1	3	8,132 (CC)
REGIONAL WORKSHOP ON TROUBLE SHOOTING AND REPAIR OF GAMMA CAMERAS, RAS/0/015/016	BOMBAY,INDIA 30 AUGUST - 24 SEPTEMBER	AGENCY	12	1	3	28,504 (CC)
REGIONAL WORKSHOP ON RADIATION PROCESSING - THE ECONOMIC BENEFITS, RAS/0/015/017	BEIJING,CHINA 11 OCTOBER - 16 OCTOBER	AGENCY	10	0	4	14,049 (CC)
REGIONAL WORKSHOP ON RADON MONITORING, RAS/0/015/018	HENGYANG, HN,CHINA 11 OCTOBER - 19 OCTOBER	AGENCY	10	0	2	10,469 (CC)
REGIONAL TRAINING COURSE ON INDUSTRIAL APPLICATIONS OF NDT AND EVALUATION, RAS/0/015/019	TAEJEON,KOREA, REPUBLIC OF 7 OCTOBER - 27 OCTOBER	KOREA, R.	15	0	0	GIFT IN KIND
REGIONAL TRAINING COURSE ON SPATIAL DATA INTEGRATION FOR URANIUM EXPLORATION, RESOURCE ASSESSMENT AND ENVIRONMENTAL STUDIES, RAS/3/007/001	BEIJING,CHINA 20 SEPTEMBER - 8 OCTOBER	AGENCY	14	0	4	87,198 (CC)
REGIONAL TRAINING COURSE ON CALCULATION AND MEASUREMENT OF NEUTRON FLUX SPECTRUM FOR RESEARCH REACTORS, RAS/4/011/007	SERPONG,TANGERANG,INDONESIA 27 SEPTEMBER - 15 OCTOBER	AGENCY	10	0	3	36,300 (CC)
REGIONAL WORKSHOP ON EVALUATION OF MODERN SPECTROSCOPY AMPLIFIERS, RAS/4/012/004	DALAT,VIET NAM 7 JANUARY - 23 JANUARY	AGENCY	5	0	2	36,312 (CC)
REGIONAL TRAINING COURSE ON STANDARDIZATION OF DOSE MEASUREMENTS THROUGH SECONDARY STANDARD DOSIMETRY LABORATORIES (SSDL'S), RAS/4/014/001	MELBOURNE,AUSTRALIA 15 MARCH - 2 APRIL	AGENCY	17	3	0	73,314 (CC)
REGIONAL WORKSHOP ON HARMONIZATION OF REGULATIONS TO FACILITATE TRADE IN IRRADIATED FOOD, RAS/5/020/007	LUCAS HEIGHTS,AUSTRALIA 6 DECEMBER - 17 DECEMBER	UNDP	10	1	0	38,338 (CC)

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 RESEARCH CO-ORDINATION MEETING FOR RPF - PHASE III, RAS/5/020/008	TAEJON, KOREA, REPUBLIC OF 20 SEPTEMBER - 24 SEPTEMBER	UNDP	13	2	1	25,455 (CC)
REGIONAL RESEARCH CO-ORDINATION MEETING OF THE USE OF ISOTOPES IN STUDIES TO IMPROVE YIELD AND NITROGEN FIXATION OF GRAIN LEGUMES IN THE TROPICS AND SUB-TROPICS OF ASIA, RAS/5/021/007	TAMWORTH AND BRISBANE, AUSTRALIA 30 AUGUST - 16 SEPTEMBER	UNDP	18	1	0	74,518 (CC)
REGIONAL TRAINING COURSE ON USE OF IMMUNOASSAY AND RELATED TECHNIQUES FOR STUDIES ON ANIMAL PRODUCTION AND DISEASE DIAGNOSIS, RAS/5/025/001	COLOMBO, SRI LANKA 16 AUGUST - 10 SEPTEMBER	AGENCY	17	0	4	117,644 (CC) 337 (NCC)
REGIONAL TRAINING COURSE ON THE PREPARATION OF BASIC REAGENTS FOR THE RIA OF HEPATITIS B MARKERS, RAS/6/018/001	BEIJING, CHINA 26 APRIL - 7 MAY	AGENCY	16	0	2	33,083 (CC) 14,211 (NCC)
REGIONAL TRAINING COURSE ON RADIOTHERAPY TREATMENT PLANNING, RAS/6/021/001	BANGKOK, THAILAND 15 NOVEMBER - 3 DECEMBER	AGENCY	20	9	2	64,299 (CC)
REGIONAL WORKSHOP ON RADIATION STERILISATION OF TISSUES: AN OPEN LEARNING PROGRAMME, RAS/7/003/005	HO CHI MINH VILLE, VIET NAM 15 NOVEMBER - 26 NOVEMBER	AGENCY	12	6	3	50,997 (CC)
REGIONAL WORKSHOP ON TOTAL QUALITY SYSTEMS FOR TISSUE BANKING OF RADIATION-STERILIZED SURGICAL GRAFTS, RAS/7/003/006	JAKARTA, INDONESIA 2 AUGUST - 13 AUGUST	AGENCY	15	1	5	49,234 (CC)
REGIONAL TRAINING COURSE ON APPLICATIONS OF RADIOISOTOPES AND MOLECULAR TECHNIQUES IN BIOLOGICAL SCIENCES SIGNIFICANT FOR HUMAN HEALTH PROBLEMS, RAS/7/006/001	TOKYO, JAPAN 25 JANUARY - 19 FEBRUARY	AGENCY	16	1	0	127,593 (CC)
REGIONAL TRAINING COURSE ON NUCLEAR METHODS IN MATERIALS DEVELOPMENT, RAS/8/067/001	BEIJING, CHINA 6 SEPTEMBER - 29 SEPTEMBER	AGENCY	12	0	3	46,071 (CC) 17,250 (NCC)
REGIONAL TRAINING COURSE ON THE APPLICATION OF MODERN ISOTOPE AND RADIATION TECHNIQUES TO INDUSTRY, RAS/8/069/001	LUCAS HEIGHTS, AUSTRALIA 3 MAY - 14 MAY	AUSTRALIA	17	3	0	80,496 (CC)
REGIONAL TRAINING COURSE ON ENVIRONMENTAL APPLICATIONS OF RADIATION TECHNOLOGY (BASICS), RAS/8/070/001	TAKASAKI, GUNMA, JAPAN 10 MAY - 21 MAY	JAPAN	11	4	0	53,956 (CC)
REGIONAL TRAINING COURSE ON RADIATION TECHNOLOGY FOR ENVIRONMENTAL CONSERVATION, RAS/8/070/002	TAKASAKI, GUNMA, JAPAN 27 SEPTEMBER - 8 OCTOBER	JAPAN	11	8	0	50,600 (CC)
REGIONAL WORKSHOP ON APPLICATIONS OF THE ICRP'S 1990 RECOMMENDATIONS FOR RADIATION PROTECTION, RAS/9/006/011	BANGI, SELANGOR, MALAYSIA 16 AUGUST - 27 AUGUST	AGENCY	12	0	2	38,817 (CC)
REGIONAL TRAINING COURSE ON IN-SERVICE INSPECTION FOR 440 MW(E) WWER-TYPE REACTORS, RER/4/003/005	PAKS, HUNGARY 22 SEPTEMBER - 25 SEPTEMBER	AGENCY	10	0	4	5,394 (CC)
RCM AND REGIONAL WORKSHOP ON THE USE OF NUCLEAR AND RELATED TECHNIQUES IN PLANT NUTRIENT AND WATER BALANCE STUDIES, RER/5/004/003	AMMAN, JORDAN 18 OCTOBER - 27 OCTOBER	AGENCY	10	0	1	13,315 (CC)
REGIONAL TRAINING COURSE ON THE USE OF ISOTOPE AND RADIATION TECHNIQUES IN SOIL/PLANT RELATIONSHIPS ON SALT-AFFECTED SOILS, RER/5/007/001	ANKARA, TURKEY 6 SEPTEMBER - 1 OCTOBER	AGENCY	14	0	4	60,532 (CC)
REGIONAL TRAINING COURSE ON RADIOTHERAPY TREATMENT PLANNING, RER/6/004/001	ISTANBUL, TURKEY 8 JUNE - 17 JUNE ANKARA, TURKEY 18 JUNE - 25 JUNE	AGENCY	20	0	29	53,517 (CC)
REGIONAL WORKSHOP ON SYNTHESIS, KIT PREPARATION AND QUALITY CONTROL OF NEW FUNCTIONAL TC-99M RADIOPHARMACEUTICALS FOR SPET IMAGING, RER/6/005/001	ISTANBUL, TURKEY 10 MAY - 21 MAY	AGENCY	7	0	8	22,058 (CC)
REGIONAL WORKSHOP ON ISOTOPE HYDROLOGY IN THE MIDDLE EAST, RER/8/002/005	DAMASCUS, SYRIAN A.R 1 NOVEMBER - 12 NOVEMBER	AGENCY	11	3	6	33,878 (CC)
REGIONAL WORKSHOP ON PROCESS CONTROL AND QUALITY ASSURANCE FOR RADIATION PROCESSING, RER/8/003/001	REZ, CZECH REPUBLIC 20 SEPTEMBER - 24 SEPTEMBER	AGENCY	12	0	0	24,972 (CC)
REGIONAL WORKSHOP ON RADIATION PROTECTION AND QUALITY ASSURANCE IN DIAGNOSTIC RADIOLOGY, RER/9/007/005	NICOSIA, CYPRUS 14 JUNE - 25 JUNE	AGENCY	11	0	2	13,781 (CC)
REGIONAL TRAINING COURSE ON RE-EVALUATION OF SEISMIC SAFETY OF NUCLEAR POWER PLANTS, RER/9/015/001	PAKS, HUNGARY 10 MAY - 21 MAY	AGENCY	13	3	6	45,319 (CC)
REGIONAL TRAINING COURSE ON MANAGEMENT OF SPENT RADIATION SOURCES, RER/9/017/001	ATHENS, GREECE 1 NOVEMBER - 18 NOVEMBER	AGENCY	19	0	3	58,147 (CC)
REGIONAL TRAINING COURSE ON MEDICAL PREPAREDNESS FOR RADIATION ACCIDENTS, RER/9/018/001	BUDAPEST, HUNGARY 3 MAY - 14 MAY	AGENCY	17	3	3	42,843 (CC)

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 SAFETY RELATED MAINTENANCE OF NUCLEAR POWER PLANTS, RER/9/026/001	OBNINSK, RUSSIAN FEDERATION 6 OCTOBER - 22 OCTOBER	AGENCY	14	0	5	92,534 (CC)
REGIONAL FORUM FOR EXCHANGE OF INFORMATION BETWEEN IAEA/UNDP AND THE COUNTRIES OF THE FORMER USSR, RER/9/027/001	VIENNA, AUSTRIA 4 MAY - 7 MAY	UNDP	40	0	0	118,100 (CC)
ADVANCED NATIONAL TRAINING COURSE ON CHARACTERIZATION OF MATERIALS THROUGH NUCLEAR TECHNIQUES, RLA/2/003/015	HAVANA, CUBA 22 NOVEMBER - 26 NOVEMBER	AGENCY	3	0	0	13,362 (CC)
REGIONAL WORKSHOP ON DETERMINATION OF TOXIC ELEMENTS AT TRACE LEVEL IN WATER AND SEDIMENT, RLA/2/003/016	SAO PAULO, BRAZIL 16 AUGUST - 28 AUGUST	AGENCY GERMANY	2	0	0	7,306 (CC) 4,701 (CC)
REGIONAL WORKSHOP ON DETERMINATION OF TOXIC ELEMENTS AT TRACE LEVEL IN WATER AND SEDIMENTS USING ATOMIC ABSORPTION, RLA/2/003/017	PIRACICABA, BRAZIL 16 AUGUST - 28 AUGUST	AGENCY GERMANY	5	0	1	6,162 (CC) 5,000 (CC)
REGIONAL WORKSHOP ON DETERMINATION OF TOXIC ELEMENTS AT TRACE LEVEL IN WATER AND SEDIMENTS USING X-RAY FLUORESCENCE, RLA/2/003/018	ASUNCION, PARAGUAY 16 AUGUST - 3 SEPTEMBER	AGENCY GERMANY	5	0	0	7,481 (CC) 8,610 (CC)
REGIONAL TRAINING COURSE ON LABELLING AND QUALITY CONTROL OF BIOMOLECULES, RLA/2/007/003	SANTIAGO, CHILE 6 SEPTEMBER - 24 SEPTEMBER	AGENCY CHILE	9	0	0	32,162 (CC) 6,000 (CC)
REGIONAL TRAINING COURSE ON HOSPITAL RADIOPHARMACY FOR CENTRAL AMERICAN COUNTRIES, RLA/2/007/004	GUATEMALA CITY, GUATEMALA 8 NOVEMBER - 26 NOVEMBER	AGENCY	6	0	0	38,335 (CC)
REGIONAL WORKSHOP ON PRODUCTION OF RADIONUCLIDES FOR PALLIATIVE THERAPY OF METASTATIC BONE PAIN, RLA/2/007/005	BUENOS AIRES, ARGENTINA 29 NOVEMBER - 3 DECEMBER	AGENCY	5	0	1	20,611 (CC)
REGIONAL WORKSHOP ON SELECTION AND OPTIMIZATION OF ANALYTICAL EQUIPMENT, RLA/4/008/008	ASUNCION, PARAGUAY 12 JULY - 30 JULY	AGENCY	9	0	0	24,873 (CC)
REGIONAL SEMINAR ON NUCLEAR INSTRUMENTATIONS FOR RESEARCH REACTOR, RLA/4/008/010	SAN CARLOS DE BARILOCHE, ARGENTINA 18 OCTOBER - 22 OCTOBER	AGENCY	8	0	0	19,491 (CC)
NATIONAL TRAINING COURSE ON BRUCELLOSIS USING ELISA AND RIA TECHNIQUES, RLA/5/028/003	HAVANA, CUBA 29 NOVEMBER - 10 DECEMBER	AGENCY	4	0	0	9,439 (CC)
SUB-REGIONAL TRAINING COURSE FOR CENTRAL AMERICA ON IMMUNOANALYSIS, COMPUTER USE AND DATA ANALYSIS IN DIAGNOSTIC OF ANIMAL DISEASES, RLA/5/028/004	SAN JOSE, COSTA RICA 6 SEPTEMBER - 17 SEPTEMBER	AGENCY	6	0	0	14,436 (CC)
FINAL RCM OF THE IAEA/FAO COORDINATED RESEARCH PROG FOR IMPROVING RUMINANT PRODUCTIVITY ON SMALLHOLDER FARMS IN LATIN AMERICA THROUGH THE USE OF RADIOIMMUNOASSAY TECHNIQUES, RLA/5/028/005	PIRACICABA, BRAZIL 27 SEPTEMBER - 1 OCTOBER	AGENCY	16 <sup>c</sup>	0	0	2,250 (CC)
REGIONAL TRAINING COURSE ON NUCLEAR AND ASSOCIATED TECHNIQUES IN PESTICIDE RESEARCH, RLA/5/031/001	QUITO, ECUADOR 30 AUGUST - 1 OCTOBER	AGENCY	15	0	5	97,352 (CC)
REGIONAL TRAINING COURSE ON THE OPTIMIZATION OF REAGENT PRODUCTION TECHNIQUES AND THE ORGANIZATION OF REGIONAL REAGENT DISTRIBUTION SCHEMES, RLA/6/016/010	MEXICO CITY, MEXICO 8 NOVEMBER - 19 NOVEMBER	AGENCY	17	0	5	49,351 (CC)
NATIONAL TRAINING COURSE ON RADIOISOTOPES AND RADIONUCLIDES METHODOLOGY, RLA/6/016/012	SALTILLO, COAHUILA, MEXICO 7 JUNE - 2 JULY	AGENCY	4	0	0	3,799 (CC)
REGIONAL TRAINING COURSE ON INTERVENTIONAL METHODS IN NUCLEAR MEDICINE, RLA/6/018/001	BOGOTA, COLOMBIA 4 OCTOBER - 15 OCTOBER	AGENCY	20	0	7	64,641 (CC)
REGIONAL TRAINING COURSE ON MEDICAL SCINTIGRAPHY, RLA/6/019/001	HAVANA, CUBA 17 MAY - 11 JUNE	AGENCY	20	0	9	126,703 (CC) 28,622 (NCC)
THIRD REGIONAL TECHNICAL COORDINATION MEETING ON THE STUDY OF RESOURCES AND CONTAMINATION OF UNDERGROUND WATER, RLA/8/014/007	CARACAS, VENEZUELA 25 OCTOBER - 29 OCTOBER	AGENCY	13	0	1	27,853 (CC)
REGIONAL TRAINING COURSE ON INDUSTRIAL STERILIZATION OF HEALTH-CARE PRODUCTS: REGULATORY ASPECTS AND CONTROL, RLA/8/016/002	SAO PAULO, BRAZIL 17 MAY - 28 MAY	AGENCY	10	0	1	42,870 (CC)
REGIONAL SEMINAR ON ENVIRONMENTAL APPLICATIONS OF RADIATION AND ISOTOPES, RLA/8/016/003	SANTIAGO, CHILE 9 AUGUST - 13 AUGUST	AGENCY FRANCE CHILE	26	0	21	46,818 (CC) 18,806 (CC) 5,000 (CC)
NATIONAL TRAINING COURSE ON APPLICATION OF RADIOTRACERS IN INDUSTRY, RLA/8/016/012	HAVANA, CUBA 25 OCTOBER - 5 NOVEMBER	AGENCY	4	0	0	4,491 (CC)
NATIONAL CO-ORDINATORS' MEETING OF THE REGIONAL PROJECT, RLA/8/017, RLA/8/017/077	SANTO DOMINGO, DOMINICAN REP 28 JUNE - 2 JULY	AGENCY GERMANY	16	0	1	24,248 (CC) 3,653 (CC)

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 INDUSTRIAL APPLICATIONS OF TRACER TECHNIQUES, RLA/8/019/001	MEXICO CITY, MEXICO 19 APRIL - 7 MAY	AGENCY	14	0	3	72,549 (CC)
REGIONAL TRAINING COURSE ON CLINICAL DOSIMETRY AND RADIOLOGICAL PROTECTION, RLA/9/011/010	MEXICO CITY, MEXICO 18 JANUARY - 29 JANUARY	AGENCY FRANCE	15	0	10	11,189 (CC) 26,451 (CC)
REGIONAL INFORMATIVE SEMINAR ON APPLICATION OF NEW ICRP RECOMMENDATIONS, RLA/9/011/011	QUITO, ECUADOR 11 OCTOBER - 15 OCTOBER	AGENCY	20	0	2	41,097 (CC)
SECOND REGIONAL CONGRESS ON RADIATION PROTECTION AND NUCLEAR SAFETY, RLA/9/011/012	MEXICO CITY, MEXICO 22 NOVEMBER - 26 NOVEMBER	AGENCY	20	0	0	39,597 (CC)
REGIONAL MEETING ON CO-ORDINATED STUDIES ON REGULATORY CRITERIA, RLA/9/011/014	MEXICO CITY, MEXICO 22 NOVEMBER - 26 NOVEMBER	AGENCY	14	0	1	33,207 (CC)
REGIONAL MEETING ON CO-ORDINATED STUDIES ON INTERCOMPARISON OF CYTOGENETIC DOSIMETRY, RLA/9/011/015	MEXICO CITY, MEXICO 22 NOVEMBER - 26 NOVEMBER	AGENCY	4	0	0	10,041 (CC)
REGIONAL TRAINING COURSE ON SAFETY AND REGULATION OF RADIATION SOURCES, RLA/9/015/001	SALAZAR, MEXICO 22 FEBRUARY - 19 MARCH	AGENCY	20	0	4	92,939 (CC)
SUB-REGIONAL WORKSHOP ON CONTROL OF RADIATION SAFETY, RLA/9/017/001	GUATEMALA CITY, GUATEMALA 15 NOVEMBER - 19 NOVEMBER	AGENCY	7	0	0	15,308 (CC)
REGIONAL TRAINING COURSE ON RADIATION PROTECTION AND NUCLEAR SAFETY, RLA/9/018/001	BUENOS AIRES, ARGENTINA 1 APRIL - 30 NOVEMBER	AGENCY	17	2	0	296,782 (CC)

<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> Research contract holders.

## ANNEX III

### PUBLISHED REPORTS: 1993

Recipient	Subject of report	Project code	Author(s)/Corporate Author	Reference no.
AFGHANISTAN	COUNTRY PROGRAMME SUMMARIES, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/04
ARGENTINA	TERMINAL REPORT	ARG/4/078	ABBATE, MAXIMO JULIO BOLANOS, ALVARO	IAEA/UNDP-ARG/89/012-TR
BANGLADESH	COUNTRY PROGRAMME SUMMARY: THE AGENCY'S TECHNICAL CO-OPERATION WITH BANGLADESH, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/02
	A DESK EVALUATION REVIEW OF PROJECT BGD/5/010	BGD/5/010	EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-PDE-93/01
	COUNTRY PROGRAMME REVIEW TO BANGLADESH	INT/0/053	DEPT. OF TC, IAEA	IAEA-TC-PM-012
BOLIVIA	COUNTRY PROGRAMME SUMMARY: THE AGENCY'S TC PROGRAMME WITH BOLIVIA, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/05
BRAZIL	ASSET FOLLOW-UP MISSION	BRA/9/041	BANGA, UCO	IAEA/NENS/ASSET/92/F/07
BULGARIA	A DESK EVALUATION REVIEW OF PROJECT BUL/8/008: STERILIZATION OF MEDICAL SUPPLIES	BUL/8/008	EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-PEE-93/03
	IAEA VVER-440 REACTOR PRESSURE VESSEL INSERVICE INSPECTION TRAINING COURSE	RER/4/003	INETEC	IAEA-TA-2461
	COUNTRY PROGRAMME SUMMARY: THE AGENCY'S TC PROGRAMME WITH BULGARIA, 1983-1993		EVALUATION SECTION, DEPT OF TC, IAEA	IAEA-CPS-93/14
CAMEROON	COUNTRY PROGRAMME REVIEW	INT/0/053	CHERIF, HADJ-SLIMANE HASLING, WILLY HERA, CHRISTIAN IOAN MTIMET, SADOK BEN AHMED MAUDARBOCUS, YOUSUF	IAEA-TC-PM-009
COLOMBIA	COUNTRY PROGRAMME SUMMARY: THE AGENCY'S TC PROGRAMME WITH COLOMBIA, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/06
DOMINICAN REP.	COUNTRY PROGRAMME SUMMARY: THE AGENCY'S TC PROGRAMME WITH THE DOMINICAN REPUBLIC		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/07
ECUADOR	COUNTRY PROGRAMME SUMMARY: THE AGENCY'S TC PROGRAMME WITH ECUADOR		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/08
EL SALVADOR	COUNTRY PROGRAMME SUMMARY: THE AGENCY'S TC PROGRAMME WITH EL SALVADOR		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/09
GREECE	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH GREECE, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/19
HUNGARY	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH HUNGARY, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/22
IRAN	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH IRAN, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/16
JAMAICA	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH JAMAICA, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/10
JORDAN	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH JORDAN, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/17
MOROCCO	WAMAP MISSION TO MOROCCO	INT/9/081	MOHD, AMIN, FATIMAH DEJONGHE, PAUL A.J. BAEHR, WERNER WILHELM BERGMAN, CURT	IAEA-TA-2464
NICARAGUA	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH NICARAGUA, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/03
PANAMA	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH PANAMA, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/11
PARAGUAY	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH PARAGUAY, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/12

Recipient	Subject of report	Project code	Author(s)/Corporate Author	Reference no.
PERU	INSARR MISSION	PER/9/029	ALCALA RUIZ, FRANCISCO DIMEGLIO, ANIELLO FRANCIS BUSH, WILLIAM R.	IAEA-NENS-INSARR/1992-03
POLAND	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH POLAND, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/13
	PROJECT DESK EVALUATION	POL/5/006	EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-PDE-93/04
REGIONAL ASIA AND PACIFIC	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-93/03
ROMANIA	NUCLEAR FUEL PERFORMANCE, MODELING AND EVALUATION	ROM/9/004	HSU, TAI-RAN	IAEA/UNDP-ROM/87/002-04
	COUNTRY PROGRAMME SUMMARY. PROGRAMME WITH ROMANIA, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/18
SENEGAL	COUNTRY PROGRAMMING MISSION	INT/0/053	BOUSSAHA, ALI VAN CLEEMPUT, OSWALD GRANCEA, VIRGIL VASILE RADICELLA, RENATO GIULIO SERGIO	IAEA-TC-PM-008
SLOVAK REPUBLIC	ASSET FOLLOW-UP MISSION TO BOHUNICE N.P.P	SLR/9/003	BENGA, UCO RAZZEL, RAYMOND DE CORONADO, MARTA GETTEMANS, MICHAEL WERDINE, HUMBERTO JUNIOR HOSHI, TSUTAO DEFFRENNES, MARC JEAN-PIERRE SIVOKON, M VLADIMIR PETROVICH	IAEA-TA-2463
SRI LANKA	COUNTRY PROGRAMME SUMMARY. SRI LANKA, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/15
SUDAN	COUNTRY PROGRAMMING MISSION	INT/0/053	BOUSSAHA, ALI CUARON-SANTISTEBAN, ALFREDO KLASSEN, WALDEMAR RIDWAN, MOHAMMAD ROZANSKI, KAZIMIERZ	IAEA-TC-PM-007
TURKEY	COUNTRY PROGRAMME SUMMARY: TURKEY, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/20
UKRAINE	FACT FINDING MISSION TO UKRAINE ON WASTE MANAGEMENT AND SPENT FUEL STORAGE	INT/9/081	BERGMAN, CURT TAKATS, FERENC SAMIEI, MASSOUD	IAEA-TA-2462
	ASSET MISSION	UKR/9/004	BANGA, UCO TOLSTYKH, VALERY SEKI, HIROAKI SUCHOMEL, JIRI CLAEYS, J.P. KOPIEV, YURI KALLIO, HARRIET SIMMS, G.	IAEA-NENS/ASSET-93-R-02
TANZANIA	A DESK EVALUATION REVIEW OF PROJECT TSETSE FLY ERADICATION	URT/5/007	EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-PDE-93/02
VIET NAM	COUNTRY PROGRAMME REVIEW: PROGRAMME WITH VIET NAM, 1983-1993		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/01
YUGOSLAVIA	COUNTRY PROGRAMME SUMMARY: PROGRAMME WITH YUGOSLAVIA		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-CPS-93/21
GENERAL	IAEA TECHNICAL CO-OPERATION WITH LEAST DEVELOPED MEMBER STATES - A SPECIAL EVALUATION		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-SE-93/01
	SPECIAL EVALUATION REVIEW - LESSONS LEARNED FROM COMPLETED EVALUATION REVIEWS (1983 TO MID 1993)		EVALUATION SECTION, DEPT. OF TC, IAEA	IAEA-SE-93/02

## ANNEX IV

### VOLUNTARY CONTRIBUTIONS PLEDGED AND PAID TO THE TECHNICAL ASSISTANCE AND CO-OPERATION FUND FOR 1993 (as at 31 December 1993)

Member State	Base rate %	Share of \$55.5 million target for voluntary contributions for 1993 using base rate <sup>a/</sup>	Pledged	Paid
Afghanistan	0.01	5,550	0	0
Albania	0.01	5,550	0	0
Algeria	0.16	88,800	45,000	45,000
Argentina	0.56	310,800	270,000	270,000
Australia	1.50	832,500	831,979	831,979
Austria	0.74	410,700	410,700	410,700
Bangladesh	0.01	5,550	5,550	5,550
Belarus	0.34	172,050	0	0
Belgium	1.05	582,750	0	0
Bolivia	0.01	5,550	0	0
Brazil	1.58	876,900	250,000	0
Bulgaria	0.13	72,150	10,000	10,000
Cambodia	0.01	5,550	0	0
Cameroon	0.01	5,550	0	0
Canada	3.09	1,714,950	3,081,261	3,081,261
Chile	0.08	44,400	44,400	20
China	0.76	421,800	421,800	421,800
Colombia	0.13	72,150	55,000	0
Costa Rica	0.01	5,550	0	0
Cote d'Ivoire	0.02	11,100	0	0
Cuba	0.09	49,950	49,950	49,950
Cyprus	0.02	11,100	0	0
Dem. P.R. Korea	0.05	27,750	27,750	27,365
Denmark	0.64	355,200	355,200	355,200
Dominican Republic	0.02	11,100	0	0
Ecuador	0.03	16,650	0	0
Egypt	0.07	38,850	38,851	38,851
El Salvador	0.01	5,550	0	0
Ethiopia	0.01	5,550	0	0
Finland	0.56	310,800	310,800	310,800
France	5.95	3,302,250	3,302,250	3,302,250
Gabon	0.02	11,100	0	0
Germany	8.86	4,917,300	4,917,300	4,917,300
Ghana	0.01	5,550	0	0
Greece	0.35	194,250	194,250	194,250
Guatemala	0.02	11,100	11,100	0
Haiti	0.01	5,550	0	0
Holy See	0.01	5,550	0	0
Hungary	0.18	99,900	99,900	99,900
Iceland	0.03	16,650	16,650	16,650

Member State	Base rate %	Share of \$55.5 million target for voluntary contributions for 1993 using base rate <sup>al</sup>	Pledged	Paid
India	0.36	199,800	199,800	199,800
Indonesia	0.16	88,800	39,000	39,000
Iran, I. R.	0.76	421,800	16,892	16,892
Iraq	0.13	72,150	0	0
Ireland	0.18	99,900	8,311	8,311
Israel	0.23	127,650	0	0
Italy	4.26	2,364,300	0	0
Jamaica	0.01	5,550	0	0
Japan	12.36	6,859,800	6,859,800	6,859,800
Jordan	0.01	5,550	0	0
Kenya	0.01	5,550	0	0
Korea, Republic of	0.68	377,400	244,755	0
Kuwait	0.25	138,750	0	0
Lebanon	0.01	5,550	0	0
Liberia	0.01	5,550	0	0
Libyan A. J.	0.24	133,200	0	0
Liechtenstein	0.01	5,550	5,600	5,600
Luxembourg	0.06	33,300	0	0
Madagascar	0.01	5,550	1,600	0
Malaysia	0.12	66,600	66,600	66,600
Mali	0.01	5,550	0	0
Mauritius	0.01	5,550	0	0
Mexico	0.87	482,850	482,850	482,850
Monaco	0.01	5,550	0	0
Mongolia	0.01	5,550	0	0
Morocco	0.03	16,650	16,650	16,650
Myanmar	0.01	5,550	0	0
Namibia	0.01	5,550	0	0
Netherlands	1.49	826,950	826,950	826,950
New Zealand	0.24	133,200	0	0
Nicaragua	0.01	5,550	0	0
Niger	0.01	5,550	0	0
Nigeria	0.20	111,000	111,000	111,000
Norway	0.55	305,250	305,250	305,250
Pakistan	0.06	33,300	33,300	33,300
Panama	0.02	11,100	0	0
Paraguay	0.02	11,100	0	0
Peru	0.06	33,300	0	0
Philippines	0.07	38,850	11,000	11,000
Poland	0.47	260,850	260,850	260,850
Portugal	0.20	111,000	0	0
Qatar	0.05	27,750	0	0
Romania	0.17	94,350	94,350	43,262
Russian Federation	9.34	5,183,700	60,769	60,769
Saudi Arabia	0.95	527,250	0	0

Member State	Base rate %	Share of \$55.5 million target for voluntary contributions for 1993 using base rate <sup>ai</sup>	Pledged	Paid
Senegal	0.01	5,550	0	0
Sierra Leone	0.01	5,550	0	0
Singapore	0.12	66,600	0	0
South Africa	0.41	227,550	0	0
Spain	1.96	1,087,800	168,695	168,695
Sri Lanka	0.01	5,550	0	0
Sudan	0.01	5,550	0	0
Sweden	1.10	610,500	610,500	610,500
Switzerland	1.15	638,250	638,250	638,250
Syrian Arab Republic	0.04	22,200	2,000	2,000
Thailand	0.11	61,050	61,050	61,050
Tunisia	0.03	16,650	16,650	16,650
Turkey	0.27	149,850	149,850	149,850
Uganda	0.01	5,550	0	0
Ukraine	1.17	649,350	0	0
United Arab Emirates	0.21	116,550	0	0
United Kingdom of Great Britain and Northern Ireland	4.98	2,763,900	2,714,080	2,714,080
U. R. Tanzania	0.01	5,550	5,500	0
USA	25.00	13,875,000	13,875,000	13,175,000
Uruguay	0.04	22,200	15,000	0
Venezuela	0.49	271,950	0	0
Viet Nam	0.01	5,550	5,550	5,550
Yugoslavia	0.42	233,100	0	0
Zaire	0.01	5,550	0	0
Zambia	0.01	5,550	5,550	0
Zimbabwe	0.01	5,550	0	0
<b>Sub-total</b>	<b>99.45</b>	<b>55,194,750</b>	<b>42,662,693</b>	<b>41,278,335</b>
<b>New Members:</b>				
Czech Republic <sup>bi</sup>	0.42	233,100	233,100	233,100
Slovak Republic <sup>bi</sup>	0.13	72,150	72,150	72,150
<b>Total</b>	<b>100.00</b>	<b>55,500,000</b>	<b>42,967,943</b>	<b>41,583,585</b>
Armenia <sup>ci</sup>	0.13	72,150	0	0
Croatia <sup>di</sup>	0.13	72,150	0	0
Estonia <sup>ei</sup>	0.07	38,850	0	0
Lithuania <sup>fi</sup>	0.15	83,250	0	0
Slovenia <sup>gi</sup>	0.09	49,950	49,950	4,596
<b>Grand Total</b>	<b>100.57</b>	<b>55,816,350</b>	<b>43,017,893</b>	<b>41,588,181</b>

<sup>ai</sup> As recommended in GC(V)/RES/100 and amended in GC(XV)/RES/286.

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

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

<sup>di</sup> Croatia became a Member of the Agency on 12 February 1993.

<sup>ei</sup> Estonia became a Member of the Agency on 31 January 1992.

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

<sup>gi</sup> Slovenia became a Member of the Agency on 21 September 1992.

## ANNEX V

### COST-FREE FELLOWSHIPS: 1993

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	3	3	3	3
China	a	5	7	5	7
Denmark	a	3	10	3	10
France	a	11	31	11	31
Germany	a	9	23	10	27
Israel	a	1	6	1	6
Spain	a	13	46	15	54
United Kingdom	a	1	3	4	17
USA	b	43	111	53	154

- a** No formal offer made however type II fellowships have been accepted.
- b** A specific amount of money was made available (\$1,250,000) 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 1993 (in thousands of dollars)

Recipient	Short title	Project code	Total amount approved	Prior to 1993	Approved budgets			
					1993	1994	1995	1996
<b>A. Projects executed by the IAEA</b>								
ALBANIA	STRENGTHENING OF NUCLEAR TECHNIQUES APPLICATIONS USING RESEARCH REACTOR	AL887001	157	143	14	0	0	0
CHINA	MANPOWER DEVELOPMENT FOR SAFE OPERATION OF NUCLEAR POWER PLANTS	CPR91221	976	0	109	663	193	11
EGYPT	NATIONAL CENTRE FOR RADIATION TECHNOLOGY, PHASE III	EGY89015	331	296	35	0	0	0
INDONESIA	AGRICULTURAL PRODUCTION, PHASE II	INS88013	448	445	3	0	0	0
ROMANIA	NUCLEAR SAFETY	ROM87002	516	460	35	21	0	0
TURKEY	INDUSTRIAL STERILIZATION OF MEDICAL SUPPLIES	TUR88040	700	660	40	0	0	0
REGIONAL ASIA	FOOD IRRADIATION PROCESS CONTROL AND ACCEPTANCE	RAS89044	590	417	173	0	0	0
	INCREASING THE CAPABILITIES OF COMMON GRAIN LEGUMES	RAS89045	970	610	286	74	0	0
	THE USE OF ISOTOPES AND RADIATION TO STRENGTHEN TECHNOLOGY AND SUPPORT ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT	RAS92073	3,037	0	217	1,139	823	858
REGIONAL EUROPE	STRENGTHENING RADIATION AND NUCLEAR SAFETY INFRASTRUCTURES IN COUNTRIES OF THE FORMER USSR	RER93006	500	0	430	70	0	0
REGIONAL LATIN AMERICA	NON-DESTRUCTIVE TESTING IN QUALITY CONTROL PROGRAMMES	RLA92021	29	14	15	0	0	0
<b>Sub-total</b>			8,254	3,045	1,357	1,967	1,016	869
<b>B. Projects for which IAEA is associated agency</b>								
CHINA	NUCLEAR SAFETY ADMINISTRATION	CPR85067	617	557	60	0	0	0
INTER-REGIONAL	ENVIRONMENTAL REHABILITATION OF LAKE MANZALA IN EGYPT	INT91G31	57	54	3	0	0	0
<b>Sub-total</b>			674	611	63	0	0	0
<b>TOTAL</b>			8,928	3,656	1,420	1,967	1,016	869

## ANNEX VII

**FOOTNOTE-a/ PROJECTS MADE OPERATIONAL  
OR EXTENDED DURING 1993**

Recipient	Project title and code	Expert services (months)	Equipment (\$)	Fellowships (\$)	Training courses (\$)	Sub-contracts (\$)	Source <sup>a)</sup>
BANGLADESH	Modernization of nuclear medicine BGD/6/011	1	150,000	0	0	0	USA
BELARUS, REPUBLIC OF	Establishment of radiation monitoring stations, BYE/9/003	2	177,200	0	0	0	UN
BRAZIL	Radiation protection in medical practice BRA/9/035	6	80,635	0	0	0	GFR
CHINA	Safety featured engineering CPR/9/018	3	0	12,000	0	0	FRA
COLOMBIA	Modernization of research reactor IAN-RI COL/4/013	2	150,000	0	0	0	USA
	Brachytherapy COL/6/006	1	175,000	0	0	0	USA
COSTA RICA	Production of DNA probes COS/5/013	2	19,300	0	0	0	USA
CZECH REPUBLIC	Quality assurance in commissioning and operation of NPPS, CZR/4/003	2	0	4,500	0	0	FRA
	Assessment of environmental risks in the North Bohemia, CZR/9/002	1	0	0	0	0	FRA
EGYPT	Personnel dosimetry EGV/9/026	3	45,000	0	0	0	USA
ETHIOPIA	Nuclear instrumentation ETH/4/002	2	20,000	0	0	0	UK
GHANA	Nuclear instruments and computer interfacing, GHA/4/009	4	75,000	0	0	0	USA
HUNGARY	Quality assurance in nuclear power plant operation, HUN/4/011	3	0	0	0	0	FRA
	Enhancement of safety in NPP operation HUN/9/014	10	0	0	0	0	FRA
	Control of low and intermediate level radioactive waste, HUN/9/015	1	0	0	0	0	FRA
		1	0	3,400	0	0	SPA
ICELAND	Establishment of early warning system ICE/9/003	0	31,000	0	0	0	ICE
INDONESIA	Neutron scattering data processing INS/1/020	2	0	42,900	0	0	UK
	University research and teaching in agriculture, INS/5/022	7	100,000	0	0	0	USA
	Establishment of a radioimmunoassay laboratory, INS/6/009	2	0	0	0	0	USA
KENYA	Nitrogen fixation by multipurpose tree species, KEN/5/015	2	25,000	39,600	0	0	UK
	Pesticide research KEN/5/016	1	18,000	0	0	0	USA
	Gamma camera KEN/6/010	3	60,000	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	149,000	0	0	0	USA
	Molecular analysis of the genetic effects of radiation, MEX/7/007	8	27,000	18,000	0	0	UK

Recipient	Project title and code	Expert services (months)	Equipment (\$)	Fellowships (\$)	Training courses (\$)	Sub-contracts (\$)	Source <sup>a)</sup>
MOROCCO	Establishment of local teaching and training laboratory, MOR/0/006	2	25,000	0	0	0	USA
	Radioisotope production and labelling MOR/4/010	1	0	0	0	0	USA
	Study on food irradiation MOR/5/018	1	80,000	0	0	0	FRA
	Establishment of a non-destructive testing laboratory, MOR/8/006 <sup>b)</sup>	0	0	0	0	0	FRA
NIGERIA	Environmental monitoring of radionuclides, NIR/9/006	2	0	0	0	0	USA
PERU	Central computer facility PER/4/015	0	35,000	0	0	0	USA
PHILIPPINES	Biological nitrogen fixation PHI/5/024	2	60,000	18,000	0	0	UK
	Applications of x-ray analysis PHI/8/017	1	30,000	0	0	0	USA
POLAND	Computer based methods for calibration of well-logging tools, POL/8/010	0	65,000	0	0	0	TACF
	Electron beam technology for flue gas purification phase III, POL/8/013	7	0	0	0	0	JPN
ROMANIA	Support of Cernavoda training centre ROM/0/004	0	0	0	0	166,200	SPA
	Computer-aided design for Cernavoda NPP engineering, ROM/4/015	0	0	0	0	44,300	SPA
	Radioimmunoassay standardization and quality control, ROM/6/010	1	40,000	0	0	0	USA
SLOVAK REPUBLIC	Quality assurance in commissioning and operation of NPPS, CZR/4/003	2	0	4,500	0	0	FRA
SLOVENIA, REPUBLIC OF	Enhancement of operational safety at Krsko NPP, SLO/9/004	8	0	0	0	0	USA
THAILAND	Establishment of a new gamma greenhouse THA/5/039	1	55,000	0	0	0	UK
UNITED REPUBLIC OF TANZANIA	Eradication of tsetse fly on Zanzibar Island, URT/5/015	18	0	0	0	30,000	BEL
	Radiotherapy facility and therapy dosimetry system, URT/6/007	2	200,000	0	0	0	USA
URUGUAY	Maintenance and repair of nuclear instrumentation, URU/4/009	1	40,000	0	0	0	USA
ZIMBABWE	Radioimmunoassay of thyroid related hormones, ZIM/2/002	3	50,000	0	0	0	USA
REGIONAL AFRICA	Nuclear instrumentation (AFRA IV) RAF/4/009	5	0	0	0	0	TACF
	Animal trypanosomiasis RAF/5/028	6	160,000	0	30,000	0	UK
	Nucl. techniques in plant breeding & biotechnology (AFRA X), RAF/5/029	5	0	0	0	0	TACF
	Local preparation of radioimmunoassay reagents (AFRA V), RAF/6/007	4	30,000	0	24,400	0	FRA
	Non-destructive testing techniques (AFRA VI), RAF/8/017	4	0	0	45,000	0	TACF
		2	50,700	0	25,300	0	SPA

Recipient	Project title and code	Expert services (months)	Equipment (\$)	Fellowships (\$)	Training courses (\$)	Sub-contracts (\$)	Source <sup>a)</sup>
REGIONAL ASIA & PACIFIC	Strengthening nuclear medicine in RCA member states, RAS/6/022	4	0	0	0	53,200	AUL
	Isotopes and radiation in industry and the environment (RCA), RAS/8/069	1	22,500	0	125,000	0	AUL
	Isotopes and radiation in industry and the environment (RCA), RAS/8/070	13	0	0	141,800	0	JPN
	Strengthening of radiation protection infrastructures (RCA), RAS/9/006	2	0	0	0	0	JPN
		1	0	0	0	92,700	AUL
REGIONAL MIDDLE EAST & EUROPE	In-service inspection design RER/4/003	0	0	0	0	139,864	SPA
	Safety analysis of WWER-1000 RER/9/020	5	40,000	0	0	0	TACF
		2	0	0	0	30,000	SPA
	Interim storage of spent fuel from nuclear power plants, RER/9/021	6	0	36,000	0	0	TACF
	Strengthening of regulatory body for nucl. power programme, RER/9/023	6	0	0	30,000	0	TACF
REGIONAL LATIN AMERICA	Nuclear analytical techniques (ARCAL IV) RLA/2/003	1	0	0	18,600	0	GFR
	Environmental studies using nuclear techniques, RLA/2/006	2	67,200	0	0	0	GFR
	Nuclear instrumentation - phase II (ARCAL II), RLA/4/008	1	8,600	0	0	0	GFR
	Immunoassay in animal production and health (ARCAL III), RLA/5/028	6	0	0	0	0	SWE
	Application of isotope techniques in hydrology (ARCAL XIII), RLA/8/014	0	40,000	0	0	0	GFR
	Industrial applications of nuclear technology (ARCAL XVI), RLA/8/016	3	55,000	9,000	25,000	0	FRA
	Non-destructive testing in quality control programmes, RLA/8/017	0	0	0	35,000	35,000	GFR
	Radiation protection for central america and caribbean, RLA/9/017	2	50,000	0	0	0	USA
0		0	0	40,000	0	TACF	

<sup>a)</sup> Explanation of abbreviations: AUL=Australia; BEL=Belgium; FRA=France, GFR=Federal Republic of Germany; ICE=Iceland; JPN=Japan; SPA=Spain; SWE=Sweden  
TACF=Technical Assistance and Co-operation Fund; UK=United Kingdom; UN=United Nations; USA=United States of America.

<sup>b)</sup> MOR/8/006 -upgraded with the provision of type II fellowships.

## ANNEX VIII

### APPROVALS AGAINST THE RESERVE FUND IN 1993

Recipient	Project title and number	Expert M/D	Expert \$	Equipment \$	Other \$	Total \$
<b>A. New Projects</b>						
Armenia	Infrastructure development for nuclear safety of NPP, ARM/9/002	3/00	31,050	18,950	0	50,000
Cuba	Studies to determine causes of epidemic neuropathy, CUB/2/008	1/00	10,350	39,650	0	50,000
Lebanon	Isotope hydrology, LEB/8/002	2/00	20,700	20,300	9,000 <sup>b</sup>	50,000
Mexico	Food irradiation, MEX/5/022	1/27	26,400	0	0	26,400
Pakistan	Design and safety review of Chasma Nuclear Power Plant, PAK/9/017	3/07	40,000	0	400 <sup>a</sup>	40,400
Regional Europe	Personnel training requirements and programmes for WWER NPP's, RER/0/008	4/00	40,852	0	548 <sup>a</sup>	41,400
Romania	Development of high efficiency air filters for Cernavoda NPP, ROM/4/018	1/00	5,000	25,000	0	30,000
Saudi Arabia	High purity I-123 production and use in radiopharmaceuticals, SAU/6/002	2/00	20,700	0	18,000 <sup>b</sup>	38,700
Syrian Arab Rep.	Isotope hydrology, SYR/8/005	0/00	0	40,000	0	40,000
Viet Nam	Workshop on design, management and evaluation of TC projects, VIE/0/007	0/00	0	0	19,954 <sup>c</sup>	19,954
	Radiation exposure assessment, VIE/9/006	0/20	6,375	0	0	6,375
<b>Sub-total</b>		18/24	201,427	143,900	47,902	393,229
<b>B. Supplementary Assistance to Existing Projects</b>						
Cyprus	Animal disease diagnosis, CYP/5/015	1/00	10,350	39,650	0	50,000
Egypt	Upgrading of an electron beam accelerator, EGY/8/011	1/00	10,350	0	0	10,350
Lebanon	Radiation protection, LEB/9/002	0/00	0	2,625	0	2,625
Sudan	Secondary standards dosimetry laboratory, SUD/1/005	0/00	0	50,000	0	50,000
Turkey	Rinderpest seromonitoring, TUR/5/017	1/00	10,350	10,000	0	20,350
<b>Sub-total</b>		3/00	31,050	102,275	0	133,325
<b>TOTAL</b>		21/24	232,477	246,175	47,902	526,554

<sup>a</sup> Approval for miscellaneous.

<sup>b</sup> Approval for fellowships.

<sup>c</sup> Approval for training courses.

## ANNEX IX

### NET PROGRAMME CHANGES BY RECIPIENT: 1993

Recipient	Component	Existing approval	Net change
AFGHANISTAN	EXPERTS (M/D)	6/22	-2/25
	EQUIPMENT (CC)	50,000	-18,000
	FELLOWSHIPS (CC)	84,150	-17,000
ALBANIA	EXPERTS (M/D)	18/09	-4/00
	EQUIPMENT (CC)	1,176,820	-206,000
	FELLOWSHIPS (CC)	79,820	-2,800
ALGERIA	EXPERTS (M/D)	41/21	-11/22
	EQUIPMENT (CC)	1,064,422	25,777
	EQUIPMENT (NCC)	30,000	-17,410
	FELLOWSHIPS (CC)	84,224	-13,879
ARGENTINA	EXPERTS (M/D)	12/00	2/10
	EQUIPMENT (CC)	679,500	24,841
	FELLOWSHIPS (CC)	415,600	55,773
BANGLADESH	EXPERTS (M/D)	22/11	0/03
	EQUIPMENT (CC)	1,068,554	-4,546
	FELLOWSHIPS (CC)	358,690	-10,092
BELARUS, REPUBLIC OF	EXPERTS (M/D)	2/00	-1/25
	EQUIPMENT (CC)	332,200	21,360
	FELLOWSHIPS (CC)	12,150	3,150
BOLIVIA	EXPERTS (M/D)	23/19	-1/25
	EQUIPMENT (CC)	1,381,726	-1,299
	FELLOWSHIPS (CC)	11,600	7,200
	TRAINING COURSES (CC)	45,938	-20,500
BRAZIL	EXPERTS (M/D)	49/08	1/20
	EQUIPMENT (CC)	3,167,055	1,953
	FELLOWSHIPS (CC)	383,811	-39,413
	FELLOWSHIPS (NCC)	3,400	-2,776
BULGARIA	EXPERTS (M/D)	51/19	-0/15
	EQUIPMENT (CC)	607,000	26,245
	EQUIPMENT (NCC)	1,106,566	-316
	FELLOWSHIPS (CC)	379,611	5,833
	FELLOWSHIPS (NCC)	0	9,788
CAMEROON	EXPERTS (M/D)	24/14	-5/12
	EQUIPMENT (CC)	245,451	-9,377
	FELLOWSHIPS (CC)	0	5,175

Recipient	Component	Existing approval	Net change
CHILE	EXPERTS (M/D)	38/09	-5/02
	EQUIPMENT (CC)	1,290,044	74,603
	FELLOWSHIPS (CC)	230,094	39,805
CHINA	EXPERTS (M/D)	33/03	2/17
	EQUIPMENT (CC)	891,002	83,633
	FELLOWSHIPS (CC)	1,230,085	8,758
COLOMBIA	EXPERTS (M/D)	28/08	-4/11
	EQUIPMENT (CC)	1,957,637	-5,264
	FELLOWSHIPS (CC)	58,150	61,392
COSTA RICA	EXPERTS (M/D)	21/18	-2/26
	EQUIPMENT (CC)	687,330	54,645
	FELLOWSHIPS (CC)	70,940	-1,422
COTE D'IVOIRE	EXPERTS (M/D)	3/00	-1/00
	EQUIPMENT (CC)	50,000	10,350
CROATIA	EXPERTS (M/D)	15/00	3/24
	EQUIPMENT (CC)	50,000	223,398
	FELLOWSHIPS (CC)	0	56,500
CUBA	EXPERTS (M/D)	12/23	-1/29
	EQUIPMENT (CC)	1,175,063	28,713
	EQUIPMENT (NCC)	126,984	-13,963
	FELLOWSHIPS (CC)	108,300	28,110
	FELLOWSHIPS (NCC)	14,510	-592
CYPRUS	EXPERTS (M/D)	8/28	-0/06
	EQUIPMENT (CC)	278,010	88,610
	FELLOWSHIPS (CC)	63,002	-11,606
	SUB-CONTRACTS (CC)	29,845	1,094
CZECH REPUBLIC	EXPERTS (M/D)	6/01	5/06
	EQUIPMENT (CC)	0	16,515
	FELLOWSHIPS (CC)	78,250	-43,600
DEM. P.R. KOREA	EXPERTS (M/D)	7/00	-1/14
	EQUIPMENT (CC)	630,580	-15,460
	FELLOWSHIPS (CC)	259,300	-62,640
DOMINICAN REPUBLIC	EXPERTS (M/D)	9/10	-2/14
	EQUIPMENT (CC)	499,331	31,462
	FELLOWSHIPS (CC)	107,973	24,882

Recipient	Component	Existing approval	Net change
ECUADOR	EXPERTS (M/D)	34/02	-8/29
	EQUIPMENT (CC)	2,201,462	39,071
	FELLOWSHIPS (CC)	232,861	-7,682
	TRAINING COURSES (CC)	0	2,000
	SUB-CONTRACTS (CC)	17,604	-652
EGYPT	EXPERTS (M/D)	111/12	-20/07
	EQUIPMENT (CC)	2,710,594	68,209
	FELLOWSHIPS (CC)	125,898	-62,264
	TRAINING COURSES (CC)	20,000	5,937
	SUB-CONTRACTS (CC)	300,360	-56,345
EL SALVADOR	EXPERTS (M/D)	21/04	-2/07
	EQUIPMENT (CC)	375,168	7,953
	FELLOWSHIPS (CC)	66,100	-22,352
ETHIOPIA	EXPERTS (M/D)	5/00	-0/23
	EQUIPMENT (CC)	270,800	49,625
	FELLOWSHIPS (CC)	122,550	-6,690
	SUB-CONTRACTS (CC)	20,000	-5,000
GHANA	EXPERTS (M/D)	57/09	-8/06
	EQUIPMENT (CC)	1,198,662	4,091
	FELLOWSHIPS (CC)	128,450	-2,215
GREECE	EXPERTS (M/D)	8/22	-1/09
	EQUIPMENT (CC)	111,711	39,326
	FELLOWSHIPS (CC)	9,000	-9,000
GUATEMALA	EXPERTS (M/D)	19/03	-6/02
	EQUIPMENT (CC)	1,092,845	11,542
	FELLOWSHIPS (CC)	113,889	1,396
HAITI	EXPERTS (M/D)	7/16	-0/05
	EQUIPMENT (CC)	91,093	-11,025
HUNGARY	EXPERTS (M/D)	4/00	1/04
	EQUIPMENT (CC)	161,400	891
	FELLOWSHIPS (CC)	24,502	-8,775
ICELAND	EXPERTS (M/D)	1/00	-0/03
	EQUIPMENT (CC)	158,884	-1,392
INDONESIA	EXPERTS (M/D)	109/13	-0/04
	EQUIPMENT (CC)	677,328	42,179
	FELLOWSHIPS (CC)	900,271	-118,858
	FELLOWSHIPS (NCC)	12,077	7,600

Recipient	Component	Existing approval	Net change
INTERREGIONAL	MISCELLANEOUS (CC)	326	7,043
	EXPERTS (M/D)	172/19	60/24
	SUB-CONTRACTS (CC)	44,250	33,301
IRAN, ISLAMIC REPUBLIC OF	EXPERTS (M/D)	90/10	1/01
	EQUIPMENT (CC)	1,623,241	156,558
	EQUIPMENT (NCC)	650,500	-46,102
	FELLOWSHIPS (CC)	182,750	-99,950
	FELLOWSHIPS (NCC)	8,567	34,000
IRAQ	EXPERTS (M/D)	4/00	-4/00
	EQUIPMENT (CC)	60,000	-60,000
	FELLOWSHIPS (CC)	46,200	-46,200
JAMAICA	EXPERTS (M/D)	9/21	0/28
	EQUIPMENT (CC)	128,000	-11,660
JORDAN	EXPERTS (M/D)	21/11	-6/06
	EQUIPMENT (CC)	513,640	75,220
	FELLOWSHIPS (CC)	89,100	-17,185
KENYA	EXPERTS (M/D)	8/00	-1/26
	EQUIPMENT (CC)	885,366	24,147
	FELLOWSHIPS (CC)	47,160	-7,087
KOREA, REPUBLIC OF	EXPERTS (M/D)	42/21	-6/28
	EQUIPMENT (CC)	209,375	2,034
	FELLOWSHIPS (CC)	797,542	-39,430
LEBANON	EQUIPMENT (CC)	35,875	5,000
LIBYAN ARAB JAMAHIRIYA	EXPERTS (M/D)	25/16	-5/18
	EQUIPMENT (CC)	597,001	41,334
	FELLOWSHIPS (CC)	154,900	-31,209
MADAGASCAR	EXPERTS (M/D)	18/05	-4/23
	EQUIPMENT (CC)	460,973	51,534
	FELLOWSHIPS (CC)	34,366	-19,800
MALAYSIA	EXPERTS (M/D)	70/15	-4/11
	EQUIPMENT (CC)	867,730	9,525
	FELLOWSHIPS (CC)	244,042	0
MALI	EXPERTS (M/D)	9/26	-1/20
	EQUIPMENT (CC)	462,927	4,212
	FELLOWSHIPS (CC)	55,350	-17,133
MAURITIUS	EXPERTS (M/D)	11/00	-2/02
	EQUIPMENT (CC)	50,000	1,380

Recipient	Component	Existing approval	Net change
MEXICO	EXPERTS (M/D)	62/19	-2/19
	EQUIPMENT (CC)	1,783,038	2,976
	FELLOWSHIPS (CC)	439,827	-11,323
MONGOLIA	EXPERTS (M/D)	4/00	1/00
	EQUIPMENT (CC)	727,220	9,051
	EQUIPMENT (NCC)	0	374
	FELLOWSHIPS (CC)	426,677	-29,824
	FELLOWSHIPS (NCC)	9,276	23,151
MOROCCO	EXPERTS (M/D)	32/12	-0/09
	EQUIPMENT (CC)	1,166,366	-93,220
	EQUIPMENT (NCC)	20,000	-14,623
	FELLOWSHIPS (CC)	394,759	-95,000
MYANMAR	EXPERTS (M/D)	8/17	1/09
	EQUIPMENT (CC)	200,512	22,394
	FELLOWSHIPS (CC)	413,160	-9,550
NICARAGUA	EQUIPMENT (CC)	769,663	291,555
	FELLOWSHIPS (CC)	152,600	-43,749
	TRAINING COURSES (CC)	3,000	3,000
NIGER	EXPERTS (M/D)	25/29	-6/03
	EQUIPMENT (CC)	86,160	10,350
	FELLOWSHIPS (CC)	109,200	-16,482
NIGERIA	EXPERTS (M/D)	43/16	-20/21
	EQUIPMENT (CC)	541,908	150,750
	FELLOWSHIPS (CC)	380,850	-36,275
PAKISTAN	MISCELLANEOUS (CC)	0	400
	EXPERTS (M/D)	45/28	0/26
	EQUIPMENT (CC)	990,802	-21,465
	EQUIPMENT (NCC)	0	9,000
	FELLOWSHIPS (CC)	611,331	26,973
	FELLOWSHIPS (NCC)	3,850	24,588
PANAMA	EXPERTS (M/D)	6/00	-1/07
	EQUIPMENT (CC)	364,620	-527
	FELLOWSHIPS (CC)	99,450	-32,048
PARAGUAY	EXPERTS (M/D)	19/17	-1/02
	EQUIPMENT (CC)	515,360	14,197
	FELLOWSHIPS (CC)	75,250	-25,586

Recipient	Component	Existing approval	Net change
PERU	EXPERTS (M/D)	17/05	-3/22
	EQUIPMENT (CC)	1,738,001	66,160
	EQUIPMENT (NCC)	552,644	-18,337
	FELLOWSHIPS (CC)	93,933	34,586
PHILIPPINES	EXPERTS (M/D)	29/02	-0/23
	EQUIPMENT (CC)	693,355	20,018
	FELLOWSHIPS (CC)	392,790	-3,970
POLAND	EXPERTS (M/D)	25/02	-1/09
	EQUIPMENT (CC)	2,007,800	46,340
	EQUIPMENT (NCC)	652,097	-6,914
	FELLOWSHIPS (CC)	38,033	-11,346
	TRAINING COURSES (CC)	0	5,000
PORTUGAL	EXPERTS (M/D)	9/06	-4/03
	EQUIPMENT (CC)	656,820	30,526
	FELLOWSHIPS (CC)	15,460	-1,765
REGIONAL AFRICA	EXPERTS (M/D)	498/29	-3/09
	EQUIPMENT (CC)	1,097,483	85,411
	FELLOWSHIPS (CC)	4,174,148	157,508
	FELLOWSHIPS (NCC)	123,000	6,415
	TRAINING COURSES (CC)	1,158,505	-117,019
	SUB-CONTRACTS (CC)	100,000	-29,308
REGIONAL ASIA AND PACIFIC	EXPERTS (M/D)	68/29	17/24
	EQUIPMENT (CC)	133,000	-8,670
	FELLOWSHIPS (CC)	1,988,893	-70,917
	FELLOWSHIPS (NCC)	375,514	-279,075
	TRAINING COURSES (CC)	1,039,835	198,696
	TRAINING COURSES (NCC)	12,184	19,800
REGIONAL EUROPE	MISCELLANEOUS (CC)	2,950	1,048
	MISCELLANEOUS (NCC)	12,973	-9,788
	EXPERTS (M/D)	262/24	65/23
	EQUIPMENT (CC)	900,578	45,830
	EQUIPMENT (NCC)	266,435	-21,398
	FELLOWSHIPS (CC)	4,226,402	-61,283
	FELLOWSHIPS (NCC)	101,422	20,341
	TRAINING COURSES (CC)	361,082	11,019
	TRAINING COURSES (NCC)	5,000	-5,000
	SUB-CONTRACTS (CC)	602,003	29,413
	SUB-CONTRACTS (NCC)	36,727	-26,183

Recipient	Component	Existing approval	Net change
REGIONAL LATIN AMERICA	EXPERTS (M/D)	303/05	10/04
	EQUIPMENT (CC)	3,328,162	96,408
	FELLOWSHIPS (CC)	916,421	-57,600
	FELLOWSHIPS (NCC)	98,899	-79,197
	TRAINING COURSES (CC)	3,089,620	230,357
	TRAINING COURSES (NCC)	27,972	-6,754
	SUB-CONTRACTS (CC)	522,878	59,650
ROMANIA	EXPERTS (M/D)	56/09	2/25
	EQUIPMENT (CC)	727,489	22,657
	FELLOWSHIPS (CC)	462,470	19,238
	SUB-CONTRACTS (CC)	210,498	-44,250
SENEGAL	EXPERTS (M/D)	2/05	-0/14
	EQUIPMENT (CC)	71,000	-20,000
	FELLOWSHIPS (CC)	66,800	-30,543
SIERRA LEONE	EXPERTS (M/D)	17/05	-5/18
	EQUIPMENT (CC)	112,400	-8,000
	FELLOWSHIPS (CC)	131,492	-28,778
SINGAPORE	EXPERTS (M/D)	10/23	-2/13
	EQUIPMENT (CC)	118,382	-62,755
	FELLOWSHIPS (CC)	7,770	-186
SLOVAK REPUBLIC	EXPERTS (M/D)	9/00	6/10
	FELLOWSHIPS (CC)	73,800	0
SLOVENIA, REPUBLIC OF	EXPERTS (M/D)	10/13	7/02
	EQUIPMENT (CC)	1,369	49,150
SRI LANKA	EXPERTS (M/D)	16/11	-0/16
	EQUIPMENT (CC)	999,683	-4,487
	EQUIPMENT (NCC)	47,000	-10,581
	FELLOWSHIPS (CC)	88,500	4,830
SUDAN	EXPERTS (M/D)	10/20	-4/07
	EQUIPMENT (CC)	770,047	2,010
	FELLOWSHIPS (CC)	76,830	14,205
SYRIAN ARAB REPUBLIC	EXPERTS (M/D)	16/07	1/21
	EQUIPMENT (CC)	1,001,560	24,449
	EQUIPMENT (NCC)	200,000	-7,899
	FELLOWSHIPS (CC)	75,605	4,224
	FELLOWSHIPS (NCC)	8,250	-8,250

Recipient	Component	Existing approval	Net change
THAILAND	EXPERTS (M/D)	42/00	-5/20
	EQUIPMENT (CC)	926,774	-15,511
	EQUIPMENT (NCC)	17,974	-2,427
	FELLOWSHIPS (CC)	658,444	847
TUNISIA	EXPERTS (M/D)	18/22	-3/06
	EQUIPMENT (CC)	482,678	36,661
	EQUIPMENT (NCC)	40,000	-27,977
	FELLOWSHIPS (CC)	15,300	-1,989
TURKEY	EXPERTS (M/D)	13/21	-1/10
	EQUIPMENT (CC)	892,838	30,404
	EQUIPMENT (NCC)	134,397	-72,640
	FELLOWSHIPS (CC)	59,150	-7,970
UGANDA	EXPERTS (M/D)	11/06	-2/04
	EQUIPMENT (CC)	532,040	18,862
	FELLOWSHIPS (CC)	267,050	-47,477
UK (HONG KONG)	EXPERTS (M/D)	6/27	0/11
	EQUIPMENT (CC)	50,000	-1,158
	FELLOWSHIPS (CC)	25,320	-15,931
UKRAINE	EXPERTS (M/D)	11/00	4/13
UNITED ARAB EMIRATES	EXPERTS (M/D)	3/00	-1/04
	EQUIPMENT (CC)	1,128,533	111,729
U.R. TANZANIA	EXPERTS (M/D)	3/26	-0/21
	EQUIPMENT (CC)	597,000	134,750
	FELLOWSHIPS (CC)	191,543	-10,127
	SUB-CONTRACTS (CC)	20,000	-10,000
URUGUAY	EXPERTS (M/D)	4/07	-0/28
	EQUIPMENT (CC)	612,816	16,002
	FELLOWSHIPS (CC)	76,171	-4,859
VENEZUELA	EXPERTS (M/D)	20/08	-3/09
	EQUIPMENT (CC)	394,825	-812
	FELLOWSHIPS (CC)	137,638	-8,486
	FELLOWSHIPS (NCC)	0	5,000
VIET NAM	EXPERTS (M/D)	10/15	-0/25
	EQUIPMENT (CC)	1,141,910	24,820
	EQUIPMENT (NCC)	1,110,694	-5,340
	FELLOWSHIPS (CC)	470,420	-22,396
	FELLOWSHIPS (NCC)	3,512	6,069
	TRAINING COURSES (CC)	25,000	-1,500

Recipient	Component	Existing approval	Net change
YUGOSLAVIA	EXPERTS (M/D)	27/11	-12/14
	EQUIPMENT (CC)	666,245	-321,356
	FELLOWSHIPS (CC)	126,200	-126,200
ZAIRE	EXPERTS (M/D)	15/04	-8/25
	EQUIPMENT (CC)	625,388	-118,313
	FELLOWSHIPS (CC)	27,450	-14,808
	TRAINING COURSES (CC)	10,000	-10,000
ZAMBIA	EXPERTS (M/D)	43/03	-3/14
	EQUIPMENT (CC)	352,215	18,862
	FELLOWSHIPS (CC)	51,594	-4,267
ZIMBABWE	EXPERTS (M/D)	27/04	-5/02
	EQUIPMENT (CC)	284,815	-22,160
	FELLOWSHIPS (CC)	55,800	3,200
TOTALS	MISCELLANEOUS (CC)	3,276	8,491
	MISCELLANEOUS (NCC)	12,973	-9,788
	EXPERTS (M/D)	3,168/05	-41/17
	EXPERTS (\$)	30,134,724	-1,275,049
	EXPERTS (\$) (NCC)	0	7,051
	EQUIPMENT (CC)	62,416,673	1,685,813
	EQUIPMENT (NCC)	4,955,295	-256,557
	FELLOWSHIPS (CC)	25,485,219	-985,439
	FELLOWSHIPS (NCC)	762,279	-232,937
	TRAINING COURSES (CC)	5,752,982	306,991
	TRAINING COURSES (NCC)	45,156	8,045
	SUB-CONTRACTS (CC)	1,867,440	-22,096
	SUB-CONTRACTS (NCC)	36,727	-26,183
	TOTAL ALLOTTED	131,472,748	-791,657

## ANNEX X

### NET REPHASINGS UNDERTAKEN DURING 1993

Recipient	Project component	Net allotted/ Net rephased	Current year	1994	1995
ARGENTINA	EQUIPMENT	ALLOTTED	60,000	75,000	0
	(CC)	REPHASED	55,000	-55,000	0
	FELLOWSHIPS	ALLOTTED	0	18,900	0
	(CC)	REPHASED	16,000	-16,000	0
BANGLADESH	EXPERTS	ALLOTTED	0/00	1/00	0/00
	(M/D)	REPHASED	1/00	-1/00	0/00
	EQUIPMENT	ALLOTTED	45,000	55,000	0
	(CC)	REPHASED	5,000	-5,000	0
	FELLOWSHIPS	ALLOTTED	59,415	0	0
	(CC)	REPHASED	-27,000	27,000	0
BELARUS, REP. OF	EXPERTS	ALLOTTED	4/00	0/00	0/00
	(M/D)	REPHASED	-3/00	3/00	0/00
BULGARIA	EQUIPMENT	ALLOTTED	30,000	10,000	5,000
	(CC)	REPHASED	7,000	-7,000	0
CAMEROON	EXPERTS	ALLOTTED	4/15	0/00	0/00
	(M/D)	REPHASED	-2/00	2/00	0/00
	EQUIPMENT	ALLOTTED	207,000	0	0
	(CC)	REPHASED	-75,000	75,000	0
CHILE	EQUIPMENT	ALLOTTED	51,410	29,700	0
	(CC)	REPHASED	29,700	-29,700	0
	FELLOWSHIPS	ALLOTTED	19,050	18,900	3,300
	(CC)	REPHASED	-7,695	16,695	0
CHINA	EXPERTS	ALLOTTED	3/10	0/00	0/00
	(M/D)	REPHASED	-1/00	1/00	0/00
COLOMBIA	EQUIPMENT	ALLOTTED	83,000	120,000	20,000
	(CC)	REPHASED	22,200	-22,200	0
COSTA RICA	EXPERTS	ALLOTTED	2/26	1/00	0/00
	(M/D)	REPHASED	0/10	-0/10	0/00
	EQUIPMENT	ALLOTTED	100,569	40,000	0
	(CC)	REPHASED	10,000	-10,000	0
COTE D'IVOIRE	EXPERTS	ALLOTTED	5/26	1/00	0/00
	(M/D)	REPHASED	-3/00	3/00	0/00
	EQUIPMENT	ALLOTTED	214,300	90,000	10,000
	(CC)	REPHASED	-54,000	54,000	0

Recipient	Project component	Net allotted/ Net rephased	Current year	1994	1995
CROATIA	EXPERTS	ALLOTTED	9/00	1/00	0/00
	(M/D)	REPHASED	-4/15	2/12	0/00
	EQUIPMENT	ALLOTTED	273,398	10,000	0
	(CC)	REPHASED	-18,550	40,000	0
CUBA	EXPERTS	ALLOTTED	7/02	1/00	0/00
	(M/D)	REPHASED	-4/00	4/00	0/00
	EQUIPMENT	ALLOTTED	199,814	35,000	0
	(CC)	REPHASED	35,000	-35,000	0
DEM. P.R. KOREA	EXPERTS	ALLOTTED	8/00	3/00	0/00
	(M/D)	REPHASED	-2/24	2/24	0/00
ECUADOR	EXPERTS	ALLOTTED	5/27	1/00	0/00
	(M/D)	REPHASED	-1/21	1/21	0/00
	EQUIPMENT	ALLOTTED	106,407	35,000	7,000
	(CC)	REPHASED	-33,072	33,072	0
EGYPT	EXPERTS	ALLOTTED	6/00	2/00	0/00
	(M/D)	REPHASED	-1/15	1/15	0/00
EL SALVADOR	EXPERTS	ALLOTTED	10/00	3/00	2/00
	(M/D)	REPHASED	-4/07	4/07	0/00
	EQUIPMENT	ALLOTTED	161,590	0	0
	(CC)	REPHASED	-33,982	33,982	0
	FELLOWSHIPS	ALLOTTED	54,000	56,700	13,200
	(CC)	REPHASED	-54,000	54,000	0
GHANA	EXPERTS	ALLOTTED	6/00	1/00	0/00
	(M/D)	REPHASED	-3/00	3/00	0/00
GREECE	EXPERTS	ALLOTTED	6/06	2/00	0/00
	(M/D)	REPHASED	-2/15	2/15	0/00
	FELLOWSHIPS	ALLOTTED	27,000	22,050	0
	(CC)	REPHASED	-24,000	24,000	0
GUATEMALA	EXPERTS	ALLOTTED	4/00	0/00	0/00
	(M/D)	REPHASED	-1/00	1/00	0/00
HUNGARY	FELLOWSHIPS	ALLOTTED	60,000	78,750	0
	(CC)	REPHASED	-26,000	26,000	0
INDONESIA	EXPERTS	ALLOTTED	1/00	1/00	0/00
	(M/D)	REPHASED	0/04	-0/04	0/00
IRAN, I.R.	EXPERTS	ALLOTTED	8/08	2/00	0/00
	(M/D)	REPHASED	-4/00	4/00	0/00
	EQUIPMENT	ALLOTTED	0	50,000	10,000
	(CC)	REPHASED	12,000	-12,000	0

Recipient	Project component	Net allotted/ Net rephased	Current year	1994	1995
JAMAICA	EXPERTS	ALLOTTED	12/21	2/00	0/00
	(M/D)	REPHASED	-5/29	5/29	0/00
	EQUIPMENT	ALLOTTED	118,700	0	0
	(CC)	REPHASED	-54,955	54,955	0
	FELLOWSHIPS	ALLOTTED	18,900	3,150	0
	(CC)	REPHASED	-18,900	18,900	0
JORDAN	EQUIPMENT	ALLOTTED	45,000	0	0
	(CC)	REPHASED	-45,000	45,000	0
KOREA, REP. OF	EXPERTS	ALLOTTED	2/00	1/00	0/00
	(M/D)	REPHASED	-0/25	0/25	0/00
MALAYSIA	EXPERTS	ALLOTTED	1/00	2/00	1/00
	(M/D)	REPHASED	-0/15	0/15	0/00
	FELLOWSHIPS	ALLOTTED	12,000	18,900	13,200
	(CC)	REPHASED	8,000	-8,000	0
MAURITIUS	EQUIPMENT	ALLOTTED	70,000	25,000	20,000
	(CC)	REPHASED	-18,000	18,000	0
MEXICO	EXPERTS	ALLOTTED	0/00	2/00	0/00
	(M/D)	REPHASED	1/00	-1/00	0/00
	SUB-CONTRACTS	ALLOTTED	169,200	0	0
	(CC)	REPHASED	-56,152	56,152	0
MONGOLIA	EXPERTS	ALLOTTED	22/25	4/00	0/00
	(M/D)	REPHASED	-3/20	3/20	0/00
	FELLOWSHIPS	ALLOTTED	49,850	18,900	0
	(CC)	REPHASED	15,500	-15,500	0
MOROCCO	EQUIPMENT	ALLOTTED	0	80,000	0
	(CC)	REPHASED	0	-80,000	80,000
MYANMAR	EXPERTS	ALLOTTED	7/00	4/00	2/00
	(M/D)	REPHASED	-0/17	0/17	0/00
NIGERIA	EQUIPMENT	ALLOTTED	60,000	45,000	0
	(CC)	REPHASED	45,000	-45,000	0
PAKISTAN	EXPERTS	ALLOTTED	31/02	4/00	0/00
	(M/D)	REPHASED	-6/00	6/00	0/00
	EQUIPMENT	ALLOTTED	208,600	70,000	0
	(CC)	REPHASED	7,000	-7,000	0
	FELLOWSHIPS	ALLOTTED	41,100	0	0
	(CC)	REPHASED	-41,100	41,100	0

Recipient	Project component	Net allotted/ Net rephased	Current year	1994	1995
PARAGUAY	EXPERTS	ALLOTTED	8/10	3/00	0/00
	(M/D)	REPHASED	-2/25	2/25	0/00
	EQUIPMENT	ALLOTTED	145,000	60,000	0
	(CC)	REPHASED	-80,000	80,000	0
PERU	EXPERTS	ALLOTTED	8/08	4/00	0/00
	(M/D)	REPHASED	-1/15	1/15	0/00
	EQUIPMENT	ALLOTTED	423,345	130,000	0
	(CC)	REPHASED	3,000	-3,000	0
PHILIPPINES	EXPERTS	ALLOTTED	6/24	6/00	0/00
	(M/D)	REPHASED	-4/06	4/06	0/00
	EQUIPMENT	ALLOTTED	125,000	0	0
	(CC)	REPHASED	-110,000	110,000	0
POLAND	EQUIPMENT	ALLOTTED	32,000	10,000	0
	(CC)	REPHASED	4,000	-4,000	0
	FELLOWSHIPS	ALLOTTED	0	9,450	9,900
	(CC)	REPHASED	2,540	-2,540	0
PORTUGAL	EXPERTS	ALLOTTED	0/00	1/00	0/00
	(M/D)	REPHASED	0/15	-0/15	0/00
	FELLOWSHIPS	ALLOTTED	12,000	12,600	0
	(CC)	REPHASED	-12,000	12,000	0
REGIONAL EUROPE	EXPERTS	ALLOTTED	2/00	2/00	0/00
	(M/D)	REPHASED	-1/16	1/16	0/00
	TRAINING COURSES	ALLOTTED	29,970	20,000	0
	(CC)	REPHASED	-6,400	6,400	0
ROMANIA	EQUIPMENT	ALLOTTED	73,000	190,000	400,000
	(CC)	REPHASED	-22,000	22,000	0
	FELLOWSHIPS	ALLOTTED	15,000	6,300	9,900
	(CC)	REPHASED	-12,000	12,000	0
SAUDI ARABIA	EXPERTS	ALLOTTED	4/00	4/00	0/00
	(M/D)	REPHASED	-2/00	2/00	0/00
	FELLOWSHIPS	ALLOTTED	9,000	9,450	0
	(CC)	REPHASED	-9,000	9,000	0
SLOVENIA, REP. OF	EQUIPMENT	ALLOTTED	70,000	110,000	0
	(CC)	REPHASED	36,500	-36,500	0
SRI LANKA	EQUIPMENT	ALLOTTED	39,200	25,000	0
	(CC)	REPHASED	25,000	-25,000	0

Recipient	Project component	Net allotted/ Net rephased	Current year	1994	1995
SYRIAN A.R.	EXPERTS	ALLOTTED	8/17	2/00	0/00
	(M/D)	REPHASED	-5/00	5/00	0/00
	FELLOWSHIPS	ALLOTTED	15,000	28,350	0
	(CC)	REPHASED	-5,000	5,000	0
THAILAND	EXPERTS	ALLOTTED	4/24	3/00	0/00
	(M/D)	REPHASED	-2/04	2/04	0/00
	EQUIPMENT	ALLOTTED	50,627	50,000	0
	(CC)	REPHASED	5,000	-5,000	0
	FELLOWSHIPS	ALLOTTED	59,300	18,900	0
	(CC)	REPHASED	13,000	-13,000	0
TURKEY	EXPERTS	ALLOTTED	12/00	6/00	0/00
	(M/D)	REPHASED	-4/15	4/15	0/00
	EQUIPMENT	ALLOTTED	79,000	41,000	0
	(CC)	REPHASED	-10,000	10,000	0
	FELLOWSHIPS	ALLOTTED	15,000	6,300	0
	(CC)	REPHASED	-15,000	15,000	0
UGANDA	EXPERTS	ALLOTTED	6/03	1/00	0/00
	(M/D)	REPHASED	-3/00	3/00	0/00
UK (HONG KONG)	EXPERTS	ALLOTTED	1/16	0/00	0/00
	(M/D)	REPHASED	-0/27	0/27	0/00
U.A. EMIRATES	EXPERTS	ALLOTTED	2/00	2/00	0/00
	(M/D)	REPHASED	-1/00	1/00	0/00
	FELLOWSHIPS	ALLOTTED	12,000	28,350	19,800
	(CC)	REPHASED	-12,000	12,000	0
U.R. TANZANIA	EXPERTS	ALLOTTED	40/14	6/00	0/00
	(M/D)	REPHASED	-6/00	6/00	0/00
	EQUIPMENT	ALLOTTED	517,000	135,000	10,000
	(CC)	REPHASED	60,000	-60,000	0
URUGUAY	EXPERTS	ALLOTTED	1/00	0/00	0/00
	(M/D)	REPHASED	-1/00	1/00	0/00
	EQUIPMENT	ALLOTTED	60,000	30,000	20,000
	(CC)	REPHASED	-30,000	30,000	0

Recipient	Project component	Net allotted/ Net rephased	Current year	1994	1995	
VENEZUELA	EXPERTS	ALLOTTED	0/15	1/00	0/00	
	(M/D)	REPHASED	-0/15	0/15	0/00	
	EQUIPMENT	ALLOTTED	80,000	105,000	0	
	(CC)	REPHASED	-14,500	14,500	0	
	FELLOWSHIPS	ALLOTTED	15,000	47,250	0	
	(CC)	REPHASED	-15,000	15,000	0	
VIET NAM	EXPERTS	ALLOTTED	3/00	2/00	0/00	
	(M/D)	REPHASED	-1/00	1/00	0/00	
	EQUIPMENT	ALLOTTED	195,200	30,000	0	
	(CC)	REPHASED	-17,239	17,239	0	
	FELLOWSHIPS	ALLOTTED	12,000	12,600	0	
	(CC)	REPHASED	-12,000	12,000	0	
ZAIRE	EQUIPMENT	ALLOTTED	122,427	0	0	
	(CC)	REPHASED	-87,895	87,895	0	
TOTALS	EXPERTS	ALLOTTED	277/29	82/00	5/00	
	(M/D)	REPHASED	-89/27	87/24	0/00	
	EXPERTS	ALLOTTED	2,579,815	885,600	57,000	
	(\$)	REPHASED	-875,260	948,240	0	
	EQUIPMENT	ALLOTTED	4,046,588	1,685,700	502,000	
	(CC)	REPHASED	-342,793	284,243	80,000	
	FELLOWSHIPS	ALLOTTED	505,615	415,800	69,300	
	(CC)	REPHASED	-235,655	244,655	0	
	TRAINING COURSES	ALLOTTED	29,970	20,000	0	
	(CC)	REPHASED	-6,400	6,400	0	
	SUB-CONTRACTS	ALLOTTED	169,200	0	0	
	(CC)	REPHASED	-56,152	56,152	0	
	TOTAL ALLOTTED			7,331,188	3,007,100	628,300
	TOTAL REPHASED			-1,516,261	1,539,691	80,000

## ANNEX XI

### EXTRABUDGETARY CONTRIBUTIONS FOR ACTIVITIES RELATING TO TECHNICAL CO-OPERATION WHICH ARE NOT INCLUDED IN THE TECHNICAL CO-OPERATION PROGRAMME: 1993

Donor	Activity	Funds Received \$
ARGENTINA	NUCLEAR DESALINATION PROJECT	10,000
AUSTRIA	STANDARDIZATION AND VALIDATION OF ENZYME-LINKED IMMUNOSORBENT ASSAY KITS FOR THE DIAGNOSIS OF POULTRY DISEASES FOR USE IN DEVELOPING COUNTRIES	12,900
BRAZIL	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	26,000
CEC	IAEA MARINE ENVIRONMENT LABORATORY, MONACO	471,500
FRANCE	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	5,500
	EVALUATION AND UTILIZATION OF PHOSPHATE FERTILIZERS	200,000
IRAN, I.R.	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	17,600
ITALY	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	13,846,200
	IMPROVEMENT OF BASIC FOOD CROPS IN AFRICA THROUGH PLANT BREEDING INCLUDING THE USE OF INDUCED MUTATIONS	281,600
JAPAN	NUCLEAR MEDICINE	48,000
	RADIATION THERAPY	58,900
	RADIATION PROTECTION	50,000
	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	39,100
JORDAN	NUCLEAR DESALINATION PROJECT	2,900
KUWAIT	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	53,800
NETHERLANDS	IMMUNOASSAY TECHNIQUES TO IMPROVE THE REPRODUCTIVE EFFICIENCY AND HEALTH STATUS OF INDIGENOUS AFRICAN LIVESTOCK	101,000
OPEC FUND	MANAGEMENT OF NITROGEN FIXATION IN TREES FOR RESTORING AND MAINTAINING SOIL FERTILITY	17,000
QATAR	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	13,100
SPAIN	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	15,000
	ASSISTANCE IN THE IMPLEMENTATION OF THE NEXT NUCLEAR POWER PLANT IN THE CZECH REPUBLIC	66,600
SWEDEN	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	708,200
	IAEA MARINE ENVIRONMENT LABORATORY, MONACO	411,000
	IMMUNOASSAY AND DNA PROBE METHODS FOR SEROSURVEILLANCE OF RINDERPEST IN AFRICA AND FOR THE DIAGNOSIS AND CONTROL OF ANIMAL DISEASES IN LATIN AMERICA	111,500
	ADVERSE SIDE EFFECTS ON FLORA AND FAUNA FROM THE USE OF ORGANOCHLORINE PESTICIDES ON THE AFRICAN CONTINENT	283,600
	INCREASING AND STABILIZING PLANT PRODUCTIVITY IN LOW PHOSPHATE AND SEMI-ARID AND SUB-HUMID SOILS OF THE TROPICS AND SUB-TROPICS	166,700
	AGROECOLOGICAL EFFECTS RESULTING FROM THE USE OF PERSISTENT PESTICIDES IN CENTRAL AMERICA	185,000
SWITZERLAND	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	50,700
TURKEY	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	100,000
UNEP	IAEA MARINE ENVIRONMENT LABORATORY, MONACO	1,324,500
UNESCO	IAEA MARINE ENVIRONMENT LABORATORY, MONACO	345,200
UNIDO	IAEA MARINE ENVIRONMENT LABORATORY, MONACO	230,000

Donor	Activity	Funds Received \$
USA	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	46,100
	INTERNATIONAL ARTIC SEA ASSESSMENT PROJECT	35,000
OTHER DONORS <i>a/</i>	INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE	120,600
	IAEA MARINE ENVIRONMENT LABORATORY, MONACO	165,200
	BRIDGING ASSISTANCE TO TSETSE CONTROL	10,000
<b>TOTAL</b>		<b>19,630,000</b>

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

## ANNEX XII

### PROJECTS CONCLUDED DURING 1993: ACHIEVEMENTS

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#### ALBANIA

##### **ALB/5/004 RADIOISOTOPES IN ANIMAL SCIENCE**

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APPROVED: **1989**

COMPLETED: **1993-11-29**

TOTAL COST: \$ **141,133**

TO ESTABLISH A LABORATORY FOR RIA AND ELISA TECHNIQUES IN ORDER TO IMPROVE THE DIAGNOSIS OF LIVESTOCK DISEASES AND THUS INCREASE THE REPRODUCTIVE EFFICIENCY OF DAIRY CATTLE AND SHEEP.

The project was first approved in 1989 in order to introduce new radioimmunoassay (RIA) techniques at the Institute of Veterinary Research of the Ministry of Agriculture, Tirana, and to assist the Institute's scientific studies and research work. The project had two components: animal diseases and animal reproduction. The Agency provided the necessary equipment for establishing a laboratory for reproduction and endocrinology. Expert missions provided training in the operation of the laboratory equipment. Five fellowships and one scientific visit were awarded. RIA techniques were introduced in animal reproduction, and a functioning RIA laboratory was set up in a specially constructed building provided by the Government. Studies were undertaken on the endocrinology of reproduction and analysis of the progesterone profile in farm animals. The counterparts can now perform progesterone measurements by RIA and diagnose bovine leucosis by the ELISA technique.

#### ALGERIA

##### **ALG/6/005 PRODUCTION OF TECHNETIUM-99m RADIOPHARMACEUTICAL KITS**

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APPROVED: **1989**

COMPLETED: **1993-01-29**

TOTAL COST: \$ **369,964**

TO SET UP A LABORATORY FACILITY FOR LOCAL PREPARATION OF TC-99M RADIOPHARMACEUTICAL KITS FOR USE IN NUCLEAR MEDICINE.

The project was initiated in 1989 at the Centre for Development of Nuclear Techniques to meet the need to prepare radiopharmaceuticals locally and to establish a national scheme for quality control. The Agency provided a complete technetium-99m production line using solvent extraction techniques, together with auxiliary equipment. Agency experts carried out four missions and gave advice on designing the radiopharmaceutical preparation laboratory, including ventilation and filtration systems for the hot cell facilities. Counterpart staff received practical training on production of instant Tc-99m, on processing irradiated molybdenum and on preparation and quality control of radiopharmaceuticals. Two fellowships and one scientific visit were awarded for training abroad. A functional, well equipped laboratory with trained personnel has been established. The laboratory is capable of preparing HSA microspheres of Tc-99m as well as EHDP, EHIDA, MDP and DTPA kits and is performing quality control procedures.

#### ARGENTINA

##### **ARG/8/009 SELECTION OF ELECTRON BEAM MACHINE FOR RADIATION PROCESSING**

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APPROVED: **1991**

COMPLETED: **1993-08-26**

TOTAL COST: \$ **39,566**

TO ADVISE ON THE TYPE, SIZE AND POWER OF AN ELECTRON ACCELERATOR FOR INDUSTRIAL APPLICATIONS.

The National Atomic Energy Commission (CNEA) requested expert advice from the Agency on the selection of an electron beam accelerator for present and future industrial applications. The project was approved in 1991. Two expert missions advised the CNEA on the most advanced electron beam technology available and on technologies suitable for development to benefit Argentine industries. One staff member was awarded a scientific visit. The CNEA has initiated a feasibility study, and the main specifications of the electron beam facility have been determined. An R&D programme on radiation modification of polymers was also initiated.

APPROVED: 1991

COMPLETED: 1993-08-26

TOTAL COST: \$ 66,951

TO ASSIST IN EVALUATING THE ENVIRONMENTAL IMPACT OF WASTES DERIVING FROM URANIUM MINING AND MILLING OPERATIONS.

For over two decades the National Atomic Energy Commission (CNEA) has been producing uranium concentrates at different locations, and a considerable amount of tailings has accumulated at the sites. The CNEA is evaluating potential environmental pollution risks arising from wastes produced by uranium mining and milling operations. In 1990 the CNEA requested Agency assistance in these studies, and the project was approved in 1991. Two experts from Australia and Canada, countries with wide experience in dealing with wastes from uranium production, visited the uranium processing facilities in Argentina. Two fellowships and two scientific visits were awarded, totalling nearly three months. Instrumentation for monitoring the radiological characteristics of mill tailings, as the basis for follow-up environmental assessment studies, was supplied under the project. Surveys conducted by Agency experts identified weaknesses and promoted corrective measures.

**BANGLADESH****BGD/1/011****UTILIZATION OF THE NEUTRON GENERATOR**

APPROVED: 1989

COMPLETED: 1993-08-26

TOTAL COST: \$ 67,405

TO STRENGTHEN FAST NEUTRON ACTIVATION ANALYSIS CAPABILITIES USING A 14 MEV NEUTRON GENERATOR.

This footnote-a project was funded by an extrabudgetary contribution from Finland and initiated in 1989. The existing neutron generator was frequently not operational and was in urgent need of repair. With the help of three Agency experts, the generator was repaired and put into operation. Local staff were trained in troubleshooting and repair. An associated particle method target head was installed and used to study the accumulation of deuterons in various elements. The staff was trained in nuclear data measurements by radiochemical separation techniques and in conducting fast neutron physics experiments. Equipment, spare parts and attachments were supplied. The neutron activation analysis group at the Institute of Nuclear Science and Technology, Savar, can now use the neutron generator for useful work in applied nuclear physics.

**BOLIVIA****BOL/5/006****IMMUNOASSAY IN ANIMAL DISEASE AND REPRODUCTION STUDIES**

APPROVED: 1991

COMPLETED: 1993-11-01

TOTAL COST: \$ 112,730

TO ESTABLISH IMMUNOASSAY TECHNIQUES FOR STUDIES OF REPRODUCTIVE EFFICIENCY IN LLAMAS AND TO IMPROVE DIAGNOSIS AND CONTROL OF IMPORTANT LIVESTOCK DISEASES.

The recipient institutions of the project, initiated in 1991, were the Veterinary Research and Diagnostic Laboratory (LIDIVET), Santa Cruz, for animal diseases, and the Technical University, Oruro, for animal production. The ELISA technique has been established at LIDIVET for the diagnosis of brucellosis, babesiosis and foot-and-mouth disease and is now used on a routine basis. A National Training Course was held in 1991 and two fellowships were awarded for training abroad. The British Overseas Development Administration, which also had a project in Santa Cruz, helped in the implementation of the project. Two Agency experts undertook four missions to the research team in Oruro for the production component of the project. The radioimmunoassay (RIA) laboratory was successfully established there and counterparts were trained in the technique and its applications by the experts. Research facilities at the University headquarters and at the experimental farm were improved. A new laboratory room and housing for animals were constructed using local funds. Valuable data on the reproductive physiology of sheep and llamas under high altitude conditions were obtained. The use of local by-products and crop residues for improving production and reproductive performance in sheep was also studied and the results are being applied by smallholder farmers.

**BOL/6/015****IMPROVEMENT OF NUCLEAR MEDICINE**

APPROVED: 1989

COMPLETED: 1993-05-24

TOTAL COST: \$ 138,948

TO UPGRADE EQUIPMENT IN ORDER TO PROVIDE STATIC AND DYNAMIC NUCLEAR MEDICINE DIAGNOSTIC TESTS.

The National Institute for Nuclear Medicine (INAMEN), La Paz, which opened in 1982, is the only nuclear medicine centre in Bolivia and serves all income groups. However, its equipment had become obsolete and spare parts were

no longer available. Through this footnote-a project, funded in 1989 by an extrabudgetary contribution from France and complementing Project BOL/6/014, a new gamma camera was installed and diagnostic procedures were improved and made available to low-income patients. The equipment is being used to determine human cardiocirculatory and pulmonary parameters of endemic diseases in the Bolivian highlands, particularly myocardiopathy, goitre and silicotuberculosis.

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**BOL/6/016                      UPGRADING OF NUCLEAR MEDICINE SERVICES**

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APPROVED: **1991**

COMPLETED: **1993-10-15**

TOTAL COST: \$ **337,174**

TO IMPROVE NUCLEAR MEDICINE SERVICES AT THE NATIONAL LEVEL; TO REACTIVATE THE NUCLEAR MEDICINE CENTRES AT COCHABAMBA, SANTA CRUZ AND SUCRE, AND EXTEND THE NETWORK TO OTHER CITIES.

The project was initiated in 1991 in the framework of a national co-operation programme. The Agency provided a refurbished gamma camera for the Nuclear Medicine Department of the San Juan de Dios Hospital, Santa Cruz, which is now being used intensively to diagnose several diseases. Two fellowships and one scientific visit were awarded for training abroad. The Agency provided the National Institute of Nuclear Medicine, La Paz, with a liquid chromatography system and related instrumentation for quality control and preparation of radiopharmaceutical kits. The Institute is now supplying low cost radiopharmaceuticals to the other nuclear medicine centres in Bolivia. Equipment was also provided to hospitals in Sucre and Tarija. Training of five professionals from Sucre was also supported by this project. The two hospitals now provide reliable radioimmunoassay services and have made a valuable contribution to the assessment of the national programme to combat goitre and endemic cretinism. These activities are being continued under the new project BOL/6/018, which will include support to the Cochabamba Nuclear Medicine Centre.

**BRAZIL**

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**BRA/0/010                      ISOTOPE-AIDED STUDIES IN THE BRAZILIAN AMAZON**

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APPROVED: **1984**

COMPLETED: **1993-04-23**

TOTAL COST: \$ **2,841,977**

TO CONTINUE QUANTITATIVE DYNAMIC STUDIES OF THE WATER CYCLE OVER THE AMAZON BASIN, ON REGIONAL AND LOCAL SCALES.

The project was first approved in 1984 for two years to finance expert missions. In 1985, the Government gave the project a higher priority and requested that some of the inputs assigned to other current projects be transferred to this one in order to provide additional expert services and to add the provision of equipment and fellowships. A revised implementation plan was then prepared which included activities in hydrology, primary production, the carbon and the nitrogen cycles, soil fertility and agrochemical use and monitoring. The project was implemented by the Centre for Nuclear Energy in Agriculture, Piracicaba, the National Institute for Research in the Amazon, Manaus, and the Centre for Agricultural and Livestock Research for the Humid Subtropics, Belem. The Agency later provided additional funds and, in 1987, Sweden granted financial support for five years through the Swedish Agency for Research Co-operation with Developing Countries to finance the activities on the hydrological cycle. Germany also contributed funds. Over 85 expert missions were undertaken to provide advice and co-ordination, and a large amount of equipment was supplied to complete the laboratories. Training abroad was granted to 23 counterpart staff members. Significant conclusions were reached on the effects of changing land use on the ecology and climate of the Brazilian Amazon, particularly the importance of water recycling in the biological cycle of the Amazon basin and the important role played by trees in the water cycle. It was also confirmed that deforestation strongly affects the carbon cycle through the decrease of growing phytomass and above-ground residues. Essential information was obtained on quantitative nitrogen balances and estimated losses and gains of nitrogen as well as on the effect of some pesticides and herbicides on the environment and soils. The project has provided valuable information and data essential for the protection of the region's natural resources and its long-term agricultural stability as well as the overall protection of the ecosystem.

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**BRA/4/040                      RADIOISOTOPE PRODUCTION WITH A CYCLOTRON**

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APPROVED: **1991**

COMPLETED: **1993-08-26**

TOTAL COST: \$ **63,158**

TO IMPROVE THE CAPABILITY OF THE CYCLOTRON FOR RADIOISOTOPE PRODUCTION.

The project was initiated in 1991 to improve the operation of the cyclotron at the Institute for Nuclear Energy and Research (IPEN), Sao Paulo. One Agency expert trained the staff on improved systems of operation and maintenance and assisted in the start-up of a diffusion pump provided by the Agency and in testing a new gas system for the ion source. The expert instructed the counterpart staff on modification of the internal target system and construction of a new deflector system and a new resonator box. Spare parts for the cyclotron were supplied by the Agency. The cyclotron system has been upgraded by the renewal of these systems, by refining the internal target and by the



missions to review the Addendum to the Angra Probabilistic Safety Assessment (PSA) and on regulatory requirements for the PSA. The follow-up OSART mission confirmed that, following the recommendations of 1989, significant improvements had been made to the operational safety of Angra 1. The main objective of the first ASSET mission was to organize two training sessions on the management of prevention of incidents, one at the National Commission of Nuclear Energy (CNEN), Rio de Janeiro, with 90 participants from six institutions, and the second at the Institute for Nuclear Energy and Research, Sao Paulo, with 85 participants from five institutions. The second ASSET mission assessed the progress made in the management of prevention of incidents at Angra 1. The expert missions assisted in developing plans to complete the PSA by FURNAS, the plant operator, and advised CNEN on formulation of the regulatory requirements for authorizing permanent operation.

## **BULGARIA**

### **BUL/0/003                    UPGRADING OF INIS SYSTEM IN BULGARIA**

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APPROVED: **1991**

COMPLETED: **1993-01-29**

TOTAL COST: **\$ 11,854**

TO ASSIST THE BULGARIAN INIS CENTRE IN UPGRADING ITS SOFTWARE AND HARDWARE SYSTEMS.

This Reserve Fund project was approved in 1991 at the request of the Bulgarian Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEP), to upgrade its INIS Centre system to accommodate significant changes in practices for information retrieval and input preparation. This was achieved mainly by the provision of CD-ROM products and associated software. Additional and advanced nuclear information services can now be provided to scientists and researchers.

## **CAMEROON**

### **CMR/1/002                    NUCLEAR ANALYTICAL LABORATORY**

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APPROVED: **1987**

COMPLETED: **1993-07-26**

TOTAL COST: **\$ 74,039**

TO INCREASE THE ANALYTICAL THROUGHPUT OF AN EXISTING LABORATORY FOR MINERAL/SOIL ANALYSIS AND TO EXPAND ACTIVITIES TO INCLUDE THE ANALYSIS OF BIOLOGICAL SAMPLES.

The project was approved in 1987 with footnote-a status and funded by an extrabudgetary contribution from the USA. The Agency provided complete equipment for X-ray and gamma spectroscopy. Expert missions assisted in the installation of the equipment supplied and trained the staff in maintenance and in selected radiochemical techniques. On-the-job training developed the new skills necessary for routine application of the nuclear analytical techniques.

### **CMR/5/004                    ESTABLISHMENT OF AN AGRICULTURAL LABORATORY**

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APPROVED: **1986**

COMPLETED: **1993-09-16**

TOTAL COST: **\$ 159,687**

TO ESTABLISH A TEACHING AND RESEARCH LABORATORY FOR THE USE OF RADIOISOTOPES IN AGRICULTURAL RESEARCH.

The project was approved in 1986 to set up at the Institute of Geology and Mine Research, Yaoundé, a laboratory specializing in the use of nuclear techniques, capable of providing technical support and expertise to organizations engaged in agricultural research. The Agency supplied equipment and chemicals. Five expert missions were carried out to assist in installing the equipment and to set up the research facility. The experts gave advice on planning research activities and on servicing/repairing the equipment, which frequently broke down. The chief counterpart and his assistant were awarded fellowship training abroad for twelve and four months, respectively. The objectives of the project have not been achieved, as the laboratory is not functional. The recommendations made on several occasions by Agency experts concerning the implementation of research activities were not followed by the Institute. The main impediment appears to have been the lack of organization and co-ordination at the institutional level, which led to poor technical management of the project.

### **CMR/5/006                    NUCLEAR TECHNIQUES IN ANIMAL DISEASES**

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APPROVED: **1991**

COMPLETED: **1993-12-13**

TOTAL COST: **\$ 79,468**

TO DEVELOP IMPROVED DIAGNOSTIC AND CONTROL METHODS FOR DISEASES OF LIVESTOCK, FOCUSING INITIALLY ON RINDERPEST AND ULTIMATELY ON OTHER DISEASES AFFECTING LIVESTOCK PRODUCTION.

This project, approved in 1991, was intended to strengthen the capabilities of the Laboratoire National Vétérinaire

(LANAVET), Garoua, through the introduction of nuclear-related techniques for animal disease diagnosis. The project initially focussed on rinderpest by introducing the FAO/IAEA rinderpest ELISA. Four expert missions were carried out to train the counterpart staff and to assist in establishing diagnosis procedures and epidemiological surveys. The Agency also provided equipment and supplies. The first part of the project was achieved: the rinderpest ELISA is now fully established at LANAVET and is being used on a routine basis. In 1993, a nationwide sero-monitoring survey was completed (surveys completed in 1991 and 1992 covered only parts of the country). As regards the second part of the project, the FAO/IAEA ELISA for contagious bovine pleuropneumonia was evaluated, and the FAO/IAEA brucella ELISA will also be used in national surveys.

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**CMR/8/002      ISOTOPE TECHNIQUES IN HYDROLOGY**

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APPROVED: **1989**

COMPLETED: **1993-01-29**

TOTAL COST: \$ **119,866**

TO INTRODUCE ISOTOPIC HYDROLOGY AND SEDIMENTOLOGY STUDIES FOR DETERMINING THE HYDROGEOLOGICAL CHARACTERISTICS OF AQUIFERS IN NORTHERN CAMEROON AND THE SUSPENDED SOLID DEPOSITS IN WATER COURSES.

The project was established in 1989 to assist the Centre for Hydrological Research (CRH) in carrying out studies aimed mainly at determining the hydrogeological function of the aquifers of Yaérés plain, particularly in terms of their supply and the cause of the fall observed in the piezometric levels. The Agency fielded expert missions to assist the counterpart project in the sampling campaigns and the elaboration of the programme of studies involving the use of environmental isotopes (deuterium, tritium, carbon-13, carbon-14 and oxygen-18) and hydrochemical analyses. Two fellowships were awarded in the field of isotope hydrology. Analytical services of isotopes were provided by the Agency's Laboratory, in Vienna. The Agency supplied meteorological and sampling equipment, basic instruments for hydrochemical laboratory analysis and a computer system with software. Results obtained show that the contribution of surface waters to the recharge of the aquifers is much less important than anticipated. Moreover, the piezometric depressions would be not so marked in depth as it is indicated in the piezometric maps available at present. It appears that there is no recharge of aquifers by the flooding waters which are totally recovered through evaporation during the dry season.

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**CMR/9/003      RADIATION PROTECTION**

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APPROVED: **1991**

COMPLETED: **1993-12-02**

TOTAL COST: \$ **114,620**

TO ESTABLISH A PERSONNEL MONITORING SYSTEM TO COVER ALL RADIATION WORKERS AND TO PROVIDE RADIATION PROTECTION TRAINING.

The project was initiated in 1991 at the Centre d'Application des Techniques Nucléaires, Yaoundé, following the recommendations of the 1989 RAPAT mission and a project programming mission in March 1991. Owing to the lack of adequate counterpart personnel, the absence of a regulatory body for radiation protection, and the failure of the counterpart institution to provide the necessary input, the project did not achieve its primary objective.

**CHILE**

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**CHI/0/008      DATA TRANSFER IN NUCLEAR EXPERIMENTS**

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APPROVED: **1991**

COMPLETED: **1993-09-16**

TOTAL COST: \$ **52,444**

TO EXPAND AND IMPROVE THE EXISTING LOCAL AREA NETWORK OF THE CHILEAN ATOMIC ENERGY COMMISSION IN ORDER TO REDUCE DELAYS IN INFORMATION TRANSFER AND PROCESSING.

The project was implemented at the Chilean Nuclear Energy Commission (CChEN) in 1991-92. The Agency provided a computer, with parts and software necessary to make the system operative within the expanded network. Expert missions were undertaken to advise on the organization and application of a computerized local area network in a research institute. They also recommended tools and protocols for optimized network service offered to the users. Training was given in operation and interfacing of the new expanded computer network as well as in troubleshooting and performance control of complex networks. One fellowship was awarded for training in fast links and administration of local area networks. The project has enabled CChEN to accelerate data transfer in its research work; it has also demonstrated that only multivendor and multiprotocol networks are suitable for data transmission and processing. All data processing equipment at the La Reina Research Centre has now been connected, and swift transfer of information at the local institutional level is possible. Installation of the server and associated software has ensured compatibility with other national and international networks.

**CHI/0/009 NATIONAL TRAINING COURSE ON DESIGN, MANAGEMENT AND EVALUATION OF PROJECTS**

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APPROVED: **1993**COMPLETED: **1993-08-26**TOTAL COST: \$ **12,185**

TO TRAIN CHILEANS IN THE DESIGN, MANAGEMENT AND EVALUATION OF AGENCY TC PROGRAMMES.

A National Training Course was carried out at the Chilean Nuclear Energy Commission (CChEN), Santiago, on 14-18 June 1993. The Agency provided three lecturers on Agency TC projects in the light of the new policies, and a UNDP representative also lectured on that Agency's involvement. The course was attended by Chilean participants from CChEN, the Universities and national research institutions, including most of the TC project counterparts.

**CHI/2/010 NUCLEAR ANALYTICAL TECHNIQUES**

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APPROVED: **1989**COMPLETED: **1993-08-26**TOTAL COST: \$ **118,630**

TO UPGRADE THE QUALITY OF ANALYTICAL SERVICES BY THE INTRODUCTION OF X-RAY FLUORESCENCE TECHNIQUES.

The project was initiated in 1989 at the Nuclear Instruments Laboratory of the La Reina Nuclear Centre, Santiago. The Agency supplied equipment and carried out three expert missions to introduce applications of X-ray fluorescence (XRF) techniques by means of excitation with polarized beams and by total reflection. On-site training of staff by the experts complemented the award of three fellowships for training abroad. Application of the XRF total reflection system has significantly improved electronic calibrations and the accuracy of analyses undertaken by the Laboratory. Studies of trace elements in atmospheric aerosols and analyses of impurities in semiconductors are being carried out. XRF by excitation with polarized beams is being adapted to the analysis of traces in solid samples of an environmental nature (aerosols, soils, sediments). The Laboratory is now embarking on joint studies of environmental projects with other Chilean research centres. The lower operating costs, multi-element character and accuracy of the new techniques make them of great value in both research and the provision of services.

**CHI/3/008 IMPURITIES IN URANIUM COMPOUNDS**

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APPROVED: **1984**COMPLETED: **1993-09-16**TOTAL COST: \$ **269,006**

TO DEVELOP SPECIFIC ANALYSIS TECHNIQUES BASED ON EMISSION SPECTROSCOPY AND VOLTAMETRY TO DETERMINE TRACE IMPURITIES IN NUCLEAR GRADE URANIUM COMPOUNDS.

This project at the Lo Aguirre Centre of the Chilean Nuclear Energy Commission (CChEN) was approved in 1984 and initiated in 1986. The project had been amended several times after an emission spectrometer, a vital piece of equipment, required extra inputs which included a Funds-in-Trust contribution from Chile. The Agency supplied a new spectrometer and the equipment required for the greater speed and accuracy of analysis required for determination of impurities in nuclear grade uranium compounds. The distillation unit supplied under the project helps to control contamination during sample digestion and, together with the standard reference material, has become a tool for quality control. Training in specific analysis techniques was provided by three expert missions, two fellowships and two scientific visits. The voltametric method is being used to analyse trace elements in the cooling circuit of the research reactors in Chile and was also used for analysis of rainwater on Easter Island. Emission spectrometry is also being used in the elemental analysis of ceramic materials and in the determination of indium and cadmium in reactor control rods. The project has provided CChEN with potential tools for determining trace elements in uranium and for implementing other research projects such as materials analysis and environmental pollution control.

**CHI/6/009 COMPUTERIZED TECHNOLOGY IN NUCLEAR MEDICINE**

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APPROVED: **1986**COMPLETED: **1993-09-16**TOTAL COST: \$ **405,893**

TO APPLY METHODS AND TECHNOLOGY REQUIRED FOR EXAMINING PATIENTS WITH ENCEPHALIC AND VASCULAR DISEASES AND FOR KIDNEY TRANSPLANTS.

The project was approved in 1986 and initiated in 1989 at the Nuclear Medicine Department of the Institute of Neurosurgery, Santiago. It was considered that the most appropriate method for examining patients with encephalic and vascular diseases was by computerized technology involving single photon emission computer tomography (SPECT). The Agency provided a gamma camera and a medical data processing system. With Agency assistance, the equipment was installed and clinical studies were carried out using the SPECT technique. A fellowship and two scientific visits were awarded for training abroad, supplemented by additional training by Agency experts, both on site and at their home institutions, the latter under bilateral arrangements. The Institute of Neurosurgery is now undertaking examinations related to kidney transplants, kidney function and cerebral blood flow, and carrying out isotope ventriculography as well as bone and lung scintigraphy. The Institute has considerably increased its teaching activities and is giving training courses on the SPECT techniques, including participants from other Latin American countries.

## CHINA

### **CPR/0/002      MANAGEMENT AND CONTROL OF NUCLEAR MATERIALS**

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APPROVED: **1989**

COMPLETED: **1993-12-31**

TOTAL COST: \$ **141,405**

TO ESTABLISH A COMPUTER-BASED STATE SYSTEM OF ACCOUNTING FOR AND CONTROL OF NUCLEAR MATERIALS SUBJECT TO SAFEGUARDS UNDER THE AGREEMENT CONCLUDED WITH THE IAEA.

Following the signing of a Safeguards Agreement with the Agency by the Government of China in 1988, the Agency was requested to assist in establishing a State System of Accounting and Control of nuclear materials. An Agency expert carried out a five-week mission to install, test and calibrate a high level neutron coincidence counter and associated electronics (JSR-11) provided under the project. He also helped establish an interface between JSR-11 and a programmable calculator for automatic transfer and collection of data. A one-week Training Course was conducted for 25 participants on non-destructive analysis methods for safeguards applications. A personal computer and relevant software were also provided. Eight counterpart staff were trained for a total of over twenty months. Five of these trainees were also awarded attachments with the Department of Safeguards at the Agency. Basic features of a nuclear management and accountancy system have been established and are working satisfactorily.

### **CPR/1/004      DEVELOPMENT OF A NUCLEAR DATA LIBRARY**

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APPROVED: **1987**

COMPLETED: **1993-12-31**

TOTAL COST: \$ **118,894**

TO DEVELOP A COMPREHENSIVE NUCLEAR DATA LIBRARY AND A RELATED PROGRAMME LIBRARY TO SUPPORT INCREASING NATIONAL ACTIVITIES.

The project was initiated in 1987 to establish a national centre for collecting, processing and disseminating nuclear data in order to meet the growing demands of the national nuclear energy programme. The Agency provided a computer and the necessary software. Three experts, for a total of two months, helped plan activities and install the software. Five of the project staff were trained under the Regional Manpower Development Project for a total of 40 months. The Chinese Nuclear Data Centre has now established computerized nuclear databases and acquired the capability for nuclear data evaluation. The Centre is also providing country-wide nuclear data services to users in various fields.

### **CPR/3/002      URANIUM RESOURCE ASSESSMENT**

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APPROVED: **1987**

COMPLETED: **1993-12-31**

TOTAL COST: \$ **347,874**

TO DEVELOP MANPOWER AND LOCAL CAPABILITY FOR ASSESSING URANIUM RESOURCES AND PERFORMING FEASIBILITY STUDIES RELATED TO IN-SITU LEACHING IN URANIUM MINING AND MILLING PROJECTS.

The project was initiated in 1987 to support the development of the national nuclear programme and to produce uranium for export. An economic appraisal was undertaken of the estimated resources using feasibility studies of production facilities, with emphasis on defining resources suitable for low-cost production. Well established techniques were used to evaluate some of the deposits already known to exist. Ten expert missions were carried out. Topics investigated included resource assessment and prediction methodologies, computer-assisted geological database development and analysis, economic project evaluation, and in-situ leaching (ISL) mining methodology and application. Four fellowships for a total of 24 months and six scientific visits were awarded for training abroad. A laboratory was equipped with computer hardware and software to provide information processing for uranium exploration. The Bureau of Geology, Beijing, now has the capability for evaluating the uranium resources of China, for estimating the production economics of known deposits, and for evaluating and implementing ISL mining projects. In 1991, the ISL facility provided 15% of China's national uranium production.

### **CPR/4/003      MANPOWER DEVELOPMENT FOR NUCLEAR POWER PROGRAMME**

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APPROVED: **1986**

COMPLETED: **1993-11-24**

TOTAL COST: \$ **1,698,995**

TO ESTABLISH NATIONAL TRAINING CAPABILITIES FOR DEVELOPING MANPOWER IN NPP ENGINEERING AND TO IMPROVE THE PRACTICAL KNOWLEDGE OF LOCAL NPP ENGINEERING STAFF.

This UNDP-funded project was approved in 1987 with some Government cost sharing, with the IAEA as the executing agency. The recipient institutions in China were the two Nuclear Power Training Centres at Qinshan and Suzhou, which provide specialized comprehensive training in basic and applied nuclear power engineering disciplines to technical personnel assigned to NPPs in China. The Agency organized 33 National Training Courses, Seminars and Workshops covering nuclear power engineering and management, quality assurance, commissioning and startup, radiation

protection and safety analysis as well as on-site emergency planning and preparedness. This involved 93 expert missions for 80 Agency experts. About 1000 management and professional staff from the two training centres and from about 30 other Chinese organizations responsible for the national nuclear power programme participated in these training activities. In addition, 65 fellows were awarded long-term fellowship training and 12 others were offered scientific visits. A basic principles simulator and an engineering work station were supplied to the Qinshan and Suzhou Training Centres, respectively. The training capabilities of the two centres have been substantially strengthened; training curricula, programmes and materials have been developed, a core of instructors trained, and the two centres are now carrying out training on a routine basis.

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**CPR/4/006                      FEASIBILITY STUDY FOR HIGH-TEMPERATURE GAS-COOLED REACTOR**

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APPROVED: **1989**

COMPLETED: **1993-12-31**

TOTAL COST: **\$ 83,102**

TO CARRY OUT FEASIBILITY STUDIES TO FACILITATE A GOVERNMENT DECISION ON INITIATING A HIGH-TEMPERATURE GAS-COOLED REACTOR DEMONSTRATION PROJECT.

The Chinese high-temperature gas-cooled reactor (HTGR) feasibility study was prepared jointly by the Beijing Institute of Nuclear Engineering, the Southwest Centre for Reactor Engineering (now the Nuclear Power Institute of China), the Dong Fong Electric Company, and the cities of Chongqing and Fijian. The study included a review of the assessment of the technical design maturity, safety risk level, and economic competitiveness of three HTGR concepts: the HTR-100 (Hochtemperatur Reaktor Baugesellschaft), the HTR-Module (Siemens/KWU), and the MHTGR-350 (General Atomics). An assessment was also made of the capability of Chinese industry to participate in the design and supply of its first HTGR plant. The maturity of each concept was judged by the study to be adequate for the assessment of feasibility and the establishment of costs relative to China's coal plants. The safety levels of all three concepts were judged to exceed that required by the national licensing authorities. China's capacity to provide design, equipment fabrication and construction work was judged adequate for 60-70% of the plant (the rest from foreign participants). The 2xMHTGR-350 (270 MW(e)) was considered the most economic of the concepts studied. The study led to the conclusion that a more detailed and project-oriented investigation should be pursued as a co-operative effort between Chinese institutions and foreign vendors.

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**CPR/5/005                      TRAINING CENTRE FOR NUCLEAR TECHNIQUES IN AGRICULTURE**

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APPROVED: **1989**

COMPLETED: **1993-12-31**

TOTAL COST: **\$ 236,979**

TO STRENGTHEN THE CAPABILITY OF THE ZHEJIANG AGRICULTURAL UNIVERSITY TO SERVE AS A MULTI-DISCIPLINARY NATIONAL AND REGIONAL CENTRE FOR TRAINING AND DEMONSTRATION IN THE USE OF NUCLEAR TECHNIQUES IN AGRICULTURE.

The project was approved in 1989. Major items of equipment were provided to the Institute of Nuclear Agricultural Sciences of the Zhejiang Agricultural University, Hangzhou. Four fellowships, from ten to thirteen months, were awarded, and three senior staff members undertook scientific visits. Four expert missions were carried out during which three National Training Courses were organized, attended by 60 scientists from about 20 institutions. The Provincial Government supplied a new cobalt-60 gamma source to the Training Centre. The Institute has been designated China's principal nuclear agricultural science laboratory.

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**CPR/5/006                      IRRADIATION OF SPICES**

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APPROVED: **1991**

COMPLETED: **1993-12-31**

TOTAL COST: **\$ 65,433**

TO IMPROVE PROCESS CONTROL AND QUALITY CONTROL IN THE IRRADIATION OF SPICES AND SEASONINGS.

The project was initiated in 1991 to assist the Sichuan Provincial Institute of Nuclear Technology Application, Chengdu, to establish hygienic standards, process control, market testing and consumer acceptance of irradiated spices. Experts trained the counterparts in good manufacturing practices and process control, and conducted seminars, attended by scientists, industrialists and consumers. The Agency also provided equipment. The experts visited food processing factories to advise on quality control of irradiated spices and end products (Sichuan sausage, vacuum-packed salted boiled beef, etc.). Up to 1992, these factories produced 10 000 tonnes of irradiated food for the domestic market. Two scientific visits for the two senior scientists and two long-term fellowships were awarded. Information services have been established to promote public acceptance. The Institute can now provide improved irradiation services to about 20 food processing factories in the Province and plays a leading role in the commercial application of food irradiation in China.

**CPR/8/005      SEDIMENT TRANSPORT INVESTIGATION WITH RADIOACTIVE TRACERS**

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APPROVED: 1989

COMPLETED: 1993-12-31

TOTAL COST: \$ 171,236

TO OBTAIN BASIC INFORMATION ON THE DYNAMICS OF SEDIMENT TRANSPORT IN THE NAVIGATION CHANNEL OF THE YANGTZE ESTUARY IN ORDER TO INCREASE DREDGING EFFICIENCY.

The project was initiated in 1989 to assist the Laboratory of Sedimentology of the Nanjing Hydraulic Research Institute to investigate sedimentation problems in the northern navigation channel of the Yangtze estuary so that rational and economic dumping sites for dredged spoils could be selected. The Agency provided the necessary equipment. Two expert missions were fielded, the first to study the available information on the dynamics of bed-load sediments in the Yangtze estuary and the second, in 1991, to conduct the experiment and to plan the largest tracer experiment in China. As a result, the direction, path, velocity and transport rate of the sediment have been determined. On the basis of these results the Shanghai Waterway Bureau stopped dumping dredging spoil at its original site in 1992. One staff member was trained in the use of tracer techniques in dynamic sedimentology. The Institute is now conducting similar studies in other rivers and estuaries.

**CPR/9/015      FOLLOW-UP OSART MISSION**

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APPROVED: 1991

COMPLETED: 1993-12-31

TOTAL COST: \$ 57,653

TO REVIEW THE OPERATIONAL SAFETY OF THE QINSHAN AND GUANGDONG NUCLEAR POWER PLANTS.

The project was originally approved to provide a full OSART mission to both the Qinshan and Guangdong NPPs, but it was modified following a Technical Exchange Mission to the Guangdong Nuclear Power Station (GNPS) in 1991. A follow-up Pre-OSART mission was undertaken to review preparations for operation of the plant before fuel loading. This Exchange Mission was fully financed by the Chinese Government. A three-week Pre-OSART mission was conducted at GNPS from 17 May to 4 June 1993 to review the preparations for future operation and to provide an objective assessment of the status of essential items for safe operation in accordance with international practices. The Pre-OSART team found that excellent progress had been made in recruiting and training plant staff, preparation of procedures and facilities, and developing the programmes necessary to place the plant in operation and to operate and maintain it in a safe, efficient and cost-effective manner. However, although construction and commissioning of GNPS was nearing completion, many essential and important activities were still to be completed before the plant could be put into commercial operation. Unit 1 achieved criticality at the end of July 1993; it was connected to the grid two months later and was in commercial operation at the end of 1993. In support of safe operation of the two NPPs, a Training Seminar on ASSET Methodology involving three Agency staff members was also organized, at the request of the national authorities, attended by 36 participants from the national regulatory body and from NPP-operating and technical support organizations.

**CPR/9/019      SEISMIC STUDIES IN NUCLEAR POWER PLANT SITING**

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APPROVED: 1993

COMPLETED: 1993-12-31

TOTAL COST: \$ 22,716

TO ORGANIZE A SEMINAR AND A WORKSHOP TO DISCUSS A REVISED IAEA SAFETY GUIDE ON EARTHQUAKES IN RELATION TO NPP SITING.

Following the revision of IAEA NUSS Safety Guide No. 50-SG-S1 "Earthquakes and Associated Topics in Relation to Nuclear Power Plant Siting", the Agency was requested to assist the staff of the National Nuclear Safety Administration (NNSA), which is responsible for implementing these guidelines in licensing NPPs, in a better understanding of the Guide. The NNSA arranged a National Seminar in preparation for a Workshop to be conducted by six experts and one Agency staff member. (One expert was provided cost-free by Japan.) Forty-five specialists from 18 organizations in China participated. The Workshop explained and clarified all issues on the application of NUSS codes relating to seismic aspects of NPP siting.

**COLOMBIA****COL/1/007      SECONDARY STANDARDS DOSIMETRY LABORATORY (PHASE II)**

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APPROVED: 1991

COMPLETED: 1993-08-26

TOTAL COST: \$ 161,734

TO IMPROVE CALIBRATION OF RADIATION SOURCES AND TO EXPAND THERMOLUMINESCENCE DOSIMETRY SERVICES.

A secondary standards dosimetry laboratory (SSDL)-type National Calibration Laboratory for ionizing radiation was established in the 1980s at the Institute of Nuclear Affairs (now the Institute of Nuclear Sciences and Alternative Energies (INEA)), Bogota, under a previous project (COL/1/005). The present project was initiated in 1991. Under INEA,

the SSDL will now become an independent unit with its own budget. The Agency supplied expert services for installing and operating the equipment and for on-the-job training. The number of radiotherapy installations in Colombia has doubled since 1983, and more than 50 radiotherapy departments are now receiving output calibration and quality assurance services. INEA now possesses an up-to-date SSDL, which provides back-up personnel monitoring for radiation workers (more than 3500 films/month and about 150 thermoluminescence dosimeters at three-monthly intervals). Local training courses related to radiation protection are being intensified. The accuracy of radiation dosimetry has been considerably improved, and there is, in general, safer application of ionizing radiation throughout the country.

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**COL/2/011      EMISSION SPECTROMETRY**

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APPROVED: **1986**

COMPLETED: **1993-08-13**

TOTAL COST: **\$ 97,374**

TO STRENGTHEN CAPABILITY IN ANALYTICAL CHEMISTRY.

The project was initiated in 1986 at the Institute of Nuclear Affairs (now the Institute of Nuclear Sciences and Alternative Energies (INEA)), Bogota, by supplementing the existing emission spectrometer accessories and spectrometer channels. The Agency supplied the equipment as well as expert advice on its use in practical applications of elemental analysis. Minerals, sediments, water, soils and agricultural products such as sorghum can now be analysed for major, minor and trace element content. Participation was arranged in Regional Training Courses; a fellowship was awarded for training abroad, and on-the-job training was provided by the Agency expert. INEA can now provide additional analytical services and offer its research facilities to the national universities, medical centres and agricultural institutions.

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**COL/4/010      NUCLEAR INSTRUMENTATION METROLOGY**

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APPROVED: **1991**

COMPLETED: **1993-10-18**

TOTAL COST: **\$ 85,880**

TO ESTABLISH AN ELECTRONICS CALIBRATION AND TESTING LABORATORY FOR NUCLEAR INSTRUMENTATION TO COMPLEMENT THE EXISTING MAINTENANCE AND REPAIR FACILITIES.

The project was initiated in 1991 and the Agency provided the necessary equipment. A three-month fellowship was awarded for training abroad. An Agency expert provided training to the staff of the Institute of Nuclear Affairs, Bogota, and to 13 undergraduate students from two universities. An electronics calibration and testing laboratory has been established which can repair nuclear electronic instruments and will also be able to carry out test and calibration procedures.

**COSTA RICA**

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**COS/2/002      NUCLEAR ANALYTICAL TECHNIQUES**

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APPROVED: **1989**

COMPLETED: **1993-09-16**

TOTAL COST: **\$ 146,153**

TO INCREASE LOCAL CAPABILITY IN TRACE ELEMENT ANALYSIS BY INTRODUCING A TOTAL REFLECTION DEVICE IN EXISTING X-RAY FLUORESCENCE EQUIPMENT AND TO INITIATE A PROGRAMME ON RADIOACTIVE CONTAMINATION OF FOOD AND THE ENVIRONMENT.

The project was initiated in 1989. Six expert missions to the School of Physics at the University of Costa Rica, San José, provided training in data analysis and radiation protection, the latter leading to a new project (COS/9/004). Equipment was also supplied, and on-the-job training was complemented by a scientific visit. The analytical capability of the School of Physics is now considerably improved and trace elements in the environment and foodstuffs can be measured with greater accuracy. The total reflection attachment provided by the Agency has tripled the detection sensitivity of the X-ray fluorescence (XRF) equipment. The University is now carrying out measurements of heavy metal content in the air, biological material analyses by XRF, determination of boron in coffee plants by nuclear detectors, and measurement of radon emanations (important in the building industry). The Santa Barbara tectonic fault is being studied by means of solid-state detectors, thus assisting in the forecast of earthquakes. The University is also co-operating with the Costa Rican Oil Refinery Co. in a study of the effects of lead concentration in petrol on environmental pollution in San José. A follow-up project (COS/2/003) has been approved.

**COS/8/004 ISOTOPE TRACING IN GEOTHERMICS**

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APPROVED: **1991**COMPLETED: **1993-04-23**TOTAL COST: \$ **109,210**

TO CARRY OUT EXPERIMENTS ON REINJECTION OF GEOTHERMAL FLUIDS, INITIALLY IN THE MIRAVALLS GEOTHERMAL FIELDS AND LATER ELSEWHERE, USING ENVIRONMENTAL ISOTOPES.

The main objectives of the project, which was initiated in 1991, were (1) to demonstrate the use of artificial isotopes as tracers of reinjected geothermal fluids, and (2) to continue to support the geochemical and isotopic exploration of new geothermal areas of Costa Rica. The Agency provided equipment to the Costa Rican Institute of Electricity, San José, and awarded a scientific visit to a staff member. Iodine-131 was successfully injected in various wells of the geothermal field of the Miravalles volcano, and the preferential underground flow directions and paths of reinjected fluids were identified. The staff of the Institute has now received sufficient training to continue the experiments. The first objective was fully achieved. However, only limited work was carried out for the second objective. A programme was prepared for the continuation of the geochemical and isotopic exploration of the Rincón de la Vieja area, and the geochemical investigations will be implemented without further Agency assistance by the Institute of Electricity, which has a fully equipped laboratory and staff who have received considerable training from two Agency experts.

**COTE D'IVOIRE****IVC/0/003 NUCLEAR SCIENCE LABORATORY**

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APPROVED: **1982**COMPLETED: **1993-02-26**TOTAL COST: \$ **455,226**

TO ESTABLISH A TEACHING AND RESEARCH CENTRE FOR THE INTRODUCTION AND DEVELOPMENT OF NUCLEAR TECHNOLOGY AND NUCLEAR PHYSICS.

This project was initiated in 1982 to establish a nuclear laboratory at the Research Institute for New Energy Sources of the University of Abidjan. Equipment was provided by the Agency. Expert services, totalling 17 months, assisted in the installation of the equipment and in training local staff. Nineteen months of fellowship training were also awarded. A nuclear analytical laboratory and a spectroscopy laboratory were established which are used for training and research, especially in relation to the analysis of geological and biological samples and to studies on the radioactive decay of an actinide. Reports on these studies have been published in scientific journals.

**IVC/5/016 RADIOIMMUNOASSAY IN ANIMAL PATHOLOGY**

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APPROVED: **1986**COMPLETED: **1993-03-18**TOTAL COST: \$ **100,612**

TO INTRODUCE NEW DIAGNOSTIC AND ANALYTICAL METHODS.

This project, initiated in 1986 and located at the Central Veterinary Laboratory, Bingerville, was principally concerned with controlling the main diseases affecting livestock in Côte d'Ivoire. ELISA and DNA probe technologies were introduced for the diagnosis of rinderpest, peste des petits ruminants (PPR), contagious bovine pleuropneumonia (CBPP), brucellosis and babesiosis. All the necessary equipment was supplied and eight expert missions, for a total duration of nearly seven months, were fielded. National surveys were conducted in 1989, 1990 and 1991 to determine the immunity of cattle vaccinated against rinderpest. Over 60 000 sera were tested and the results analysed. Initial studies have been undertaken to determine the incidence of PPR and CBPP throughout the country and this work will continue under a new project, IVC/5/021.

**CUBA****CUB/5/008 NUCLEAR TECHNIQUES IN SOIL-SCIENCE STUDIES**

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APPROVED: **1986**COMPLETED: **1993-09-16**TOTAL COST: \$ **214,595**

TO UPGRADE FACILITIES AND CAPABILITY TO APPLY ISOTOPE TECHNIQUES IN THE STUDY OF SOIL/WATER/FERTILIZER RELATIONSHIPS FOR SELECTED STAPLE FOOD AND EXPORT CROPS.

A pre-project mission was financed in 1986 from the Reserve Fund, to identify areas in which nuclear techniques could be utilized most effectively. As a result, this project was initiated in 1990 for the Institute of Basic Research in Tropical Agriculture (INIFAT), Havana, to carry out studies on soils by means of labelled fertilizers. Equipment was supplied to establish a radioisotope laboratory. Expert missions advised on nitrogen-15 analysis by emission spectrometry, nitrogen fixation studies, use of phosphorus-32 in soil fertility, and soils physics. Four fellowships and two scientific visits were granted for training abroad. A large number of experiments were completed or initiated by INIFAT and other

agricultural institutes on biological nitrogen fixation in tomato, soybean and rice crops, the dynamics of nitrogen on plants and soils, and the efficiency of nitrogen fertilization on rice, coffee and potato. An evaluation of phosphoric and phosphate rocks in connection with the use of P-32 for corn, tomato and soybean crops led to the conclusion that there is a great potential for partial substitution of the fertilizer by phosphate rocks, and the study is being continued. The experiments already completed show that Cuba can achieve significant savings by utilizing what is abundant in the air through the improvement of nitrogen biological fixation in legumes. The experiments also demonstrated that the application of urban refuse can supplement nitrogen, phosphorus and other fertilizers.

## **CYPRUS**

### **CYP/5/014 RADIOISOTOPES IN AGRICULTURE**

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APPROVED: **1989**

COMPLETED: **1993-09-30**

TOTAL COST: \$ **162,994**

TO CARRY OUT SOIL/PLANT PRODUCTIVITY STUDIES AND TO EXAMINE PRACTICAL AND MANAGEMENT MEASURES TO OVERCOME CONSTRAINTS THAT LIMIT CROP PRODUCTION.

The Government sought Agency assistance in studies aimed at identifying major soil factors affecting the availability of some plant nutrients such as iron, potassium and nitrogen. The project was approved with footnote-a status in 1989 and subsequently funded by the United Kingdom. The Agency supplied equipment, radioisotope-labelled fertilizers and computer facilities to the Agricultural Research Institute (ARI) of the Ministry of Agriculture and Natural Resources, Nicosia. Agency experts undertook three missions to advise the ARI on nitrogen-15 and phosphorus-32 fertigation (fertilizers applied via irrigation water) studies and on analysis of results. Three scientific visits were awarded. The studies have indicated that fertigation and the efficient use of water and fertilizer substantially increase crop yields in Cyprus. It was also found that not only is the concentration of the nutrients in the irrigation water important, but so is the form of the fertilizer, and that fertility problems associated with marginal soils (calcareous, sandy and rocky) can be solved successfully by fertigation. The counterparts are continuing the fertigation studies and extending their findings to agricultural establishments in Cyprus. The project leader is also functioning as an Agency expert in Middle East countries where fertigation practices are considered promising.

### **CYP/8/004 POLLUTION DISPERSION**

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APPROVED: **1989**

COMPLETED: **1993-12-22**

TOTAL COST: \$ **57,643**

TO STUDY THE CIRCULATION AND TRANSPORT OF POLLUTANTS FROM SEWAGE OUTFALLS.

The Sewage Board of Limassol is at an advanced stage in planning and design of a sewage treatment and disposal scheme for the city of Limassol and the surrounding area. Options under consideration included land reuse of the treated effluent and/or a sea outfall to dispose of the sewage. Agency assistance was requested in the study of the circulation and transport of pollutants from proposed sewage outfalls, using nuclear techniques, in order to improve understanding of the flow patterns prevailing at the coastal zones from which a site for the outfall would be selected. The project was given footnote-a status in 1989, and was implemented through an extrabudgetary contribution from the United Kingdom. Three experts assisted the Fisheries Department of the Ministry of Agriculture to undertake tracer experiments during which experimental data were obtained on the direction, velocity and dispersion of fluorescent and radioactive tracers injected into the sea at the proposed sites. The Agency also provided the necessary equipment. The results of the studies on speed and direction measurements showed that there is extreme variability of sea currents in the Limassol area and that tracers with density less than sea water diffuse more easily towards the surface of the sea. The project has made it possible to evaluate all essential parameters for the location and construction of a waste-water outfall in the Limassol area (should that option be adopted) that would minimize pollution and impact of effluent discharge on the marine environment.

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

### **DRK/1/002 FAST NEUTRON ACTIVATION ANALYSIS**

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APPROVED: **1978**

COMPLETED: **1993-06-25**

TOTAL COST: \$ **264,714**

TO SET UP A FAST NEUTRON ACTIVATION ANALYSIS LABORATORY FOR MULTI-ELEMENTAL ANALYSIS, SERVICING VARIOUS NATIONAL DEVELOPMENT PROGRAMMES.

The Institute of Nuclear Physics of the State Committee for Atomic Energy, Pyongyang, sought Agency assistance in 1978. Following the recommendations of a programming mission, the main facility, a neutron generator, was provided in 1980. This was badly damaged in transport. A replacement was delivered in 1983, but the tube was found to be broken on arrival and some accessories were missing. Numerous problems arose with the neutron generator, caused by bad design and workmanship, and many of its components broke after a short period of operation. In addition, the infrastructure of the Institute was inadequate to support such a sophisticated facility,

especially in view of the lack of personnel trained to deal with maintenance and repair. The counterparts and the Agency made great efforts and succeeded in putting the facility into operation in 1986. Other items of equipment were provided. Three expert missions assisted in installing and testing the neutron generator, advised on operating the computers in nuclear experiments, and on repair of the equipment. The experts also trained local staff in operation and maintenance of the facility. Two fellowships were awarded. A fast neutron activation analysis laboratory has now been established and the neutron generator is in operation, despite some deficiencies. The measuring equipment is being used to analyse soil and metal samples to determine elements such as aluminium, silicon, manganese and phosphorus.

## **DOMINICAN REPUBLIC**

### **DOM/9/002 RADIATION PROTECTION**

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APPROVED: **1988**

COMPLETED: **1993-11-02**

TOTAL COST: **\$ 56,255**

TO ESTABLISH NATIONAL RADIATION PROTECTION REGULATIONS AND PROCEDURES; TO ADVISE ON INFRASTRUCTURE REQUIREMENTS FOR INSPECTION AND LICENSING OF NUCLEAR INSTALLATIONS AND FOR MONITORING RADIATION WORKERS AND THE GENERAL PUBLIC.

The project was approved in 1988 and subsequently extended. The National Commission for Nuclear Affairs (CNAN) was assisted by an Agency expert in the preparation of national regulations for radiation protection. One consequence was the establishment of a National Council for Radiation Protection (CONAPRA) in 1991, which carried out a study of radiation protection regulations pertaining to the possession, use, sale, importation and transport of radioactive material and ionizing radiation sources. A Workshop was organized for the development of an infrastructure for radiological safety and radiation protection; it was attended by radiologists, radiotherapists, physicists, a lawyer and a nuclear medicine specialist. The resulting final draft regulations for radiation protection were approved by CONAPRA and the Ministry of Health in 1992 for submission to the Presidency. Additional staff was recruited by CNAN for licensing and inspection of radiation sources. The Agency provided a complete computer-assisted thermoluminescence dosimetry system which was calibrated by an expert, and staff was trained in its use. A scientific visit was awarded to a neighbouring country. The follow-up project, DOM/9/003, will emphasize licensing, inspection and quality control of radiodiagnosis and radiotherapy equipment.

## **ECUADOR**

### **ECU/5/010 MUTATION BREEDING**

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APPROVED: **1987**

COMPLETED: **1993-11-16**

TOTAL COST: **\$ 254,607**

TO FACILITATE THE INTRODUCTION OF IN-VITRO TISSUE CULTURE AND MODERN MUTATION BREEDING TECHNIQUES IN ORDER TO INCREASE THE PRODUCTION OF STAPLE FOOD CROPS.

The Ecuadorian Atomic Energy Commission (CEEA) and the National Institute for Agricultural and Stockbreeding Research (INIAP) requested Agency assistance to introduce in-vitro tissue culture and mutation breeding techniques at the INIAP's experimental stations. The project was approved in 1987 with footnote-a status and in the same year became operational through an extrabudgetary contribution from the USA supplemented by the Agency's regular funds. Equipment for laboratory and field experiments was supplied to both institutions. A gamma irradiation source was installed at the CEEA's Nuclear Centre, Aychapichu, and a tissue culture laboratory at the INIAP's Santa Catalina Experimental Station. Experts gave advice on the organization of an in-vitro culture laboratory and techniques, dosimetry, and induced mutation and mutation breeding techniques. Two fellowships and one scientific visit were awarded. Mutation induction through gamma irradiation in barley began at the CEEA in 1988 to improve resistance to leaf rust in the variety "Clipper". Ten promising mutant lines have already been selected, and the barley breeding programme continues. The in-vitro laboratory has been used mainly to establish a germoplasm collection for crops of national importance. Owing to reorganization, the INIAP stopped work on mutation breeding, and activities in this area will be taken over by the CEEA under Project ECU/5/016.

### **ECU/5/011 IMPROVEMENT OF LIVESTOCK PRODUCTIVITY**

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APPROVED: **1988**

COMPLETED: **1993-11-16**

TOTAL COST: **\$ 125,630**

TO IMPROVE REPRODUCTIVE EFFICIENCY, NUTRITIONAL STATUS AND DISEASE DIAGNOSIS OF LIVESTOCK THROUGH RADIO-AND ENZYME-IMMUNOASSAY TECHNIQUES.

Since 1982, the Agency has been assisting Ecuador in animal sciences. Under previous projects (ECU/5/006 and ECU/5/007), preliminary trials were successfully conducted with radio-attenuated vaccine against dictyocaulosis, radioimmunoassay (RIA) laboratory capabilities were set up at the Ecuadorian Atomic Energy Commission (CEEA), and an RIA programme for farmers was established. The present project was approved in 1988 as a continuation, with

two main components: (1) The use of RIA to study the onset of ovarian activity in dairy cows raised under different environmental conditions and to study the effect of nutrition on reproductive performance. (2) To continue work on the preparation of dictyocaulus vaccine and the development of immunoassay procedures (ELISA) for diagnosis of various diseases. Experts advised on RIA of reproductive and metabolic hormones and on establishing immunoassay techniques for animal disease diagnosis. Laboratory equipment kits and chemicals were supplied and two fellowships awarded. In spite of the adverse effect of constant turnover of counterparts, some relevant data on animal reproduction and nutrition were collected at farms in the tropics and in the highlands. One research contract was awarded to study the reproductive physiology of female South American cameloids. ELISA procedures were established at the Animal Health Laboratory of the Ministry of Health, and a programme on diagnosis of brucellosis was initiated. These activities will continue under Project ECU/5/017 for diagnosis and epidemiology of foot-and-mouth disease, brucellosis and babesiosis.

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**ECU/5/012                      NUCLEAR TECHNIQUES IN AGRICULTURE (PHASE II)**

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APPROVED: **1988**

COMPLETED: **1993-11-16**

TOTAL COST: **\$ 155,366**

TO APPLY ISOTOPE-AIDED STUDIES ON SOIL/WATER/FERTILIZER/PLANT RELATIONSHIPS WITH A VIEW TO IMPROVING SOIL, WATER AND FERTILIZER MANAGEMENT PRACTICES AND INCREASING CROP PRODUCTION.

The project was approved in 1988 in continuation of previous assistance. Experts gave advice and assistance in crop management practices, the use of rock phosphate, and repair and operation of the nitrogen-15 emission spectrometer supplied by the Agency. Two fellowships were awarded for training abroad. Facilities for N-15 analysis and the quality of analytical data were improved. Laboratories for work on phosphorus-32 were set up. Water balance studies were carried out on potato, maize, wheat, quinoa and common bean (main food crops). Nitrogen fixation studies on soybean were initiated. An evaluation of nitrogen fertilizer was undertaken on palm oil, an important cash crop. Most of these studies have been published and presented at scientific meetings and have resulted in practical recommendations for farmers.

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**ECU/6/008                      ADVANCED TRAINING IN MEDICAL PHYSICS**

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APPROVED: **1984**

COMPLETED: **1993-09-30**

TOTAL COST: **\$ 122,614**

TO ESTABLISH A GRADUATE COURSE IN HEALTH AND MEDICAL PHYSICS.

In 1983 the Government sought Agency Assistance for the implementation of a post-graduate programme at the Pontifical Catholic University of Ecuador (PUCE), Quito, to train medical physicists from Ecuador and other Latin American countries. The project was approved in 1984 and funded through an extrabudgetary contribution from the USA. The course was established with four semesters at PUCE linked with a final course at the Health Science Center of the University of Colorado, USA. The Agency gave expert advice on the design and conduct of the programme and provided lecturers and essential laboratory equipment. The Ecuadorian Atomic Energy Commission fully supported the project, making available its SSDL Laboratory and staff as lecturers. The first part of the course was conducted at PUCE from September 1987 to July 1989. Five students completed the four-semester programme successfully (four Ecuadorians and one participant from the region). The final semester, at the University of Colorado, was attended by only two students and could not be completed until 1992. Moreover, resignation of the staff in charge of the course at PUCE prevented the continuation of activities and the development of a second course of the programme.

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**ECU/7/004                      APPLICATION OF NUCLEAR TECHNIQUES IN ENVIRONMENTAL STUDIES**

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APPROVED: **1992**

COMPLETED: **1993-11-15**

TOTAL COST: **\$ 8,372**

TO PROVIDE LECTURERS FOR A SEMINAR ON CURRENT TECHNIQUES FOR STUDY AND CONTROL OF POLLUTANTS.

At the request of the Ecuadorian Atomic Energy Commission (CEEA), a Reserve Fund project was approved to provide two lecturers for a National Seminar on Environmental Problems and International Co-operation organized by the Society of Engineers of Ecuador and sponsored by the CEEA and other national organizations. The possibilities offered by nuclear and related techniques in environmental studies and the promotion of sustainable development, as well as possible funding sources, were discussed. The seminar consisted of lectures, consultations and panel discussions on four main topics: the nitrogen cycle in the system soil/plant/atmosphere; the water cycle and climatology; modern techniques of food preservation; and analytical techniques in assessing contamination of the environment. More than eighty participants from different sectors attended the seminar, which concluded that there is an urgent need to initiate co-ordinated environmental studies in the country with emphasis on the Amazon Region, where international co-operation would have a major role.

## **EGYPT**

### **EGY/1/021 TRAINING IN SOLID PHYSICS**

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APPROVED: **1991**

COMPLETED: **1993-12-29**

TOTAL COST: **\$ 85,409**

TO UPGRADE THE SPECTROSCOPY LABORATORY BY INTRODUCING THE PERTURBED ANGULAR CORRELATION TECHNIQUE IN STUDIES OF DEFECT STRUCTURE IN SOLIDS.

The project was approved in 1991 with footnote-a status and initiated in 1992 through an extrabudgetary contribution from the United Kingdom in order to introduce advanced nuclear techniques in solid state physics at the Physics Department, Ain Shams University, Cairo. The existing facility was upgraded by provision of additional equipment to set up the perturbed angular correlation technique. The laboratory will be used for training graduate students and carrying out research activities in materials science and nuclear physics.

### **EGY/3/010 POTENTIAL FOR YELLOW CAKE PRODUCTION**

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APPROVED: **1990**

COMPLETED: **1993-08-13**

TOTAL COST: **\$ 59,469**

TO UNDERTAKE A PRE-FEASIBILITY STUDY TO ASSESS THE POTENTIAL OF TWO SITES FOR THE PILOT PLANT.

The project, with the objective of starting a pilot-scale production of uranium concentrate (yellowcake), was approved in 1990, with the Nuclear Materials Authority (NMA) as the counterpart organization. A preliminary mission had suggested as a prerequisite a review of the country's uranium resources, which comprise about twenty small deposits and prospects discovered since the mid-1950s. Three expert missions were carried out, one of which critically reviewed the status of the Egyptian uranium resources. It was found that some prospects are unlikely to be economic, while the others require further work before funds could be assigned. It was also recommended that the potential of the country should be studied in order to discover more economic types of uranium deposits. Much work was also done on the completion and startup of the pilot plant then under construction. Two expert missions were undertaken and equipment was supplied. A trial was performed at the pilot plant on ore from one of the prospects (Atshan), but, owing to lack of extractant, no solvent extraction purification of the leach solution was carried out. At the termination of this project it had only been possible to carry out the initial stages of the prescribed work. Agency experts recommended that, in order to complete the work already accomplished, a number of experiments should be carried out related to the bench tests on some of the ores, that work should be continued with the mixer settler, and that the pilot plant should be run for an extended period to better establish the conditions and capability of the circuit. The possibility of constructing a mobile processing unit, particularly for some of the remote areas, needs to be considered. The need for environmental control and monitoring related to these activities is still to be addressed. Probably the most important accomplishment of the project was the complete and critical review of the potential for uranium production in Egypt, covering available uranium resources and the various experiments needed for processing ore samples.

### **EGY/3/011 INFORMATION SYSTEM FOR URANIUM EXPLORATION**

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APPROVED: **1989**

COMPLETED: **1993-12-31**

TOTAL COST: **\$ 84,778**

TO ESTABLISH AN INFORMATION AND DATA PROCESSING SYSTEM TO SUPPORT URANIUM EXPLORATION.

Under this project, initiated in 1989, the Agency was requested to assist the Nuclear Materials Authority (NMA) to establish computer data capabilities for processing airborne and ground geophysical and geochemical data by setting up an Information System for Uranium Exploration to deal with the large amount of scattered data pertaining to uranium exploration programmes in Egypt. An expert mission assisted the NMA in planning the system, and the Agency provided a DOS operating microcomputer and peripherals for the creation of databases, in addition to other equipment. Two fellowships were awarded for training abroad. An expert mission installed the equipment and trained the technical staff in its operation. An information and data processing system has been established to support uranium exploration activities in Egypt, and several databases have been created. Databases for borehole data related to the phosphatic beds in the Abu Tartor area and for data on black sand deposits on the beach in the Abu Khashaba area have also been established. A feasibility study of the economics of the black sands was carried out.

APPROVED: 1986

COMPLETED: 1993-05-04

TOTAL COST: \$ 518,679

TO STRENGTHEN THE COUNTRY'S TECHNICAL CAPABILITIES FOR QA/QC THROUGH THE PROVISION OF EXPERT SERVICES, EQUIPMENT AND FELLOWSHIPS IN NON-DESTRUCTIVE TESTING.

This large-scale project was approved in 1986 with footnote-a status and financed by an extrabudgetary contribution from Germany. Equipment and expert services were provided. Two Group Training Courses were organized in Germany, one on eddy current techniques and the other on vibration analysis, each with 15 participants drawn from the Atomic Energy Authority and from various Egyptian industries. One scientific visit and three fellowships were awarded for more specialized training. A document based on international and national recommendations on the minimum requirements for qualification and certification of non-destructive testing (NDT) personnel in Egypt was prepared. A national committee on NDT was established. A viable and modern NDT centre has been established for training, certification and validation. The centre is now providing training to participants from industry. Two training courses in ultrasonics, one at level 1 and one at level 2, were organized for one month for 24 participants from Egyptian petroleum companies. Another training course in ultrasonics level 1 was organized for participants from the Nasr Boiler Company. The NDT centre also provides services to industry, including those for pipelines, mechanical equipment, the steel, petrochemical and metal industries, and for the national airline.

APPROVED: 1989

COMPLETED: 1993-12-20

TOTAL COST: \$ 164,673

TO CARRY OUT A FEASIBILITY STUDY ON SMALL AND MEDIUM NUCLEAR POWER REACTORS.

Following a report in 1987 by an Agency expert group on the promotion and financing of nuclear power programmes in developing countries, the Nuclear Power Plants Authority (NPPA) of Egypt sought Agency assistance in 1988 to perform a feasibility study of small and medium power reactors (SMPRs). The project was given footnote-a status and made operational in 1989 through extrabudgetary contributions from the USA and Finland and contributions in kind from Canada and Germany. The aim of the study was to investigate the feasibility of an implementation programme of SMPRs to supply a portion of Egypt's future electrical energy requirements. An Advisory Group of five experts conducted the study in collaboration with the NPPA, and four scientific visits were awarded. Technical and cost information on SMPRs were received on eight different water-cooled reactor designs from suppliers in the USA, Canada, Germany and Sweden. The Egyptian counterpart performed a detailed study for load and energy forecasting and the generation expansion plan. The feasibility study was limited to medium size power plants, which are the most competitive with coal-fired plants, and covered technical and economic aspects. The results of the study will undoubtedly benefit the NPPA in taking the decision to launch a nuclear power programme. The draft report of the study was reviewed and edited at a Consultants Meeting in Vienna in September 1992. The NPPA requested deletion of some specific information concerning Egypt in early 1993, and the final draft was completed in June 1993.

APPROVED: 1985

COMPLETED: 1993-07-05

TOTAL COST: \$ 90,615

TO STUDY PESTICIDE RESIDUES IN COTTON SEED OIL AND VEGETABLES, USING NUCLEAR TECHNIQUES.

To feed a fast growing population, the Egyptian Government has for many years been stimulating intensive agricultural practices, including increased use of pesticide chemicals. The ensuing risks of environmental contamination and the danger to public health are now cause for concern, and research was required to tackle residue problems. This project, approved in 1985 with footnote-a status, was initiated in 1987 at the Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo, through an extrabudgetary contribution from the United Kingdom, aimed at determining terminal residues of some pesticide chemicals in cotton seed oil and vegetables and at evaluating the persistence of such residues in food. The Agency provided equipment and supplies and awarded two scientific visits. Three expert missions were undertaken to work out the research programme and define the experimental approach. The experts also trained the project staff on operation and troubleshooting procedures with the main laboratory analytical equipment and on the application of nuclear and chromatographic techniques for analysis of pesticide residues in food and agricultural products. Effective local capabilities to tackle residue issues related to the practices of pesticide use in food, animal feed and environment have now been established. Several studies were carried out to determine residues from commonly used pesticides in soil, rice/fish systems, grain and phytoplankton. One major finding was that the use of the fumigant methylbromide results in substantial binding to seeds (e.g. beans). These bound residues were highly bioavailable to experimental animals and were shown to possess a toxicological potential. A study of DDT in the Egyptian environment was carried out. The results indicate that this insecticide dissipates at rates that would preclude accumulation of residues in soil, and its use may therefore be accepted under certain climatic conditions.

APPROVED: **1989**COMPLETED: **1993-12-31**TOTAL COST: \$ **145,274**

TO TRAIN SCIENTISTS AND TECHNICIANS TO CARRY OUT ENVIRONMENTAL STUDIES ON THE CONTROL OF RADIOACTIVE RELEASES INTO THE ENVIRONMENT.

The project was initiated in 1989 to develop the capability of the Atomic Energy Authority (AEA) to determine atmospheric dispersion parameters, as part of the national effort to support present and future nuclear facilities. This particular research effort was intended to develop, improve and evaluate atmospheric dispersion models needed to estimate effluent concentration from the release of radioactive materials from sites at Inshas and El Dabaa. The experiments were intended to provide a better understanding of transport and diffusion within the desert environment of Egypt. The Agency provided the equipment necessary to carry out field dispersion studies. One 15-month fellowship was awarded. Two experts conducted two missions to help plan the field work. In 1993, four experts worked alongside Egyptian counterparts in conducting a full field determination of dispersion parameters at the El Dabaa site, using tracer techniques. This was the first tracer diffusion experiment carried out on the African continent. The AEA now has the necessary equipment and knowledge to undertake field studies independently and to assist other African countries in this area.

**EL SALVADOR****ELS/0/005 NUCLEAR SCIENCE LABORATORY CONSTRUCTION**

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APPROVED: **1988**COMPLETED: **1993-09-16**TOTAL COST: \$ **32,151**

TO RECONSTRUCT FACILITIES DESTROYED BY AN EARTHQUAKE IN ORDER TO HOUSE EQUIPMENT BEING USED FOR TRAINING AND RESEARCH.

The earthquake of 1986 destroyed the nuclear laboratories of the Faculty of Engineering and Architecture of the University of El Salvador. The equipment was temporarily installed in the basement of the Physics Department, but that building was neither safe nor suitable for continuous use. The meagre resources of the University, and the priorities of the Government in reconstructing San Salvador, did not permit the University to embark on design and construction of new laboratories without external help. A Reserve Fund project was approved in 1988 for this purpose. The work was completed in 1991 and the nuclear laboratories moved to new premises where academic and research activities as well as analytical services are carried out normally by a very active group of professionals and technicians. The work will be continued under two new projects, ELS/4/003 and ELS/4/004.

**ETHIOPIA****ETH/8/002 ISOTOPE INVESTIGATIONS IN SELECTED GEOTHERMAL FIELDS**

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APPROVED: **1991**COMPLETED: **1993-06-24**TOTAL COST: \$ **41,061**

TO ASSIST IN ISOTOPE INVESTIGATIONS IN TWO GEOTHERMAL FIELDS.

This Reserve Fund project was established as a result of a country programming mission undertaken in April 1991. A six-week expert mission was carried out and resulted in the installation and calibration of the nuclear logging equipment which was already available at the Ethiopian Institute of Geological Surveys, Addis Ababa, and training local staff in field use of the equipment. A two-week national workshop on isotope application in water and geothermal resources development, conducted with Agency assistance through provision of four lecturers, was attended by 62 participants from national institutions involved in water resources. A follow-up project (ETH/8/003) is being implemented.

**GHANA****GHA/4/008 TRAINING IN NUCLEAR INSTRUMENTATION**

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APPROVED: **1982**COMPLETED: **1993-02-26**TOTAL COST: \$ **279,582**

TO UPGRADE THE ELECTRONICS LABORATORY AND STRENGTHEN LOCAL CAPABILITY FOR PREVENTIVE MAINTENANCE AND REPAIR OF NUCLEAR ELECTRONIC EQUIPMENT.

Under this project, initiated in 1982, three fellowships were awarded, equipment was supplied, and two National Training Courses organized. Eight expert missions, for a total of 14 months, trained the staff in the use of the equipment and assisted in the design and production of modular electronic instruments on a small scale. The electronics laboratory of the National Nuclear Research Institute, Accra, is now well equipped and the staff sufficiently well trained to provide maintenance and repair services to other departments of the Institute and to the University of

Ghana Medical School, where the Agency is supporting TC projects. A related US-funded project on nuclear instrumentation and computer interfacing is being implemented.

## **GREECE**

### **GRE/6/007 RADIOPHARMACEUTICAL QUALITY CONTROL**

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APPROVED: **1989**

COMPLETED: **1993-06-24**

TOTAL COST: **\$ 360,954**

TO IMPROVE LOCAL CAPABILITIES FOR PRODUCTION AND QUALITY CONTROL OF RADIONUCLIDES AND LABELLED COMPOUNDS FOR USE IN NUCLEAR MEDICINE STUDIES.

The Institute of Radioisotopes and Radiodiagnostic Products of the Demokritos National Research Center, Athens, requested Agency assistance in 1988 to expand and modernize the existing laboratory facilities for the production of iodine-131 using the local nuclear research reactor, and to modernize the instrumentation for quality control of radiolabelled products for in-vivo and in-vitro biomedical applications. The Agency provided complete radiochemical processing equipment for production of high purity iodine-131 by the dry distillation method. Additional instrumentation for quality control was supplied. A laboratory freeze dryer was also provided to support the local programme to develop new radiopharmaceuticals. Two fellowships and two scientific visits were granted. The Institute is now capable of supplying high quality radiopharmaceutical kits to the local medical community. Twenty-four radiolabelled products are produced routinely (primary radionuclides, radiopharmaceutical and radioimmunoassay kits) and distributed to 150 public hospitals, private clinics and laboratories. Research work to develop new radiopharmaceuticals and improved quality control procedures is being actively pursued. The Institute trained 30 fellows on behalf of the Agency and hosted an Interregional Training Course. Scientists from the Institute have acted as field experts in Agency TC projects.

## **GUATEMALA**

### **GUA/4/003 NUCLEAR INSTRUMENTATION LABORATORY**

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APPROVED: **1989**

COMPLETED: **1993-03-19**

TOTAL COST: **\$ 67,444**

TO ESTABLISH A PREVENTIVE MAINTENANCE PLAN; TO REDUCE OUTAGES CAUSED BY BREAKDOWN OF EQUIPMENT; TO DESIGN ANALOG AND DIGITAL ELECTRONIC CIRCUITS.

The Agency provided the assistance necessary to establish the laboratory at the General Directorate of Nuclear Energy (DGEN), Guatemala City, which supplies repair and maintenance services to all the institutions involved in implementing the project as well as to other institutions, mainly hospitals. A corrective and preventive plan was designed for all the equipment at DGEN and other institutions, and a preventive maintenance plan is now in effect for medical equipment. Expert services were provided to organize maintenance and the repair of nuclear instrumentation. One fellowship was awarded in Argentina and other training was financed under regional activities. Equipment, including electronic components, was supplied to complete the laboratory. Repair and maintenance of data processing equipment will continue under Project GUA/4/004.

## **ICELAND**

### **ICE/9/002 RADIATION PROTECTION**

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APPROVED: **1987**

COMPLETED: **1993-01-29**

TOTAL COST: **\$ 133,548**

TO ASSIST IN THE ESTABLISHMENT OF RADIATION PROTECTION SERVICES FOR PERSONNEL DOSIMETRY AND ENVIRONMENTAL MONITORING.

The project was approved in 1987 to assist the National Institute of Radiation Protection, Reykjavik, to establish a national network for personnel dosimetry and for environmental radiation monitoring. In addition to Agency regular and reserve funds, Iceland contributed additional funds under a Funds-in-Trust arrangement for the procurement of equipment and supplies. Counterparts monitored environmental radioactivity from various samples, taking measurements of low-level radioactivity in fresh milk and milk powder from selected dairy farms, lamb meat from slaughterhouses, soil and vegetation from selected sites, rain-water and marine samples. Within the framework of research co-operation among the Nordic countries, the Institute used the equipment supplied under the project in a radioecology study, measuring the transfer of caesium from soil to vegetation and to meat (mainly lamb and reindeer). Two Agency experts advised on sampling and low-level gamma spectrometry techniques. The counterparts are continuing routine monitoring programmes and participating in an intercomparison exercise to determine environmental radioactivity in various samples. A continuation project (ICE/9/003) has been approved as a footnote-a project for implementation by Iceland.

## **INTERREGIONAL**

### **INT/4/079 NUCLEAR POWER PROGRAMME IMPLEMENTATION**

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APPROVED: **1985**

COMPLETED: **1993-06-08**

TOTAL COST: \$ **334,941**

TO CO-ORDINATE PLANNING ACTIVITIES IN CONNECTION WITH TC PROJECTS IN THE FIELD OF NUCLEAR POWER; TO PREPARE DOCUMENTS, EVALUATE BIDS AND PROVIDE QUALITY ASSURANCE SURVEILLANCE DURING PROJECT IMPLEMENTATION.

This interregional project was initiated in 1985 to assist developing Member States to assess prospects for nuclear power, in planning preparatory activities and undertaking owner's responsibilities, including the supervisory role. The project involved more than 20 expert missions, two scientific visits and the procurement of specialized documentation. This advice and assistance met the specific requirements of the participating countries: Bulgaria, China, Cuba, Indonesia, Iran, the Republic of Korea, Poland, Romania and Yugoslavia. National Training Courses on project management and programme implementation were organized in the Republic of Korea and Yugoslavia to meet their specific needs. The Republic of Korea was assisted in the evaluation of advanced reactor technologies and development of criteria for the choice of reactor types for long-term development. Iran was assisted in a review of the status of the Bushehr nuclear power project, including damage to the buildings and structures. This led to Project IRA/9/011, to provide continued assistance towards the development of organizational infrastructure and manpower in Iran. Seminars were organized on NPP commissioning (in Romania), on quality assurance (in Poland) and on the application of WWER probabilistic safety assessment (in Cuba). China was assisted in the introduction of R&D activities in the area of high temperature gas cooled reactor technology. Indonesia received advice on assessing the viability of nuclear power. The need was recognized for a formal feasibility study, including site selection procedure, and a tentative time horizon for a nuclear power project. Two follow-up projects (INS/0/012 and INS/4/028) in Indonesia were approved. The objectives of this project were fully achieved.

## **IRAN, ISLAMIC REPUBLIC OF**

### **IRA/2/004 RADIOISOTOPE PRODUCTION**

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APPROVED: **1982**

COMPLETED: **1993-12-22**

TOTAL COST: \$ **898,962**

TO EXTEND THE POTENTIAL OF RADIOPHARMACEUTICAL PRODUCTION AND TO ENSURE STRICT QUALITY CONTROL.

The project was initiated in 1982. The Agency provided expert missions and equipment, fellowships and scientific visits for training abroad. A funds-in-trust component provided molybdenum-99 for one year for medical applications. A laboratory was established for the production of isotopes and the preparation of radiopharmaceuticals with strict quality control. Facilities for the production of technetium-99m generators, in-vivo kits for the main Tc-99m radiopharmaceuticals and iodine-131 were commissioned. Systematic quality control and good manufacturing practice in routine work have been established. About 24 Tc-99m generators per week and several in-vivo kits of Tc-99m radiopharmaceuticals are routinely produced. A highly motivated and well trained staff has been created. The Nuclear Research Centre, Tehran, can now serve as a regional training centre in the field of radioisotopes and radiopharmaceuticals.

## **IRAQ**

### **IRQ/0/003 NUCLEAR POWER PROGRAMME**

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APPROVED: **1991**

CANCELLED: **1993-04-26**

TOTAL COST: \$ **0**

TO ASSIST THE COUNTRY IN NUCLEAR POWER DEVELOPMENT AND TO HELP TO DEVELOP THE INFRASTRUCTURE FOR IMPLEMENTATION OF THE NUCLEAR POWER PLANT PROJECT WITH MAXIMUM NATIONAL PARTICIPATION.

This project, approved by the Board of Governors for 1991/92 programming cycle, is temporarily cancelled in compliance with UN Security Council Resolutions 661 (1990), 687 (1991) and other related resolutions.

### **IRQ/1/010 NEUTRON TRANSMUTATION DOPING OF SILICON**

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APPROVED: **1991**

CANCELLED: **1993-04-26**

TOTAL COST: \$ **0**

TO USE THE ALREADY EXISTING 5 MW(T) RESEARCH REACTOR FOR NEUTRON TRANSMUTATION DOPING OF SEMICONDUCTOR MATERIALS.

This project, approved by the Board of Governors for 1991/92 programming cycle, is temporarily cancelled in compliance with UN Security Council Resolutions 661 (1990), 687 (1991) and other related resolutions.

**IRQ/2/007            DEVELOPMENT OF RADIOPHARMACEUTICALS**

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APPROVED: **1991**CANCELLED: **1993-04-26**TOTAL COST: **\$ 0**

TO DEVELOP NEW AGENTS MERCAPTO ACETYL TRIGLYCINE (MAG 3) AND MAGROAGGREGATED ALBUMIN (MAA), FOR KIDNEY FUNCTION STUDIES AND PULMONARY DISEASE DIAGNOSIS, RESPECTIVELY. TO START THE PRODUCTION OF MAG 3 AND MAA KITS.

This project, approved by the Board of Governors for 1991/92 programming cycle, is temporarily cancelled in compliance with UN Security Council Resolutions 661 (1990), 687 (1991) and other related resolutions.

**IRQ/4/011            CYCLOTRON FACILITY**

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APPROVED: **1989**CANCELLED: **1993-04-26**TOTAL COST: **\$ 2,938**

TO ASSIST THE IRAQI ATOMIC ENERGY COMMISSION IN A FEASIBILITY STUDY TOWARDS THE ACQUISITION AND UTILIZATION OF A LOW ENERGY CYCLOTRON. TO HELP IN THE CONSTRUCTION AND PUTTING THE CYCLOTRON INTO OPERATION.

This project, approved by the Board of Governors for 1989/90 programming cycle, is temporarily cancelled in compliance with UN Security Council Resolutions 661 (1990), 687 (1991) and other related resolutions.

**IRQ/5/009            PILOT SCALE IRRADIATION FACILITY**

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APPROVED: **1991**CANCELLED: **1993-04-26**TOTAL COST: **\$ 0**

TO ADVISE ON IRRADIATION PROCESSING, IN PARTICULAR FOR FOOD PRESERVATION, AND ON A FEASIBILITY STUDY ON THE SELECTION OF AN IRRADIATOR.

This project, approved by the Board of Governors for 1991/92 programming cycle, is temporarily cancelled in compliance with UN Security Council Resolutions 661 (1990), 687 (1991) and other related resolutions.

**IRQ/5/010            CONTROLLED RELEASE OF PESTICIDES AND RESIDUES**

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APPROVED: **1991**CANCELLED: **1993-04-26**TOTAL COST: **\$ 0**

TO IMPROVE AGRICULTURAL PRACTICES IN IRAQ THROUGH MORE EFFICIENT USE OF PESTICIDES AND UPGRADING OF PESTICIDE RESEARCH BY USING RADIOTRACER TECHNIQUES.

This project, approved by the Board of Governors for 1991/92 programming cycle, is temporarily cancelled in compliance with UN Security Council Resolutions 661 (1990), 687 (1991) and other related resolutions.

**IRQ/9/004            NUCLEAR POWER SAFETY**

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APPROVED: **1980**COMPLETED: **1993-05-04**TOTAL COST: **\$ 507,723**

TO ASSIST IN INFRASTRUCTURE DEVELOPMENT FOR NUCLEAR POWER SAFETY AND TO ADVISE ON THE LICENSING PROCEDURES FOR THE FUTURE NUCLEAR POWER PLANT IN IRAQ.

The project was approved in 1979 and was extended following Iraq's negotiations with the USSR for the acquisition of a WWER reactor. The Agency provided the Iraqi Atomic Energy Commission with general and specific advice on regulatory matters, advice on startup of the Temmuz 2 research reactor and advice on a safety analysis report for the Temmuz 14 research reactor. A NUSS training course and a training course for qualification of research reactor operators were organized by the Agency. The PSAR format was adapted for a WWER-type reactor. Comprehensive assistance on site study was initiated but had to be suspended in view of the UN resolutions in respect of Iraq. Twelve fellowships and two scientific visits were awarded. Equipment provided was limited to earthquake risk software, a desktop computer system and books for the training course. Under a subcontract, training on nuclear safety and probabilistic safety assessment was implemented. The project contributed to the development of infrastructure for nuclear research and power reactor safety.

## **JORDAN**

### **JOR/2/002 RADIOCHEMICAL LABORATORY**

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APPROVED: **1985**

COMPLETED: **1993-09-16**

TOTAL COST: \$ **113,991**

TO SET UP A RADIOCHEMISTRY LABORATORY FOR THE PRODUCTION OF RADIOPHARMACEUTICALS.

The principal aim of the project, which was initiated in 1985, was to establish a laboratory for training radiochemistry students at the University of Jordan and, later, to begin monitoring low-level radioactivity and undertake other analytical studies in connection with environmental pollution in Jordan. The Agency provided the Chemistry Department of the University with nuclear spectroscopy instruments and supplies. As the liquid nitrogen plant supplied under a previous project, on which the laboratory's activities relied, had broken down, spare parts were supplied by the Agency as quickly as possible. Two experts repaired the plant and trained the counterparts in its operation and maintenance. The project provided training of students in radiochemistry and strengthened the local capability for undertaking analytical activities in low-level counting and environmental pollution monitoring.

### **JOR/4/002 NUCLEAR INSTRUMENTATION MAINTENANCE WORKSHOP**

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APPROVED: **1989**

COMPLETED: **1993-04-26**

TOTAL COST: \$ **174,395**

TO ESTABLISH A CENTRALIZED WORKSHOP THAT WOULD PROVIDE TECHNICAL SUPPORT IN THE REPAIR, MAINTENANCE AND CALIBRATION OF NUCLEAR INSTRUMENTS FOR VARIOUS INSTITUTIONS.

The Royal Scientific Society and the Electro-Mechanical Workshop at the University of Jordan, both in Amman, were the main beneficiaries. Through this project, approved in 1989, nuclear instruments, electronic components and accessories were provided. Three National Training Workshops were organized on nuclear measurement techniques, practical methods for testing and troubleshooting analog and digital circuits, hands-on training, demonstrations and exercises on power conditioning and protective instruments. Nuclear spectroscopy systems were studied. Exercises in fault-finding and repair of modular instruments and interfacing of personal computers to nuclear instruments were performed. One staff member took part in group fellowship training at the Agency's laboratories at Seibersdorf. The project has improved Jordanian capability to repair, maintain and calibrate nuclear instruments.

## **KENYA**

### **KEN/0/003 NUCLEAR SCIENCE LABORATORY**

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APPROVED: **1979**

COMPLETED: **1993-02-26**

TOTAL COST: \$ **763,774**

TO ESTABLISH A NUCLEAR SCIENCE LABORATORY FOR THE INTRODUCTION AND DEVELOPMENT OF ADVANCED ANALYTICAL TECHNIQUES.

Under this project, initiated in 1979, the Agency supplied equipment and 62 months of expert services. Eight fellowships were awarded for training abroad. The X-ray fluorescence analytical technique has been introduced and the Centre for Nuclear Science Techniques at the University of Nairobi has been attracting workers in trace elements research and analysis. Research was carried out at the Centre covering agriculture (plant nutrition), geology (mineral content of rocks in various parts of the country), construction industry (use of nuclear/density moisture gauge in road construction), and medicine (trace elements in blood and urine of hypertensive patients and in medicinal herbs). Environmental pollution studies were also undertaken, including the effects of industrial effluents and trace elements in lake waters. More than 20 post-graduate students using the facilities have obtained MSc degrees and about 15 scientific papers were presented at domestic scientific meetings. This notable scientific work was achieved through close collaboration with other Departments of the University and with other institutions. A new project (KEN/2/003) on practical applications of the techniques developed under this project has been approved.

### **KEN/5/013 FATE OF TRYPANOCIDAL DRUGS IN CATTLE**

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APPROVED: **1991**

COMPLETED: **1993-05-04**

TOTAL COST: \$ **38,910**

TO DETERMINE THE QUANTITATIVE AND QUALITATIVE FATE OF TRYPANOCIDAL DRUGS IN CATTLE INFECTED WITH TRYPANOSOMES.

This is an extension of a larger-scale project (KEN/5/012) which started in 1983 with extrabudgetary funding from Italy until 1990 and from UNDP for part of 1991, under which essential equipment and supplies had been provided. Under the present project, initiated in 1991, a laboratory was constructed and commissioned, with ancillary facilities, for studies of the pharmacokinetics of trypanocidal drugs using radioisotope techniques. Research programmes in both field and laboratory were established which extended beyond pharmacokinetics to include drug sensitivity studies, drug testing in culture systems and in cattle, testing of controlled-release formulations, improvements in a diagnostic

technique for trypanosomiasis, and improvements in the analysis of trypanocidal drugs. The facilities and expertise were such that fellowship training was given at the laboratory to scientists from other countries. The project strengthened and sustained the activities initiated under the earlier project.

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**KEN/6/008 TREATMENT OF CERVICAL AND OESOPHAGEAL CANCER**

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APPROVED: **1991**

COMPLETED: **1993-06-24**

TOTAL COST: \$ **113,934**

TO INTRODUCE CANCER TREATMENT PROCEDURES AND TO PROVIDE CAESIUM-137 SOURCES AND RELATED EQUIPMENT.

This one-year project has provided brachytherapy facilities for the treatment of cancer of the oesophagus and the uterine cervix at the New Nyanza General Hospital, Kisumu. The Agency provided equipment and awarded project-related fellowships for training in preventive maintenance, repair and operation of the equipment. The project, which is managed by an experienced local radiotherapist, has improved the cancer treatment facilities in Kenya.

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**KEN/9/004 RADIATION PROTECTION**

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APPROVED: **1986**

COMPLETED: **1993-09-30**

TOTAL COST: \$ **238,165**

TO EXTEND THE PERSONNEL MONITORING SERVICE.

The project, approved in 1986, was implemented at the Radiation Protection Board (RPB), Ministry of Health, Nairobi, to expand the personnel monitoring service to cover the 2600 radiation workers in Kenya and to establish a calibration facility. The Agency provided equipment and three experts to assist in the operation of the automatic thermoluminescence dosimetry system supplied, in formulating the radiation protection programme, in commissioning the calibration equipment supplied, in establishing calibration procedures and training local staff in their application. Two fellowships were awarded for training abroad. The project was also central to the organization of a Regional Training Course for radiation protection officers and a Regional Seminar on radiation protection service for developing countries in Africa, both which were held in Nairobi in 1988. The RPB has also hosted scientific visits from other African countries sponsored by the Agency. The radiation protection infrastructure in Kenya has been considerably strengthened. Agency support to the RPB is continuing through Project KEN/9/005, which aims at the establishment of a national waste management system.

**LIBYAN ARAB JAMAHIRIYA**

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**LIB/5/007 ERADICATION OF THE SCREWORM IN LIBYA**

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APPROVED: **1989**

COMPLETED: **1993-05-20**

TOTAL COST: \$ **624,749**

TO ERADICATE THE SCREWORM FROM LIBYA AND INSTITUTE QUARANTINE PROCEDURES AGAINST POSSIBLE RE-INVASION.

The New World Screwworm (NWS), the most damaging livestock insect parasite in the Western Hemisphere, was discovered in Libya in 1988 and the infestation confirmed by FAO. In 1989 strategies were worked out to contain, control and subsequently eradicate the NWS in Libya and it was decided to apply the sterile insect technique (SIT). The project was initiated in 1989, funded by the Agency and an extrabudgetary contribution from Sweden, to support the FAO-led eradication programme in North Africa. The Agency provided more than 50 months of expert services as well as vehicles, computer equipment and chemicals. Epidemiological analysis of the NWS, quality control tests and R&D activities related to the sterile fly release programme were carried out. The project was implemented in collaboration with the Libyan Government, the IAEA, FAO, the International Fund for Agricultural Development (IFAD) and UNDP. The NWS was declared eradicated by the Libyan Government in June 1992. The benefit: cost ratio was estimated at 50:1.

**MADAGASCAR**

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**MAG/5/005 NITROGENOUS FERTILIZATION OF RICE PADDIES**

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APPROVED: **1987**

COMPLETED: **1993-05-20**

TOTAL COST: \$ **142,054**

TO DEFINE THE ROLE OF ORGANIC MATTER IN IMPROVING THE FERTILITY OF RICE PADDIES.

Rice is the most important food crop in Madagascar but the average yields are very low owing to low soil fertility levels, poor water management and insufficient use of fertilizers. This project was initiated in 1987 at the Malagasy Radioisotope Laboratory to determine by means of the nitrogen-15 technique the effect of organic fertilizers on the growth of wetland rice. The Agency provided equipment and supplies. Three experts undertook five missions to assist in developing the research programmes and designing the laboratory experiments. The experts also trained scientists in the N-15 technique for biological nitrogen fixation and trained technicians in the laboratory analysis of nitrogen

uptake by plants. Two fellowships were awarded for training abroad. Laboratory experiments using N-15 labelled urea and Azolla were made to monitor the mineralization of Azolla nitrogen under flooded conditions. Experiments were carried out to assess the efficiency of Azolla strains as green manure under farmers' field conditions. Yield increases were of the same order of magnitude as those obtained by costly inorganic fertilizers. N-15 isotopes were used in studies of nitrogen fertilizer uptake and turnover. These activities have resulted in a significant number of publications.

## **MAURITIUS**

### **MAR/5/004      STUDIES ON SOIL MOISTURE AND FERTILISER USE EFFICIENCY**

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APPROVED: **1983**

COMPLETED: **1993-03-19**

TOTAL COST: \$ **269,133**

TO DETERMINE THE NITROGEN NEEDS OF SUGAR CANE AT DIFFERENT PHASES OF GROWTH.

The project was approved in 1983 to improve fertilizer management practices for sugar cane in Mauritius. Five expert missions were undertaken for a total duration of seven months. The experts trained local staff and assisted in planning and carrying out nitrogen-15 fertilizer use efficiency studies. The Agency provided equipment and supplies. Two fellowships were awarded for training abroad. The Mauritius Sugar Industry Research Institute (MSIRI), where the project was implemented, now has a fully functional laboratory with scientists competent in the use of the N-15 isotope in soil fertility studies and technicians to operate the N-15 analyser. Field studies were carried out successfully, and useful practical results were obtained. By means of the N-15 isotope, MSIRI demonstrated that 80 kg of fertilizer nitrogen per hectare applied through a drip irrigation system gives the same sugar cane yield as the recommended rate of 120 kg per hectare applied by the standard method. A follow-up project (MAR/5/008) has been approved.

### **MAR/5/006      STUDY ON CONTROL OF PLUTELLA XYLOSTELLA BY F1 STERILITY**

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APPROVED: **1993**

COMPLETED: **1993-12-14**

TOTAL COST: \$ **15,049**

TO ASSESS THE FEASIBILITY OF IMPLEMENTING A PROGRAMME INVOLVING THE STERILE INSECT TECHNIQUE TO CONTROL THE DIAMOND-BACK MOTH.

The diamond-back moth (*Plutella xylostella*), the pest of cruciferous vegetables in Mauritius, has become resistant to virtually all pesticides formerly used to control it. An Agency expert studied the situation and submitted a report on the feasibility of using the sterile male technique for the control of this pest to the Ministry of Agriculture, Fisheries, and Natural Resources, recommending an integrated pest management (IPM) programme for control of insects on cruciferous crops. The expert also prepared a work plan for integrating inherited sterility into an IPM programme for control of the diamond-back moth, which will be valuable for guiding future pest control activities.

### **MAR/8/003      GROUNDWATER ASSESSMENT**

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APPROVED: **1991**

COMPLETED: **1993-06-19**

TOTAL COST: \$ **119,017**

TO DELIMIT UNDERGROUND WATER BASINS TO PREVENT POLLUTION BY INDUSTRIAL EFFLUENTS AND FERTILISERS AND TO ASSESS THEIR POTENTIAL FOR RATIONAL EXPLOITATION.

The project was approved in 1991 to assist the Central Water Authority of Mauritius in the application of isotope and geochemical methods for the assessment of groundwater resources. Agency experts assisted in designing and implementing a sampling scheme to study the potential of environmental isotopes in water resources assessment. They also assisted in planning and implementing hydrological field experiments, using dye tracers and artificial tritium. The Agency supplied equipment and expert missions to give on-the-job training. One scientific visit was awarded. A comprehensive sampling programme for environmental isotope and geochemical analysis of surface water and groundwater has been completed. Most of these samples were analysed by the Agency's Isotope Hydrology Laboratory, in Vienna, and a preliminary evaluation of the analytical results was made. The hydraulic connection between surface water and groundwater used for drinking water was identified by experiments and it was found that the groundwater supply from two well fields examined appeared to be endangered by surface water pollution caused by industrial contaminants. The results can be used on groundwater protection measures in the examined area. Agency assistance continues under the project MAR/8/004.

**MEXICO****MEX/0/008      NUCLEAR APPLICATIONS**

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APPROVED: **1985**COMPLETED: **1993-06-08**TOTAL COST: **\$ 138,323**

TO UPGRADE SEVERAL CURRENT ACTIVITIES IN THE NUCLEAR FIELD.

The project was approved in 1985 to upgrade the activities of the National Institute of Nuclear Research (ININ), Mexico City, in applications of nuclear techniques in industry as well as to increase ININ's capability in radiation dosimetry and nuclear instrumentation. Through expert services and fellowship training, improvements have been made in the use of tracer techniques in industry, research on radiation polymerization, analysis of uranium compounds, personnel dosimetry and nuclear instrumentation. The Agency also provided equipment and material. The use of nuclear tracer techniques in geothermal prospecting has been established; irradiated polyethylene compounds have been developed for insulation of wire and cable, and a method for calibration of hydraulic turbines has been studied. The project also contributed to local construction and commissioning of an electron accelerator for R&D.

**MEX/1/010      RADIOACTIVE STANDARDS**

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APPROVED: **1984**COMPLETED: **1993-05-20**TOTAL COST: **\$ 97,269**

TO DESIGN AND PRODUCE RADIOACTIVE STANDARDS FOR MEDICAL, ENVIRONMENTAL AND INDUSTRIAL APPLICATIONS.

This project was approved in 1984 to assist the National Institute of Nuclear Research (ININ), Mexico City, to improve its capability for accurate measurement of radiation sources, aiming at the design and production of radioactive standards. The Agency provided expert services, staff training and equipment. A laboratory for the production and measurement of radioactive standards has now been established, the laboratory staff has been trained and ININ is producing radioactive (mainly cobalt-60) sources, calibrated by coincidence methods, which are used as standards in medical, industrial and environmental applications.

**MEX/2/012      TRACE-ELEMENT ANALYSIS**

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APPROVED: **1989**COMPLETED: **1993-08-13**TOTAL COST: **\$ 63,797**

TO IMPROVE THE DETECTION LIMITS AND RELIABILITY OF PLASMA EMISSION SPECTROMETRY TECHNIQUES IN ORDER TO PROVIDE BETTER ANALYTICAL SERVICES.

This footnote-a project, funded by an extrabudgetary contribution from the United Kingdom, helped to improve the necessary infrastructure for contamination-free trace element analysis at the National Institute of Nuclear Research (ININ), Mexico City. Expert missions and training provided the basic knowledge for successful utilization of existing facilities for induction coupled plasma emission spectrometry. Equipment as well as laboratory and reference materials were also supplied. Determination of impurities in uranium and the analysis of Zircalloys and steels have been considerably improved. Analytical services to the nuclear fuel fabrication activities at ININ have been strengthened.

**MEX/4/039      TRAINING FOR NUCLEAR POWER PLANT OPERATING PERSONNEL**

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APPROVED: **1989**COMPLETED: **1993-08-13**TOTAL COST: **\$ 28,446**

TO ESTABLISH SIMULATOR TRAINING PROGRAMMES.

The Federal Electricity Commission (CFE), Vera Cruz, has designed and built a simulator to train NPP operators and auxiliary staff. The Agency was requested to provide expert services to review current training activities and to design training programmes. With their assistance, the procedures for certifying the simulator have been set up, the instructors' guide has been reviewed and a programme of scenarios for simulator instruction sessions, together with the methodology and content of training courses for operators, has been established. A simulator maintenance programme and plans for its implementation have also been developed. The simulator is being intensively used to train personnel for the operational Laguna Verde Nuclear Power Plant Unit 1 and to prepare the operating team for Unit 2, currently undergoing commissioning.

**MEX/4/042                    UPGRADING OF RADIOPHARMACEUTICAL PRODUCTION**

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APPROVED: **1991**COMPLETED: **1993-06-15**TOTAL COST: **\$ 82,168**

TO INCREASE THE PRODUCTION OF RADIOPHARMACEUTICALS AND TO IMPROVE QUALITY CONTROL.

The project was initiated in 1991 to assist the National Institute of Nuclear Research (ININ), Mexico City. The Agency provided expert assistance, fellowship training and some equipment for radiation protection and counting. To meet the radiological safety requirements of the production facility, a new ventilation system was designed and installed. Two experts assisted in redesigning the radioisotope production lines and in improving their operation. Guidelines were given for closer co-operation between the nuclear medicine practitioners at hospitals and the ININ group to obtain wider acceptance of the locally produced radiopharmaceuticals. Quality control and assurance procedures have been improved. ININ now has the potential of doubling, under strict safety and quality standards, its production of radiopharmaceuticals.

**MEX/5/022                    FOOD IRRADIATION**

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APPROVED: **1993**COMPLETED: **1993-10-15**TOTAL COST: **\$ 26,081**

TO ANALYSE AND EVALUATE DATA ON FEASIBILITY STUDIES FOR COMMERCIAL SCALE IRRADIATION OF FOOD.

The project was approved in 1993 and financed from the Reserve Fund. An Agency expert assisted in the analysis of food irradiation feasibility studies and recommended that food irradiation could be successfully and profitably introduced by building a commercial multi-purpose plant in Central Mexico designed to process both food and non-food products.

**MEX/8/016                    RADIATION TECHNOLOGY**

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APPROVED: **1988**COMPLETED: **1993-12-31**TOTAL COST: **\$ 49,082**

TO STUDY POSSIBILITIES FOR USING ELECTRON BEAM TECHNOLOGY TO PURIFY FLUE GASES; TO ACQUIRE THE CAPABILITY TO MANUFACTURE COMPONENTS FOR GAMMA IRRADIATION FACILITIES.

This footnote-a project was initiated in 1988 and funded by an extrabudgetary contribution from the USA. To implement the first objective, several expert missions were undertaken to make a prefeasibility study and to introduce the technology. Training was given at a large demonstration unit in Poland and some equipment was provided. A small laboratory unit has now been established for training and studying processes in gases. The national requirement for purification of flue gases by electron beam has been ascertained. The second objective of the project was too ambitious and was not fully achieved. An expert mission to the gamma irradiation facility at the National Institute for Nuclear Research has improved its operating capabilities, however, and a computer programme for dose mapping was developed.

**MEX/9/033                    RADIATION PROTECTION**

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APPROVED: **1986**COMPLETED: **1993-04-23**TOTAL COST: **\$ 35,450**

TO ESTABLISH A RADIATION PROTECTION PROGRAMME AT THE LAGUNA VERDE NPP.

Under this project, initiated in 1986, the Agency provided five expert missions to advise on a broad spectrum of issues related to operational radiation protection at the Laguna Verde nuclear power plant (LVNPP). Four expert missions were undertaken to advise on the health physics programme, in particular on monitoring exposure from internal and external irradiation, and on planning and preparedness for radiological emergencies. The project has contributed to the establishment of a sound radiation protection programme for safe operation of the LVNPP. Procedures for monitoring radiation exposure at the LVNPP have been set up and planning and preparedness for radiological emergencies established.

**MEX/9/034                    ACCIDENT ANALYSIS (LAGUNA VERDE NUCLEAR POWER PLANT)**

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APPROVED: **1989**COMPLETED: **1993-06-08**TOTAL COST: **\$ 29,390**

TO ESTABLISH CAPABILITY FOR ANALYSIS OF SEVERE TRANSIENTS, SUCH AS MAJOR AND MINOR LOSS OF COOLANT ACCIDENTS AND ANTICIPATED TRANSIENTS WITHOUT INSERTION OF CONTROL RODS.

The project was approved in 1989 to strengthen the capability of the Institute of Electricity Research (IIE), Cuernavaca, for analysis of severe accidents. Agency experts gave basic training in two-phase flow thermohydraulics relevant to transient analysis in boiling water reactors. The TRAC-BF1 code was introduced for modelling the Laguna Verde

nuclear power plant (LVNPP) for the control system and the balance-of-plant systems. Agency experts also assisted in the development of a work station version of the TRAC-BF1 computer code and provided training in its use. Lectures and seminars were given by experts on severe accident research. Mexico has now developed the methodology and written procedures for the transient and accident analysis currently used for safety studies at the LVNPP.

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**MEX/9/037 ENVIRONMENTAL MONITORING**

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APPROVED: **1989**

COMPLETED: **1993-08-13**

TOTAL COST: **\$ 186,335**

TO ESTABLISH A CAPABILITY FOR DETERMINING THE DISTRIBUTION OF NATURAL AND OTHER RADIONUCLIDES IN THE ENVIRONMENT AND IN STAPLE FOOD PRODUCTS; TO PREPARE THE BASIS FOR A NATIONAL REFERENCE LABORATORY.

The National Institute of Nuclear Research (ININ), Mexico City, has been carrying out and developing an occupational and environmental radiation monitoring programme for many years. The infrastructure needed to be upgraded in view of the increase in services due to the continuous operation of a research reactor and the final disposal of radioactive wastes. Expert missions reviewed current activities and developed a long term plan to satisfy demands for measurement services of environmental radioactivity in connection with the future operation of an NPP. The Agency supplied radiation measurement equipment and awarded a fellowship for training abroad. ININ's Laboratory for Environmental Control is determining environmental contamination around the National Nuclear Research Centre, Mexico City, and at the Maquixco waste disposal site. The Laboratory can also support the Ministry of Health in the emergency plan for the Laguna Verde NPP by determining the radionuclide content of water and foodstuffs.

**MONGOLIA**

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**MON/2/004 X-RAY FLUORESCENCE FOR COAL ANALYSIS**

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APPROVED: **1987**

COMPLETED: **1993-09-16**

TOTAL COST: **\$ 86,961**

TO APPLY X-RAY FLUORESCENCE SPECTROMETRY IN THE ANALYSIS OF ASH AND CERTAIN TOXIC ELEMENTS IN COAL.

Coal production is increasing in Mongolia, and the industry needs a faster and more practical method of determining the amount of ash and toxic elements such as sulphur in coal. In 1987, Agency assistance was sought in setting up laboratory facilities based on X-ray fluorescence (XRF) techniques to determine trace and minor elements in coal at the Institute of Chemistry of the Academy of Sciences, Ulan Bator. The project was initiated in 1988. Two experts undertook two missions for a total of three months to install the equipment supplied under the project and to demonstrate its operation and maintenance. The main counterpart received fellowship training in XRF techniques at the Agency's Laboratories at Seibersdorf. Coal samples are now being analysed at the Institute. A functional well equipped laboratory with trained personnel can now carry out routine analyses. The rapid analysis technique has contributed to the formulation of more rational policies on coal burning for electricity generation and domestic consumption as well as on environmental control of waste products.

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**MON/5/002 PLANT MUTATION BREEDING**

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APPROVED: **1982**

COMPLETED: **1993-08-26**

TOTAL COST: **\$ 228,461**

TO DEVELOP RADIATION-INDUCED MUTATION BREEDING OF CROPS AIMED AT COLD- AND DROUGHT-RESISTANT, HIGH YIELDING AND EARLY MATURING SPECIES.

The Scientific Research Institute for Plant Breeding and Agriculture, Darhan, requested the Agency in 1982 to establish mutation breeding to improve drought tolerance and to shorten the vegetation cycle of wheat and barley. Four experts undertook seven missions to train the counterpart staff, to assist them in solving mutation breeding problems and to establish a long-term programme for breeding crops tolerant to drought. Four fellowships and one scientific visit for a senior staff member were awarded for training abroad. Equipment was provided. This intensive programme has produced important results. A spring wheat mutant variety "Hara 86" with a short vegetation period (under 90 days) was officially released. The variety, induced by fast neutron irradiation, has very good grain quality. Other promising mutant lines were obtained from new irradiations, among which are mutants with high yield potential, earliness, improved drought tolerance and grain quality. Some of these are already awaiting official approval as new varieties. Mutation breeding of spring barley was also initiated, and mutated materials were transferred to another plant breeding institute.

## **MYANMAR**

### **MYA/6/014 NUCLEAR MEDICINE SERVICES**

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APPROVED: **1984**

COMPLETED: **1993-10-18**

TOTAL COST: \$ **215,962**

TO UPGRADE EXISTING FACILITIES FOR IN-VIVO ORGAN IMAGING DIAGNOSIS AND TO ESTABLISH A NUCLEAR MEDICINE UNIT FOR IN-VITRO RADIOIMMUNOASSAY DIAGNOSIS.

With support from the Agency during 1974-83 under the project MYA/7/002, a fairly well equipped and functional Nuclear Medicine Department was established at the Yangon General Hospital (YGH), providing in-vitro and in-vivo diagnostic services. The present project was initiated in 1984 to upgrade the existing facilities for in-vivo organ imaging diagnosis at YGH and to establish an in-vitro radioimmunoassay (RIA) unit at Mandalay General Hospital (MGH). The Agency provided MGH with equipment in 1984 but no project-related activities were carried out because trained nuclear medicine staff had gradually been withdrawn from the hospital since 1986. All the equipment supplied by the Agency was transferred to YGH in 1992. The Agency had already provided a gamma camera to YGH in 1985. Chemicals and reagents have been supplied regularly since the project began. Three expert missions were undertaken between 1990 and 1993, totalling about three months, and four fellowships were awarded for training abroad. Technical staff at YGH have been trained in the use of equipment provided under the project. The RIA laboratory at YGH is reasonably well equipped, has trained staff, and is providing nuclear medicine diagnostic services related to a variety of hormones.

### **MYA/6/015 HORMONAL STUDIES ON PITUITARY ADRENAL DISORDERS**

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APPROVED: **1989**

COMPLETED: **1993-07-26**

TOTAL COST: \$ **64,195**

TO DETERMINE THE INCIDENCE, FACILITATE EARLY DIAGNOSIS AND ASSESS THE VALUE OF THERAPY IN HYPOPITUITARISM FOLLOWING SNAKE BITE.

The project was initiated in 1989 to assess the effects of snake bite on the hypothalamic-pituitary-adrenal axis. The short- and long-term endocrine effects of snake bite were assessed by measuring serum levels of the pituitary, gonadal and adrenocortical hormones by radioimmunoassay (RIA) methods. The Agency provided a gamma counter and regular supplies of reagents and chemicals. Three expert missions totalling about four months were undertaken, and the protocol for in-house assay using bulk reagents was introduced. One fellowship was awarded for training abroad. All the necessary RIA has now been established, and over 100 snake bite survivors have been studied by means of basal hormone measurements. Dynamic studies have been performed to assess pituitary and adrenocortical reserve. The results, particularly those related to hGH, are proving to be of prognostic significance and may influence the future management of snake bite survivors.

## **NICARAGUA**

### **NIC/6/003 NUCLEAR MEDICINE DIAGNOSTIC SERVICES**

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APPROVED: **1988**

COMPLETED: **1993-12-02**

TOTAL COST: \$ **1,829**

TO ESTABLISH A RANGE OF NUCLEAR MEDICINE DIAGNOSTIC SERVICES INCLUDING IN-VITRO AND IN-VIVO TECHNIQUES.

The project was approved in 1988 to establish basic nuclear medicine infrastructure at the Concepcion Palacios Hospital of the Ministry of Health, Managua. The Nicaraguan authorities later gave higher priority to the establishment of radiotherapy facilities. Expert services were therefore provided to review this new orientation, and funds were transferred to Project NIC/6/004 (upgrading radiotherapy services), approved in 1991, for the purchase of cobalt-60 teletherapy equipment for the Oncological Centre of the Ministry of Health's Bertha Calderon Hospital.

### **NIC/8/004 ISOTOPE HYDROLOGY STUDIES OF THE MANAGUA AQUIFERS**

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APPROVED: **1989**

COMPLETED: **1993-12-13**

TOTAL COST: \$ **154,909**

TO USE ENVIRONMENTAL ISOTOPES FOR DETERMINING THE POTENTIAL OF A NEW WATER SUPPLY FOR MANAGUA.

The Nicaraguan Institute for Territorial Studies, Managua, sought Agency assistance to establish environmental isotopic techniques to study the dynamics and origin of groundwater in the Las Sierras aquifer, which is the main source of water supply for the city of Managua. The project was initiated in 1989. Expert services and field and laboratory equipment were provided. Two local researchers were trained in basic hydrogeology. The major areas of recharge and dynamics of the groundwater system have now been identified.

## **NIGERIA**

### **NIR/5/015      NITROGEN FIXATION - MIXED CROPPING SYSTEM**

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APPROVED: **1986**

COMPLETED: **1993-03-19**

TOTAL COST: \$ **141,468**

TO STUDY GRAIN/LEGUME/RHIZOBIUM RELATIONSHIPS WITH A VIEW TO DEVELOPING METHODS FOR ENHANCING BIOLOGICAL NITROGEN FIXATION AND REDUCING THE NEED FOR NITROGENOUS FERTILIZERS.

The project was initiated in 1986 and was implemented at the Anambra State University of Technology, Enugu. The Agency provided laboratory equipment and nitrogen-15 fertilizer. Five expert missions were undertaken and training was given in the use of N-15 isotopes in soil/plant studies through training courses, fellowships and scientific visits. The N-15 technique is now being successfully used in Nigeria to quantify nitrogen fixation and to select soybean cultivars and rhizobium strains capable of supporting high levels of nitrogen fixation under mixed cropping and under stress conditions such as low phosphorus availability. In the research work carried out by the University, the N-15 technique showed that there was no direct transfer in one season of fixed nitrogen from cowpea to rice grown in a mixed cropping system. These activities will be supported under the regional project RAF/5/010.

### **NIR/5/018      NITROGEN FIXATION AND FERTILIZER USE EFFICIENCY**

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APPROVED: **1989**

COMPLETED: **1993-03-19**

TOTAL COST: \$ **67,930**

TO CONTINUE THE PROGRAMME OF STUDYING FACTORS RELATED TO BIOLOGICAL NITROGEN FIXATION USING NITROGEN-15 TECHNIQUES.

The project was initiated in 1989 to resume assistance provided under previous projects, in order to enhance biological nitrogen fixation in legumes grown in the farming systems of the humid tropics, and to assess the influence of the legume on the nitrogen economy of the soil. The project was executed by the Institute of Agricultural Research and Training, Ibadan. The Agency supplied the necessary equipment. Three scientists were trained in the use of nitrogen-15 in soil/plant studies, and two technicians were trained in the use and maintenance of the optical emission spectrometer supplied by the Agency. The Institute now has a fully functional laboratory with adequate staff to carry out work with N-15 in soil/plant studies. The studies undertaken at the Institute revealed that cowpea derived not less than 60% of its nitrogen from the atmosphere (biological nitrogen fixation). The Institute showed, by means of the N-15 technique, that nitrogen enrichment of the soil from nitrogen fixing cowpeas is not automatic, and depends on the cowpea genotype/bradyrhizobium association and the stage at which the cowpea is harvested. The technique was also used to determine the uptake in nitrogen fertilizer timing and placement studies for maize in order to maximize fertilizer utilization by the crop. A follow-up project (NIR/5/023) has been approved.

### **NIR/6/004      RADIATION THERAPY**

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APPROVED: **1989**

COMPLETED: **1993-03-24**

TOTAL COST: \$ **125,999**

TO IMPROVE RADIATION THERAPY SERVICES.

The project was initiated in 1989 with the main objective of reactivating the radiotherapy services of the Lagos University Teaching Hospital. A new cobalt-60 teletherapy unit and a computerized dose-planning system were provided. Experts inspected the site, installed the equipment and trained the local staff in its operation. Some of the staff who were awarded fellowships for training abroad have already returned to Lagos and are assisting in the operation of the radiotherapy services. The brachytherapy facilities at the hospital were upgraded by the donation of two CurieTron machines by the Vienna University Clinic. The Agency provided expert services for the installation of these machines and related training of local staff. Both the teletherapy and brachytherapy facilities are now functional. Phase II of the project (NIR/6/007) is now operational.

### **NIR/6/006      THYROID-RELATED RADIOIMMUNOASSAY UNIT**

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APPROVED: **1991**

COMPLETED: **1993-06-08**

TOTAL COST: \$ **54,894**

TO ESTABLISH A MODERN, WELL EQUIPPED RADIOIMMUNOASSAY LABORATORY FOR MEDICAL DIAGNOSTICS AND OTHER INVESTIGATIONS.

The project was initiated in 1991 to establish radioimmunoassay (RIA) facilities for thyroid-related hormones in eastern Nigeria, where goitre is endemic. A new RIA laboratory was set up at the University of Nigeria Teaching Hospital, Enugu, and supplied with all necessary basic equipment. Bulk reagents for RIA of the thyroid-related hormones T4, T3 and TSH were supplied on a regular basis. A two-month expert mission set up the laboratory and introduced the necessary techniques. Staff were trained both locally and abroad. The laboratory can now carry out assays for thyroid-related hormones using bulk reagents and offer clinical diagnostic services. It is capable of expanding these services to include the diagnosis of disorders not related to the thyroid alone.

## **PANAMA**

### **PAN/2/005 RADIOANALYTICAL LABORATORY**

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APPROVED: **1991**

COMPLETED: **1993-08-26**

TOTAL COST: \$ **106,081**

TO UPGRADE THE ANALYTICAL CAPABILITIES OF THE RESEARCH CENTRE BY ESTABLISHING THERMOLUMINESCENCE ANALYSIS.

The Agency has been assisting the University of Panama in the establishment of the Centre for Research Using Nuclear Techniques (CITEN) for more than ten years. To complement the existing analytical capabilities, the Government requested Agency assistance in the introduction of thermoluminescence techniques for dating archeological objects, and the project was initiated in 1991. CITEN has expanded its analytical capabilities and can now reliably date ceramics and other art objects of interest to the programmes of the national archeological museum and the University. Joint international research projects with Austrian and French institutes have been established for dating ceramics of pre-Columbian cultures.

### **PAN/5/007 PESTICIDE RESIDUES IN FOOD AND AGRICULTURE**

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APPROVED: **1989**

COMPLETED: **1993-09-16**

TOTAL COST: \$ **178,268**

TO SET UP A LABORATORY TO STUDY PESTICIDES IN A TROPICAL ENVIRONMENT USING RADIOISOTOPES; TO ESTABLISH NORMS FOR MAXIMUM LIMITS FOR PESTICIDE RESIDUES IN CROPS.

Since pesticides are used extensively in Panama, it has become necessary to establish their fate in foodstuffs and the environment. In 1988 the Government sought Agency assistance to evaluate Panamanian pesticide practices. In 1989 this project was approved to assist the Panamanian Institute for Research in Agriculture and Livestock (IDIAP) in studies of pesticide residues in various agricultural ecosystems and to evaluate their potential for contamination. The University of Panama collaborated with IDIAP in these studies. The Agency provided basic equipment for establishing a laboratory to measure minute quantities of pesticides in biological matrices. Implementation of the project was guided by expert missions totalling five months. Four fellowships were awarded for training at advanced institutes for about ten months. The laboratory was set up and is now functioning. IDIAP has substantially improved its capabilities to tackle local problems related to pesticide use. Studies have been carried out which show that the widely used carbofuran insecticide in soil leads to acceptable residue levels in tomato and is therefore considered safe. Malathion levels in stored rice are considered safe since they are well within the maximum residue limit. A highly efficient herbicide, 2,4-D, was shown to cause phytotoxicity in tomato. A follow-up project (PAN/5/008) has been approved.

### **PAN/6/007 UPGRADING IN NUCLEAR MEDICINE**

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APPROVED: **1991**

COMPLETED: **1993-12-21**

TOTAL COST: \$ **108,544**

TO UPGRADE NUCLEAR MEDICINE FACILITIES BY PROVISION OF A SINGLE-PHOTON EMISSION COMPUTERIZED TOMOGRAPHY SYSTEM.

The Agency has already assisted the Santo Tomas Hospital, Ciudad de Panama, in upgrading its nuclear medicine service by providing a gamma camera. The Government of Panama requested further Agency assistance in improving the facilities of the service, and this project was approved in 1991 in order to increase the scope of nuclear medicine investigations. The main objective was to upgrade the existing planar imaging system to a tomographic system, SPECT, and to provide experts to train local staff in its operation and the use of the system for patient studies, with emphasis on quality assurance. The gamma camera originally provided by the Agency was upgraded to SPECT capability by the provision of an array processor. Other equipment supplied has made it possible to increase the number of patient studies. Expert training enabled the staff to undertake more sophisticated studies with the upgraded system. The Hospital can now carry out new and more accurate studies on patients, particularly those with cardiac and vascular diseases.

### **PAN/9/004 MONITORING AND CONTROL OF RADIOACTIVE CONTAMINATION**

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APPROVED: **1991**

COMPLETED: **1993-09-16**

TOTAL COST: \$ **79,119**

TO ESTABLISH A SYSTEMATIC PROGRAMME AT NATIONAL LEVEL TO MONITOR AND CONTROL RADIOACTIVE CONTAMINATION.

Panama has embarked on a programme to upgrade its national radiation programme in accordance with recommended international standards. The Agency was requested to assist the Department of Radiological Health (DRH) of the Social Security Fund in establishing such a programme, and this project was approved in 1991. Three expert missions were undertaken and equipment was provided. Individual training was also given for a total period of five months. The DRH provided the necessary accommodation and made available the additional staff required.

Although the objective was not completely achieved, Panama now has the capability to organize a systematic programme at the national level to monitor and control radioactive contamination. A follow-up project (PAN/9/005) has been approved.

## **PERU**

### **PER/9/018 RADIOACTIVE WASTE MANAGEMENT**

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APPROVED: **1989**

COMPLETED: **1993-10-22**

TOTAL COST: \$ **158,819**

TO INTRODUCE TECHNIQUES FOR THE TREATMENT AND CONDITIONING OF RADIOACTIVE WASTES IN ORDER TO ENSURE THEIR PROPER MANAGEMENT.

This project was initiated in 1989 at the Peruvian Institute of Nuclear Energy's Nuclear Research Centre at Huarangal, near Lima. The Agency provided expert and consultant services for the treatment, conditioning and storage of low level radwaste and supplied equipment required for the establishment of a chemical plant for the management of low level liquid radwaste. The two main counterparts received on-site training and fellowships for training abroad that will enable them to plan any future expansion of the facilities resulting from increased production of radioisotopes. A chemical radwaste treatment plant has been constructed to treat segregated radioactive liquid effluents containing long-lived radiolotopes by precipitation treatment before discharge into a dispersal trench system. Solid wastes will be compacted in drums or immobilized by cementation. Chemical precipitation techniques of the radionuclides in liquid radwaste as well as their immobilization in concrete are being further studied in the Research Centre's Laboratories to which the Agency has supplied major items of equipment.

## **PHILIPPINES**

### **PHI/1/016 IMPROVEMENT OF SECONDARY STANDARDS DOSIMETRY LABORATORIES**

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APPROVED: **1989**

COMPLETED: **1993-09-16**

TOTAL COST: \$ **233,535**

TO UPGRADE X-RAY, THERAPY-LEVEL AND HIGH-DOSE METROLOGY AND CALIBRATION SERVICES.

The Philippine Nuclear Research Institute (PNRI) and the Radiation Health Service (RHS) of the Department of Health are collaborating to improve the services of two secondary standards dosimetry laboratories (SSDLs). The project was approved in 1989 and the Agency provided the necessary equipment. An Agency expert assisted the RHS in the installation and testing of the X-ray machine and accessories supplied by the Agency, and advised on the determination of calibration qualities. A staff member of the PNRI SSDL was granted a fellowship for training abroad. The PNRI SSDL has developed dosimetry methods for standardizing radiation application in industry as well as dose quality control of its cobalt-60 multipurpose irradiation facility. The PNRI SSDL also participated in the International Dose Assurance Service (IDAS) of the Agency's Dosimetry Section, and accuracy was found to be plus or minus 15%. Routine calibration of radiation monitoring instruments used in research, industry and medicine is being carried out at both SSDLs. Project activities were delayed owing to malfunction of the X-ray machine at RHS in 1992, but the machine was repaired and re-installed in 1993 and is now being used to train local medical physicists in calibrating radiation-measuring instruments in the low and medium energy range. The RHS staff also evaluate sources of errors in the determination of dose delivered to cancer patients in radiation therapy centres and have conducted consistency tests of dosimeters. The safe application of ionizing radiation has been improved on a national scale.

### **PHI/7/005 UPGRADING OF THE RADIATION CYTOGENETICS LABORATORY**

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APPROVED: **1989**

COMPLETED: **1993-09-16**

TOTAL COST: \$ **62,642**

TO UPGRADE THE FACILITIES AND PERSONNEL OF THE RADIATION CYTOGENETICS LABORATORY.

The Radiation Cytogenetics Laboratory of the Philippine Nuclear Research Institute sought Agency assistance to upgrade its facilities and personnel to meet the demand for biological dosimetry services and to develop technical expertise in the field of radiation and medical cytogenetics. The project was approved in 1989. The Agency provided equipment, and two Agency experts gave advice on biological dosimetry for radiation protection and clinical cytogenetics applications in human health problems. They also assisted in setting up radiation cytogenetics monitoring protocols through biological dosimetry for radiation protection of occupational workers in population monitoring. A scientific visit was awarded. The laboratory is now adequately equipped and the staff has conducted research work on biological indicators of radiation exposure. They have also organized regular training courses for biologists and physicians. The laboratory now provides biological dosimetry services for radiation workers as a supplement to the regular national personnel radiation monitoring system.

## **POLAND**

### **POL/9/009      WHOLE-BODY COUNTING**

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APPROVED: **1989**

COMPLETED: **1993-03-18**

TOTAL COST: **\$ 73,101**

TO UPGRADE THE EXISTING WHOLE BODY COUNTER.

This footnote-a project was approved in 1989 to enable the Radiation Protection Department of the Institute of Atomic Energy, Swierk, to upgrade the measuring equipment for the existing whole body counter and to make the relevant expertise and information more easily available. The project did not start until 1990, when the cost was shared between the USA and the Agency, and the necessary equipment was supplied. Direct analysis of the measured spectrum is now possible, and better accuracy has been achieved in the estimation of radionuclide contents in the body. An advisory mission on whole body counting techniques and practices was undertaken in 1991 and fellowship training was awarded to the head of the group.

### **POL/9/016      HEALTH EFFECTS OF IONIZING RADIATION**

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APPROVED: **1992**

COMPLETED: **1993-01-29**

TOTAL COST: **\$ 20,795**

TO ORGANIZE A SEMINAR ON RADIATION-INDUCED DISEASES AND RELATED MEDICAL PROBLEMS, THEIR DIAGNOSIS AND TREATMENT.

This project followed a successful series of medical seminars held in the former USSR in 1990 as part of the Agency's activities concerning the radiological consequences of the accident at Chernobyl nuclear power plant. The Polish medical community wished to organise an international seminar on the health effects of ionizing radiation. Four specialists from Sweden, USA and Japan were invited to make presentations at a three-day seminar in Warsaw in October 1992, hosted by the Polish National Atomic Energy Commission and attended by members and guests of the Polish Nuclear Medicine Society.

## **PORTUGAL**

### **POR/1/007      A MOESSBAUER STUDY OF REDOX EQUILIBRIA IN GLASSES**

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APPROVED: **1991**

COMPLETED: **1993-06-24**

TOTAL COST: **\$ 51,162**

TO STRENGTHEN THE CAPABILITY OF THE PHYSICS DEPARTMENT OF THE UNIVERSITY OF COIMBRA IN THE USE OF MOESSBAUER SPECTROSCOPY TECHNIQUES FOR THE CHARACTERIZATION OF PHYSICO-CHEMICAL PROCESSES IN GLASSES.

The project was approved in 1991 as a follow-up to POR/1/004, under which a Moessbauer spectroscopy system was supplied to the Physics Department of the University of Coimbra. It was aimed at understanding the properties and structure of amorphous silicate materials such as glasses. The Moessbauer spectrometer was used to measure the vibrational spectroscopy of iron-bearing titanium structures and thermodynamic properties. A new set of radioisotope sources was provided for the spectrometer. As a result of a scientific visit to the Carnegie Institute, Washington, DC, to study Raman and other spectroscopic techniques, two counterpart staff members built a high performance cryogenic facility for the spectrometer. Several spectra of glass samples were obtained at 298K and 95K. An expert from the Geophysical Laboratory of the Carnegie Institution undertook three advisory missions mainly to do with the ongoing study of solubility mechanisms of ferrous and ferric iron in titanium-silicate glasses. The project has enabled the Physics Department to amass information on the effects of composition, temperature, etc., on the structural roles of ferric and ferrous iron in glasses.

### **POR/4/012      RESEARCH REACTOR MODERNIZATION**

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APPROVED: **1987**

COMPLETED: **1993-06-24**

TOTAL COST: **\$ 779,291**

TO IMPROVE THE OPERATION AND SAFETY OF A RESEARCH REACTOR THROUGH MODERNIZATION.

This project was approved in 1987 in order to modernize the research reactor supplied to the National Laboratory of Engineering and Industrial Technology, Sacavem, in the early 1960's by the USA. Leaks in the primary cooling circuit and the pool liner had limited the operation of the reactor, which is used mainly for production of radioisotopes for medical and other applications. Some components of the circuit were replaced. Equipment was provided from the former Soviet Union and France, and reactor stack monitoring equipment was designed and built at the Agency's Laboratories in Seibersdorf. Four expert missions were undertaken, mainly to assist in a review of safety analysis for the refurbished 1-MW reactor, and in neutron flux measurements. The principal counterpart visited the Agency's headquarters in Vienna for consultation with the technical staff; two counterparts received extended fellowship training. The project has led to increased utilization of the reactor facility.

**POR/5/003 NITROGEN FIXATION**

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APPROVED: **1989**COMPLETED: **1993-12-31**TOTAL COST: \$ **73,787**

TO EMBARK ON SOIL NITROGEN FIXATION STUDIES TOWARDS IMPROVED SOIL MANAGEMENT AND PRODUCTIVITY.

This footnote-a project was approved in 1989 and put into operation by an extrabudgetary contribution from the USA in order to study fertilizer use efficiency in the major wheat-growing areas of Portugal. Three expert missions were undertaken to train the staff at the National Agricultural Research Centre, Oeiras, in nitrogen-15 techniques. The Agency supplied equipment and N-15 fertilizer. The experts also assisted the counterparts to locate potential field research sites and to plan and initiate field research programmes on soil-water-fertilizer use efficiency at the research plots. Plant samples were analysed at a laboratory in the USA, and intercomparison of the results was performed at the Agency's Laboratories at Seibersdorf. The work is continuing under Project POR/5/004.

**POR/8/004 ISOTOPE HYDROLOGY**

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APPROVED: **1986**COMPLETED: **1993-03-18**TOTAL COST: \$ **252,960**

TO UPGRADE THE NATIONAL RADIOCARBON MEASURING LABORATORY BY INTRODUCING MASS SPECTROMETRY.

The project was initiated in 1986 as a follow-up to Project POR/8/003 (1983-86) to upgrade the environmental isotope analytical laboratory at the Institute of Nuclear Sciences and Technology (formerly the National Laboratory of Engineering and Industrial Technology). The Agency provided equipment for measuring carbon-14, tritium and other environmental isotopes. In collaboration with other research organizations, the counterparts investigated the origin of salination in the coastal aquifers of the Algarve Region and in the aquifers of the Setubal Region, the meteoric water line of Portugal, which required the systematic isotopic analysis of precipitation water collected in several meteorological stations, and a study of the environmental impact from the Urgeirica uranium mine. Eight expert missions were undertaken by Agency staff members and external experts, who advised on calibration procedures for the carbon-14 and tritium measurements, field sampling methodology, the interpretation of results and on isotope techniques for groundwater pollution risk assessment. One counterpart was awarded group fellowship training at the Agency's Isotope Hydrology Laboratory in Vienna and a scientific visit. The equipment supplied under the project and the techniques acquired in the measurement of environmental isotopes are being used routinely. A follow-up project on the study of Aveiro's cretaceous aquifer (POR/8/007), has been approved.

**POR/9/007 ENVIRONMENTAL RADIOACTIVITY MONITORING**

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APPROVED: **1987**COMPLETED: **1993-09-30**TOTAL COST: \$ **131,015**

TO STUDY THE ENVIRONMENTAL BEHAVIOUR OF RADON, TO ESTABLISH COUNTRYWIDE RADIOLOGICAL ENVIRONMENTAL MONITORING AND TO PERFORM INDIVIDUAL AND COLLECTIVE DOSE ASSESSMENTS FOR THE POPULATION.

Under this footnote-a project, approved in 1987 and funded by the Federal Republic of Germany, a national radiological environmental surveillance programme was designed and established by the Radiological Protection and Safety Department of the National Laboratory for Engineering and Industrial Technology (LNETI) at Sacavem. The Agency supplied the necessary equipment for the establishment of a central monitoring station at LNETI. The local authorities provided equipment for two other monitoring stations at the Azores and Castelo Branco (near the Spanish border). Environmental surveillance of two rivers in the region bordering Spain, which planned the construction of a nuclear power plant in the vicinity, was performed on a regular basis. A programme and methods for indoor and outdoor radon monitoring were developed, with assistance from an Agency expert; for indoor radon measurements, the programme was expanded to cover the whole country. An outdoor radon measurement programme was developed for monitoring the uranium tailings zone at Urgeirica. However, internal administrative problems prevented the programme for outdoor radon monitoring at other uranium mining and milling sites from being fully implemented. Two fellowships were awarded for training abroad. A national environmental surveillance programme has now been established in Portugal, and routine monitoring activities are continuing.

**POR/9/008 RADIATION AND ENVIRONMENTAL PROTECTION**

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APPROVED: **1988**COMPLETED: **1993-04-26**TOTAL COST: \$ **183,937**

TO IMPROVE ENVIRONMENTAL RADIATION MONITORING OF PORTUGUESE TERRITORY (EXCLUDING MARINE SURVEILLANCE AND RADIATION DOSIMETRY) AND TO STRENGTHEN RADIATION PROTECTION CAPABILITY IN NUCLEAR MEDICINE.

In line with recommendations of a RAPAT mission to Portugal in 1986, the National Laboratory of Engineering and Industrial Technology (LNETI), Sacavem, established a national radiological and environmental surveillance programme and sought Agency assistance to implement parts of it. The initial request (POR/9/007) was approved as a footnote-a project in 1987 and received extrabudgetary funding from Germany in the same year. The present project was initiated in 1988 for reasons of urgency. A co-ordinated programme of activities was set up in Vienna

in 1988 between the Agency, the counterparts, and representatives of the donor country. Under this present project, the Agency supplied alarm detectors for the environmental network, as well as other equipment, expert services and fellowships. The project covered three areas: (1) environmental monitoring, including advice on the establishment of a national network, surveillance of mines, rivers and effluent discharges; (2) personnel dosimetry, including specialized training; and (3) radiation protection in industry and medicine, including a three-month fellowship and training on the whole body counter supplied by the Agency. The alarm detectors provided by the Agency (from Poland) were returned unused as the counterpart decided to install another system purchased locally. The equipment and services furnished under this project and its related project POR/9/007 enabled the national radiological and environmental protection programme to be implemented. LNETI, in co-operation with other national institutions, is now actively involved in the operation of the monitoring stations, radiation exposure control, and radiation protection.

## **REGIONAL AFRICA**

### **RAF/0/003                      MANPOWER DEVELOPMENT IN THE AFRICA REGION**

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APPROVED: **1989**

COMPLETED: **1993-01-29**

TOTAL COST: **\$ 2,440,930**

TO PROVIDE FELLOWSHIP TRAINING AND SCIENTIFIC VISITS REQUESTED BY COUNTRIES IN THE AFRICA REGION WHICH CANNOT BE DIRECTLY INCLUDED AS PART OF AN APPROVED PROJECT.

This project was initiated in 1989 as part of the Agency's efforts to support African Member States in setting up and strengthening their national infrastructure for research, development and practical applications of nuclear energy. The aim was to upgrade the skills and enhance the capabilities of the human resources required to implement activities in nuclear science and technology applications. The project was designed as a framework for the funding of fellowships and scientific visits relevant to the countries' priorities and needs that were not planned under an operational Agency-assisted technical project. Special attention was attached to training aimed at furthering Agency-supported activities pertaining to the applications of nuclear techniques in areas of social and economic interest. Training was also arranged to develop the basic services necessary to sustain any nuclear technology infrastructure, such as radiation protection and maintenance and repair of nuclear instruments. Under the project, 228 fellowships have been awarded, totalling more than 1500 months. The project was evaluated in 1992 and its effectiveness in achieving its main objectives confirmed. However, it appears that the project did not ensure an equitable share of training opportunities among the concerned African countries, to the detriment of the least developed. The main reason seems to be that the competent authorities in some countries were not aware of the value of such a training framework for building up national capabilities.

### **RAF/5/006                      REPRODUCTION, NUTRITION AND HEALTH OF LIVESTOCK**

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APPROVED: **1985**

COMPLETED: **1993-05-07**

TOTAL COST: **\$ 1,451,659**

TO PROMOTE THE USE OF RADIOIMMUNOASSAY AND RELATED TECHNIQUES IN STUDIES ON LIVESTOCK REPRODUCTION, NUTRITION AND HEALTH AND TO FACILITATE REGIONAL CO-OPERATION AND EXCHANGE OF INFORMATION BETWEEN COUNTRIES IN AFRICA.

This regional project was established in 1985 to improve livestock production in Africa through research studies on the reproductive performance and nutritional status of indigenous breeds of cattle and sheep, as well as through the establishment of appropriate and effective systems of disease diagnosis and control. Central to this programme has been the use of FAO/IAEA radioimmunoassay (RIA) and ELISA kits developed and distributed by the Agency to scientists throughout the region. A full-time regional expert and numerous expert missions assisted the participating countries. Regional Training Courses were held on the ELISA system and data analysis. In identifying nutritional constraints to improving reproductive performance, the FAO/IAEA RIA system for progesterone measurement has provided the basis for determining reproductive cyclicity in local breeds of both cattle and sheep in a number of African countries. Changes in nutrition were subsequently evaluated for their ability to improve cyclicity. In 1992, some 25 scientific papers were published on these studies. The work on animal health has focussed on the two most important diseases affecting livestock in Africa, namely, rinderpest and trypanosomiasis. In the case of rinderpest the aim was to monitor national rinderpest vaccination programmes in 24 African countries using an FAO/IAEA ELISA-based system. In 1992, the Agency published detailed sero-monitoring results from 19 countries involving the testing of over 100 000 cattle sera. In support of the FAO/IAEA programme of research into improving the diagnosis of trypanosomiasis, the development of fully validated and standardized ELISA kits for the detection of the three main trypanosomiasis affecting cattle and one affecting camels was completed in 1992. This regional project has consolidated activities which started under national TC projects and has ensured the continued supply of crucial reagents after termination of the national projects. It has also contributed to the dissemination of research findings within the region. New related regional projects (RAF/5/026-8) have been approved.

## REGIONAL ARAB STATES

### **RAB/0/002 PROJECT FORMULATION MISSION FOR UNDP PROJECT SYR/92/005**

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APPROVED: **1992**

COMPLETED: **1993-10-19**

TOTAL COST: \$ **9,385**

TO ASSIST THE ATOMIC ENERGY COMMISSION OF SYRIA TO REVIEW PARAMETERS FOR A PILOT PLANT ON URANIUM RECOVERY.

Syria is considering the option of a future nuclear power programme and desires to study the possibility of developing a domestic uranium supply as one component in the overall programme. A commercial fertilizer operation at Homs produces phosphoric acid from phosphatic rock mined in the region which contains about 60 to 100 parts per million of uranium. The uranium recovery from the phosphoric acid - same as the uranium yellow cake available on the open world market - is one step in the overall multi-stage reactor fuel production process. The basic technology to extract uranium from phosphoric acid is well known, but industrialization of the process depends on the particular and often unique characteristics of the phosphoric acid produced in each specific industrial plant. The mission of an Agency expert, which was funded extrabudgetarily by the UNDP, was to assist the counterparts at the Atomic Energy Commission of Syria to review all parameters for a Pilot Plant on uranium recovery from the phosphoric acid plant at Homs. His revision of a draft Project Justification document addressed construction, process engineering and operating cost projections, a credible workplan and, most importantly, an economic justification of the project, which, in view of the present low price of yellow cake uranium on the world market, would be very unprofitable. The Syrian authorities stressed the technology training aspect of the proposal, as this would enhance the technology transfer to its staff, who had previously participated in a TC project (SYR/3/003) on uranium extraction through a microplant facility. The Project Document which was produced after the Agency expert mission has been transmitted to the Syrian authorities and the UNDP.

### **RAB/8/003 TRAINING OF TECHNICIANS IN WATER RESOURCES USE IN LDAC**

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APPROVED: **1989**

COMPLETED: **1993-10-19**

TOTAL COST: \$ **20,610**

TO STRENGTHEN THE UN-DTCD TRAINING PROGRAMME BY INTRODUCING NUCLEAR TECHNIQUES FOR HYDROLOGICAL/GEOLOGICAL INVESTIGATIONS IN THE AL-HAIMA EXPERIMENTAL CATCHMENT, YEMEN ARAB REPUBLIC.

In view of its rising demand for water (for households, industries and agriculture), the Republic of Yemen sought Agency assistance for advice on planning and management of its groundwater resources. Through extrabudgetary funding by the UNDP, with the IAEA as executing agency, the project was initiated in 1989. An Agency staff member undertook a two-week mission to the National Water and Sewerage Authority, Taiz, to discuss hydrogeological problems concerning a catchment area located about 20 km from Taiz. He later visited the experimental area, advised on sampling procedures and prepared a sampling programme for the study. Samples were collected and sent to the Agency's laboratory in Vienna, where the isotopic analyses were undertaken. The counterpart was awarded a three-month fellowship training at the Agency, where he discussed the results of the analysis with the technical staff in the Isotope Hydrology Section and obtained training in the interpretation of environmental isotope data. The results of the isotopic study established the rate of recharge of the aquifers in the catchment area, estimated to be in the order of 1-8% of the amount of precipitation. A final report recommended that a pumping rate in the order of 50 to 100 litres per second would seem appropriate for the replenishment of the aquifers.

## REGIONAL ASIA & PACIFIC

### **RAS/0/012 REGIONAL/WASP USERS WORKSHOP (RCA)**

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APPROVED: **1987**

COMPLETED: **1993-01-29**

TOTAL COST: \$ **23,498**

TO ORGANIZE A WORKSHOP TO COMPARE WASP OUTPUTS OBTAINED BY VARIOUS COUNTRIES IN THE REGION AND TO INTERPRET THE DATA.

This Regional (RCA) Workshop for WASP users in the region was held in Jakarta on 7-11 December 1987 with a view to facilitating long-term electrical generation planning studies and determining the optimum share of nuclear power. There were 23 participants/observers from 10 RCA Member States. The Proceedings were published as IAEA TECDOC 474 in October 1988.

**RAS/0/014      MANPOWER DEVELOPMENT IN THE ASIA AND PACIFIC REGION**

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APPROVED: **1989**COMPLETED: **1993-01-29**TOTAL COST: **\$ 2,241,693**

TO PROVIDE FELLOWSHIP TRAINING AND SCIENTIFIC VISITS REQUESTED BY COUNTRIES IN THE ASIA AND PACIFIC REGION WHICH CANNOT BE DIRECTLY INCLUDED AS PART OF AN APPROVED PROJECT.

Under this project, initiated in 1989, 220 fellows from all recipient Member States in the Asia and Pacific Region received training for an average period of three to six months. Another 73 scientific visits were awarded for periods of one to four weeks. The total period covered by fellowships and scientific visits was 1304 months. The project has contributed significantly to the development of trained manpower in the region.

**RAS/5/015      MUTATION BREEDING OF FOOD LEGUMES**

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APPROVED: **1985**COMPLETED: **1993-06-15**TOTAL COST: **\$ 216,321**

TO PROVIDE RADIATION-INDUCED MUTANT LINES WITH GENETIC IMPROVEMENT IN ONE OR MORE AGRONOMICALLY RELEVANT CHARACTERS WITH THE AIM OF DEVELOPING IMPROVED CULTIVARS OF FOOD LEGUMES.

Mutation breeding is the most effective technique used by local crop breeders to improve crops. Under this regional project, initiated in 1985, eight missions were undertaken by five experts to disseminate mutation breeding techniques and to improve biotic/abiotic stress resistance in legumes. Three fellowships and 12 scientific visits were awarded for training abroad. A modest amount of equipment was effectively distributed among 15 participating institutes. A Regional Training Course with 15 participants was held in India.

**RAS/6/011      RADIOIMMUNOASSAY OF THYROID HORMONES**

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APPROVED: **1986**COMPLETED: **1993-01-29**TOTAL COST: **\$ 901,811**

TO REDUCE COSTS AND INCREASE ANALYTICAL RELIABILITY IN THE RADIOIMMUNOASSAY OF THYROID-RELATED HORMONES (T4, T3, TSH).

This regional project was approved in 1986 and achieved a number of successes. Bulk reagent methodology, as opposed to commercial kits, has been successfully introduced in over 100 participating laboratories in 14 countries, and over 600 scientists have been trained in the technique. The cost of assays has been reduced by a factor of 10 in real terms, with consequent increase in workloads of over 100%, on average. Regional, and in some cases national, self-sufficiency has been achieved for all primary reagents required, except for iodine-125, which is still imported. Analytical reliability of the assays has been assured by the establishment of good radioimmunoassay practice, with special attention to quality control. A regional scheme for reagent sharing and distribution has been set up. A regional external quality assessment scheme established under the project is continuing without further Agency support. Research studies have been stimulated, particularly in the areas of neonatal hypothyroidism and endemic goitre. An analogous regional project (RAS/6/018) on diagnosis of hepatitis B was initiated in 1992 with similar methodology and project strategy.

**RAS/8/059      ISOTOPE HYDROLOGY WORKSHOP AND SEMINAR SUPPORT (RCA)**

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APPROVED: **1987**COMPLETED: **1993-01-29**TOTAL COST: **\$ 17,555**

TO PROVIDE DOMESTIC TRAVEL AND FACILITIES TO SUPPORT AN RCA REGIONAL WORKSHOP AND AN EXECUTIVE MANAGEMENT SEMINAR IN BEIJING.

The Workshop on Isotope Hydrology for Asia and the Pacific and the Regional Executive Management Seminar on Isotope Techniques on Water Resources Development and Management were organized by the Agency and held in Beijing on 15-26 June 1987. The meetings assessed the results achieved during the RCA project on isotope applications in hydrology and sedimentology. An extrabudgetary contribution from Australia funded publication as a TECDOC by the Research Institute of Uranium Geology, Beijing, of all the papers presented at the two meetings and provided domestic travel.

APPROVED: 1987

COMPLETED: 1993-11-30

TOTAL COST: \$ 3,410,688

TO PROMOTE THE INTRODUCTION OF ISOTOPE AND RADIATION TECHNOLOGY IN MAJOR REGIONAL INDUSTRIES THROUGH TRAINING, DEMONSTRATIONS AND INFORMATION EXCHANGE.

This UNDP project, which was also funded by Japan, Australia and IAEA/TC, constitutes Phase II of the RCA States' endeavour to obtain economic and social gains to participating countries through the expanded use of isotopes and radiation technologies. More specifically, the overall aim of the project was to increase the use of nuclear technology in regional industries, including minerals, paper, rubber, steel, coal, cable manufacture, surface coating and medical products sterilization and thus to improve regional economic development and industrial competitiveness. The major objectives of the project have certainly been achieved. In the area of tracer technology, 42 persons participated in Regional Training Courses and 364 in national training activities. Ten demonstrations were carried out in industry. The objective in the field of non-destructive testing (NDT) was to establish indigenous rather than imported services. All participating countries have formed NDT societies or co-ordinating committees. A total of 156 persons participated in Regional Training Courses and 1289 in National Training Courses; an additional 503 attended National Seminars and Workshops and 69 attended Regional Workshops. In radiation technology, eight of the twelve participating countries now have commercial radiation facilities for industrial radiation sterilization. A total of 306 persons attended Regional Training Courses. In nucleonic control systems (NCS), 100 senior technicians and engineers received training. The use of NCS for coal processing is being demonstrated at a lignite mine in Thailand. Regional Training Courses were attended by 115 persons, and over 600 senior administrators attended national promotional activities. Through these efforts, the project has been successful in raising awareness throughout the region of the potential for this technology to increase productivity and quality as well as to reduce raw material inputs and energy requirements. This has directly or indirectly led to an investment of more than US\$ 190 million since the project was initiated in 1987: US\$ 40 million from the Government sector and US \$150 million from the private sector. The two biggest areas for investment were radiation technology (US \$117 million) and nucleonic control systems (US \$71 million).

## REGIONAL LATIN AMERICA

RLA/0/009

NUCLEAR INFORMATION (ARCAI X)

APPROVED: 1985

COMPLETED: 1993-09-16

TOTAL COST: \$ 679,428

TO PRODUCE A REGIONAL SYSTEM OF NUCLEAR INFORMATION CENTRES THAT WILL PERMIT THE SHARING OF INFORMATION RESOURCES.

The project was approved in 1984 and initiated in 1985 to assist Latin American countries in developing their nuclear information resources and services. Requests for assistance in the area had been received from several Latin American countries and it was necessary to co-ordinate the Agency's assistance in an integral programme to benefit the whole region. The existence of informal subregional groups which already received nuclear information services from Argentina, Brazil and Mexico provided a favourable background for the project, particularly since these three focal Member States were well advanced in technical know-how and already possessed modern nuclear information technology and facilities. Argentina developed a librarian automation package that is now being used in the nuclear information centres of the region. Brazil developed a collection catalogue (RECOBI) and provided document delivery services to other centres so that information could be shared within the region. Brazil also created a handbook (Standardized Nuclear Information Centre Package) which other countries could use to develop their own nuclear information centres and which is now also being used in other regions to establish nuclear information centres. Under this package, more than US \$200 000 worth of equipment was provided to the region. Two Co-ordination Meetings, five Regional Training Courses, three Workshops and one Evaluation Meeting were held. Over 70 staff within the region were trained in nuclear information, including library automation and new information technologies, library processing, INIS, management and promotion. Fifteen fellowships and scientific visits totalling 159 months were provided. The infrastructure of nuclear information centres in the region has been improved (in Chile, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Panama, Paraguay, Peru and Uruguay, ten of the fifteen participating countries). Great improvements have been made in the efficiency of information professionals, co-operation with other information centres, the level of nuclear information services to the users, and the participation of Latin American countries in the Agency's Nuclear Information System (INIS).

RLA/0/014

MANPOWER DEVELOPMENT IN THE LATIN AMERICA REGION

APPROVED: 1991

COMPLETED: 1993-12-31

TOTAL COST: \$ 1,084,155

TO MAKE FUNDING AVAILABLE FOR FELLOWSHIP TRAINING AND SCIENTIFIC VISITS REQUESTED BY COUNTRIES IN THE LATIN AMERICA REGION WHICH COULD NOT BE DIRECTLY INCLUDED AS PART OF AN APPROVED PROJECT.

The project was initiated in 1991 and has provided funding for fellowships and scientific visits requested by member states of the region outside the framework of the approved national projects. Sixty-four scientific visits for a total of 34 months were awarded to nationals of 10 countries, and 77 fellowships to nationals of 15 countries for a total of 385

months, about 28% of which were hosted by countries of the region. The following areas of study were covered: 24.5% to the application of isotopes and radiation in medicine; 24.5% to safety in nuclear energy, including radiation protection; 16.7% to nuclear engineering and technology, including nuclear instrumentation; 13.8% to the application of isotopes and radiation in agriculture; and 8% to the application of isotopes and radiation in industry and hydrology. The remaining 12.5% covered different fields such as general atomic energy development, nuclear physics and chemistry and the application of isotopes and radiation in biology.

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**RLA/5/023                      NUCLEAR TECHNIQUES IN AGRICULTURE (ARCAL XI)**

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APPROVED: **1988**

COMPLETED: **1993-04-30**

TOTAL COST: \$ **109,554**

TO CO-ORDINATE REGIONAL EFFORTS IN AGRICULTURAL RESEARCH; TO STUDY SPECIFIC PROBLEMS WITH ISOTOPE-AIDED TECHNIQUES RELATED TO SOIL-PLANT-WATER-FERTILIZER INTERACTIONS.

ARCAL Member States requested the Agency to establish a project to co-ordinate efforts already being implemented under several national TC projects on soil research and under a Co-ordinated Research Programme on the use of isotopes in studies to improve yield and nitrogen fixation of common beans in Latin America, initiated in 1987. The Agency approved a two-year footnote-a project for this purpose in 1988 and upgraded it in the same year. A regional expert was recruited for one year to provide technical support and advice on the execution of all soil science projects in Latin America. This included continuous contact with counterparts in ARCAL Member States concerning expert missions, provision of equipment, training and periodic follow-up visits to countries in the region. The expert assisted in the planning and design of isotope-aided studies to be conducted within the framework of the TC projects. A training manual on the use of nuclear techniques in soil-plant studies was translated into Spanish and distributed in the region. The project was discontinued owing to inadequate funds, and therefore the objectives were only partly achieved.

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**RLA/8/006                      NON-DESTRUCTIVE TESTING NETWORK**

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APPROVED: **1984**

COMPLETED: **1993-08-26**

TOTAL COST: \$ **1,084,155**

TO ESTABLISH A NON-DESTRUCTIVE TESTING NETWORK: (A) APPLICATION OF PROCEDURES, STANDARDS AND TECHNIQUES; (B) TRAINING; (C) ISSUE OF LICENSES AND CERTIFICATES OF COMPETENCE.

As a result of a meeting in February 1984 with the United Nations Fund for Science and Technology for Development (UNFSTD), UNIDO, the IAEA and the Italian authorities in Milan, the Italian Government supported this project with a contribution of US \$1.6 million over a three-year period, channelling the funds through UNFSTD with the IAEA as the executing agency. The provision of basic equipment for training purposes and of the international lecturers was co-ordinated in Italy through a subcontract with the Centro Informazioni Studi Esperienze (CISE). The surge of activity in NDT within Latin America and the Caribbean has attracted the attention and respect of the industrialized world. The region's impact on and contribution to the work of ISO Sub-committee 7 is highly regarded. Within the region, every country can cite specific benefits, savings and increased capabilities directly due to its participation in the regional NDT project. With the large number of trained specialists now available, the need to hire NDT services from industrialized countries has been drastically reduced. The main objective, that of creating an autonomous NDT capacity, has largely been achieved. All countries are now able to provide training nationally up to the second of the three internationally agreed levels in most of the basic techniques. Although a few countries still need some assistance at the third level, the knowledge and experience now available are sufficient to make regional autonomy viable in the near future. There are currently over one hundred registered specialists in the region capable of giving recognized training. There is now a well established base in Latin America and the Caribbean for the implementation of in-service inspection programmes critical to the success not only of nuclear power programmes but also of the region's industrial development in general. These activities were closely tied to the regional projects RLA/8/005 and RLA/8/013.

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**RLA/9/009                      RADIATION PROTECTION (ARCAL I)**

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APPROVED: **1986**

COMPLETED: **1993-08-26**

TOTAL COST: \$ **684,166**

TO HARMONIZE RADIATION PROTECTION PRACTICES.

Simultaneously with the development in Latin America of programmes involving nuclear technology in its various forms, special efforts have been made to develop and implement appropriate radiation protection programmes. To this end, a project to harmonize radiation protection practices by enhancing multilateral co-operation in countries of the Latin America region was approved in 1986. The project was established in support of a regional initiative of five sub-Andean countries (Bolivia, Colombia, Ecuador, Peru, Venezuela), and by the end of 1990 the number of participating countries had increased to 15. In addition to Agency assistance, financial support by Germany and France made this project feasible. Important in-kind contributions were received from Argentina, Brazil, Colombia, Mexico and the Pan-American Health Organization, by the provision of experts, equipment or by the award of fellowships. The project provided over 24 months of expert missions. Over 600 individuals were trained during 1986-1990. Four Regional

Seminars and over 40 Regional and National Training Courses were organized on specialized radiation protection topics. Activities included a survey of national training activities on radiation protection offered in the region, analysis of the technical status of domestic radiation protection regulations promulgated in the countries, RAPAT missions to six countries, several co-ordinated studies of selected radiation protection topics, regional intercomparison experiments, and procurement of equipment for training events as well as for upgrading existing facilities in some countries. The national safety infrastructures have been strengthened; radiation protection approaches and procedures in the region are better harmonized; professional contacts and exchange of experience among radiation protection experts have intensified; greater awareness of radiation protection needs has been created; and the dissemination of specific skills and manpower development has increased. A follow-up project to upgrade the regulatory framework was initiated in 1991.

## **REGIONAL MIDDLE EAST AND EUROPE**

### **RER/5/003 FOOD IRRADIATION**

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APPROVED: **1987**

COMPLETED: **1993-12-02**

TOTAL COST: **\$ 161,133**

TO PROMOTE AND CO-ORDINATE THE APPLICATION OF FOOD IRRADIATION TECHNOLOGY IN SEVERAL MEMBER STATES IN EUROPE AND THE MIDDLE EAST.

At the request of a number of Member States in the region, including Bulgaria, former Czechoslovakia, Iran, Iraq, Jordan, Poland, Syria, Turkey and former Yugoslavia, the Agency initiated a regional project on food irradiation in 1987 to provide assistance in programme planning and the promotion and harmonization of food irradiation regulations, in addition to assisting participating Member States to assess the technological and economic feasibility of food irradiation. Encouragement of trade in irradiated foodstuffs and quality assurance of the irradiation process were also envisaged. The Agency organized two Co-ordination Meetings to review and refine the programmes of the participating Member States, and four workshops on current food irradiation procedures for pilot-scale and techno-feasibility studies. At a Workshop in Poland, a novel technology using electron accelerators was demonstrated. Six missions were undertaken by Agency experts to assist in setting up programmes and advising on various aspects of food irradiation, quality assurance, public information and acceptability. A follow-up review of the project will be undertaken in 1994 to plan an accelerated programme on food irradiation as a future TC project.

### **RER/6/002 RADIOPHARMACEUTICALS IN THE MIDDLE EAST**

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APPROVED: **1988**

COMPLETED: **1993-10-21**

TOTAL COST: **\$ 282,726**

TO PROVIDE TRAINING IN QUALITY CONTROL OF RADIOPHARMACEUTICALS AND RADIATION PROTECTION PRACTICES RELATING TO THEIR USE.

This regional project was approved in 1988. Five Regional Workshops and two Training Workshops were organized dealing with preparation and quality control of short-lived pharmaceuticals produced mainly from generators and cyclotrons, radiation protection and safety practices in radiopharmacy, radioimmunoassay (RIA) and related assays, nuclear medicine, data processing in RIA and the use of bulk reagents. Basic aspects of the preparation, quality control and use of the most widely used "first generation" radiopharmaceuticals, mainly of technetium-99m preparations, and RIA, were taught through lectures, practical exercises and discussions. One fellowship was awarded for training abroad. A total of about 90 individuals participated in these training activities. Phase II of the project (RER/6/005) has been approved.

## **REPUBLIC OF KOREA**

### **ROK/1/007 STANDARDIZATION OF NEUTRON MEASUREMENTS**

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APPROVED: **1983**

COMPLETED: **1993-08-26**

TOTAL COST: **\$ 224,429**

TO ESTABLISH A NEUTRON CALIBRATION FACILITY AND TO ACHIEVE ABSOLUTE MEASUREMENT OF NEUTRON SOURCE INTENSITY, ENERGY SPECTRUM, NEUTRON FLUX AND NEUTRON DOSE OF MIXED NEUTRON-GAMMA RADIATION.

This footnote-a project, funded by an extrabudgetary contribution from the USA, was initiated in 1983 to establish a neutron calibration laboratory at the Radiation Laboratory of the Korea Research Institute of Standards and Science (KRISS). Four experts undertook six missions to train KRISS staff on the operation and calibration of the image analyser system provided by the Agency and to advise them on the development of thermal and cold neutron beam techniques. One twelve-month fellowship was funded by the USA, and a project-related scientific visit was also awarded. A functional, well equipped laboratory with trained personnel, capable of calibrating and standardizing neutron measurements, has now been established.

**ROK/4/020 SUPPORT FOR NUCLEAR POWER PROJECT IMPLEMENTATION**

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APPROVED: 1989

COMPLETED: 1993-08-26

TOTAL COST: \$ 43,985

TO TRAIN MANPOWER TO SUPPORT THE NATIONAL NUCLEAR POWER PROGRAMME.

The Republic of Korea has nine nuclear power units in operation, producing about 50% of the electricity generated. Two more units will be completed in 1995 and in 1996. Within the framework of nuclear manpower development, the Korea Atomic Energy Research Institute sought Agency assistance in 1989 in training manpower to support the national nuclear power programme. Two advanced National Training Courses, one on quality assurance during commissioning and operation of NPPs and the other on nuclear steam supply system and turbine/generator inspections, were conducted by six Agency experts for about 50 participants. These activities will be continued under the Manpower Development Project ROK/0/007.

**ROK/9/028 NUCLEAR SAFETY RESEARCH**

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APPROVED: 1986

COMPLETED: 1993-03-24

TOTAL COST: \$ 223,361

TO DEVELOP LOCAL CAPABILITY IN VARIOUS ASPECTS OF NPP SAFETY AND ACCIDENT ANALYSIS, INCLUDING DEVELOPMENT OF COMPUTER CODES AND MODELS AND PROBABILISTIC SYSTEMS ANALYSIS.

The Republic of Korea is engaged in a large-scale nuclear power development programme. To meet the need for ensuring safety in reactor design and operation and for accident prevention and emergency planning, the Nuclear Safety Research Department of the Korea Advanced Energy Research Institute sought Agency assistance in three areas: deterministic safety analysis, probabilistic safety analysis (PSA), and severe accident policy. Under this project, initiated in 1986, 10 Agency experts undertook 10 missions, providing advice and training on various aspects of nuclear safety. PWR-related assistance covered Zircaloy/water interaction, core transient analysis and loss of coolant accident analysis. CANDU-related assistance covered thermal hydraulics as part of safety analysis and pressure/calandria tube behaviour analysis. PSA activities involved system reliability analysis, accident sequence analysis, with a specific PSA training course attended by more than 30 participants, conducted by six Agency experts and two staff members. The Agency provided a corrosion measurement system and film thickness measuring equipment. Six fellowships were awarded for training abroad. The project has contributed to local capability for independently assessing the safety of nuclear installations. The work will be continued under a new project, ROK/9/036.

**ROK/9/032 EMERGENCY PLANNING AND PREPAREDNESS**

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APPROVED: 1989

COMPLETED: 1993-08-13

TOTAL COST: \$ 29,705

TO ESTABLISH EMERGENCY RESPONSE METHODOLOGY FOR AN NPP INCIDENT.

The Republic of Korea wished to improve its capability and preparedness to respond effectively to a nuclear accident at any of its reactor sites, and, in particular, to improve the ability to perform consequence assessments and to determine appropriate protective actions for the public. Under this project, approved in 1989, the Agency fielded four experts on four separate missions to assist the Korea Institute of Nuclear Safety (KINS), Daejeon. The experts reviewed the national programme for responding to a nuclear accident and gave specific guidance for improving preparedness. They also provided specific and detailed assistance to improve the ability to model dispersion of radioactive material from the reactors during a nuclear accident. The head of the programme was awarded a scientific visit to several institutes abroad. Korean radiological emergency planning regulations have been updated and the overall capability of Korea to respond to a nuclear accident has been considerably improved.

**SINGAPORE****SIN/8/009 INDUSTRIAL APPLICATIONS**

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APPROVED: 1982

COMPLETED: 1993-12-31

TOTAL COST: \$ 206,525

TO ESTABLISH NON-DESTRUCTIVE TESTING FOR PROCESS PLANT CONTROL IN THE POWER GENERATING, REFINING AND PETRO-CHEMICAL INDUSTRIES; TO INTRODUCE X-RAY FLUORESCENCE TECHNIQUES FOR THE SHIPPING AND OIL INDUSTRIES.

With Agency assistance, the Singapore Institute of Standards and Industrial Research (SISIR) established a Non-Destructive Testing (NDT) laboratory in 1974. The present project was initiated in 1982 to upgrade the laboratory. An energy dispersive X-ray fluorescence (XRF) analyser with peripheral equipment was installed with expert services to commission it and to train staff in quantitative element analysis. Although fellowship training did not materialize owing

to insufficient manpower at SISIR, various techniques using XRF were transferred through National Training Courses. The upgraded laboratory can now supply NDT and XRF services and quality control to industry throughout the island.

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**SIN/9/015 ENVIRONMENTAL RADIOACTIVITY MONITORING**

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APPROVED: **1991**

COMPLETED: **1993-07-26**

TOTAL COST: **\$ 79,627**

TO SET UP A COMPREHENSIVE ENVIRONMENTAL RADIOACTIVITY MONITORING PROGRAMME WITH ROUTINE SAMPLING, CAPABLE OF HANDLING EMERGENCY MEASUREMENTS.

The project was approved in 1991, and a sophisticated gamma spectroscopy system was provided to the Radiation Protection Inspectorate of the Ministry of Health, Singapore. An Agency expert recommended that, since the Inspectorate had insufficient manpower, the liquid scintillation and alpha spectrometric system, which had been envisaged, should not be provided. The scientific visit awarded was carried out but two fellowships were withdrawn by the Agency. The Agency proposed a final mission but, despite four reminders, received no response. It was impossible to implement the project under these conditions.

**SRI LANKA**

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**SRL/1/005 RADIATION DOSIMETRY**

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APPROVED: **1984**

COMPLETED: **1993-08-11**

TOTAL COST: **\$ 263,681**

TO DEVELOP A NATIONAL DOSIMETRY CALIBRATION AND RADIATION PROTECTION SERVICE AND TO RELATE RADIATION MEASUREMENTS TO INTERNATIONALLY ACCEPTED PRIMARY DOSIMETRY.

The project, approved in 1984 with footnote-a status, was made operational through Agency regular funds. The Agency supplied essential equipment. Six experts carried out seven missions to assist the staff of the Atomic Energy Authority (AEA) in the installation of the radiation protection instruments supplied under the project and in personnel dosimetry services and quality assurance of radiotherapy. They also assisted in organizing a National Training Course and a Workshop on radiation protection. An expert advised on the revision and updating of Atomic Energy Regulations for the Use of Radioactive Material, Irradiating Apparatus and Transport of Radiation Material (1975) of Sri Lanka. Two AEA staff members were awarded fellowships for training abroad for a total of 15 months. The AEA is now capable of providing external radiation personnel monitoring services to about 650 radiation workers, as well as dosimetry calibration services to isotope and radiation users, and has also provided training to local staff in radiation dosimetry and calibration. The work is being continued under Project SRL/9/006.

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**SRL/5/022 MUTATION PLANT BREEDING**

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APPROVED: **1988**

COMPLETED: **1993-09-16**

TOTAL COST: **\$ 48,016**

TO CREATE RADIATION-INDUCED MUTANTS OF PEPPER, CACAO AND BETEL WITH IMPROVED DISEASE RESISTANCE AND HIGH YIELD.

The project was approved in 1988 but could not be implemented until 1990 when the unfavourable situation in the Matale area had improved. The Agency supplied equipment to the Research Station of the Genetics and Crop Improvement Division of the Department of Export Agriculture, Matale. Three Agency experts assisted in establishing strategy for obtaining disease-resistant mutants, and advised on both seed and vegetative propagation in mutation breeding. Three staff members of the Research Station were awarded fellowships under the Regional Manpower Development Project and attended an Agency Interregional Training Course. With Agency assistance, the counterparts conducted four preliminary irradiation experiments using both seed and vegetative propagation. They developed an effective screening procedure for disease-resistant mutants of black pepper. In-vitro culture technology was associated with mutation breeding to increase the efficiency of the experiments. The in-vitro laboratory has been strengthened and a new research building was completed in 1992. Optimum doses of gamma irradiation have been identified for seeds and cuttings.

## **SUDAN**

### **SUD/0/006 NUCLEAR SCIENCE LABORATORY**

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APPROVED: **1980**

COMPLETED: **1993-06-25**

TOTAL COST: **\$ 1,127,009**

TO ESTABLISH A NUCLEAR SCIENCE LABORATORY FOR TRAINING AND RESEARCH; TO EXPAND THE LABORATORY FOR ENERGY-DISPERSIVE X-RAY ANALYSIS.

The project was approved in 1980 to introduce nuclear analytical techniques in the Department of Physics, University of Khartoum. The Agency provided equipment for a Nuclear Science Laboratory and Agency experts assisted in transferring analytical techniques. Training in the operation and repair of the equipment supplied was given through fellowships and scientific visits. The laboratory has been set up and is now being used as an interdisciplinary centre for the promotion of teaching, research and training in nuclear science and its applications to national needs. A regular MSc programme is operating, and in the last ten years 50 MSc and 10 PhD students have graduated from the Department, using the Nuclear Science Laboratory for their research. Papers have been published in international journals on work carried out at the Laboratory.

### **SUD/5/018 MUTATION BREEDING**

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APPROVED: **1989**

COMPLETED: **1993-11-16**

TOTAL COST: **\$ 141,979**

TO ESTABLISH A MUTATION BREEDING PROGRAMME FOR SPECIFIC CHARACTERS IN COTTON, SUGAR CANE AND VEGETABLE CROPS WITH THE AIM OF DEVELOPING DISEASE- AND INSECT-RESISTANT VARIETIES.

The project was initiated in 1989 to transfer mutation breeding techniques so that conventional breeding methods in cotton, sugar cane and vegetables could be supplemented with modern nuclear techniques. Three experts assisted in the design, layout and establishment of an in-vitro culture laboratory, which is now operational. Three fellowships were awarded for training abroad. A four-week local training course on in-vitro culture was organised, using the laboratory, during which eight technical staff were trained in some theoretical and practical aspects of mutation breeding.

## **SYRIAN ARAB REPUBLIC**

### **SYR/0/005 PROCUREMENT ASSISTANCE**

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APPROVED: **1984**

COMPLETED: **1993-02-26**

TOTAL COST: **\$ 592,182**

TO PROCURE EQUIPMENT.

The Syrian Atomic Energy Commission (AECs) requested Agency assistance in 1984 for the purchase of equipment under a Funds-in-Trust arrangement. Approximately US \$300 000 was deposited by the AECs, and Kuwait contributed a further US \$350 000. Substantial quantities of equipment and supplies, including chemicals and spare parts for equipment supplied under previous or ongoing TC projects, were provided, and these were used in Agency-supported projects or related activities. The AECs received technical advice from the Agency and benefitted from the favourable purchase and delivery services available within the TC programme.

### **SYR/4/003 NUCLEAR ELECTRONICS**

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APPROVED: **1986**

COMPLETED: **1993-04-23**

TOTAL COST: **\$ 265,612**

TO PROVIDE SPARE PARTS AND COMPONENTS FOR LOCAL DESIGN AND CONSTRUCTION OF USEFUL INSTRUMENTS AND TO PROVIDE FELLOWSHIP TRAINING.

The project was approved in 1986 to provide spare and replacement parts to the Syrian Atomic Energy Commission (AESC) in order to ensure the serviceability of its nuclear equipment and instruments. The project is also intended to train electronics personnel in the repair, maintenance and servicing of nuclear instruments, and in the design and construction of modular electronic units for research activities. Equipment and supplies were provided. Eight Agency experts provided training in analog and digital electronics. An intensive National Training Course on interfacing personal computers with nuclear instruments was organized during which three Agency experts provided training on the design and construction of modular computer-controlled instruments. In a follow-up project (SYR/4/005) an Agency expert advised on design and construction activities. Five staff members received advanced training abroad for a total of about 22 months. The Electronics Section of the AECs can now satisfactorily maintain and repair its nuclear equipment and is developing dedicated electronic devices for use in research activities. One counterpart staff member has assisted at training courses in Madagascar and Thailand. In Phase II of the project (SYR/4/004), which is already being implemented, the development of computer-based devices will continue.

**SYR/8/003                    NON-DESTRUCTIVE TESTING LABORATORY**

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APPROVED: **1989**COMPLETED: **1993-11-15**TOTAL COST: **\$ 238,248**

TO ORGANIZE NON-DESTRUCTIVE TESTING TRAINING PROGRAMMES.

This project was approved in 1989 to set up a non-destructive testing (NDT) laboratory at the Syrian Atomic Energy Commission and to train personnel in basic NDT techniques. The Agency provided equipment, expert advice and training. Experts undertook eleven missions, for a total of about eight months, to assist in setting up the laboratory. They trained staff in NDT techniques and assisted in the preparation of standard training programmes. Eight National Training Courses on various NDT techniques were organized, each with about 12 participants. Four fellowships were awarded for training abroad and the head of the NDT group also undertook a scientific visit. The NDT laboratory has been established and is being used for routine training of NDT personnel. It also provides NDT services to local industries and other establishments in the country.

**THAILAND****THA/1/004                    SECONDARY STANDARDS DOSIMETRY LABORATORY**

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APPROVED: **1981**COMPLETED: **1993-07-06**TOTAL COST: **\$ 449,133**

TO ESTABLISH A SECONDARY STANDARDS DOSIMETRY LABORATORY IN ORDER TO STANDARDIZE AND CALIBRATE DOSIMETERS USED IN RADIATION PROTECTION, INDUSTRIAL RADIATION PROCESSING, AND NUCLEAR MEDICINE.

The project was initiated in 1981 to assist the Office of Atomic Energy for Peace (OAEP), Bangkok, in establishing a Secondary Standards Dosimetry Laboratory (SSDL). Through the provision of equipment, expertise and training, an SSDL for radiation protection calibrations, high-dose dosimetry and environmental survey has been successfully established and is now fully operational. The SSDL at OAEP is now capable of providing a wide range of dosimetry services to radiation and radioisotope users, including calibration of dosimeters and dose rate meters, radiation safety and measurement, certification of radiation instruments, as well as occupational radiation safety. The Laboratory provided calibration services for 1500 dosimeters and 250 dose rate meters for users in 1991. A high-dose laboratory was also established as part of the SSDL, which can calibrate a dose range from 40 to 400 Gy. It provides calibration and dosimetry services for industrial radiation processing, including sterilization of medical supplies, and irradiation of food and tissue grafts. It also provides radiation therapy standardization and personal dosimeters to nuclear medicine centres. The SSDL is also involved with environmental radiation assessments and regularly analyses environmental samples. The OAEP has developed a training programme in radiation protection and dosimetry under which 300 local staff have been trained. The project has made a significant contribution to radiation protection and safe applications of radiation and radioisotopes in Thailand.

**THA/1/008                    CALIBRATION AND STANDARDIZATION OF RADIONUCLIDES**

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APPROVED: **1988**COMPLETED: **1993-08-11**TOTAL COST: **\$ 96,022**

TO ESTABLISH A LABORATORY FOR CALIBRATING AND STANDARDIZING RADIONUCLIDES.

To deal with the increasing use of radioactive materials and the increasing production of radioisotopes, the Office of Atomic Energy for Peace (OAEP) sought Agency assistance in establishing a laboratory for calibrating and standardizing radionuclides. The project, approved in 1988 with footnote-a status, was made operational through an extrabudgetary contribution from the USA and was subsequently financed from Agency regular funds. The Agency supplied sophisticated equipment which the counterpart installed and put into operation. A well equipped laboratory for calibrating and standardizing radionuclides has now been established at the OAEP with staff capable of providing services to radionuclide users. The accuracy of radiation measurements and the quality control of radioactive materials have improved.

**THA/3/003                    NUCLEAR RAW MATERIAL PROSPECTING**

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APPROVED: **1979**COMPLETED: **1993-08-26**TOTAL COST: **\$ 381,795**

TO EXPLORE URANIUM IN SANDSTONE-TYPE DEPOSITS IN THE KHORAT PLATEAU AND OTHER REGIONS OF THAILAND.

The project, originally approved in 1979 with footnote-a status, was made operational through an extrabudgetary contribution from the USA, and was subsequently financed from Agency regular funds. The Agency supplied the Department of Mineral Resources (DMR), Bangkok, with field and laboratory equipment. Seven Agency experts undertook nine missions for a total period of 25.5 months to assist in evaluating survey results from subcontractors. The experts also assisted in uranium exploration and project management, geochemical analysis of uranium, and

automatic data processing. Six fellowships were awarded for training abroad for a total of 30 months. A subcontract was made in 1982, and a combination of stream sediment and airborne radiometric surveys over the Khorat plateau was carried out by the contractor and evaluated by an Agency expert in 1984. The results were disappointing and the area under study was eliminated for further follow-up work. The Government then decided to conduct a country-wide airborne radiometric, electromagnetic and magnetic survey, which was subcontracted to a Canadian company as part of a much larger project known as the Mineral Resources Development programme. The results were delivered to the Government in early 1990. During this period, the Agency assisted the DMR in conducting a complementary reconnaissance geochemical survey and advised counterpart staff on the strategy and methodology for evaluating airborne survey results of radioactive minerals prospecting. A capable core of local staff has been established, who are steadily continuing to investigate the country's uranium potential. A fluorometric analytical laboratory for uranium has been set up and a computer facility for processing and interpreting the field survey and laboratory results, and for production of maps, has been established. The national uranium exploration programme is now focussed on target areas with a potential for viable uranium deposits. This is a long process, which will continue under a new project, THA/3/004, on computer processing of airborne radiometric data.

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**THA/4/009                      NUCLEAR ELECTRONICS TRAINING LABORATORY**

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APPROVED: **1983**

COMPLETED: **1993-06-15**

TOTAL COST: **\$ 94,248**

TO ESTABLISH PRACTICAL TRAINING IN MAINTENANCE AND QUALITY CONTROL OF NUCLEAR MEDICINE INSTRUMENTS FOR MEDICAL PHYSICS STUDENTS, PHYSICIANS AND TECHNICIANS.

The School of Medical Physics (SMP) at Mahidol University, Bangkok, intended to strengthen the maintenance and quality control of nuclear medicine instruments by establishing a practical training programme. This footnote-a project was approved in 1983 and subsequently financed by an extrabudgetary contribution from the USA. The Agency provided the equipment and radioactive sources required for establishing a nuclear electronics training laboratory. An Agency expert undertook three missions to assist in planning and preparing the training programme, in particular the operation, quality control and preventive maintenance of instruments used in nuclear medicine. The expert also assisted in preparing a series of lectures and practicals in nuclear medicine instrumentation for medical physicists. The SMP now provides training courses and has a well equipped nuclear electronics training laboratory. Ten graduate students and technicians have already been trained under the programme. The counterparts are planning to expand the programme and provide training to 39 students every year. The improved utilization of instruments and the increased number of trained personnel will allow more effective application of nuclear techniques in medical treatment.

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**THA/4/010                      UPGRADING OF A RESEARCH REACTOR**

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APPROVED: **1986**

COMPLETED: **1993-06-24**

TOTAL COST: **\$ 255,217**

TO INCREASE THE POWER OUTPUT OF THE RESEARCH REACTOR FOR PLANNED ISOTOPE PRODUCTION.

The Office of Atomic Energy for Peace (OAEP) has been operating a 2 MW Triga Mark III research reactor for over 20 years. To meet the increasing demand for reactor-produced radioisotopes for medical applications and analytical services, the OAEP sought Agency assistance to upgrade this aged reactor. The project was approved in 1986 with footnote-a status, financed by an extrabudgetary contribution from the USA, and subsequently supported by Agency regular funds. The Agency supplied equipment, materials and supplies for reactor experiments. Eleven expert missions were fielded. Three staff members were awarded long-term fellowships abroad. Agency experts also advised the OAEP on relocation of the research reactor and site selection for the new Thai Nuclear Research Centre. The research reactor is now operating with improved performance and safety and with well trained scientists and engineers. All reactor-dependent activities have been resumed, in particular radioisotope production and neutron activation analytical services. The ancillary systems are also operating efficiently. When the installation is complete, the OAEP will be able to expand the utilization of the reactor for prompt gamma activation analytical services. The staff is undertaking routine core management using computer programmes and provides services to other Thai institutions. The project has contributed to the establishment of the new Thai Nuclear Research Centre.

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**THA/4/012                      RELOCATION OF THE NUCLEAR RESEARCH CENTRE**

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APPROVED: **1991**

COMPLETED: **1993-09-16**

TOTAL COST: **\$ 98,882**

TO ASSIST IN THE CONCEPTUAL DESIGN OF A NUCLEAR RESEARCH CENTRE AND ITS FACILITIES AND EVENTUALLY IN DECOMMISSIONING OLD FACILITIES.

In 1989 the Government decided to relocate the present Nuclear Research Centre of the Office of Atomic Energy for Peace (OAEP) to a low population density area, away from the airport. A pre-project mission visited the nuclear facilities and recommended Agency assistance in the conceptual design of the new Centre and in decommissioning the existing research reactor and its facilities. The project was approved in 1991 and the Agency provided expert

services to assist the OAEF in drafting technical specifications for a research reactor, an isotope production facility, and a radioactive waste processing and storage facility. Agency experts also advised on site selection and evaluation, and on decommissioning the present reactor. Five OAEF staff members were awarded Agency fellowships and scientific visits for training abroad. A site has been selected for the new Nuclear Research Centre about 60 km northeast of Bangkok. A draft document calling for bids for the research reactor, isotope production facility and centralized waste processing and storage facility has been prepared and submitted to the Thai Government by OAEF. The work is being continued under Project THA/4/013, which is expected to lead to the construction of the new Nuclear Research Centre.

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**THA/5/031                      IMPROVING FOOD AND AGRICULTURAL PRODUCTION**

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APPROVED: **1985**

COMPLETED: **1993-12-02**

TOTAL COST: **\$ 1,479,799**

TO IMPROVE PRODUCTION OF FOOD AND LIVESTOCK THROUGH WIDER APPLICATION OF ISOTOPE RADIATION AND RELATED TECHNOLOGIES.

This multi-disciplinary UNDP project was approved in 1985. Eight institutes, including four Universities and the Department of Agriculture, Bangkok, participated. The project was implemented at over 30 experimental stations and laboratories. A Central Service Facility and an In-Vitro Mutation Breeding Service Unit were established at the Department of Agriculture, for which equipment was provided. Forty-three expert missions were undertaken by 32 experts; 34 fellowships and four scientific visits were awarded for training abroad. Eleven national training events, including Training Courses, Workshops and Seminars, were organized. Successes in mutation breeding included evolution of disease and pest resistant varieties of soybean, mungbean, cowpea, upland rice and Job's tears. In soil sciences, studies on fertilizer use efficiency, water management, biological nitrogen fixation, and use of local deposits of natural rock phosphate were carried out in relation to specific crops, soils and regions of Thailand. In the area of animal reproduction, milk and blood progesterone assays were extensively popularized among farmers.

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**THA/5/036                      ANIMAL DISEASES**

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APPROVED: **1989**

COMPLETED: **1993-06-16**

TOTAL COST: **\$ 58,661**

TO DEVELOP NEW METHODS FOR DIAGNOSIS OF AUJESZKY'S DISEASE IN SWINE AND TO COMPARE THE SENSITIVITY OF DIFFERENT METHODS.

The Faculty of Veterinary Science of Chulalongkorn University, Bangkok, sought Agency assistance to develop new methods for diagnosis of Aujeszky's disease in swine, which had been a major cause of economic loss. This footnote-a project was approved in 1989 and financed by an extrabudgetary contribution from the USA. The Agency provided equipment, including enzyme-linked immunosorbent assay (ELISA). Expert missions were undertaken to assist in the establishment of the ELISA and DNA probe techniques in order to compare the sensitivity of different diagnostic methods and to train local staff. A fellowship was granted for training in diagnostic virology. The project has successfully developed a new technique, the DNA probe, to diagnose Aujeszky's disease. A serological laboratory has been established in the Faculty of Veterinary Science which serves as the national reference centre for the disease. The control of Aujeszky's disease in swine is expected to improve viability of piglets and sows, thus increasing the production of pork and therefore of export earnings.

**TUNISIA**

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**TUN/5/009                      ASSESSMENT OF NITROGEN FIXATION IN TREES**

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APPROVED: **1987**

COMPLETED: **1993-02-26**

TOTAL COST: **\$ 133,221**

TO ASSESS NITROGEN FIXATION IN VARIOUS VARIETIES OF TREES WITH A VIEW TO DEVELOPING METHODS FOR IMPROVING THE FERTILITY OF POOR AND MARGINAL SOILS.

This project was initiated in 1987 mainly to investigate ways of improving marginal and poor agricultural and forest soils by the selection of high yielding tree genotypes with superior ability to fix atmospheric nitrogen. The Agency provided the Institut National de Recherches Forestières (INRF), Ariana, with nitrogen-15 fertilizer and an optical emission spectrometer. One scientist was trained in the use of N-15 in soil/plant studies, and two technicians were trained in the operation and maintenance of the spectrometer. A fully functional N-15 laboratory has now been established. A field study was set up to evaluate biomass production and to measure nitrogen fixation, using the N-15 technique, in *Acacia cynophylla* and *Casuarina glauca* in an arid area of Tunisia. The results show that *A. cynophylla* is superior to *C. glauca* in biomass production and nitrogen accumulation. The benefit of inoculation with nitrogen fixing organisms was demonstrated in the two tree species. A follow-up project (TUN/5/014) has been approved.

**TUN/5/012                    NUCLEAR AGRICULTURAL LABORATORY**

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APPROVED: **1989**COMPLETED: **1993-11-16**TOTAL COST: **\$ 146,810**

TO ESTABLISH A NUCLEAR AGRICULTURAL LABORATORY FOR TEACHING AND RESEARCH.

The project was initiated in 1989 at the National Agronomic Institute of Tunisia (INAT). The Agency supplied equipment and laboratory supplies. A fellowship and a scientific visit were awarded for training abroad. One expert assisted in installing the equipment and training local staff; another evaluated the established facilities, assisted in selecting areas of research, and identified other national institutions that could make use of the facilities. INAT now possesses adequate infrastructure, equipment and personnel for teaching purposes, for nuclear studies with phosphorus (P-32) and carbon (C-14), and for studies of soil moisture using neutron probes.

**TUN/6/002                    NUCLEAR MEDICINE**

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APPROVED: **1983**COMPLETED: **1993-12-22**TOTAL COST: **\$ 436,480**

TO UPGRADE NUCLEAR MEDICINE FACILITIES AND INTRODUCE IMPROVED IMAGING TECHNIQUES.

The project was initiated in 1983. The Agency provided the Salah Azaiz Institute, Tunis, with a nuclear medicine computer and a gamma camera, both of which were subsequently upgraded to perform single-photon computerized tomography (SPECT). Upgrading the equipment in phases resulted in performance problems, which were later remedied. Six experts were fielded for a total of over four months, and seven fellowships were awarded for a total of six years. The capability of the Institute in radioimmunoassay of hormones, particularly thyroid related, was increased. The Institute now has the necessary equipment and trained personnel to perform advanced imaging in nuclear medicine and routine assays of thyroid hormones.

**TUN/6/003                    RADIOIMMUNOASSAY LABORATORY**

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APPROVED: **1988**COMPLETED: **1993-02-26**TOTAL COST: **\$ 34,695**

TO STRENGTHEN THE EXISTING RADIOIMMUNOASSAY LABORATORY BY IMPROVING DATA ACQUISITION AND TREATMENT SYSTEMS.

The main objective of this project was to equip the Salah Azaiz Institute, Tunis, as a central laboratory from which an external quality control scheme (EQAS) could be organized. The Agency provided a sophisticated multi-user computer system and software, with equipment and reagents needed for radioimmunoassay (RIA). An expert mission was undertaken to assist in the installation of the computer and data processing system and to provide training. A staff member was awarded a three-months fellowship for training abroad. The project has laid the foundation for a training centre and an EQAS in Tunisia. The next step, which is being implemented under the regional RIA project (RAF/6/007), is to organize a local educational programme for potential EQAS participants.

**TURKEY****TUR/5/012                    NUCLEAR TECHNIQUES IN ANIMAL SCIENCE**

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APPROVED: **1986**COMPLETED: **1993-09-16**TOTAL COST: **\$ 329,888**

TO IMPROVE THE NUTRITION, REPRODUCTIVE EFFICIENCY AND DISEASE CONTROL OF LIVESTOCK.

The project was approved in 1986 to strengthen the national capability in nuclear techniques in animal science. Assistance was provided to the Lalahan Nuclear Research Institute in Veterinary Medicine and Animal Science, near Ankara, in the design and conduct of on-farm studies and analysis of the results, with the aim of improving the production of milk from cows kept by smallholder farmers. The Agency provided expertise in 14 specific activities as well as equipment, two fellowships and two scientific visits. The Institute was also awarded four related Research Contracts. Technologies were transferred for assessing the reproductive status of cattle by radioimmunoassay and the nutritive value of locally available feeds by in-vitro and in-vivo isotopic methods. These activities demonstrated that sugar beet pulp can be used in cattle diets with considerable financial saving for farmers. Attempts are now being made to increase the use of this plentiful agroindustrial by-product for feeding dairy cattle in Anatolia.

**TUR/8/011                      NUCLEAR TECHNIQUES IN HYDROLOGY**

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APPROVED: **1989**COMPLETED: **1993-11-29**TOTAL COST: **\$ 225,380**

TO IMPROVE THE FACILITIES OF THE ISOTOPE HYDROLOGY LABORATORY SO AS TO ENABLE IT TO EXTEND ITS ANALYTICAL SERVICES TO OTHER INSTITUTIONS IN TURKEY.

The project was initiated in 1989 to strengthen the capability of the Research and Quality Control Department of the State Hydraulic Works (DSI) in the application of nuclear techniques as part of the hydrological and hydrogeological investigations pertinent to the national programmes in the water resources inventory. The analytical capabilities of the DSI's isotope hydrology laboratory have been upgraded so that major isotopic analyses can be undertaken routinely in order to meet long-term national requirements. The obsolete tritium counting system was replaced by a modern liquid scintillation counting system, and a new electrolytic enrichment system was installed. The means of preparing and measuring samples of carbon isotopes were provided. The existing mass spectrometer for isotope ratio measurements was upgraded by provision of a new electronic system. Applied isotope field investigations were carried out at various sites, during which expert services and training were provided. The DSI can now apply environmental isotope techniques to the hydrological and geological problems encountered in Turkey, such as seawater intrusion dynamics at coastal regions, water pollution and pollutant transport mechanisms in groundwater, waterlogging problems in heavily irrigated agricultural areas, hydro-structural and geo-technical problems in groundwater circulation and its connections to surface waters within highly karstified terrains.

**UGANDA****UGA/5/012                      INTEGRATED TSETSE CONTROL PROGRAMME**

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APPROVED: **1988**COMPLETED: **1993-08-26**TOTAL COST: **\$ 127,660**

TO CARRY OUT STERILE INSECT TECHNIQUE STUDIES AS PART OF AN INTEGRATED PROGRAMME TO ERADICATE THE TSETSE FLY.

The project, initiated in 1988, aimed at control of the tsetse fly on the Buvuma Islands and thus prevention of animal trypanosomiasis and human sleeping sickness. The Agency supplied the necessary laboratory equipment and supplies to the Tsetse Control Department of the Ministry of Animal Industries and Fisheries, Kampala. Three Agency experts assisted in organizing the laboratory infrastructure, detection and monitoring of flies, and trapping procedures to be used during future mark-release-recapture studies. The experts also gave on-the-job training. Control activities started on Buvuma Island, which is the largest in the group of 29, with an area of 220 square km. Currently, 400 traps are deployed in predetermined ideal tsetse habitat. It is planned to increase the trap density and to expand trapping activities into new areas. Collaboration has been initiated with the Uganda Trypanosomiasis Research Organization, which will participate in mass rearing activities. Two related Research Contracts were also undertaken by local scientists. Support is being continued under Project UGA/5/015 to achieve the final objectives. However, the success of the project largely depends upon the Government's commitment to develop further the sterile insect technique as part of an integrated programme to eradicate the tsetse fly.

**UGA/9/003                      RADIATION PROTECTION SERVICE**

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APPROVED: **1988**COMPLETED: **1993-09-16**TOTAL COST: **\$ 112,004**

TO ESTABLISH A PERSONNEL MONITORING SERVICE AND CALIBRATION FACILITY.

The project, initiated in 1988, was implemented at the Department of Physics, Makerere University, Kampala. The Agency provided equipment, and four Agency experts assisted in drafting and elaborating radiation protection regulations and codes of practice. They also installed equipment and trained counterpart staff to operate the computerized system. Data was collected on the existing X-ray machines, and an inventory of radiographers, including users of radioisotopes, has been compiled. Quality control and quality assurance of the X-ray machines has been effected. The project achievement is not entirely satisfactory, owing to lack of local inputs for running the radiation protection service, and the absence of a national regulatory scheme to enforce radiation safety standards. Further support is being provided under the follow-up project UGA/9/004.

## **UNITED ARAB EMIRATES**

### **UAE/9/002 RADIATION PROTECTION**

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APPROVED: **1988**

COMPLETED: **1993-09-30**

TOTAL COST: \$ **166,265**

TO ESTABLISH RADIATION PROTECTION SERVICES.

Following an initial planning mission to review the infrastructure, recommendations were made on the basic requirements for the establishment of a national radiation programme. The project was approved in 1988, and two expert missions advised the counterparts and trained about 20 local staff, designated to become radiation protection officers, on procedures. A draft Radiation Protection Act was prepared and submitted to the national authorities for approval. The Agency provided major equipment, and initial steps were taken to establish a National Radiation Protection Laboratory. The project suffered delays because of difficulties in appointing local scientists to staff the project (the Emirates rely heavily on an expatriate work force). Following new initiatives and some reorganization, Phase II of the project (UAE/9/004) was approved.

## **UK (HONG KONG)**

### **HOK/9/002 EMERGENCY PLANNING AND PREPAREDNESS**

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APPROVED: **1989**

COMPLETED: **1993-10-18**

TOTAL COST: \$ **89,517**

TO SET UP A BACKGROUND RADIATION MONITORING PROGRAMME AND TO DEVELOP A SOUND EMERGENCY RESPONSE PLAN AND PROCEDURES IN THE EVENT OF A SERIOUS ACCIDENT FROM AN NPP.

The first unit of the Daya Bay NPP in China was scheduled for completion in 1992. Before the NPP became operational, the Hong Kong Government wished to have a sound emergency response plan to protect the public from the consequences of a serious accident. The Agency fielded a pre-project mission in July 1988 to study the requirements in detail. This project, based upon the mission's recommendations, was initiated in 1989 and mainly consisted of expert services. Eight expert missions were carried out for a total of over six months. Their principal activities were to review several versions of the Government's Daya Bay Contingency Plan and to assist in the preparation and conduct of two comprehensive exercises in November 1990 and May 1993. One two-month fellowship was awarded for training in the USA. The project has provided Hong Kong with a well tested emergency plan. The Government can now apply radiological safety measures and procedures appropriate to its responsibility for a large population centre less than 50 km from an NPP.

### **HOK/9/003 RADON SURVEYS IN THE HONG KONG AREA**

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APPROVED: **1991**

COMPLETED: **1993-09-30**

TOTAL COST: \$ **42,057**

TO DETERMINE INDOOR RADON LEVELS AND EXHALATION RATES IN LOCAL BUILDING MATERIALS AND SOILS.

The project was approved in 1991 and the Agency provided a radon detector and monitoring equipment. An expert mission was undertaken in 1991 at the Hong Kong Polytechnic, with a follow-up mission by the same expert in 1993. The measuring technique has been successfully transferred.

## **UNITED REPUBLIC OF TANZANIA**

### **URT/5/008 LIVESTOCK REPRODUCTION AND HEALTH**

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APPROVED: **1986**

COMPLETED: **1993-03-18**

TOTAL COST: \$ **141,955**

TO IMPROVE REPRODUCTIVE EFFICIENCY AND DISEASE DIAGNOSIS OF LIVESTOCK THROUGH RADIO- AND ENZYME-IMMUNOASSAY TECHNIQUES.

This project, initiated in 1986, had two distinct components: (1) to introduce immunoassay techniques for carrying out studies on ways of improving the reproductive performance of local breeds of cattle and (2) to conduct investigations into salmonellosis in cattle and poultry in the areas around Morogoro. The radioimmunoassay (RIA) technique for measuring progesterone levels in cattle was successfully established at the Sokoine University of Agriculture, Morogoro. All necessary equipment was supplied. Expert services, for about five months, were provided to assist in developing the skills of the local staff in RIA techniques and disease diagnosis. Two staff members were also awarded fellowships for training abroad. An effective capability has been established to study the productivity of local breeds of cattle. These studies are already bringing benefits through simple management practices to improve reproductive performance and thus overall productivity. The second component of the project was implemented through the

establishment of an ELISA-based system for studying salmonella infections in cattle and poultry in the Morogoro area. Equipment was provided and local staff were trained by Agency experts to perform salmonella diagnosis. An innovative dot ELISA for use in poultry was developed and used to carry out an extensive survey on poultry farms in the region. The survey identified flocks with a high incidence of salmonella, and corrective measures were taken. The Department of Veterinary Surgery and Reproduction of the University can now diagnose and monitor the major diseases affecting livestock in the region, and significant progress has already been made towards the control of salmonellosis.

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**URT/5/009                      DIAGNOSIS OF ANIMAL DISEASES**

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APPROVED: **1989**

COMPLETED: **1993-03-26**

TOTAL COST: **\$ 131,969**

TO IMPROVE THE NATIONAL CAPABILITY IN DIAGNOSING ENDEMIC DISEASES IN LIVESTOCK AND WILDLIFE.

This project was initiated in 1990 to improve the national capability for utilizing nuclear and related techniques to diagnose and monitor the major diseases affecting livestock in Tanzania. ELISA-based systems were established at the Veterinary Laboratories, Temeke, for the diagnosis and monitoring of rinderpest, foot-and-mouth disease, brucellosis and trypanosomiasis. The Agency supplied equipment and six expert missions for a total duration of nearly four months to assist in introducing the techniques. Three staff members were awarded fellowships for training abroad. A national survey was undertaken to monitor rinderpest antibodies in cattle in the frame of a national vaccination programme. The survey revealed that levels of immunity were well below what was expected and that revaccination was urgently required. Development and validation work on the FAO/IAEA trypanosomiasis antigen detection kits were also carried out and this assay has subsequently been used to assist the trypanosomiasis eradication programme on the island of Zanzibar. The project also provided reagents for the diagnosis of foot-and-mouth disease by ELISA, but thorough studies of this disease have not yet been undertaken. It is now possible for the Research Institute to use the ELISA-based systems for diagnosis of the major diseases affecting livestock in Tanzania, with limited assistance from the Agency through the regional project (RAF/5/026) on animal diseases.

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**URT/8/006                      GROUNDWATER MONITORING IN THE DODOMA REGION**

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APPROVED: **1988**

COMPLETED: **1993-06-24**

TOTAL COST: **\$ 39,344**

TO DETERMINE THE GROUNDWATER POTENTIAL OF THE MAKATUPORA BASIN BY MEANS OF ISOTOPE TECHNIQUES.

This project was approved in 1988 with footnote-a status and implemented in the same year through extrabudgetary funding from Germany. The Agency supplied equipment and two fellows were trained at the Agency's Isotope Hydrology Laboratory in Vienna; another received training in air photo/satellite image interpretation at the Technical University, Berlin. Expert services focussed primarily on evaluating hydrogeological and isotope data in connection with the Makutapora Basin, the most important source of water supply for Dodoma City, and Lake Duluti, near Arusha. Moreover, 110 water samples were analysed for oxygen-18 and deuterium and 23 samples for tritium at the University of Heidelberg. Aerial photographs from the study areas were evaluated at the Technical University of Berlin. On the basis of this work, it was estimated that the present groundwater withdrawal in the Makutapora Basin is within the safe yield of the Makutapora aquifer system. When the production wells are decentralized to cover the total area of the Makutapora Basin, a slight increase in groundwater use should be possible. Lake Duluti was found to be a very small water source of good quality in the area of Arusha. The results of this project are of practical significance to efficient management of the groundwater resources in the Dodoma and Arusha region. A related project (URT/8/008) has been approved.

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**URT/9/002                      RADIATION PROTECTION**

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APPROVED: **1984**

COMPLETED: **1993-10-18**

TOTAL COST: **\$ 491,581**

TO ASSIST THE AUTHORITIES TO ENFORCE THE CODES OF PRACTICE; TO CONSOLIDATE ENVIRONMENTAL MONITORING AND TO ESTABLISH CALIBRATION SERVICES.

This project was initiated in 1984 following the establishment of the National Radiation Commission (NRC). The Agency supplied the necessary equipment. Expert missions totalling nearly ten months assisted the local staff in personnel and environmental monitoring, maintenance and repair of nuclear instrumentation, and the establishment of a calibration laboratory. Sixteen fellowships, totalling over 70 months, were awarded for training abroad. A personnel monitoring laboratory using thermoluminescence dosimetry, a food contamination and environmental monitoring laboratory, an instrumentation and maintenance workshop, a national calibration laboratory and a service for quality control of medical equipment are now fully operational. Over 450 workers likely to be exposed to radiation in 170 workplaces are being monitored on a regular basis. A follow-up project (URT/9/003) will consolidate and expand these activities.

## URUGUAY

### URU/5/018 NUCLEAR TECHNIQUES IN AGRICULTURE

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APPROVED: 1988

COMPLETED: 1993-12-22

TOTAL COST: \$ 208,222

TO INTRODUCE ISOTOPE TECHNIQUES FOR THE STUDY OF NITROGEN FERTILIZER USE EFFICIENCY, BIOLOGICAL NITROGEN FIXATION, PHOSPHORUS UPTAKE AND WATER BALANCE.

The project was approved in 1988. The counterpart institutions were the National Directorate for Nuclear Technology (DNTN), the National Institute for Agricultural Research, and the Faculty of Agronomy of the University of the Republic. The Agency provided equipment and laboratory supplies. Local staff received expert assistance; two fellowships and two scientific visits for training abroad were awarded. The transfer of nitrogen-15 technology in fertilizer use efficiency and biological nitrogen fixation studies was successfully completed. Studies on water and nitrogen fertilizer were initiated to assess losses (leaching and denitrification). Research activities in biological nitrogen fixation in pasture legumes produced valuable information on pasture management. A complete laboratory for N-15 analysis was established at the DNTN, which is now the regional facility for training and N-15 analytical services. Activities will continue under Project URU/5/019 to establish phosphorus-32 techniques for phosphate research.

## VENEZUELA

### VEN/1/006 SECONDARY STANDARDS DOSIMETRY LABORATORY (PHASE II)

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APPROVED: 1989

COMPLETED: 1993-11-02

TOTAL COST: \$ 219,380

TO ESTABLISH A DOSIMETRY LABORATORY FOR CALIBRATION OF X-RAY TELETERAPY UNITS AND COBALT-60 THERAPY SOURCES.

This project was approved in 1989 for one year and extended to allow completion of the Secondary Standards Dosimetry Laboratory (SSDL) at the Venezuelan Institute of Scientific Research (IVIC), Caracas. The SSDL had already been established and equipped with major items under Phase I (VEN/1/004), and the present project was intended to provide expertise and training in dosimetry applied to radiotherapy while ensuring uniformity and accuracy of radiation measurements throughout the country. The Agency provided expert services in dosimetry, calibration and quality assurance in radiotherapy, including on-site training as well as the necessary instrumentation and analytical equipment. The SSDL is fully operational, with state-of-the-art equipment recently upgraded and is now providing calibration services on a national basis. Venezuela has established compulsory quality control and calibration for all its teletherapy units, and the centralized standardization system is making a major contribution to the safe application of ionizing radiation in Venezuela.

### VEN/5/011 CENTRE FOR NUCLEAR AGRICULTURE

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APPROVED: 1987

COMPLETED: 1993-06-30

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/5/014 NUCLEAR TECHNIQUES APPLIED TO SOIL SCIENCE

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APPROVED: 1991

COMPLETED: 1993-11-01

TOTAL COST: \$ 98,895

TO STUDY BIOLOGICAL NITROGEN FIXATION BY LEGUMES AND PHOSPHORUS FERTILIZER USE EFFICIENCY.

This project was initiated in 1991 and implemented at three institutions in the Central University of Venezuela's (UCV) Faculty of Agronomy, Maracay, at the National Fund for Agricultural and Livestock Research (FONAIAP), Maracay, and

at the Venezuelan Institute for Scientific Research (IVIC), Caracas. The Agency provided equipment, including a liquid scintillation counter, and chemical supplies. Expert services were provided in connection with the operation of the nitrogen-15 analyser at FONAIAP and for phosphorus-based studies. Two UCV staff members were awarded fellowships for training abroad which qualified them to initiate studies on the dynamics of phosphorus in Venezuelan soils and to evaluate the agronomic effectiveness of natural and modified rock phosphates by means of phosphorus-32 isotope techniques. A well equipped radioisotope laboratory for the use of P-32 is now available at UCV, and local scientists have been trained in the use of P-32 isotopic tracer techniques in phosphate research. Some progress was also made on research activities related to biological nitrogen fixation by grain legumes (IVIC) and by forage legumes (FONAIAP), although major results are only expected after completion of the on-going follow-up project VEN/5/016.

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**VEN/8/007                    SEDIMENTOLOGICAL STUDIES**

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APPROVED: **1985**

COMPLETED: **1993-11-02**

TOTAL COST: **\$ 146,670**

TO DEVELOP NUCLEAR TECHNOLOGY FOR PERFORMING LABORATORY AND FIELD STUDIES IN HYDROLOGY AND SEDIMENTOLOGY.

The project was initiated in 1985. The Agency provided the National Hydraulics Laboratory (LNH), Caracas, with equipment and expert services for the introduction of isotope techniques in sedimentology. Implementation was delayed owing to a change of counterpart and the lack of sufficiently trained staff. An Agency expert had made specific recommendations for training, but no fellowship applications were received. Nevertheless, the project succeeded in introducing nuclear techniques in the study of sedimentological problems. On the Arauca River and Alto Apure the LNH, with assistance from the Ministry of the Environment, installed the fixed systems for sediment measurements supplied by the Agency and has also been using the portable turbidimetry system. Measurements of sediment concentration in the Arauca River have demonstrated the usefulness of nuclear-based techniques in providing information on river sediment dynamics. However, the insufficient training of counterpart staff working with nuclear techniques may seriously affect their future use in hydrology and sedimentology.

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**VEN/8/008                    NUCLEAR ENGINEERING TEACHING**

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APPROVED: **1991**

COMPLETED: **1993-11-16**

TOTAL COST: **\$ 27,421**

TO ESTABLISH A TRAINING PROGRAMME ON THE APPLICATIONS OF RADIATION, RADIOISOTOPES AND RADIATION SOURCES IN INDUSTRY, WITH EMPHASIS ON SAFETY AND RADIATION PROTECTION.

This project was initiated in 1991 at the Technological Institute of the Faculty of Engineering of the Central University of Venezuela. Experts provided training, including lectures to staff of the Faculties of Engineering and Applied Physics, who are now conducting courses and seminars on the applications of nuclear techniques in industry, with particular emphasis on radiation protection and safety. The Agency provided the small laboratory at the Technological Institute with the equipment required to carry out experiments and demonstrations, including dosimetry and calibration of monitors. One fellowship was awarded for training abroad. A follow-up project (VEN/8/009) has been approved to expand the courses on safe application of nuclear techniques in engineering and industry and to establish a laboratory for nuclear equipment maintenance.

**VIET NAM**

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**VIE/0/007                    WORKSHOP ON DESIGN, MANAGEMENT AND EVALUATION OF TC PROJECTS**

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APPROVED: **1993**

COMPLETED: **1993-10-18**

TOTAL COST: **\$ 21,080**

TO FAMILIARIZE THE COUNTERPARTS OF AGENCY TC PROJECTS WITH CURRENT PRACTICES AND PROCEDURES AND TO PROVIDE GROUP TRAINING IN DESIGN, MANAGEMENT AND EVALUATION OF TC PROJECTS.

The project was approved in 1993 and financed from the Reserve Fund. Three Agency staff members conducted a National Workshop on Project Design, Management and Evaluation Techniques on 19-24 April 1993 at the Vietnam National Atomic Energy Commission (VINATOM), Hanoi, with 33 participants and six observers from 11 Vietnamese organizations and institutes. The Workshop dealt with salient features of Agency TC projects and was designed to assist national project counterparts, members of VINATOM and other institutions in understanding the Agency's structure and the services available from Agency programmes, with a view to improving the planning and execution of their national projects and programmes. Recent changes and shifts in emphasis in TC programming and implementation were thoroughly reviewed. An improvement is expected in the quality of project requests and their implementation in Vietnam.

**VIE/5/012 ANIMAL SCIENCE**

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APPROVED: **1989**COMPLETED: **1993-10-13**TOTAL COST: \$ **178,036**

TO INTRODUCE NUCLEAR TECHNIQUES IN STUDIES ON ANIMAL HUSBANDRY AND VETERINARY SCIENCE.

The project was initiated in 1989 and involved three institutes engaged in studies on improving livestock production and control of animal diseases. The Institute of Agriculture Sciences of South Vietnam, Ho Chi Minh City, was equipped for measuring reproductive hormones using the radioimmunoassay (RIA) technique; the Veterinary Research Institute, Ho Chi Minh City, and the National Institute for Veterinary Research, Hanoi, were equipped for undertaking enzyme-linked immunosorbent assays (ELISA) for diagnosis of trypanosomiasis in cattle and buffalo and pseudorabies (Aujeszky's disease) in pigs. The Agency provided equipment, and three Agency experts carried out five missions to train counterparts in laboratory techniques and the design and implementation of field studies. One fellowship was awarded for training abroad and two others participated in an Agency training course. Vietnamese scientists are now able to use RIA and ELISA techniques for applied field studies on improving livestock production by selection of appropriate genotypes for the climatic conditions and by improved management, feeding and disease control.

**VIE/8/003 ISOTOPE HYDROLOGY**

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APPROVED: **1982**COMPLETED: **1993-08-26**TOTAL COST: \$ **243,314**

TO ESTABLISH THE USE OF ISOTOPIC AND NUCLEAR TECHNIQUES IN THE INVESTIGATION AND MANAGEMENT OF MEKONG DELTA GROUNDWATER RESOURCES.

The project was approved in 1982. Five expert missions advised the Centre for Nuclear Techniques of the Viet Nam National Atomic Energy Commission, Ho Chi Minh City, on hydrological surveying, water tracing and sampling, interpretation of data, planning further investigations, and setting up a carbon-14 laboratory. They also provided on-the-job training, supplemented by seven fellowships for training abroad. Analytical and measuring equipment was provided by the Agency. A better understanding of recharge of the aquifer system was achieved and it was therefore possible to establish the relationship between the different bodies of the aquifer system. The proportion of matrix dissolution with respect to sea water intrusion in groundwater salinity and the groundwater flow velocity over the Mekong Delta from carbon-14 isochrones have been determined. The results of the study were presented at the IAEA/UNESCO Symposium on Isotope Techniques in Water Resources Development held in Vienna in 1991. Scientists in Viet Nam can now use radiocarbon analysis for hydrological studies as well as in other geological and archeological fields.

**VIE/8/004 FOOD IRRADIATION**

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APPROVED: **1984**COMPLETED: **1993-10-18**TOTAL COST: \$ **1,360,344**

TO DEVELOP FACILITIES FOR PILOT-SCALE STUDIES AND DEMONSTRATION OF FOOD PRESERVATION BY IRRADIATION.

The project was approved in 1984 until 1987, and extended at the request of the Government, to develop facilities for semi-commercial scale food irradiation in order to reduce post-harvest losses and improve the hygienic quality of food, particularly potatoes, fruit, spices and fish. The Agency provided a USSR-made cobalt-60 gamma irradiation facility in 1989, which has been in operation since August 1991. The facility is being used for R&D, pilot irradiation of food and for sterilizing medical supplies. Seven expert missions, totalling four months, were carried out and six fellowships were awarded for training abroad. Vietnam has now established a technological basis for food preservation by irradiation with a view to the introduction of commercial-scale food irradiation.

**VIE/9/006 RADIATION EXPOSURE ASSESSMENT**

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APPROVED: **1993**COMPLETED: **1993-10-13**TOTAL COST: \$ **14,296**

TO EVALUATE THE ACCIDENTAL OVEREXPOSURE TO RADIATION OF AN INDIVIDUAL.

The project, financed from the Reserve Fund, was initiated in March 1993 in response to a request for assistance by the Vietnam National Atomic Energy Commission under the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. Two experts went to Hanoi in March to evaluate the accidental overexposure of an individual at an institute of the National Centre for Scientific Research, Hanoi, and to determine what further action was needed. The experts studied the cause of the accident, performed computer simulations and made a dose assessment. They recommended transfer to a specialized hospital, and the French Government provided and financed diagnosis and treatment at a hospital in Paris. The experts made recommendations for the improvement of the radiation protection and safety system at the Centre.

## **YUGOSLAVIA**

### **YUG/1/010 NUCLEAR ANALYTICAL LABORATORY**

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APPROVED: **1986**

COMPLETED: **1993-03-24**

TOTAL COST: \$ **143,492**

TO ESTABLISH A CENTRAL LABORATORY FOR ADVANCED STUDIES IN TRACE ELEMENT ANALYSIS.

The project was approved in 1986 to assist in the installation of a Van de Graaff accelerator at the Rudjer Boskovic Institute, Zagreb. The accelerator was donated by the USA and transport to Yugoslavia was arranged through the Agency. Upgrading was effected by the provision of peripheral and computer equipment. The accelerator is the principal instrument of the Institute and is used for identifying trace elements in samples from industry, the environment and scientific activities.

### **YUG/3/011 GEOLOGICAL AGE DETERMINATION IN URANIUM EXPLORATION**

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APPROVED: **1991**

CANCELLED: **1993-03-26**

TOTAL COST: \$ **0**

TO ESTABLISH A GEOCHRONOLOGICAL LABORATORY FOR THE DETERMINATION OF GEOLOGICAL AGE IN YUGOSLAVIA.

Owing to the UN embargo on Yugoslavia, the project has been cancelled.

### **YUG/4/014 RESEARCH REACTOR MODERNIZATION**

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APPROVED: **1979**

COMPLETED: **1993-04-23**

TOTAL COST: \$ **1,628,994**

TO IMPROVE, MODERNIZE AND REVIEW EQUIPMENT FOR A RESEARCH REACTOR.

The project was approved in 1979 as the second stage of assistance to the research reactor at the Boris Kidric Institute of Nuclear Science, Belgrade, following the design of instrumentation and control for upgrading the reactor under a previous project. A contract for manufacturing equipment was signed with Atomenergoexport. 20-30% of the equipment was delivered and stored to await completion of delivery. Owing to the situation in the former USSR, the manufacturer could not complete the contract, particularly since some reactor components were to have been delivered from other regions which had become independent states. In any case, the available funds were insufficient to procure the remaining parts elsewhere. Meanwhile, political changes in former Yugoslavia had caused communication difficulties between the counterpart and the manufacturer. A limited modernization programme was performed by the counterpart, which resulted in upgrading emergency core cooling, electric power systems and ventilation systems. With the United Nations embargo on Yugoslavia, all technical assistance ceased. Any future technical assistance for the research reactor programme would require the formulation of a new project.

### **YUG/4/026 NUCLEAR POWER PLANT ANALYSIS**

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APPROVED: **1989**

COMPLETED: **1993-01-02**

TOTAL COST: \$ **88,681**

TO ANALYSE THE BEHAVIOUR OF CLASS I COMPONENTS OF KRSKO NUCLEAR POWER PLANT.

Achievements for this project will be reported under the continuation projects CRO/4/002 and SLO/4/002.

**YUG/5/030      ENDOCRINE REGULATION OF REPRODUCTIVE FUNCTION**

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APPROVED: **1991**COMPLETED: **1993-08-11**TOTAL COST: \$ **39,592**

TO STUDY METHODS OF IMPROVING FERTILITY IN CATTLE. TO INSTITUTE NECESSARY CHANGES AND MONITOR PROGRESS USING HORMONE MEASUREMENT AND CLINICAL METHODS.

The project was approved in 1991 and focussed on the application of progesterone measurements to study methods for improving fertility. The Agency provided the Institute of Biology, University of Novi Sad, with a liquid scintillation counter and other supplies in order to upgrade the laboratory, which suffered from obsolete equipment. The close collaboration between the Institute of Biology and the Institute of Animal Reproduction and Artificial Insemination, Tamarin, was an important factor in the successful completion of the project.

**YUG/8/013      INSTALLATION AND COMMISSIONING OF LINAC.**

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APPROVED: **1991**COMPLETED: **1993-03-24**TOTAL COST: \$ **8,234**

TO INSTALL AND COMMISSION A LINEAR ACCELERATOR AS A TOOL FOR RADIATION TECHNOLOGIES BASED ON THE ELECTRON BEAM ACCELERATOR.

The project was approved in 1991. Preparations were made for the necessary infrastructure for a linear accelerator at the Rudjer Boskovic Institute, Zagreb, and the building to contain it. Local staff were recruited. The Agency provided expertise and some essential components. The project is Phase I of the installation, and the remaining work will be completed under Project CRO/8/003.

**YUG/9/023      PROCUREMENT ASSISTANCE**

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APPROVED: **1988**COMPLETED: **1993-03-26**TOTAL COST: \$ **65,816**

TO ASSIST IN THE PROCUREMENT OF EQUIPMENT.

The Josef Stefan Institute, Ljubljana, was assisted in the procurement of equipment needed for research and upgrading of its calculation capabilities. Five items of equipment were procured using Funds-in-Trust. The project was of great assistance to Slovenia at a time of political and economic changes.

**YUG/9/025      OPERATIONAL NUCLEAR SAFETY**

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APPROVED: **1989**COMPLETED: **1993-04-26**TOTAL COST: \$ **143,042**

TO STUDY THE OPERATIONAL SAFETY MANAGEMENT OF KRSKO NPP WITH STEAM GENERATOR PLUGGING AND TO PREPARE A LEVEL-ONE PROBABILISTIC SAFETY ASSESSMENT FOR THE PLANT.

The project was initiated in 1989 as part of an effort to improve PWR safety and to extend design analysis. The provision of computer services upgraded the calculational capabilities of the Faculty of Electrical Engineering of the Jozef Stefan Institute, Ljubljana, and of the Rudjer Boskovic Institute, Zagreb. About 20 expert missions gave advice on safety limits, accident analysis, steam generator tubes plugging criteria and probabilistic safety assessment (PSA). The steam generators had been the main operational safety concern since plant operation began, first, tube vibrations, and then the gradual degradation of U-tubes. The plugging margin for full power operation has now been clearly established. A level-1 PSA for the Krsko NPP has been initiated and studied in depth with Agency assistance. A database for critical components of the NPP has been established. The Agency assisted in setting up an engineering work station for safety analysis studies; parametric assessments and plant data handling were performed. The project contributed to the development of technical expertise and analytical tools for thermohydraulic safety analysis, improved the professional base for regulatory decisions, improved and increased the detailed database and formation of standardized modules for future thermohydraulics and safety analysis. The Krsko NPP and the University of Ljubljana received advice and assistance on PSA analysis, including seismic hazard methodology, from Agency experts. This work will be continued under Project CRO/9/002 and CRO/9/003 in Croatia, and SLO/9/002 in Slovenia.

**YUG/9/029 ENVIRONMENTAL RISK IN ZAGREB AREA**

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APPROVED: 1991

COMPLETED: 1993-03-24

TOTAL COST: \$ 43,278

TO STUDY AND ASSESS THE RISKS FROM ENERGY AND OTHER INDUSTRIAL SYSTEMS IN THE ZAGREB AREA.

The study of industrial risk assessment was initiated in 1991 and, with Agency guidance, an interdisciplinary team was created. The Agency provided a computer system and software to run the analysis as well as continuous guidance. Advice on handling the radioactive sources affected by the war was also given. The work on risk assessment will be continued and completed under Project CRO/9/004.

**YUG/9/031 MAINTENANCE AND AGEING OF NUCLEAR POWER PLANTS**

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APPROVED: 1991

COMPLETED: 1993-03-24

TOTAL COST: \$ 19,270

TO TRANSFER KNOWLEDGE OF AGEING PHENOMENA IN NUCLEAR POWER PLANTS.

A Workshop on Safety Aspects of Preventive Maintenance was organized on 14-18 September 1992 at the Milan Copic Training Centre, Ljubljana. The workshop was organized by five experts from the USA and covered overview, maintenance optimization concepts, reliability-centred maintenance, risk-focussed maintenance, and new approaches to maintenance regulations. Thirty-five engineers from the Krsko NPP and supporting institutions participated. The project contributed to the transfer of knowledge of ageing phenomena and safe operation of NPPs.

**ZAIRE****ZAI/4/009 STRENGTHENING OF MAINTENANCE CAPABILITY**

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APPROVED: 1987

COMPLETED: 1993-10-13

TOTAL COST: \$ 43,512

TO STRENGTHEN THE LOCAL CAPABILITY FOR REPAIR AND MAINTENANCE OF ELECTRONIC AND NUCLEAR EQUIPMENT.

The project was initiated in 1987 to assist the Reactor Service and Technical Division of the Kinshasa Regional Nuclear Research Centre, which is responsible for the maintenance and repair of all nuclear equipment at the Centre, the University, and some hospitals, in upgrading the local capability in this field through staff training and provision of test instruments and spare parts. One staff member was awarded a four-month fellowship for training abroad, and a senior service engineer received training on maintenance of nuclear spectroscopy instrumentation at the Agency's Laboratories in Seibersdorf for eight months. Expert missions introduced a computerized management system for maintenance and repair of nuclear equipment. Several defective items have now been put back into operation, and nearly 250 are being maintained on a routine basis. Agency assistance will continue and spare parts will be provided through the regional project RAF/4/004.

**ZAI/5/008 RADIATION-INDUCED MUTATIONS**

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APPROVED: 1986

COMPLETED: 1993-10-18

TOTAL COST: \$ 164,176

TO IMPROVE THE QUALITY AND INCREASE THE YIELD OF VIGNA VEXILLATA AND RICE THROUGH RADIATION-INDUCED MUTATIONS AND IN-VITRO CULTURES.

The Agency's assistance to the Kinshasa Regional Nuclear Research Centre in radiation-induced mutations in plants dates back to 1974 (ZAI/5/003). The present project was initiated in 1985 to further improve the quality and increase the yield of local food crops, e.g. cowpea, rice and soybean. The Agency provided the necessary equipment. Five experts undertook missions totalling eighteen weeks to install equipment, establish the tissue culture facility, advise on in-vitro culture techniques, plan experiments and identify future needs. Two fellowships were awarded for training abroad. Advanced generation of radiation-induced mutants of Vigna vexillata (a tropical root crop) was produced for field evaluation. In-vitro culture of soybean, albizzia (a legume tree) and rice was initiated and resulted in callus formation. Studies are in progress to regenerate plants from the callus culture. The counterparts should now be able to continue the work with very little outside assistance.

**ZAI/8/008                    ACTIVATION ANALYSIS IN MINING**

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APPROVED: **1986**COMPLETED: **1993-02-26**TOTAL COST: \$ **106,047**

TO USE ACTIVATION ANALYSIS FOR AN INVENTORY OF MINING RESOURCES AND FOR AN ENVIRONMENTAL STUDY THAT WILL LEAD TO THE PREPARATION OF A GEOCHEMICAL MAP.

This project was initiated in 1986 as a follow-up to a related project, ZAI/2/007. The objective of the new project was to upgrade the analytical capability of the Central Analytical Laboratory of the Kinshasa Regional Nuclear Research Centre. A liquid nitrogen plant was successfully installed with Agency assistance and some major items of equipment were provided. Two experts assisted in the training of the local staff and the installation of some equipment. The laboratory is now functional and has analysed ore samples of gold, copper, manganese, tin and uranium for the mining industry. Analyses have also been performed on hydrogeological and geochemical samples to assess environmental pollution, and on hair samples of workers in the copper industry to evaluate possible contamination. This work will be continued and expanded under Project ZAI/8/011, which is already operational.

**ZAI/8/010                    GAMMA IRRADIATION FACILITY**

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APPROVED: **1991**COMPLETED: **1993-07-26**TOTAL COST: \$ **17,946**

TO DEVELOP RADIATION TECHNOLOGY FOR THE STERILIZATION OF MEDICAL PRODUCTS AND FOR RADIATION TREATMENT OF FOOD CROPS.

The project was initiated in 1991 to provide the Kinshasa Regional Nuclear Research Centre with a multipurpose 100 kCi cobalt-60 irradiator. A one-month expert mission was undertaken. In view of the lack of commitment at the local level and the absence of a suitable building to house the irradiator, implementation of this project is not possible.

**ZAI/9/005                    RADIATION PROTECTION**

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APPROVED: **1991**COMPLETED: **1993-03-18**TOTAL COST: \$ **119,261**

TO IMPROVE RADIOLOGICAL SAFETY BY UPGRADING PERSONNEL DOSIMETRY FACILITIES.

Under previous projects, the Agency has assisted the Kinshasa Regional Nuclear Research Centre in establishing a radiation protection service to monitor radiation doses received by workers exposed to ionizing radiation in medical and industrial facilities. The project under review was initiated in 1991. The Agency provided a new thermoluminescence dosimetry system to replace obsolete film dosimetry in addition to other major items of equipment. The system was installed in 1992 and the local staff trained in its operation. The radiation protection service is now well established.

**ZAMBIA****ZAM/0/005                    NUCLEAR ANALYTICAL LABORATORY**

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APPROVED: **1981**COMPLETED: **1993-09-30**TOTAL COST: \$ **907,052**

TO ESTABLISH A MULTIDISCIPLINARY NUCLEAR ANALYTICAL LABORATORY FOR TEACHING, RESEARCH AND DEVELOPMENT.

The project was initiated in 1981. Nuclear analytical equipment was provided by the Agency, and eleven expert missions were undertaken. Ten fellowships and two scientific visits were awarded. A well equipped and staffed nuclear analytical laboratory has been established, at which about ten graduate students from the University and collaborating institutes have already received training in nuclear analytical analysis and research. The work carried out under this programme includes: analysis of samples of industrial minerals and processing products; measurement of primordial radionuclides in coal, coal wastes, rock phosphates, copper ores and copper tailings; study of the nutritional quality of Zambian stock feeds; study of soil samples from different agricultural zones. Nuclear analytical techniques have been introduced in various areas of Zambian industry, and the laboratory staff has gained experience in applications of these techniques. The laboratory can now provide service in agriculture, industry, medicine, the environment and manpower training.

**ZAM/1/006      NUCLEAR SCIENCES AND TECHNIQUES**

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APPROVED: **1989**COMPLETED: **1993-03-18**TOTAL COST: **\$ 82,060**

TO CREATE A POST-GRADUATE CURRICULUM IN NUCLEAR SCIENCES FOR MANPOWER DEVELOPMENT.

The project was initiated in 1990, focussing on upgrading the experimental nuclear laboratory at the Physics Department, University of Zambia. Major items of equipment were supplied. With two months expert assistance, the measurement systems provided by the Agency were put into operation and computer programs for quantitative analysis and other useful functions were successfully installed. A computer-based isotopic X-ray fluorescence system has now been established which is being used for post-graduate teaching and research work.

**ZAM/5/004      RADIOISOTOPES IN AGRICULTURE (FERTILIZER STUDIES)**

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APPROVED: **1979**COMPLETED: **1993-06-08**TOTAL COST: **\$ 258,179**

TO IMPROVE BASIC CROP YIELDS BY THE INTRODUCTION OF NUCLEAR TECHNIQUES IN AGRICULTURE, PARTICULARLY IN THE USE OF NITROGENOUS AND PHOSPHATIC FERTILIZERS.

Soils in Zambia are generally too low in nitrogen for optimum crop yields. Biological nitrogen fixation by legumes provides a valuable source of nitrogen at modest cost and the legumes, in rotation with other crops, improve overall yields. The purpose of this project was to assist the local staff of the Soils Chemistry and Soils Physics Sections of Mount Makulu Central Research Station to develop expertise in the use of nitrogen-15 to assess nitrogen fixation by legumes. Six expert missions assisted in planning and initiating experiments aimed at increasing yields through improving the efficient use of water and fertilizer nitrogen and in evaluating the efficiency of Zambian rock phosphate. The experts also assisted in the statistical analysis and interpretation of data and in installing equipment and standardizing chemical techniques. The Agency provided equipment and the on-the-job training. Five project-related fellowships were awarded for training abroad. From quantitative work with labelled fertilizers, valuable information was obtained on the optimal placement, timing and nutrient source to give maximum utilization of the fertilizer by the crops. In some cases Zambian rock phosphate appeared to be a good substitute for imported superphosphate. By means of phosphorus-32, it was established that the uptake of phosphorus by maize and soybean from partially acidulated phosphate rock locally produced on a pilot scale was the same as that from the more expensive commercial Triple Super Phosphate fertilizer. These results are of great practical significance and Agency support is continuing under Project ZAM/5/019. The Central Research Station is now making a valuable contribution to increasing the production of wheat, soybean, maize and rice with reduced amounts of fertilizer by increasing the efficiency with which plants use the applied nutrients.

**ZAM/5/009      TSETSE FLY CONTROL**

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APPROVED: **1982**COMPLETED: **1993-06-21**TOTAL COST: **\$ 265,106**

TO HELP CONTROL THE TSETSE FLY BY INTRODUCING THE STERILE MALE TECHNIQUE AND SETTING UP A MASS REARING LABORATORY.

About 33% of Zambia is infested with tsetse flies, and trypanosomiasis is one of the country's most widespread animal diseases. Previous methods of tsetse control have recently been replaced by large scale use of odour-baited insecticide impregnated screens. This project was approved in 1982 to complement these new methods by introducing the sterile male technique (SIT) into the tsetse control programme. The Agency supplied a caesium-137 gamma irradiator and equipment for insect and ecological studies to the Livestock and Pest Research Centre of the National Council for Scientific Research, Chilanga. Fellowships and scientific visits were also awarded. Agency experts undertook field missions to establish routine procedures for blood collection and in-vitro feeding of tsetse and to standardize practices of maintaining and managing colonies. The experts also provided on-the-job training and advice on mass rearing. Although the SIT could not be fully implemented in the field because of the difficulties encountered in raising and sustaining the required number of tsetse flies, the results achieved so far will, if the Government provides the necessary input, contribute to the overall tsetse control/eradication strategy.

**ZAM/5/015      TICK RESISTANCE TO ACARICIDES**

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APPROVED: **1986**COMPLETED: **1993-12-14**TOTAL COST: **\$ 255,650**

TO INTRODUCE RADIOTRACER TECHNIQUES IN THE STUDY OF TICK RESISTANCE TO ACARICIDES.

The project was initiated in 1986. The Agency supplied equipment and chemicals required for experiments; experts trained the counterparts in the use of the equipment and in the application of radiotracer techniques. Three fellowships were awarded for training abroad. A well equipped and well staffed laboratory has been set up at the

Livestock and Pest Research Centre, Chilanga. The pattern and degree of tick resistance to acaricides have been established.

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**ZAM/8/003                      MULTI-PURPOSE GAMMA IRRADIATION FACILITY**

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APPROVED: **1983**

COMPLETED: **1993-03-19**

TOTAL COST: **\$ 772,604**

TO ESTABLISH A GAMMA IRRADIATION FACILITY WITH A VIEW TO DEVELOPING RADIATION TECHNOLOGY FOR FOOD PROCESSING AND STERILIZATION OF MEDICAL SUPPLIES.

The project was approved in 1983 to establish a multipurpose, demonstration type gamma radiation facility at the Nuclear Analytical Laboratory in the Radioisotopes Research Unit of the National Council for Scientific Research, Lusaka. Two six-month fellowships for training abroad were awarded, and nine expert missions were undertaken for a total duration of seven months. The Agency also provided the necessary equipment. The technology has been transferred and the gamma irradiation facility is being used for small-scale sterilization of medical supplies and for irradiation experiments with foodstuffs. A programme on radiation vulcanization of natural rubber latex and its use in medicine has also been initiated.

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**ZAM/9/004                      RADIATION PROTECTION SERVICES**

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APPROVED: **1982**

COMPLETED: **1993-03-19**

TOTAL COST: **\$ 185,863**

TO STRENGTHEN AND EXPAND RADIATION PROTECTION SERVICES.

The project was approved in 1982 to assist the Ministry of Health. Six expert missions were undertaken to advise on drafting radiation protection legislation, environmental monitoring and food contamination, to install a thermoluminescence dosimetry (TLD) system, and to provide on-the-job training. Two fellowships were awarded for training abroad. A TLD system, laboratory equipment and supplies were provided. The project has provided the basis for routine application of radiation protection in Zambia. The Ministry of Health has established a comprehensive register of all radiation facilities and workers in the country and is capable of monitoring more than 600 radiation workers, using its personnel dosimetry laboratory. It has also developed a comprehensive national register of spent radiation sources. Under a follow-up project (ZAM/9/005), which is already operational, these activities are expanding into the field of radioactive waste management.

**ZIMBABWE**

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**ZIM/6/003                      MEDICAL PHYSICS**

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APPROVED: **1989**

COMPLETED: **1993-06-09**

TOTAL COST: **\$ 97,312**

TO PROVIDE EXPERTISE AND ON-THE-JOB TRAINING IN MEDICAL PHYSICS.

The project was initiated in 1989. The major part of the training programme was sponsored by WHO and the Swiss Government in co-operation with the Ministry of Health in Zimbabwe. Agency assistance consisted in provision of long-term expert services in medical physics as part of the teaching faculty of the post-graduate training programme for radiotherapists at the Radiotherapy Centre, Parirenyatwa Hospital, Harare. Agency support is continuing under a new project, ZIM/6/005.

