THE AGENCY'S TECHNICAL CO-OPERATION ACTIVITIES IN 1989

Report by the Director General

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INTERNATIONAL ATOMIC ENERGY AGENCY

PREFACE

Following its usual practice, the Board of Governors has requested the communication to the General Conference of the material it used in reviewing the Agency's technical co-operation activities in 1989; 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.*[1]

1 See document INFCIRC/267.

CONTENTS

LIST OF ABBREVIATIONS

AAPC	Agency's Area of Activity/Project Codes
AERE	Atomic Energy Research Establishment (Bangladesh)
Agency	International Atomic Energy Agency
ARCAL	Regional Co-operative Arrangements for the Promotion of Nuclear Science and Technology in Latin America
ASSET	Assessment of Significant Safety Events Team
BATAN	Badan Tenaga Atom Nasional (National Atomic Energy Agency - Indonesia)
CAIR	Centre for the Application of Isotopes and Radiation (Indonesia)
CC	Convertible Currency
CEC	Commission of the European Communities
CINAGRI	Centro de Investigaciones Nucleares Aplicados a la Agricultura (Venezuela)
CRP	Co-ordinated Research Programme
ECOSOC	United Nations Economic Social Council
EEC	European Economic Community
ELISA	Enzyme-linked immunosorbent assay
ENDF	Evaluated Nuclear Data File
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization of the United Nations
FICS	Financial Information Control System
GM	Geiger-Mueller
IAEA	International Atomic Energy Agency
IBRD	International Bank for Reconstruction and Development (World Bank)
IFFIT	International Facility for Food Irradiation Technology
INIS	International Nuclear Information System
ISO	International Organization for Standardization
KAERI	Korea Advanced Energy Research Institute
KANUPP	Karachi Nuclear Power Plant
LAN	Local area network
LDAC	Least-developed Arab country
LDC	Least-developed country
MAED	Model for analysis of energy demand
MOSCAMED	Mediterranean Fruit Fly (Mosca de Mediteranea) Programme
MSc	Master of Science
NCC	Non-convertible currency
NDT	Non-destructive testing

NENF	Division of Nuclear Fuel Cycle, IAEA
NENP	Division of Nuclear Power, IAEA
NENS	Division of Nuclear Safety, IAEA
NIM	Nuclear Instrumentation Module
NPP	Nuclear power plant
OAEP	Office of Atomic Energy for Peace (Thailand)
OSART	Operational Safety Review Team
PC	Personal Computer
PHWR	Pressurized heavy water reactor
PINSTECH	Pakistan Institute of Nuclear Science and Technology
PNRI	Philippine Nucleaar Research Institute
PSA	Probabilistic Safety Analysis
PUSPATI	Tun Ismail Atomic Research Centre (Malaysia)
PVC	Polyvinyl Chloride
PWR	Pressurized water reactor
QA	Quality assurance
QC	Quality control
RAPAT	Radiation Protection Advisory Team
RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology
RIA	Radioimmunoassay
RIAL	Agency's Laboratories
RIFA	Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development
RILS	Division of Life Sciences, IAEA
RIPC	Division of Physics and Chemistry, IAEA
SIT	Sterile insect technique
SPECT	Single Photon Emission Computed Tomography
SSDL	Secondary Standard Dosimetry Laboratory
TACF	Technical Assistance and Co-operation Fund
TC	Department of Technical Co-operation, IAEA
TCDC	Technical co-operation among developing countries
TCIM	Division of Technical Co-operation Implementation
TCMS	Technical Co-operation Management System
TCPM	Division of Technical Co-operation Programmes
TCSPC	Programme Co-ordination Section
TLD	Thermoluminescence dosimetry

TSH	Thyroid-stimulating hormone
TUV	Technischer Ueberwachungsverein
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFSTD	United Nations Fund for Science and Technology for Development
UNIDO	United Nations Industrial Development Organization
UNTCD	Department of Technical Co-operation for Development, United Nations
UV-VIS	Ultra-violet to visible
WAMAP	Waste Management Advisory Programme
WASP	Wien Automatic System Planning Package
WHO	World Health Organization
WWER	Pressurized water-cooled and water-moderated power reactor

COUNTRY ABBREVIATIONS

Byelorussian SSR	Byelorussian Soviet Socialist Republic
Dem. Kampuchea	Democratic Kampuchea
Dem. P.R. Korea	Democratic People's Republic of Korea
German D.R.	German Democratic Republic
Germany, F.R.	Federal Republic of Germany
Iran, I.R.	Islamic Republic of Iran
Korea, R.	Republic of Korea
Libyan A.J.	Libyan Arab Jamahiriya
St. Christopher	St. Christopher-Nevis
Syrian A.R.	Syrian Arab Republic
Ukrainian SSR	Ukrainian Soviet Socialist Republic
USSR	Union of Soviet Socialist Republics
U.A. Emirates	United Arab Emirates
UK	United Kingdom of Great Britain and Northern Ireland
U.R. Tanzania	United Republic of Tanzania
USA	United States of America

AAPC PROGRAMME-LEVEL 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**

INTRODUCTION

The focus of the report at hand remains on data as to where, on what and to which extent the various funds made available for technical co-operation activities in a particular year – in this case, 1989 – were used.

In addition to quantitative data, which are expressed in financial terms and through other indicators such as expert months and numbers of assignments, qualitative aspects of the programme are covered in narratives on each project completed during the year under review (Section IV). In-depth assessments of quality and programme achievements are primarily addressed through evaluation activities.

Descriptions of the Agency's technical co-operation activities in a particular region – for example, Latin America in 1987 and Africa in 1988 – continue to be provided, narratives covering the region of Asia and the Pacific appearing in the current report.

Statistical data classified by the Agency's area of activity/project codes (AAPCs) are presented – at the "Programme" level – for the first time and account for some changes in the "Figures" Section. Rearrangements are kept to a minimum since users of the report value the fact that particular information can be found in figures, tables and annexes which bear from the same identification number year after year.

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

The glossary which follows provides definitions of terms and concepts used in the report as applied in respect of the technical co-operation activities of the Agency.

GLOSSARY

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.

Disbursements – actual cash outlays for goods provided and services rendered.

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).

New obligations – the sum of disbursements during the year and year-end unliquidated obligations minus unliquidated obligations carried over from the previous year.

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.

Special Programme – projects identified jointly by donor and recipient Member States and executed by the Agency utilizing extrabudgetary funds and in-kind contributions especially provided for this purpose.

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

UNDP Programme – projects executed by the Agency on behalf of UNDP and its associated funds, including UNFSTD.

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.

I. EXECUTIVE SUMMARY

- The Agency's first two-year technical co-operation programme began in 1989. As the programme had been prepared in 1988 – under the constraints of the one-year cycle – it is too early to draw definite conclusions on the advantages/disadvantages of a two-year cycle. Neverthless, fears that a two-year programme would be too rigid to respond to changing needs proved unfounded.

- The Department of Technical Co-operation was reorganized, the former Division of Technical Assistance and Co-operation being divided into two new divisions – namely, Technical Co-operation Programmes and Technical Co-operation Implementation.

- Detailed in-house discussions with other Agency Departments involved in technical co-operation, aimed at establishing optimum conditions for the delivery of a growing technical co-operation programme, were started or continued in 1989.

- Computerization progressed further with a considerable expansion of the Department's local area network (LAN), made possible through in-kind contributions from the USA and the Republic of Korea.

- Preparatory work relating to the establishment of a regional co-operative agreement for Member States in Africa was successfully completed with the formulation of a proposed text.

- The Agency actively participated in on-going interagency discussions concerning the operational activities of the UN system, in particular in respect of the issues raised in General Assembly resolution 44/211 and successor arrangements to the present UNDP Executing Agency support cost system.

- A total of 1135 projects were operational during 1989, of which 165 were completed; 106 regional and interregional training courses were held. A total of 2189 persons received nearly 4000 months of training abroad, and 2144 expert assignments were undertaken.

- New resources for technical co-operation grew by 9.9% over the previous year, reaching $50 million for the first time. The Technical Assistance and Co-operation Fund (TACF) accounted for 74.5% of all resources; 14.7% was derived from extrabudgetary funds, 6.2% from UNDP and 4.6% from assistance in kind.

- **The total adjusted programme for 1989 was valued at $66.7 million, an increase of 10.7 % over the previous year. As implementation did not fully keep pace with the growth in resources, an implementation rate of 56.5% was obtained.**

- **Two major sectoral evaluations and a third country evaluation were completed in 1989. Two additional, less intensive country reviews were conducted, and a total of 65 projects underwent mid-project or end-of-project evaluations.**

- **The distribution of the adjusted programme among the components of the programme became more balanced, equipment accounting for 45.8%, fellowships and training for 26.8% and experts for 24.1%.**

- **The percentage of the target for voluntary contributions actually pledged continued to decline and stood at 85% at the end of 1989. With additional income, however, largely in the form of payments of assessed programme costs, 88.8% of the target amount for 1989 could be reached.**

- **Overprogramming was further reduced, from $4.8 million to $3.3 million, which made it possible to present the 1990 programme without initial overprogramming.**

II. REVIEW OF THE AGENCY'S TECHNICAL CO-OPERATION ACTIVITIES

A. Overview

1. General issues

(a) Programmatic issues

1. With the year under review the first two-year cycle for the Agency's technical co-operation activities was introduced. The drawing of any conclusions as to the advantages/disadvantages of a biennial programme – versus an annual one – is not yet warranted. One of the major points in favour of a two-year programme is that a longer time-frame exists for the preparation of soundly formulated projects; this can only start to bear fruit in the next biennial programme, since the current programme had to be prepared under constraints prevailing during the one-year cycle.

2. Adequate provisions for preparatory assistance enabled the Agency to field 28 preparatory missions to 25 countries during 1989. Owing to the felicitous establishment of a special reserve for 1990, in addition to the normal Reserve Fund, it was possible to accommodate several new projects in the 1990 programme on the basis of these missions, so that the feared delays in meeting urgent needs during the two-year cycle did not arise. The flexibility that the programme has to effect project changes within approved objectives has further contributed to its capacity to remain responsive to Member States' needs. A major concern of some Member States – namely, that in a two-year cycle the programme would be frozen for too long a period – proved, therefore, unfounded.

3. The rate of return of project management plans by Member States to the Agency was satisfactory during 1989, 50 of the 61 that had gone out having been returned. Nevertheless, delays still occur, and possible measures to ensure more prompt compliance will be reviewed with Member States in connection with discussions on the 1991-92 programme. The experience gained with management plans points to the fact that their real usefulness is difficult to assess. While they provide a valuable reminder to all parties involved in a project of their respective obligations, there is no evidence that projects without a management plan are more susceptible to delay than those which have a well-designed work plan. Final conclusions will have to await the outcome of an evaluation of the subject which is now in progress.

4. Efforts have been intensified to determine the special needs of least-developed Member States through a number of programming missions. It has become clear that, in addition to the development of local manpower resources, these countries require concomitant assistance in the preparation of an adequate physical infrastructure without which they would remain unable to absorb technical assistance in the Agency's field of expertise.

(b) In-house developments

5. A re-organization of the Department of Technical Co-operation took place in 1989 whereby the former Division of Technical Assistance and Co-operation was split into two new divisions – Technical Co-operation Programmes (TCPM) and Technical Co-operation Implementation (TCIM) – and the Programme Co-ordination Section (TCSPC) reverted to the Office of the DDG-TC. TCPM comprises the four regional Sections (Africa, Latin America, Asia and the Pacific, and the Middle East and Europe).

TCIM consists of the Field Procurement, the Experts, the Training Courses and Fellowships and Training Sections. The arrangement started on 1 July 1989 and became fully effective on 1 January 1990 with the appointment of a Director for TCIM.

6. Extensive consultations were initiated with the Department of Research and Isotopes and the Department of Nuclear Energy in order to strengthen the degree of involvement of technical staff in technical co-operation activities with due consideration for respective roles as well as for the difficulties faced in providing adequate backstopping for a growing technical co-operation programme. Consultations with the Department of Administration, in particular with the Division of Budget and Finance, the Legal Division, and the Office of Internal Audit and Evaluation Support continued during 1989 with a view to establishing streamlined working procedures geared towards facilitating the delivery of the Technical Co-operation programme.

7. The year 1989 saw a major expansion in the Department's local area network (LAN), which is the Agency's first and largest production LAN. Thanks to generous in-kind donations of equipment and consultancy services from the United States of America and of equipment from the Republic of Korea, the LAN hardware base was expanded from 26 workstations in 1988 to some 80 workstations at the end of 1989. Various other hardware items were acquired and installed during the year, including laser printers, hard disk storage units and a gateway to the IAEA's mainframe computer. With the new equipment, the hardware base was extended to cover some 70% of the staff in TC, which is important in view of the increasing reliance of the Department on computers for programme management. However, apart from imposing heavy additional requirements for maintenance and backstopping, the expanded hardware base generates demands for accelerated application development which cannot be satisfied with existing staff resources.

8. Significant enhancements to the computerized Technical Co-operation Management System (TCMS) were made relating to Field Procurement activities. On-line retrieval programs now allow the display of previous orders and prospective vendors. Data entry was decentralized to the Field Procurement Section, which is now able to create, check and transfer obligations directly from the TCMS into the Financial Information Control System (FICS). As data checking is done on the spot, errors in obligation records have been drastically reduced.

9. Another TCMS development involved the management of fellowships. Relevant programs were modified to accommodate simplified procedures for the monitoring of this component.

10. All of the above measures are an investment in the future, intended to lead to the more efficient delivery of a higher quality product, but numerous problems remain; these are being addressed by the Department of Technical Co-operation in collaboration with other units within the Secretariat.

(c) External developments

11. The initiative of African Member States to establish a Regional Co-operative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA) was successfully pursued during 1989, resulting in the finalization of a text for such an agreement. This text was presented to and endorsed by the Board in February 1990.

12. Deliberations within the UN System during the last few years on key issues pertaining to operational activities, in which the Agency has actively participated, found their reflection and were analysed in documents prepared under the responsibility of the Director General for Development and International Economic Co-operation for the comprehensive triennial policy review of operational activities of the United

Nations System. Following the review of this documentation by the Second Committee of the General Assembly, the substantive response of Member States to these issues was reflected in GA Resolution 44/211 adopted on 22 December.

13. The overall aim of the various actions proposed in the resolution is to maximize the utilization of national capacities in all aspects of the programming process and project cycle, to facilitate the exercise of management and co-ordination responsibilities by recipient governments and to strengthen national capacities in this regard.

14. The issues requiring action on the part of the organizations of the UN System cover areas such as **country level structures**, including the role of Resident Co-ordinators, the provision of multi-disciplinary advice, common premises and other improvements in the field representation of the System; **programming**, including formulation by governments of integrated national programme frameworks and measures to adapt the programming procedures of the System to those of national governments; **government/national execution**, including adaptation of rules and procedures relating to this implementation modality, the simplification and harmonization of rules and procedures pertaining to all phases of programme and project cycles and a redefinition of the participation of specialized agencies and technical bodies towards the provision of technical support to governments; **decentralization and delegation of authority**; **technical co-operation among developing countries**, including improving the ability to provide governments at country level with information on the capacities and needs of other countries; and **diversification of procurement**, with enhanced utilization of capacities of developing countries and of under-utilized major donors.

15. The General Assembly requested that a three-year schedule for the implementation of the resolution by all organizations within the UN System be submitted to ECOSOC in July 1990.

16. Being an autonomous intergovernmental organization, the Agency is not obliged automatically to respond to General Assembly resolutions; in these matters, however, it is closely co-operating with other agencies in the System through existing consultative mechanisms and thus participating in a common follow-up.

17. From preliminary reactions by major agencies it is clear that the degree to which the resolution will be implemented will of necessity vary, owing to the specific mandates of each agency and, also, to local circumstances in individual recipient countries. In the Agency's case, for instance, several of the issues raised in the resolution – particularly those referring to country-level structures and decentralization – do not directly apply, as the Agency does not have field offices for operational activities and already works in technical co-operation matters, wherever relevant, through the offices of the UNDP Resident Representative as UN Resident Co-ordinator.

18. Nevertheless, the resolution provides an up-to-date summary of the thinking of the international community on development issues and confirms the validity of the concepts upon which the Agency's own technical co-operation is based. Although the future direction of the Agency's technical co-operation programme will continue to be set by its own governing body, the resolution provides an overall framework of guidelines in this respect.

19. During 1989, the Agency was closely involved in another major issue concerning the technical co-operation activities of the system, namely, that of UNDP support costs. As expiry of the present system is scheduled for 1991, a group of experts was appointed by the Governing Council of UNDP to identify a possible new system for reimbursing agencies for costs incurred in the execution of UNDP projects. This matter has become particularly crucial since there is a continuing increase in the

number of cases where agencies provide initial identification and appraisal work for projects which are ultimately executed by governments so that no overhead accrues for the Agencies involved.

20. In their draft report, which became available only in December 1989, the experts propose a number of options for new arrangements. For the Agency, the most important element of the report is the recognition of the special position of technical agencies which handle a relatively small UNDP programme and therefore benefit from a higher reimbursement percentage than the major agencies (in IAEA's case 22% versus 13%). The expert group recommend that, whatever new system is ultimately decided upon, smaller agencies have the option to continue with the present system if they consider this more suitable. In the series of UN System discussions which is continuing on the support cost successor arrangements, the Agency, in close co-operation with other smaller technical Agencies of the system, is concentrating its efforts on ensuring that this clause is maintained in any new arrangement.

21. The size of operational projects ranged from one month of expert services valued at $8100 to large-scale multi-year projects with 1989 budgets of well over $1 million each. There were eleven projects which had 1989 budgets exceeding $0.5 million, the two largest of these being regional undertakings in Asia and Latin America funded from multiple sources.

2. Resources and Delivery

Total new resources	**$50.1 million**
Adjusted current year programme	**$66.7 million**
New obligations $37.7 million	
Implementation rate	**56.5%**
Disbursement and assistance in kind	**$41.1 million**

22. For the first time ever, total new resources available for Agency technical co-operation in any one year reached $50 million, increasing by $4.5 million, or 9.9%, over the previous year. This growth was due not only to a 8.1% increase in the TACF but also to a substantial (29.2%) increase in extrabudgetary resources. The TACF accounted for 74.5% of total resources and extrabudgetary funds for 14.7%. UNDP funds, which grew only slightly, represented 6.2%, and assistance in kind, which again declined slightly, 4.6% of the total. Figure 1 provides information on the development of these resources over the past seven years.

23. The total value of all technical co-operation activities approved for a given calendar year, plus the value of all approved but as yet unimplemented assistance brought forward from previous years (and adjusted during the year owing to cancellations, rephasings and additions), constitutes the "adjusted programme". In 1989, the value of the current-year adjusted programme increased by $6.5 million, or 10.7%, to $66.7 million. An additional $39.9 million had been approved for future-year activities.

24. Implementation actions during 1989 resulted in new obligations valued at $37.7 million, a figure somewhat below that of 1988 ($38.6 million). If new obligations against future years ($3.1 million) are also taken into account, the volume of technical assistance set in motion during 1989 was $0.3 million, or 0.8%, lower than in 1988. While this is in itself a negligible decline, when measured against a substantially increased programme, a much lower implementation rate results.

25. The following table, summarizing financial performance during the past five years, shows this development.

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

Year	TACF	Funds in trust	Extrabudgetary funds	UNDP	Total
	(%)	(%)	(%)	(%)	(%)
1985	66.3	24.3	35.4	76.3	57.9
1986	75.7	68.7	32.2	83.7	67.6
1987	67.0	55.0	37.5	77.7	61.3
1988	65.0	25.6	56.5	82.8	64.1
1989	58.0	44.1	46.7	70.2	56.5

26. As indicated in the table, implementation was lower in respect of all funds except of funds in trust. As this category of funds represents only 1.4% of the adjusted programme, it has little or no influence on the overall implementation rate. The performance of each of the funds is discussed separately in Part E of this Section, and a detailed and comprehensive overview of the status of the total programme at end 1989 is given in Implementation Summaries I and II.

27. As will be explained further in Section II.D.2 of this report, the decline in implementation rates was particularly pronounced in respect of the non-convertible currency portion of the programme, where the volume of new obligations decreased by over $1.3 million. The overall implementation rate was also depressed because the volume of the obligations made in 1989 against extrabudgetary funds was lower by $1.3 million.

28. Whatever individual fluctuations between the various funds and components have occurred, the overall volume of technical assistance delivered in 1989, while roughly equal to that of 1988, did not keep up with growth in resources. A substantial effort had to be made during the year under review in order to the prepare and implement the previously mentioned measures aimed at providing an optimum framework for the delivery of technical assistance, which, it is hoped, will lead to tangible improvement in future.

29. Disbursements, after declining in 1988, rose considerably (from $37 million to $41 million), reflecting payments made in 1989 against obligations raised towards the end of 1988.

30. A total of 191 new projects were approved for the 1989-90 programme. As 844 projects were already operational at the start of 1989, there were 1,035 projects financed from all sources and in various stages of implementation on the books on 1 January 1989.

31. In the course of the year, 38 training courses were approved, 35 footnote-a/ projects were upgraded, and 17 Reserve Fund projects were established. Furthermore, 7 new UNDP projects and 3 special programme projects became operational. These 100 additional projects brought the total number of operational projects in 1989 to 1,135 (1988: 1,009).

32. During the year, 165 projects were completed, 34 of which were training courses. As three projects were cancelled, 967 projects remained operational at year-end.

33. A total of 469 reports were produced for submission to national authorities in Member States. Listed in Annex III are the 77 reports which were published.

3. Evaluation

34. The Agency's project implementation reporting system continues to be the major instrument by which national counterparts report regularly on the progress of their projects. Some 500 reports emanate annually from the system. Action was under-

taken to take advantage of office automation, now being extensively introduced throughout the Department of Technical Co-operation, in the preparation of these reports.

35. On the whole, the interim project implementation reports completed in 1989 indicate a satisfactory performance. The trend noted last year of improvement in the performance of Agency-supplied equipment continued in 1989. While the equipment maintenance problems faced in many recipient Member States have by no means been completely solved, there have been considerable improvements in the situation, particularly in Asia and in Latin America. However, serious problems in obtaining necessary spare and replacement parts continue to be reported with considerable frequency. In most cases, these problems are closely connected with financial difficulties, e.g. lack of foreign exchange, and the unresponsiveness of suppliers in filling small overseas orders. This conclusion seems to be borne out by the results obtained so far from the Agency's pilot project in Latin America aimed at meeting spare and replacement part requirements. This pilot project will be evaluated in 1990 to determine whether it offers lessons that can be directly applied in other regions.

36. A major sectoral evaluation was completed in 1989 on animal production and health in Africa. This evaluation was given particularly high priority by the Department of Technical Co-operation as the strategy in this programme area of combining in an integrated fashion technical co-operation project funds with Regular Budget and bilateral donor support – through the research contract programme – has allowed the Agency to pursue an innovative approach focused on the creation of mutually supporting networks of African institutions. The conclusions reached by the evaluation are of general significance. The organization of the Agency's programme in Africa into networks is a very effective way of tackling the problems of Africa on a regional basis. The technical co-operation inputs (training, equipment and expert services) have played an invaluable and complementary role in the development of research activities and represent inputs that counterpart institutions and contract holders would otherwise not have had. The integrated approach has strengthened the capabilities of counterpart institutions for research and teaching. Moreover, the African projects in animal production and health at present under implementation are of universal application throughout Africa and the benefits will eventually accrue to smallholder farmers who are the backbone of livestock production in Africa. A similar evaluation will be undertaken in 1990 of animal production activities being carried out in Latin America through the ARCAL programme. The results of both evaluations will be incorporated into an ongoing major review of Agency activities in the agricultural field which is to be completed in 1990.

37. The second sectoral evaluation completed in 1989 covered the follow-up on Radiation Protection Advisory Team (RAPAT) missions conducted since 1985 to nine Latin American Member States. The overall purpose of this evaluation was to identify ways and means of increasing the contribution of RAPAT missions to the improvement of national radiation protection efforts. It was determined that delays in the dispatch of RAPAT reports to Member States resulted from uncertainty in the Department of Technical Co-operation as to where the responsibility rested for dispatching the reports. Difficulties in organizing systematic follow-up to the missions arose from the generally poor state of knowledge in the Secretariat concerning radiation protection legislation and infrastructure at the national level and from the fact that most reports were couched in very general language. New procedures designed to ensure the timely dispatch of reports and their fuller utilization during the preparation of the technical co-operation programme have already been introduced. A review of the follow-up on RAPAT missions to African countries is in progress and will be completed early in 1990.

38. The third country evaluation aimed at assessing the impact of the Agency's total programme of co-operation in a Member State was completed late in 1989. Such evaluations include an in-depth examination of the link between the Agency's assis-

tance and the wider national development programme and thus provide guidance for the future programming of Agency assistance. The 1989 country evaluation covered Agency co-operation with Hungary during the period 1976-1989, during which assistance valued at approximately $7 million was provided through 23 projects. The evaluation has shown that Hungary – by making full use of its own considerable resources in well-qualified manpower, combined with judiciously requested Agency assistance – has been able to make rapid advances in the use of nuclear techniques and technology. A strong infrastructure has been developed in research, development and isotope applications. The assistance provided by the Agency has been directed to those areas where a real need existed.

39. Less intensive country reviews were conducted in 1989 for two African countries, and work began on preparing country reviews of a number of programmes in Asia and the Pacific. These will be completed during the first half of 1990.

40. Mid-project and end-of-project evaluations of 65 projects were conducted in 1989, individually or as part of country programme evaluations. Individual project evaluations covered such areas as intracavitary radiation therapy for cancer, advanced training in medical physics, radioimmunoassay in animal science, plant mutation breeding, uranium recovery and exploitation, radioisotope production and radiation protection. It is hoped that by selecting projects that represent to as great an extent as possible the range of approaches and areas of activity of the Agency's technical co-operation programme as a whole, the relatively small number of in-depth evaluations that can be conducted each year will have a wider impact.

41. A new report format, "Evaluation Notes", was introduced in 1989 to highlight problems and to suggest areas of policy and procedure that need to be explored by management. Such "Notes", which are brief and generally based on shorter, less comprehensive research efforts (and can be subsequently expanded if management so requires), were prepared on issues, such as "The Information Needs of International Experts"; "SSDL Projects and the Technical Co-operation Programme"; "The Administrative Costs of Technical Co-operation Projects Funded from Extrabudgetary Resources"; and "The Views of Technical Officers Concerning the Technical Co-operation Fellowship Process".

42. Follow-up to the recommendations made in previous evaluation reports is an important feature of the Agency's approach to evaluation. Following such recommendations, a number of improvements were introduced with regard to the expert reporting process, the information requirements of international experts, radiation protection programmes, nuclear power training courses and the fellowship programme.

43. The suggestion by the Technical Assistance and Co-operation Committee that the Secretariat organize national and regional courses on project evaluation has been followed up and preparations were begun for holding in 1990 a national course (in Pakistan) and two regional courses (one in Indonesia and one in Mexico).

B. Review by Field of Activity and Division

1. Field of Activity

44. Looking back over the past ten years (1980-89) at the end of the decade, some clear trends are visible: during this period one fifth of all Agency assistance was provided in the field of agriculture. Nuclear engineering and technology came second, accounting for 15.7% of all disbursements, followed by safety in nuclear energy with 14.7%. Substantive shifts took also place. Activities relating to nuclear materials prospecting, mining and processing, which in 1980 stood in third place with 15.4% of all technical co-operation disbursements, declined to 4.2% in 1984 and further, to

3.2%, in 1989. Nuclear safety, on the other hand, which only accounted for 7.6% of disbursements in 1980, has risen steadily, from 14.7% in 1984 and to 18.4% in 1989. A similar increase was observed in industry and hydrology, whose share grew from 8.8% in 1980 to 11.7% in 1984 and to 17.4% in 1989.

45. An analysis of the above type is based on the ten broad fields in which the Agency has traditionally classified its technical co-operation activities. Indicators for these fields are imbedded in the code numbers for each technical co-operation project, allowing rapid identification and sorting within this classification.

46. AAPC codes were introduced in the Agency in 1986. Reflecting more refined criteria, they permit a more precise and up-to-date classification of Agency activities. They do, however, present certain problems and drawbacks as regards technical co-operation.

47. Firstly, there is not always a simple one-to-one relationship between the old "fields of activity" and the new "areas of activity". Secondly, because the new areas of activity are less broad and more precisely defined, changes are more likely to be made in the classification of a particular regular programme activity from year to year. When technical co-operation projects are linked with such activities, problems arise since technical co-operation projects are not limited to two-year cycles, but stay on the books until completion.

48. The above-mentioned factors have jointly delayed technical co-operation reporting by AAPC. However, as new technical co-operation programmes have been presented with a breakdown by AAPC since 1987, tables and figures in this report referring to distribution of technical co-operation by field of activity – (Figures 2 and 8) now reflect the AAPC classification.

49. In order to retain the possibility of making comparisons with prior years and to be able to analyse longer term trends, statistics based on old fields are still being maintained.

2. Division

50. The Agency's technical co-operation programme benefits from the close involvement of the Department of Research and Isotopes and the Department of Nuclear Energy and Safety. The technical knowledge available in these Departments is indispensable for the appraisal of new requests, for the precise determination of inputs required and for the timely implementation of approved projects.

51. Major interdepartmental discussions were started in 1989 between the Department of Technical Co-operation and all technical Divisions, aimed at identifying ways and means to improve further the interrelationship between these partners in technical co-operation. In these discussions, various proposals emerged: more systematic and comprehensive briefing of technical officers, a closer involvement of technical officers in the programming process and more effective transfer of follow-up information. These proposals are now crystallizing and will be applied in 1990, during the formulation of the 1991-92 programme. Zero real growth of the Regular Budget remains a limiting factor and poses particular difficulties for many technical Divisions, which have to provide adequate technical backstopping for a growing technical co-operation programme on a continuing basis.

52. In the following paragraphs, as well as in the table and bar charts at the end of this Section, information is provided on quantitative aspects of the relationship between technical co-operation and technical departments, including departmental workloads in connection with technical co-operation.

53. During 1989, a total of 1135 projects were handled by 172 technical officers, so that the overall ratio of project to technical officer rose slightly from 6.4 in 1988 to 6.6 in 1989. The number of fellowship nominations evaluated by technical officers increased marginally – from 1200 in 1988 to 1257 in 1989. However, as 1989 was the first year of the two-year cycle, no new requests had to be appraised with the exception of a few urgent ones for Reserve Fund financing. Follow-up to preparatory assistance missions and involvement in technical co-operation deliberations with government counterparts concerning future requests remain on-going tasks, even in "non-programme" years.

54. The Department of Research and Isotopes provided technical backstopping for 67% of the adjusted technical co-operation programme. Its staff representing only 40% of all Agency technical officers, made 65% of all fellowship evaluations and handled 70% of all operational projects. The average number of 11 projects handled by each technical officer in this Department was well above the overall average.

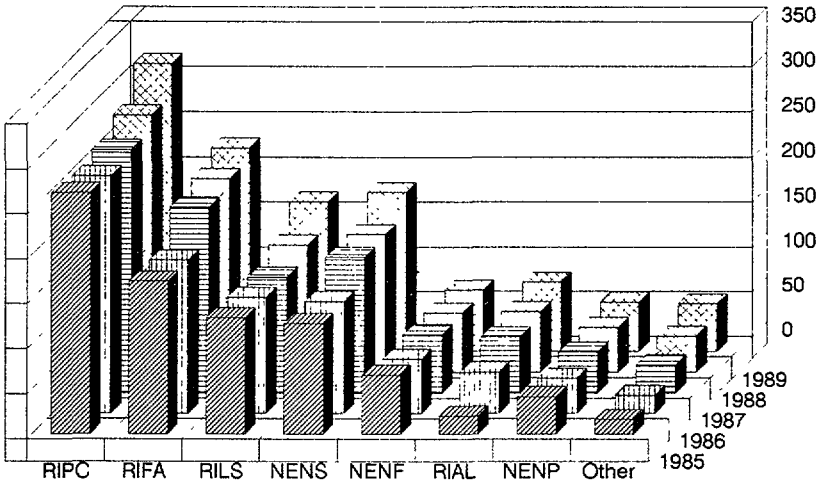
55. The Department of Nuclear Energy and Safety, with 47% of all technical officers, handled 26% of the adjusted programme, dealing with 27% of all projects and evaluating 31% of all fellowship nominations.

56. Technical officers continued to provide direct services to Member States as experts on technical co-operation projects. The number of such assignments carried out by technical officers rose from 324 in 1988 to 336 in 1989, 107 months of expert services being provided as against 102 months in 1988. In addition, technical officers undertook 108 assignments as lecturers on training courses, providing 34 months of service.

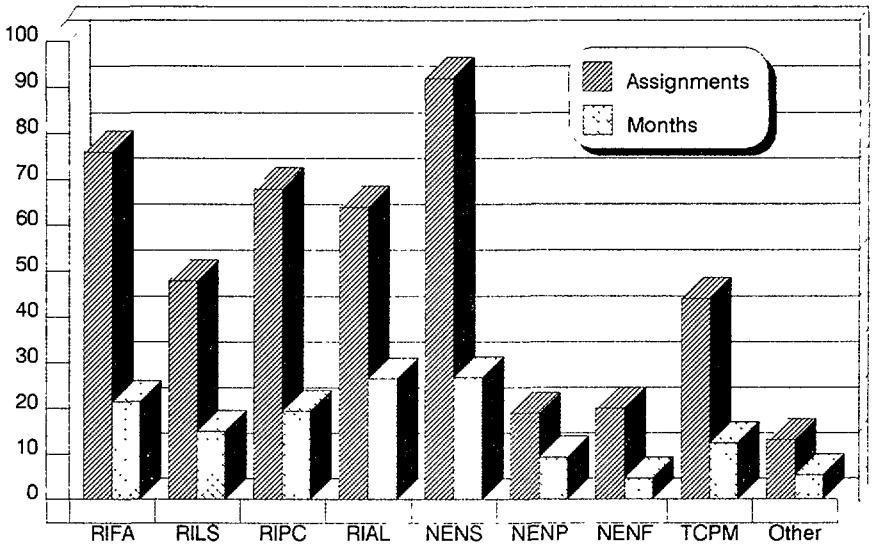
57. The table below and the bar chart that follow provide detailed information on the contribution the various Divisions made to the technical co-operation programme.

Department/ Division	Number of technical officers	Number of projects supported	Number of fellowship applications evaluated	Number of expert/lecturer assignments	Number of months
Research and Isotopes					
RIFA	26	227	274	76	21/19
RILS	13	168	162	48	15/00
RIPC	17	321	296	68	19/14
RIAL	13	78	88	64	26/17
Sub-total	69	794	820	256	82/20
Nuclear Energy					
NENS	53	178	195	92	26/25
NENP	13	56	102	19	9/10
NENF	15	69	92	20	4/19
Sub-total	81	303	389	131	40/24
Other	22	38	48	57	17/19
Total	172	1135	1257	444	141/03

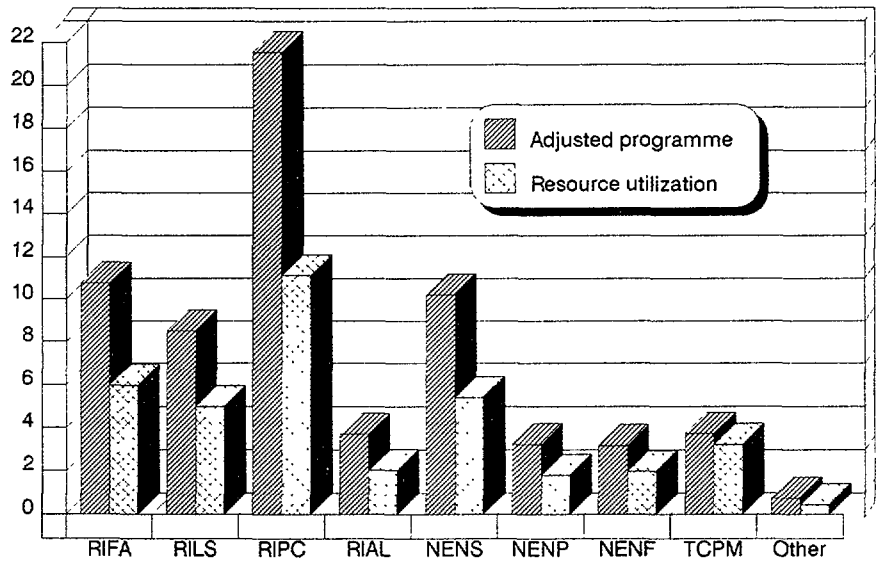
PROJECT WORKLOADS BY DIVISION: 1985 - 1989
(number of projects)



TECHNICAL SUPPORT FOR PROJECTS: 1989
EXPERT AND LECTURER ASSIGNMENTS



IMPLEMENTATION BY DIVISION: 1989
(IN MILLIONS OF DOLLARS)



C. Review by Area

1. Africa

58. The share of Africa in total project assistance approved from the TACF, which, over the years, had been around 20%, rose to 24% in the 1989-90 programme. With all sources of financing taken into account, the region received 20.5% of the technical assistance delivered through the Agency in 1989.

59. The traditional emphasis on agriculture and nuclear safety continued. In respect of the latter, RAPAT missions were undertaken to Cameroon, Ghana, Morocco and Zimbabwe; WAMAP missions were undertaken to Egypt, Kenya, Zaire and Zambia.

60. Preparatory assistance missions to enable on-the-spot appraisals of project proposals or to facilitate project formulation were undertaken to Algeria, Egypt, Ghana, Kenya, Morocco and Sierra Leone.

61. The year under review saw considerable training activities with strong regional character. Regional training courses were hosted by Algeria, Senegal, Sudan and Zambia in the fields of nuclear medicine, preventive maintenance and quality control of nuclear equipment, nuclear instrumentation maintenance, hydrology and soil/plant nutrition.

62. In addition to these stand-alone regional courses, it should be stressed that, within most regional projects, group training and co-ordination meetings involving many African countries are an important element. As examples, a meeting was held in the United Republic of Tanzania of Chief Radiation Protection Officers from nine countries, where possibilities for regional co-operation between groups of countries were discussed in the context of a regional project on radiation protection. Within the framework of a regional project on biological nitrogen fixation, a meeting was organized in Tunisia where views were exchanged and plans co-ordinated for future

activities under the project. A training course was held within the framework of a regional project dealing with nuclear techniques in insect physiology and biochemistry; 10 participants from 6 countries were instructed in the use and safe handling of radioisotopes. As part of an isotope hydrology project for the Sahelian countries, a training course and co-ordination meeting were organized in Mali and attended by participants from all three countries involved in the project.

63. Preparatory work on a draft African Regional Co-operative Agreement for Research, Development and Training related to Nuclear Science and Technology came to fruition, resulting in a final text that was presented to and endorsed by the Board in February 1990.

64. A special evaluation review by independent consultants on the Agency's animal production and health programme in Africa during the period 1975-89 was completed, while the project "Intracavitary radiation therapy for cancer" in Egypt was the subject of a field evaluation. Both evaluations confirmed positive results.

2. Asia and the Pacific

65. Elsewhere in this report (Section III) detailed narratives are provided on Agency's technical co-operation activities in the Asia and Pacific region. In 1989, the region was again the largest recipient of technical assistance. Whereas 25% of TACF resources approved in the 1989-90 programme was allocated to it, the region's share of the total adjusted programme (all funding sources) was 28.6%, disbursements accounted for 29.4% of the total. Nine of the 24 on-going UNDP projects for which the Agency is either the executing or an associated agency, including the largest, are being carried out in Asia.

66. Applications of isotopes and radiation in industry and hydrology continue to be the most important activities in the region. Assistance remains centered on the establishment of radiation processing facilities and on the introduction of other industrial applications of radiation and radioisotopes, especially in the area of non-destructive testing and tracer technology. Tracer techniques for sedimentology studies in harbours are being applied in Bangladesh, China and Malaysia.

67. In several of the Member States with research reactors, much assistance made available through the technical co-operation programme is focused on the operation and utilization of these reactors, mainly for the production of radioisotopes and radiopharmaceuticals. In countries with nuclear power programme, (China, the Republic of Korea and Pakistan), Agency technical assistance covers areas relating to the operation and safety of nuclear power plants and fuel cycle activities, such as uranium exploration and fuel fabrication. Indonesia also received assistance in the latter two fields, while the Democratic People's Republic of Korea, Malaysia, the Philippines, Sri Lanka, Thailand and Viet Nam received considerable assistance in nuclear raw minerals prospecting.

68. In the field of agriculture, assistance was provided under 46 projects in 13 countries, including four large-scale UNDP projects in China, Indonesia, the Republic of Korea and Thailand. The most important assistance areas were the application of isotope techniques in soil plant studies, Nitrogen-15 fertilizer studies, mutation breeding and animal production and health. Considerable interest in food irradiation is reflected by the fact that there are six operational projects in the region. Semi-pilot-scale facilities are being set up by the Agency in Bangladesh and Viet Nam. Demonstration irradiation facilities were established by the Government in Malaysia and Thailand during 1989. Following the approval of several kinds of food items for irradiation by Viet Nam, the number of countries in the region of Asia and the Pacific having such facilities has grown to eleven.

69. RAPAT missions visited the Democratic People's Republic of Korea, Mongolia and Thailand; A WAMAP mission to the Philippines and OSART missions to Pakistan, China and the Republic of Korea were also undertaken during 1989. As a result of these and earlier missions to other countries in the region, a strong nuclear safety orientation is emerging in the Asian programme.

70. In the health sector, Agency assistance was provided for establishing and upgrading radiotherapy and nuclear medicine facilities, for the training in medical physics; for the production and quality control of radiopharmaceutical kits; and for radioimmunoassay reagent production. This assistance was provided to over 40 hospitals and nuclear medical centres in the region.

71. There has been a significant growth of nuclear technology in a number of countries of the region, which should lead to an increasing role for Technical Co-operation among Developing Countries (TCDC) in the years to come.

3. Latin America

72. Latin America's share of all TACF assistance approved for 1989-90 rose to 23%, a figure significantly higher than that prevailing during the period 1984-1988 (18%). In terms of both its share of the total adjusted programme and the volume of technical co-operation disbursements, the region ranked second, with 22.7% and 25.8% respectively.

73. The economic problems prevailing in many countries of the region in several instances hampered the timely delivery of planned assistance. Delays in the construction of structures to house equipment and the unavailability of personnel for training not only affected these programme components but also led to the postponement of expert missions. In spite of these difficulties, the region achieved the highest implementation of all areas, with 66.7% for the total programme and 70.3% for TACF-funded projects. Intensified contacts with counterparts and with Government representatives in Vienna have certainly contributed to this positive result.

74. A programming mission to Haiti, the only LDC in the region, and several pre-project missions to other countries were carried out, as were RAPAT missions to El Salvador and Cuba, a WAMAP mission to Chile and an OSART mission to Brazil.

75. Various activities took place in the field of radiation protection. In addition to the emergency assistance extended by the Agency in connection with the radiation accidents which occurred in Goiania, Brazil, and in San Salvador, El Salvador, increased assistance was provided to Brazil to improve the radiation protection infrastructure. Ecuador implemented a system for monitoring all radiation sources in the country under the responsibility of a national authority. Jamaica and Uruguay received assistance in the establishment of radiation protection legislation.

76. Significant activities were carried out in the field of hydrology, where isotope techniques were applied to the study of seepage in lakes and reservoirs (the Dominican Republic), the evaluation of aquifers (the Dominican Republic, Nicaragua and Peru) and of geothermal reservoirs for electricity generation (El Salvador, Mexico, Nicaragua), and to sedimentation studies in the Magdalena River in Colombia and irrigation dams in Cuba. Studies on the hydrological cycle, carbon cycle, soil fertility and the impact of agrochemicals continued in the Brazilian Amazon region.

77. Cultural and linguistic homogeneity in much of Latin America has promoted the increased use of expertise from the region and is an important contributing factor in the successful regional activities undertaken within the framework of the ARCAL programme and under a regional non-destructive testing (NDT) project. Under the ARCAL umbrella, 151 activities, mostly training events, took place. The NDT project, which, through its national counterparts, maintains close links with the manufacturing sectors in each country, has led to the establishment of a Latin American NDT

federation. Successful development of autonomous capability in the utilization of NDT techniques, the harmonization of standards, procedures and the certification of NDT personnel have provided a basis for an expansion of training activities into the area of quality assessment. Plans are under way to organize and to construct a regional centre for quality assessment which would have considerable technological and economic impact on the region.

4. The Middle East and Europe

78. The high share (26%) of total TACF approvals for the Middle East and Europe in the 1989-90 programme was in particular due to the large number of projects funded from non-convertible currency approved for the region, which took 55% of all programmed NCC. The share of the region as a percentage of the total adjusted programme stood at 21.3% in 1989, but disbursements from all funds only amounted to 15.6% of the total.

79. The low implementation rate during 1989 (46.2%) after a high of 70.6% in 1988 is not only a reflection of difficulties in respect of the NCC portion of the programme but also of the fact that, following retirements, the Section handling the Middle East and Europe was seriously understaffed for over half the year.

80. On the basis of 1989 disbursement figures, the emphasis of technical co-operation in the region was mainly on physical and chemical sciences, which accounted for 28.2% of all disbursements, followed by industry and earth sciences which accounted for 21.7%.

81. A joint effort to define common criteria pertaining to the safety analysis of WWERs, which began in 1988 with Eastern European countries in which this type of reactors is in operation, continued during 1989. Safety analyses focused on design aspects and on Beyond Design Basis Accidents. Through a series of workshops and on-the-job training, a transfer of knowledge in in-service inspection was initiated or increased.

82. Other regional activities, largely concentrated in the Middle East, dealt with the improvement of environmental monitoring capacities, the upgrading and co-ordination of radiation protection regulations and practices, the use of isotopes techniques in hydrology through co-ordinated sampling programmes and measurements, the quality control of radiopharmaceuticals and medical applications of ionizing radiation.

83. The focus of many of the national projects in the region was on similar subjects. In addition, advice on nuclear power safety and on in-service inspection was provided to Bulgaria, Hungary and Romania, on site ranking to Iraq, on quality assurance to Poland and on safety analysis to Yugoslavia. Preparatory work for the construction of a small research reactor in Albania, financed from UNDP resources, continued.

84. In the last few months of 1989, an increasing number of requests for advice and assistance, some of an urgent nature, were received from Eastern European countries with advanced nuclear power programmes. It is likely that, in the coming years, the programme for the region will have to accommodate more such urgent requests in the area of nuclear safety.

5. Global and Interregional

85. While most of the Agency's technical co-operation resources were allocated to projects in a particular country or region, 8.3% of the adjusted programme for 1989 was intended for interregional and global activities. The interregional part (6.9% of the adjusted programme) included specific interregional projects – especially preparatory assistance projects approved by the Board – as well as training courses.

86. The global category, which includes funds set aside for miscellaneous purposes, amounted only to 1.4% of the adjusted programme in 1989. This is a much lower percentage than in prior years (for example, 7.9% in 1988) since, in the past, substantial funds were reserved for non-project fellowships under this global heading. In the 1989-90 programme, however, these fellowship funds were allocated to manpower projects in each of the four regions so as to permit closer monitoring and closer linkage with development activities in each region.

D. Review by Component

1. Experts

87. The decline in the share of the expert component in the overall programme, noted in the report for 1988, did not continue in 1989. In fact, the share of the total programme earmarked for the provision of expert services rose again to 24.1%, a figure approaching one quarter of the adjusted programme which had traditionally prevailed.

88. The following table provide a five year perspective on the delivery of expert services.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings
	$ millions	$ millions	%	$ millions
1985	15.1	7.7	51.0	7.4
1986	13.2	7.3	55.1	5.9
1987	14.4	8.0	55.6	6.4
1988	14.3	7.7	54.1	6.6
1989	16.1	7.8	48.2	8.3

Year	Number of persons	Number of assign-ments	Number of months	Months per assign-ment
1985	1188	1846	1585	0.86
1986	1168	1930	1516	0.79
1987	1100	1808	1356	0.75
1988	1263	2023	1239	0.61
1989	1337	2144	1246	0.58
Increase over five years (%)	12.5	16.1	(21.4),	

89. The average duration of assignments continued to decline and amounted to just over two weeks per assignment during 1989. The workload implications of this development on the Section involved, already mentioned in the 1988 report, consequently were more severe. Although nearly 6% more experts had to be recruited and 6% more assignments had to be arranged for, the total months of expert services delivered rose only imperceptibly – from 1239 to 1246 – that is, by less than 0.6%. This had an effect on the implementation rate as well. Notwithstanding the increase in recruitment actions, only 48.2% of the provisions could be used, so that a backlog of 1041 months, valued at $8.3 million, had accumulated by the end of the year.

90. In view of the increase in expert costs during 1988, the figure budgeted for one month of expert services in 1989 had been set at $8100. The actual costs per expert month during the year under review rose only slightly, however, from $7568 in 1988 to $7695 in 1989, and remained 5% below the budgeted figure. There were indications in the latter half of the year that costs were rising , so that it was considered prudent to maintain the budget figure of $8400 for 1990.

91. More than two-fifths (42.6%) of the individuals who carried out assignments within the framework of technical co-operation programme originated from developing Member States. Confirming the ten-year trend of increasing emphasis on nuclear safety, it is noticeable that over 27% of all expert assignments in 1989 were carried out in this field, followed by agriculture with 16%. In terms of expert time delivered, agriculture stood first with 24% and nuclear safety second with 20%, indicating a shorter average duration of nuclear safety missions. This reflects the fact that missions in nuclear safety often aim at assessment and immediate advise, whereas assignments in agriculture tend to be of more traditional character requiring longer presence of the expert on the spot.

92. Additional information on the expert component appear in Table 3A and Figure 4, which show, inter alia, where the experts provided in 1989 came from and to which regions they went. In Table 3A, all experts, including Agency staff on expert assignments, are now shown by nationality. Table 6A provides a further breakdown by each recipient country.

2. Equipment

93. Equipment remains by far the largest component of Agency technical assistance although its share in the total adjusted programme has been declining: – it dropped from 50.3% in 1987 to 45.8% in 1989. A roughly similar percentage (45.7%) was allocated for equipment in the TACF programme.

94. Although disbursements for equipment increased from $16.3 million in 1988 to $19 million in 1989, the monetary value of assistance of this type set in motion during 1989, as reflected by the volume of new obligations, declined by $2.3 million, from $19.9 in 1988 to $17.6 million in 1989.

95. It is noted that, whereas new obligations for equipment against all funds dropped, new obligations for equipment provided from the TACF in 1989 ($13.3 million) were at comparable levels in 1988 ($13.7 million), indicating that most of the decrease took place in the extrabudgetary part of the programme.

96. As regards the TACF, the implementation rate for equipment was dampened by a decrease in obligations against non-convertible currency. Whereas obligations in convertible currency increased by $1.5 million, equipment obligations against NCC decreased by $1.8 million. This indicates that quite sudden and increased difficulties were encountered in the utilization of a many of these currencies. In many cases, supplier firms are becoming reluctant to accept national currencies or require at least partial payment in convertible currencies, a fact that has led to protracted negotiations. In addition, extreme fluctuations in the exchange rates of selected NCC currencies may compound problems in future programming. Suppliers have been reluctant to quote prices in local currency as, by the time payment is due, the exchange value of the amount received may be much lower than at the time the quotation was made. Conversely, if the amount is quoted in dollars and payable in local currency, it may happen that, at the time of invoicing, the Agency may not have enough of the required local currency available.

97. The following table shows various indicators relating to the work of the Field Procurement Section and illustrates that, notwithstanding a decline in implementation rate, the number of purchase orders processed was higher than in any previous year.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings	Disbursements	Number of purchase orders
	$ millions	$ millions	%	$ millions	$ millions	
1985	24.9	15.9	63.8	9.0	16.0	3,391
1986	26.7	18.1	67.9	8.6	19.5	3,738
1987	28.2	16.2	57.5	12.0	23.1[a]	3,701
1988	29.8	19.9	66.9	9.9	16.3[a]	3,386
1989	30.5	17.6	57.7	12.9	19.0[a]	3,894

[a] Excluding training course equipment.

98. As of 1 December 1989, the threshold above which procurement orders have to be submitted to the Procurement Authorization Committee for approval was raised to $40,000, bringing it into line with levels prevailing in other organizations of the United Nations System. This will undoubtedly have a positive impact on the administrative workload relating to equipment procurement.

99. Through the further computerization of the Section, the list of vendors and possible suppliers is being updated; this will permit invitations to tender to be obtained from the widest range of suppliers, including those in underutilized major donor and developing countries.

100. The expenditures on equipment during 1989 reflect the emphasis of the Agency's programme: 24% was devoted to agriculture followed by nuclear safety with 17% of the total. Further information on equipment delivery is given in Figure 5, which shows where the equipment was procured and to which regions it went.

3. Fellowships

101. The fellowship programme, expressed as the number of fellows who underwent training in a given period, recovered somewhat from the sharp decline which occurred in 1988. However, as the average duration of each fellowship continued to decline (from 5.1 months in 1987 to 4.5 months in 1988 to 3.7 months in 1989), the total number of months of training provided dropped by 11.2% in the last year alone.

102. This development, comparable to that already noted for the expert component, has had a similar impact on the workload of the section involved.

103. In addition, the declining average duration of each fellowship has had a noticeable impact on the cost of each month of fellowship training provided as more travel is involved to deliver it. Whereas in 1988 the actual cost per month had reached $1902 and was well below the budgeted figure of $2250, in 1989, with a budget figure per month of $2400, the actual cost was $2392. The sharp increase in costs is also due to the significant increase in the number of scientific visits, which rose from 156 to 192; scientific visits tend to be more expensive than ordinary fellowships.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings	Number of fellows	Number of fellowship months	Number of visiting scientists	Number of visiting scientist months
	$ millions	$ millions	%	$ millions				
1985	4.5	3.2	72.0	1.2	615	3323	188	108
1986	6.4	5.0	78.3	1.4	734	3610	203	137
1987	7.8	6.5	83.1	1.3	870	4437	160	101
1988	7.7	5.3	68.3	2.4	682	3056	156	88
1989	9.6	6.0	62.4	3.6	732	2713	192	129
Increase over five years (%)					19	(18)	2	19

104. High priority has been placed on reducing the considerable delays experienced in the placement of project personnel nominated for Agency fellowships. Various measures were adopted to streamline the Agency's internal procedures for the administration of the fellowship programme, such as a clearer delineation of the responsibility of the Area Sections in monitoring the utilization of fellowship funds within each region, and a new organizational structure that should provide closer day-to-day monitoring of the fellowship process – it is hoped that these measures will lead to an improvement in 1990.

105. Agriculture, taking 23% of all fellows and visiting scientists, remained the predominant field in which individual training was provided, followed by nuclear safety with 18%. Additional information on fellowship training is given in Figure 6 and Tables 3B and 6B which show the place of study and the country of origin of fellowship holders.

4. Training Courses

106. During 1989, a total of 85 regional and 21 interregional training courses were organized and carried out by the Training Courses Section. In addition to these 106 courses, the Section was involved in the implementation of 82 national group training activities. Of the 106 regional and interregional training events, 74 took place in developing Member States. In Annex II details are provided concerning the subject and location of these events.

107. It must be stressed that the developing Member States which hosted the courses have, without exception, made significant in-kind contributions to these activities by making premises available, providing equipment and assigning staff. While it is impossible to express these contributions in precise monetary figures, they are considerable and without them it would not have been possible to carry out the Agency's extensive training course programme.

108. The table below provides an overview of the regional and interregional training course programme during the past five years. There have been significant increases in the number of training events held, in the number of participants and in the total number of months of training. As not all of the funds advanced to training institutes and course directors for 1989 courses were obligated and final disbursements will in many cases only be made in 1990, the implementation rate in financial terms is 60.2%, although all 106 events took place as planned. From April 1990 onwards, obligation procedures for training courses will be considerably expanded so that future implementation rates for this component will again be more accurate.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings	Number of courses	Number of participants	Number of months
	$ millions	$ millions	%	$ millions			
1985	4.0	3.4	85.2	0.6	60	926	1098
1986	4.6	4.3	93.5	0.3	71	972	992
1987	4.5	2.9	65.4	1.5	64	945	915
1988	6.9	4.5	65.0	2.4	88	1109	958
1989	8.3	5.0	60.2	3.3	106	1265	1090

109. Although in the new structure of the Department of Technical Co-operation the Training Courses Section belongs to the Division of Technical Co-operation Implementation, it retains a twofold function: participating in the formulation of the Agency's interregional training course programme and implementing the entire interregional and regional training course programme as well as some of the national training events.

110. Most of the rapidly expanding training course programme is still financed from the TACF; however, many of the events are made possible through extrabudgetary contributions from Member States, particularly from Australia, the Federal Republic of Germany, India, Italy, Japan, the Republic of Korea, and the United States of America.

5. Sub-contracts

111. Although their share in the total adjusted programme rose from 1.6% in 1988 to 2.5% in 1989, sub-contracts remain a very minor modality through which Agency technical co-operation inputs are delivered. Consequently, any delay in a single sub-contract may result in wide fluctuations in the implementation rate from year to year, as is shown in the following table.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings
	$	$	%	$
1985	5 107 505	831 622	16.3	4 275 883
1986	1 229 604	506 740	41.2	722 864
1987	904 314	549 535	60.8	354 780
1988	933 023	756 598	81.1	176 425
1989	1,654,629	806,811	48.8	33,641

112. Nearly all sub-contracts are placed with governmental and academic institutions rather than with commercial firms; none of them is primarily for the delivery of equipment, most dealing with the provision of training. Sample analysis and the development of specific techniques are also areas in which services are sub-contracted.

E. Review by Fund

1. Technical Assistance and Co-operation Fund

Resources ..... **$37.3 million (74.5% of total)**
Adjusted programme ..... **$48.9 million (73.2% of total)**
New obligations ..... **$28.3 million (75.2% of total)**
Implementation rate **58.0%**
Disbursements ..... **$29.3 million (71.3% of total)**

113. Resources for the TACF continued to grow, albeit at a lesser rate than in 1988 (8.1% in 1989 versus 14.4% in the previous year). The $37.3 million in TACF resources represented nearly three quarters of all resources available to the Agency's technical co-operation programme in 1989.

114. The decline in pledges against the target continued unabated: from 93.1% in 1982 to 86.1% in 1988 and 85% in 1989. However, owing to other, additional sources of income for the TACF, such as assessed programme costs and interest earnings, total 1989 resources of $37.3 million represent 88.8% of the 1989 target. Tables 1 and 2 show these developments and the growth of the TACF over the past ten years.

115. The programme for 1989 as presented to the Board was kept within conservative and generally accurate resource forecasts without the inclusion of any additional new overprogramming. Moreover, the TACF was closely monitored throughout the year, ensuring that any essential project budget increases were offset by corresponding decreases. This approach led to a considerable reduction in overprogramming. It had stood at $4.8 million at the end of 1988 and was down to $3.3 million by end 1989, as is illustrated in the following table.

Resources available and programme commitments by year-end

Year	Available financial resources			Programme			Balance		
	CC	NCC	Total	CC	NCC	Total	CC	NCC	Total
1980	8,267	4,467	12,734	9,470	3,925	13,395	(1,203)	542	(661)
1981	11,336	3,721	15,057	11,277	3,843	15,120	59	(122)	(63)
1982	14,186	3,670	17,856	13,788	4,071	17,859	398	(401)	(3)
1983	17,044	3,351	20,395	17,407	3,442	20,849	(363)	(91)	(454)
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)

116. It is intended to pursue a similar prudent course during 1990, and, if resource projections remain accurate, the aim of reducing overprogramming to zero by the end of the first biennial cycle should be achievable.

117. As discussed already above in connection with the equipment component (Section II.D.2), implementation rates for the TACF were particularly affected by lower obligations in non-convertible currency. There is, however, an additional factor inherent in a two-year cycle which depresses implementation rates by some percentage points during the first year. In a one-year programme – and in the second year of a biennial programme – a considerable amount of resources is usually rephased into the following year. This reduces the volume of the adjusted programme against which implementation is measured, particularly during years when the resources thus freed are not fully reallocated to increase other activities but serve to offset overprogramming. During 1989, no full-scale rephasing exercise took place, and the relatively few individual projects that were re-scheduled only involved a minor overall net amount. Consequently, while new obligations were virtually identical with 1988, the implementation rate, as measured against a much higher adjusted programme, was below that of previous years. The following table provides a five-year comparison in this regard.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings
	$	$	%	$
1985	34,810,179	23,064,817	66.3	11,745,362
1986	37,020,799	28,015,778	75.7	9,005,021
1987	40,436,825	27,078,352	67.0	13,358,473
1988	43,652,306	28,383,470	65.0	15,268,836
1989	48,867,916	28,320,331	58.0	20,547,585

118. Much more extensive use was made of the Reserve Fund in 1989 than in prior years. Of the $600,000 set aside by the Board for the Reserve Fund, $413,029 was allocated to new activities and $80,446 to urgently needed supplementary assistance to on-going projects. Details of these approvals in 1989 are given in Annex VIII.

2. Extrabudgetary Resources

Resources ..... $7.4 million (14.7% of total)
Adjusted programme ..... $13.4 million (20.1% of total)
New obligations ..... $6.2 million (15.5% of total)
Implementation rate 46.5%
Disbursements ..... $6.7 million (16.4% of total)

119. Owing in particular to significantly increased contributions from Italy, France, Australia and Finland, extrabudgetary resources grew by nearly 30% in 1989. As a result, extrabudgetary funds accounted for 14.7% of all technical co-operation resources, versus only 12.5% during the previous year.

120. The utilization of extrabudgetary funds during 1989 was below that of 1988. Co-operation with donors remained excellent, but the extrabudgetary part of the programme is naturally subject to constraints which do not prevail in the TACF-financed part of the programme. As the 1989 implementation rate of 46.7% is still well above that recorded for any year prior to 1988, it is hoped that the 1989 slump will prove temporary.

121. Most of the new extrabudgetary resources, namely $6.32 million, were received for footnote-a/ projects for which financing was still being sought at the beginning of 1989. With this amount, 54 projects were supported, 35 of which were made operational for the first time. Of the $9.9 million worth of footnote-a/ projects in the 1989 programme, projects and project components for a total of $5.3 million could thus be upgraded. Whereas the value of footnote-a/ projects approved as part of the 1989 programme was 21% higher than that for 1988, the extrabudgetary resources made available for these projects increased by 41%, so that the 53.7% share of footnote-a/ projects made operational during 1989 was significantly above that for 1988. This is illustrated in the following table.

Year	Approved footnote-a/ projects	Footnote-a/ projects & components made operational	Share of footnote-a/ projects made operational
	$	$	%
1985	7,779,500	4,187,000	53.8
1986	8,361,205	3,455.500	41.3
1987	6,352,200	3,005,300	47.0
1988	8,182,800	3,782,102	46.2
1989	9,933,900	5,332,606	53.7

122. The USA remained the largest single contributor of extrabudgetary funds. Italy became the second largest donor in 1989, followed by the Federal Republic of Germany, the United Kingdom and Australia.

123. Incorporated in the figures pertaining to extrabudgetary resources is the funds-in-trust category, consisting of funds for activities in the country of the donor. While funds in trust cover a very minor part of the Agency's technical co-operation activities, their share of the total adjusted programme in 1989 did increase from 0.6% to 1.4%. This was largely due to an increase of $0.5 million for activities in the United Arab Emirates. These and other details on extrabudgetary funds for technical co-operation can be found in Table 5.

3. UNDP

Resources	**$3.1 million (6.2% of total)**
Adjusted Programme	**$4.4 million (6.6% of total)**
New obligations	**$3.1 million (8.2% of total)**
Implementation rate	**70.2%**
Disbursements	**$2.8 million (6.7% of total)**

124. In the UNDP context, "resources" also represent total delivery as UNDP makes available whatever the executing agency spends within the approved budget of a UNDP project. The "adjusted programme" reflects the total value of approved UNDP projects at year-end.

125. UNDP resources increased only slightly, by $55,000, but the adjusted programme rose by $745,000 and disbursements by $297,000 as compared with 1988.

126. A drop in the implementation rate from 82.8% in 1988 to 70.2% in 1989 was observed. This decrease was due to the fact that the placement of a single large equipment order for a new project foreseen for just before year-end could not be finalized as planned.

127. The peak budgets for UNDP projects approved during the year – that is, the amount of resources that would have been available for implementation in 1989 –, amounted to $5.9 million as compared with $5.6 million in 1988. In accordance with UNDP procedures, project budgets are rephased during the year to keep them in line with expected delivery in that year. This usually leads to a downward revision of these peak budgets in autumn, against which implementation is then measured at the end of the year.

Year	Adjusted programme	New obligations	Implementation rate	Earmarkings
	$	$	%	$
1985	3,475,903	2,653,512	76.3	822,391
1986	4,157,676	3,480,543	83.7	677,133
1987	3,307,300	2.568,677	77.7	738,623
1988	3,682,121	3,080,530	82.8	631,591
1989	4,427,249	3,105,808	70.2	1,321,440

128. The 24 projects under implementation in 1989 are listed in Annex VI. The IAEA acted as an associated agency for two UNDP-financed projects executed by the United Nations Department of Technical Co-operation for Development (UNTCD), and one project executed by the Government of China.

129. As UNDP pays around 22% support costs, the amount of $3.1 million delivered from UNDP resources in 1989 will generate support cost income to the Agency of approximately $680,000. An internal arrangement has been worked out whereby, from 1990 onwards, that part of the UNDP Support costs earned over the amount by which the annual delivery exceeds $2.7 million, (in other words, support costs in excess of $594,000) will be at the disposal of the Department of Technical Co-operation to

strengthen technical and administrative support for the technical co-operation programme. See "The Agency's Budget for 1990" (document GC(XXXIII/875, page 4) in this respect.

130. To ensure that countries allocate a larger proportion of their UNDP funds to activities in the Agency's sphere of competence, closer co-operation between national atomic energy agencies and their national planning authorities is essential. Stimulating this process requires, in turn, more intensive on the spot contacts between Agency staff, national counterparts and local UNDP offices. Budgetary constraints have been a severely limiting factor in this respect. The new arrangements concerning UNDP support costs, mentioned above, are expected to alleviate this situation somewhat.

4. Assistance in kind

Resources	**$2.3 million (4.6% of total)**
Disbursements	**$2.3 million (5.6% of total)**

131. In this resource category, resources made available equal disbursements as the assistance actually given in kind during the year is recorded at the end of the year. The concepts of "adjusted programme", "new obligations" and "implementation rate" do not apply. In 1989, the volume of assistance in kind was identical to that of 1988 ($2.3 million).

132. The Agency's training activities benefit significantly from this type of funding. About one fifth of all fellowships and 14% of all the expert services provided by the Agency during 1989 were made possible through assistance in kind.

133. As shown in Annex I, the USA remained the largest donor, followed by the Federal Republic of Germany. The percentage of assistance in kind donated by Member States who are themselves recipients of technical co-operation has rose to 29%.

134. The considerable in-kind contributions made by Argentina ($125,700) and India ($146,100) in the form of stipends and travel for fellows and experts, and for lecturers and equipment for training courses in other countries in the region are particularly worthwhile examples of true technical co-operation among developing countries (TCDC).

III. A PROFILE OF TECHNICAL CO-OPERATION ACTIVITIES IN ASIA AND THE PACIFIC

INTRODUCTION

135. The feature introduced in 1987 – a profile of technical co-operation activities in one of the four regions recognized in the Agency's technical co-operation programme – is continued in this report with an overview of the programme in the Asia and Pacific region. It is the region with the largest programme, some US $57 million were disbursed in Asia during the past five years.

136. The countries in the region differ widely in size, population, and geophysical attributes. Although substantial differences also occur in the role nuclear energy and applications play in each of them, many have in common that they started exploiting the advantages of the peaceful uses of atomic energy as far back as in the 1950s, have built up considerable know-how, and have been co-operating on a regional basis through the Regional Co-operative Agreements (RCAs) since the 1960s. Thus, while their individual interests are in certain areas quite different, there are many points of close contact: indeed, the continuing exchange of scientific and technical information, the collaboration in certain areas of technology, as well as the provision of training to fellows from co-operating countries and the hosting of Agency training courses at well equipped institutes, are firmly established facts.

137. As examples of such region-wide co-operation, it is only necessary to mention the adoption of standardized certification of technical staff engaged in non-destructive testing, the regular intercomparisons of radiation calibration standards, and the co-operation between countries having only one research reactor each to assure continuity of supply of the radioisotopes used in medicine during reactor shut-down.

138. Perhaps the one aspect in which the Member States can be seen to differ markedly is in the use of nuclear power to meet electricity demands. In the Republic of Korea, one sees a country with one of the highest installed nuclear capacities in the world, with nuclear power meeting nearly half its needs. At the other end of the scale are the countries that have no interest in nuclear power, at least at the present time, for a variety of reasons. Nevertheless, whatever the national programmes, a common feature is the growing emphasis on radiological protection and nuclear safety.

139. The following narratives describing the Agency's programme in the Region do not purport to be comprehensive; they merely present an overview that should enable the reader to form a picture of aspects of that programme that the Agency considers to be of particular interest at the present time. The focus is more specifically on activities undertaken during the past five years, with an indication in most cases of how programmes are expected to develop.

140. All monetary figures given in the tables preceding the narratives are in thousands of United States dollars.

BANGLADESH

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	7.8	7.8	0.0	2.2	2	0
1986	9.0	0.0	0.0	0.0	6	1
1987	6.8	0.0	0.0	2.0	4	2
1988	7.6	0.0	0.0	2.5	10	0
1989	8.4	0.0	0.0	1.3	7	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	420.1	365.0	785.1	14.0	535.4	456.4	7.2	0.8	68.4	1068.2
1986	397.8	350.0	747.8	12.0	477.2	346.7	21.5	0.0	51.0	896.4
1987	500.9	280.0	780.9	10.8	753.2	89.2	67.9	0.0	120.6	1030.9
1988	367.4	200.0	567.4	8.2	492.1	70.0	24.4	0.0	31.7	618.2
1989	371.5	0.0	371.5	5.0	399.7	103.2	90.4	0.0	29.8	623.1

141. Bangladesh has a broad-based programme covering practically all fields of activity in nuclear science and technology. Major facilities established include a 3 MW(th) TRIGA Mark II research reactor, a 3 MeV Van de Graaff accelerator, a 14 MeV neutron generator and a multi-purpose irradiation facility. Plans for the construction of the first nuclear power plant in Bangladesh are under active consideration of the Government. During the last five years, the main thrust of technical assistance to Bangladesh has been in the broad area of nuclear science and technology, with emphasis on building the research and development facilities at the Atomic Energy Research Establishment (AERE) at Savar, near Dhaka, and on the utilization of its research reactor. In the field of agriculture, the main emphasis has been on food preservation; a multi-purpose irradiation facility is being established at Faujdarhat (Chittagong) for irradiation of food and of medical supplies. Nearly 25% of the assistance provided to Bangladesh since 1980, has come from extra-budgetary resources and gifts-in-kind.

142. Bangladesh has been one of the most active beneficiaries of the fellowship training programme and has also been very well represented at Agency training courses.

143. The TRIGA Mark II research reactor was commissioned by the Bangladesh Atomic Energy Commission at the AERE in 1986. In support of this, the Agency made possible the training of several reactor operators at TRIGA reactors in various countries. In addition, equipment needed for start-up testing and maintenance, as well as expert services to assist with initial flux measurements made immediately after commissioning and for conducting operator licensing examinations were provided. The reactor is now operational at full power.

144. In order to aid the Commission in improving the utilization of the research reactor, the Agency is assisting the Institute of Nuclear Science and Technology to develop neutron activation analysis, neutron scattering studies and neutron radiography. The analytical facilities have been established, and the Institute is carrying out multi-element neutron activation analysis for the various laboratories of the Commission as

well as for other organizations in the country. The research reactor is also being used to produce technetium-99m and high- and low-activity iodine-131 for use in nuclear medicine.

145. The Institute also received through the Agency the 14 MeV neutron generator together with a matching data analysis system. This is being fully utilized, for neutron activation analysis as well as for nuclear data measurements.

146. A nuclear analytical laboratory was set-up at the Atomic Energy Centre, Dhaka, with Agency assistance provided over the period 1980-89, which has been designated as the national laboratory to provide analytical services to the various sectors of the national economy.

147. The Bangladesh Atomic Energy Commission is the only organization in the country which is capable of training personnel in different aspects of non-destructive testing (NDT), and of rendering NDT services to industry. The expertise has been developed with Agency support, and it is being used for various practical applications. The Commission has already adopted the course curricula for different levels of NDT training and certification, in harmony with the other countries collaborating in the Regional Co-operative Agreement, and training is given to NDT practitioners in co-operation with the University of Dhaka and the Bangladesh University of Engineering and Technology.

148. A secondary standards dosimetry laboratory (SSDL) has been established at the AERE under a multi-year project initiated in 1985. The Agency assisted with equipment and expert services and the facility now provides calibration services for dosimeters used in radiation protection and radiotherapy. In addition, an environmental monitoring programme and improved techniques needed for the measurement of low-level radiation have been developed to assess radiation exposure in the population, including radiation workers. Pre- and post-operational surveys in and around the nuclear facility at Savar and an environmental monitoring survey at Rooppur, where a nuclear power plant is to be established, were carried out. Radiation protection services to the radiation workers are provided and the design and development of a whole-body counter for determining nuclide body burdens has been initiated. A survey of all radiation sources including X-ray machines used in hospitals and clinics is being undertaken.

149. Following the recommendations of Agency RAPAT and WAMAP missions to Bangladesh, another radiation protection project, on occupational radiation monitoring, was initiated in 1989 to assist the Bangladesh Atomic Energy Commission in preparing basic nuclear legislation and a regulatory framework for radiation protection in the country.

150. In the field of radioactive waste management, procedures for the handling, treatment and storage of radioactive wastes have been established at AERE with Agency assistance. Safety aspects of ground disposal of radioactive wastes from the 3 MW(th) research reactor and the radioisotope production facilities at the Establishment were evaluated. The solid and liquid wastes are now being collected and stored according to international safety codes of practice.

151. An important component of technical co-operation has involved the strengthening of the capability of the Institute of Electronics at AERE to repair and maintain nuclear electronic equipment. A number of simple items of equipment such as a hand and foot monitor, portable survey meters, scintillation and GM detectors, pH meters, and nuclear counting and measuring equipment have been designed and fabricated locally.

152. Assistance in the application of nuclear techniques in agriculture has been provided mainly to the Bangladesh Institute of Nuclear Agriculture, Mymensingh. Under a multi-year project initiated in 1985, a good laboratory has been established

through the provision of equipment, as well as expert services. Field studies resulted in the identification of peanut mutants with high nitrogen fixing capacity. Two of these mutants were also resistant to foliar diseases and stem rot. In addition, several Rhizobium strains were isolated from lentils and peanuts, which are now being evaluated for their potential for biological nitrogen fixation in combination with their host plants. Peat samples collected from ten different locations in the country were tested for their suitability as carriers for Rhizobium inocula; one type was found to be much superior to the others. Assistance was also given for studies on the effect of water and fertilizer management on crop yield, in particular as these relate to multiple cropping.

153. Assistance is being provided to establish a multi-purpose irradiation facility for irradiating foods as well as for sterilizing medical supplies. The facility is being set up at Faujdarhat Industrial Area in Chittagong and is expected to become operational in 1990, with a capacity to irradiate 10,000 tons of potatoes, 10,000 tons of onions, 6000 tons of frozen fish, and 500 tons of dried fish, and to sterilize some 140 cubic metres of medical products annually. The initial loading of the cobalt-60 source is 110 kilocuries, to be doubled later. In the field nuclear medicine, Agency assistance has been provided to the Institute of Nuclear Medicine, Dhaka, and to the Nuclear Medicine Centres at Chittagong, Rajshahi and Sylhet. Particular mention may be made of the Institute of Nuclear Medicine which provides about 30,000 patients annually with diagnostic and therapeutic services involving in-vivo and in-vitro investigations. It has now been recognized as the Central Laboratory for Nuclear Medicine in the country, affiliated to the University of Dhaka for post-graduate studies in nuclear medicine.

154. The Agency has supported isotopic tracer investigations into the movement of bottom sediment in the Chittagong Harbour to identify a suitable dumping area for dredged material such that it would not be quickly redistributed by currents. Complementary devices for tracer injection were constructed locally according to drawings supplied by the expert. The irradiation of samples of the labelled sands are to be carried out locally in the research reactor; the first full-scale tracer experiments are to be conducted in 1990.

155. The Agency's technical co-operation with Bangladesh will continue in the areas described above, but additional emphasis on energy and nuclear power planning is likely to develop.

CHINA

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	226.2	228.3	0.0	3.9	3	41
1986	261.0	261.0	0.0	1.5	6	54
1987	265.2	265.2	0.0	4.7	8	16
1988	296.4	296.4	0.0	0.8	13	60
1989	327.6	327.6	0.0	29.7	24	40

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	23.0	0.0	23.0	0.4	108.4	0.0	0.0	0.0	33.8	142.2
1986	430.7	0.0	430.7	6.9	348.5	0.0	0.0	88.6	15.5	452.6
1987	419.6	0.0	419.6	5.8	700.8	2.4	6.9	357.9	40.9	1108.9
1988	454.6	8.0	462.6	6.7	598.2	10.6	223.1	414.7	31.9	1278.5
1989	539.2	0.0	539.2	7.2	763.3	104.9	117.7	488.1	68.3	1542.3

156. China became a Member State of the Agency in 1984. Since that time, the Government has given highest priority to nuclear power related projects in its technical co-operation with the Agency. Particular emphasis has been placed on updating the knowledge of Chinese scientists about the latest developments in nuclear science and technology, through experts' visits, including visits of lecturers to assist with national training courses, through fellowships abroad, and through participation in regional and inter-regional training courses. The programme of technical co-operation has focused attention on strengthening China's nuclear industry, and includes projects on manpower development for staff who are involved in all aspects of a major nuclear power programme, including a feasibility study for a high temperature gas cooled reactor.

157. Several technical co-operation projects are concerned with the industrial application of radiation techniques. They include radiation sterilization of medical supplies, non-destructive testing, in-situ coal analysis, oil exploration, and sediment transport investigations using radioactive tracers. In agriculture, assistance has been provided in several areas, while UNDP is funding a broad-based project on the use of radioisotopes in food and agriculture. The largest disbursements over the last five years have been for nuclear safety and radiation protection, followed by nuclear engineering and technology, and then agriculture.

158. China's extensive nuclear energy programme involves power reactors, research reactors, nuclear fuel cycle facilities, particle accelerators and radiation sources of various sizes. The construction of a 300 MW(e) PWR nuclear power plant at Qinshan is scheduled to be completed by 1990. This plant has been designed, and is being constructed by China, although some components have been manufactured abroad. Two other nuclear power plants of 900 MW(e) each are under construction at Guangdong and are expected to be completed by 1993. The construction of a 1200 MW(e) (2x600 MW(e)) nuclear power plant, has been approved by the State Council and has reached the stage of technical and commercial negotiations with foreign firms.

159. During the period 1986-89, as part of the UNDP funded manpower development project, 27 training courses and workshops on different aspects of nuclear power were organized at the Qinshan and Suzhou Training Centres. In addition, 82 scientists and engineers received or are receiving training abroad. A basic principles simulator and a computer system needed for local training are being provided. Additional training has been provided under a project on nuclear power plant engineering. With the support of Agency experts three workshops, were organized in which a total of 102 scientists and engineers from the major nuclear-power related institutes in China, participated. The principles recommended by the experts are being incorporated into the engineering designs for future nuclear power plants.

160. Support is being provided for studies of fabrication of nuclear fuel elements with the aim of achieving greater operational safety at the Qinshan Nuclear Power Plant through the establishment of a quality control/quality assurance programme for fuel assemblies to be supplied to the plant. As part of its efforts to develop the safety aspects of its nuclear power programme, the Government sought Agency assistance

in a number of safety-related areas. An Agency expert reviewed the draft Atomic Energy Act and the suggestions are being incorporated into the final version. A UNDP-supported project provided training of National Nuclear Safety Administration staff to assist with its licensing and regulatory functions. Radiation protection activities were expanded, including upgrading of personal dosimetry services; emergency planning and preparedness procedures were initiated, and regulations on the safe transport of radioactive materials were promulgated. In 1989, the Government invited the Agency to send an advance Operational Safety Review Team (pre-OSART mission) to undertake a preliminary inspection of the Quinshan nuclear power project. The mission was able to suggest a number of improvements that have been taken note of in connection with construction of the plant.

161. With the expansion of China's nuclear power programme, the Government is seeking to make optimum use of indigenous nuclear raw materials. The Bureau of Geology, under the Ministry of Energy and Resources, which is responsible for reviewing and assessing these resources, has decided to undertake a feasibility study, together with some testing, on in-situ leaching in one promising area in Hengyang, Hunan Province. To facilitate the development of a cadre of trained personnel capable of conducting a re-evaluation of indigenous uranium resources, Agency assistance is focusing on training on the spot as well as abroad. In this ongoing project, Agency experts have so far advised on economic project evaluation, resource assessment, geological mapping and practical aspects of managing and planning in-situ leaching.

162. Agency assistance was also provided to modernize radiation protection procedures in nuclear power and fuel cycle activities. The counterparts have been able to develop their expertise in personal dosimetry, safe transport of radioactive materials and emergency response. Under a follow-up project on planning and preparedness for emergency response a computer system is being supplied to help in the evaluation of atmospheric dispersion and radiological dose projection.

163. In 1982, the Government designated the Ionizing Radiation Department of the Shanghai Institute of Metrology as a Secondary Standards Dosimetry Laboratory (SSDL). It became a member of the IAEA/WHO network of SSDLs in the same year and joined the IAEA/IDAS (International Dose Assurance Service) in 1986. The Beijing SSDL also became a member of IAEA/WHO SSDL network, in 1984. These SSDLs in Shanghai and Beijing, with 300 million strong population in each area, are providing calibration services for radiation dosimeters used in radiation therapy and for radiation protection. The work loads are thus exceptionally high. In order to strengthen these two SSDLs, the Agency is providing various items of measuring and calibration equipment, Since 1985, the Beijing SSDL has organized 50 hospitals in China to participate in the IAEA/WHO international postal-dose intercomparison, and the results were presented at the Symposium on Dosimetry in Radiotherapy in Vienna in 1987. Calibration of output for cobalt-60 teletherapy units and medical accelerators has now been carried out in seven provinces in China. Nation-wide calibration and intercomparison experiments are also being carried out with the aim of checking the instruments used for medical X-ray monitoring.

164. The Chinese Nuclear Data Centre at the Institute of Atomic Energy, Beijing, is responsible for national nuclear data collection, processing and dissemination, as well as for nuclear data evaluation and the national nuclear data library. It provides data services to domestic users and exchanges data internationally. To develop a comprehensive data library and a related programme in support of the growing activities in the nuclear energy field in China, a computer system suitable for compiling and evaluating nuclear data has been provided.

165. Radiation sterilization of medical products is an important activity in China. The Agency has assisted the Beijing Radiation Centre of the Beijing Normal University in these activities. In another industrial area, the Shanghai Institute of Nuclear Engineering has been supported in broadening the non-destructive testing services on components for China's nuclear power plants.

166. The Government is recognizing that application of nuclear techniques to Agriculture could bring considerable economic benefits. The Institute for the Application of Atomic Energy, Beijing, has been collaborating with the Agency in work on radiation-induced mutation breeding. The Agency is also working with the Zhejian Agricultural University to strengthen its capability to serve as a national and regional training centre for the use of nuclear techniques in agriculture. A UNDP-supported project at the South Western Agricultural University in Sichuan, on the use of radiation and isotopes in agriculture, is promoting development of manpower in the region.

167. Methods of extending the shelf-life of agricultural produce are of great economic importance. The Shanghai Irradiation Centre, under the Shanghai Institute of Nuclear Research, is operating a 200 kilocurie cobalt-60 gamma irradiator for irradiation preservation of food items on a semi-commercial scale. To assist in its endeavour, a project was initiated in 1987 through which a national seminar and a training course on food irradiation were organized during 1988. An Agency expert also assisted with an economic feasibility study during 1987. Some equipment was also provided. Commercial feasibility as well as consumer acceptance were tested. The results were found to be positive on both counts, and the process is being continued on a larger scale.

168. China is already hosting a number of Agency-organized regional training courses and providing individual training to Agency fellows from other developing Member States. There is valuable expertise to support these activities, especially in the areas of nuclear engineering and technology, nuclear physics, radiation chemistry, industrial application of radiation technology, food irradiation, and radiation sterilization of tissue grafts and other medical products. The future trend in the technical co-operation with China is likely to show a growing emphasis on nuclear power and safety.

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	13.0	13.0	0.0	0.0	0	0
1986	15.0	15.0	0.0	0.0	0	0
1987	17.0	17.0	0.0	0.0	0	0
1988	19.0	19.0	0.0	0.0	0	0
1989	21.0	21.0	0.0	0.0	0	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	223.3	120.0	343.3	6.1	239.9	41.5	0.0	0.0	81.0	362.4
1986	156.5	100.0	256.5	4.1	202.2	435.1	17.1	0.0	72.7	727.1
1987	158.5	500.0	658.5	9.1	185.0	801.8	12.7	0.0	0.0	999.5
1988	205.0	745.0	950.0	13.8	218.4	25.5	-1.1	0.0	9.1	251.9
1989	287.3	321.0	608.3	8.1	200.6	135.1	0.0	0.0	3.5	339.2

169. In the past five years, the Agency's technical co-operation with Democratic People's Republic of Korea has concentrated on nuclear physics, isotope production and radiation protection. The main recipient of Agency technical assistance is the Ministry of Atomic Energy, which is also the co-ordinating organization for all Agency technical co-operation activities. The Ministry operates a Nuclear Research Centre which comprises five institutes: Nuclear Physics, Radiochemistry, Radioisotope Use, Electronics, and Radiological Protection. At the end of 1985, the Ministry also established an Atomic Energy Institute.

170. The major facilities at the Nuclear Research Centre comprise: a 2 MW swimming pool research reactor that was built in 1965 to use 10% enriched uranium fuel and that was upgraded in 1974 to 4 MW with 80% enriched uranium fuel. It is mainly used for nuclear physics research and isotope production; a water-moderated, lattice-type sub-critical assembly built in 1968 for reactor experiments; a 25 MeV betatron which has been modified to serve as a pulse-type neutron source; and a laboratory for radioisotope production.

171. Agency assistance was provided to the Institute of Radiochemistry to upgrade its laboratory facilities for the production of technetium-99m and iodine-131 for medical uses, and to improve the quality control techniques. Problems remain due to an insufficient local infrastructure, particularly with respect to the supply of spare parts and electronic components. The Agency also assisted the Centre to establish a cyclotron facility and laboratories for fast neutron activation analysis, radioisotope production and nuclear instrumentation. A neutron generator has been installed at the Institute of Radiological Protection and preliminary measurements with fast neutrons have been performed. However, a shortage of manpower and other resources, have hindered full-scale operation of the laboratory.

172. The Agency is supporting a cyclotron facility project under a "cost-sharing" scheme through the provision, over a six-year period, of an equivalent of US$2.8 million in NCC. The Government is furnishing the balance required for the purchase of the cyclotron at an estimated total cost of about US $4.3 million. The cyclotron facility is mainly to be used for radioisotope production, particularly for applications in nuclear medicine, and to provide charged-particle activation analysis services to industry and research. The MGC-20 cyclotron was delivered to the Institute of Atomic Energy from the USSR in October 1989. The construction of the cyclotron building is behind schedule, but the installation of the cyclotron is tentatively planned for mid-1990.

173. The Agency has supported the Institute of Radiological Protection in establishing a facility for the repair and maintenance of nuclear equipment which forms a basic part of the infrastructure needed to operate the Centre. The main obstacle is the acute shortage of spare parts, electronics components and other necessary simple items of equipment.

174. The Institute of Radiological Protection has also been assisted in establishing a well-equipped secondary standards dosimetry laboratory (SSDL). Personnel dosimetry services are being provided regularly (1500 personal dosimeters read per

month) to selected radiation workers, but the Institute plans to expand its services to all radiation workers in the country. An environmental radioactivity monitoring programme has also been started. A future programme will have to expand into areas such as neutron personnel monitoring and inspection and calibration of X-ray diagnostic machines in the different hospitals (about 1000 X-ray machines are in use).

175. In order to strengthen the local capability for assessing the country's nuclear raw material resources, the Agency is supporting geoprospecting and analysis of geological samples. Intensive training to the counterpart staff has been provided.

176. An Agency-supported project on fertilizer-use efficiency has recently been completed. The results of the studies show that rice and maize production can be increased by about 10% through the application of bio-fertilizer such as farmyard manure and by enhancing biological nitrogen fixation. Soybean cultivars are being tested for high nitrogen fixing ability using nitrogen-15 tracer techniques. The activities to derive high-yield varieties of soybean suitable for local conditions are being continued.

177. In nuclear medicine, the Agency is supporting the upgrading of radiotherapy facilities and has provided a new 4 kilocurie cobalt-60 source to replace an old source in a teletherapy unit at the Second People's Hospital in Pyongyang; a gamma camera is to be provided to the Department of Radioisotopes of the Red Cross General Hospital to extend the diagnostic possibilities, and support is being given to realize automated radioimmunoassay.

178. A particular priority for future technical co-operation between the Democratic People's Republic of Korea and the Agency should involve a manpower development programme. This would provide the necessary human resource base to expand the use of nuclear techniques in the country in support of socio-economic development.

HONG KONG

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	0.0	0.0	0.0	0.0	0	0
1986	0.0	0.0	0.0	0.0	0	0
1987	0.0	0.0	0.0	0.0	0	0
1988	0.0	0.0	0.0	0.0	0	0
1989	0.0	0.0	0.0	0.0	0	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.0	0.0	0.0	0.0	13.4	0.0	0.0	0.0	0.0	13.4
1987	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	2.7
1988	55.2	0.0	55.2	0.8	6.2	0.0	0.0	0.0	0.0	6.2
1989	39.6	0.0	39.6	0.5	50.4	0.0	0.0	0.0	0.0	50.4

179. The Agency provides technical assistance to Hong Kong through the United Kingdom of Great Britain and Northern Ireland. The Radiation Monitoring Division of the Royal Observatory and the Department of Geography and Geology of Hong Kong University have been the main recipients of Agency technical assistance during the past five years.

180. The Agency has helped to establish calibration facilities at the Royal Observatory for monitors being used for radiation monitoring and radiological protection. The design and construction of an irradiator and a collimator have been completed, and an alignment system for the irradiator and the standard ionizing chamber is now under construction. A 20 millicurie caesium-137 source for calibration has still to be provided. With the establishment of these calibration facilities, and with the expertise of the Royal Observatory staff, it is expected that calibration of dose and dose-rate meters, and quality assurance of their performance, can be carried out locally on a routine basis.

181. In the area of nuclear safety, assistance has been provided in developing a sound emergency response plan and procedures to protect the public from off-site consequences of a possible accident occurring at a nuclear power plant. Further assistance will be provided to review the comprehensive exercise designed to test the effectiveness of the emergency plan and procedures, and to evaluate the exercise.

182. The Agency has also assisted with the application of isotopes in hydrological studies being undertaken by the Department of Geography and Geology of the University of Hong Kong. The Department sought to determine the stability of the lower slopes of Victoria Peak as a function of soil-water dynamics. With the equipment and expert services provided, the Department has been able to set-up a network of observation wells where the soil-moisture-content profile in the unsaturated zone is regularly monitored with the help of neutron probes. Such an investigation delivers important data, especially immediately before, during and after exceptional rains, such as those that occur during typhoons. Instability of the soil may result in landslides on the steep hillsides, and these represent a serious risk for many of the buildings that have been constructed in the foothills, with a concomitant threat to public safety. Many moisture profiles have already been determined and they are being evaluated and interpreted by the Department. Nevertheless, several years of observations will be needed before sufficient data have been collected to be statistically significant. In addition to the above mentioned technical assistance in Hong Kong, the Agency laboratories also provide analytical services for environmental samples to the Royal Observatory on regular basis. Inter-calibration and intercomparison have been established between Hong Kong counterpart institutions and the Agency's dosimetry and hydrology laboratories.

183. It is very clear that Hong Kong has reached a high level of development in science and technology, with highly qualified expertise. Agency assistance will continue to focus on radiation protection and environmental monitoring, and will tend to concentrate on the technically more specialized disciplines.

INDONESIA

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	33.8	33.8	0.0	4.4	9	17
1986	39.0	39.0	0.0	0.0	7	14
1987	47.6	39.0	0.0	0.0	6	30
1988	53.2	39.0	0.0	3.2	14	6
1989	58.8	39.0	0.0	1.1	11	15

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	451.5	0.0	451.5	8.1	415.2	0.5	45.1	247.2	30.9	738.9
1986	534.0	0.0	534.0	8.6	498.0	0.0	64.9	257.2	51.4	871.5
1987	497.6	200.0	697.6	9.6	668.9	216.9	164.7	175.6	86.4	1312.5
1988	326.5	150.0	476.5	6.9	408.4	343.3	186.6	73.3	35.3	1046.9
1989	492.3	400.0	892.3	11.9	476.2	98.3	141.7	190.3	92.6	999.1

184. Indonesia became a Member State of the Agency in 1957 and has since then been actively participating in the Agency's technical co-operation programme. The technical co-operation projects in Indonesia cover almost the entire spectrum of the Agency's fields of activity. Because of a large UNDP project in agriculture, for which the IAEA is the executing agency, the largest disbursements over the last five years have been made in that field. This was closely followed by nuclear engineering, nuclear physics, and nuclear safety and radiation protection. The Government of Indonesia has embarked on a large-scale nuclear energy programme in support of which the National Atomic Energy Agency (BATAN) is establishing a multi-disciplinary nuclear research complex at Serpong, West Java, in addition to the existing institutes at Jakarta, Bandung and Yogyakarta. The Serpong research complex comprises a 30 MW(th) high-flux multi-purpose research reactor (MPR-30), a radiometallurgy laboratory, an Informatics Development Centre with a VAX 8550 computer system, a Nuclear Fuel Element Centre for fabrication of fuel elements – including silicide fuel elements for the MPR-30, a Radioactive Waste Technology Centre that treats all types of radioactive waste generated in the country, a Radioisotope Production Centre whose central facility is a 30 MeV fixed energy cyclotron, and a Reactor Safety Technology Centre where the studies of thermohydraulic aspects of reactor safety for power reactors are to be studied. Construction of the complex was initiated in 1985 and most of the afore-mentioned institutes came into operation by the end of 1989. Very recently, the Government announced its intention to introduce nuclear power generation. A national authority responsible for regulations, licensing and inspection as they relate to radiation protection, exists in Indonesia, and there are Government regulations in force. However, the activities need to be strengthened to cover all X-ray machines in use by private clinics and firms.

185. Under a project on nuclear power planning executed during 1982-87, the counterparts prepared energy projections which are being used to check on possible future supply constraints. The economics of using nuclear power have also been studied. To ensure a proper basis for these studies, BATAN has set up a Nuclear Energy Studies Centre that is the focus of all studies relating to nuclear power development in the country. The Agency is also assisting in the evaluation of the site investigation plan for a power reactor site. In order to assist BATAN to cater for the needs of the expanding nuclear energy programme recommendations were made for manpower

development using indigenous, bilateral and IAEA resources. As a follow-up, the Education and Training Centre of BATAN is organizing training courses for the new recruits covering various disciplines of nuclear science and technology. The Agency is providing assistance in organizing national training courses on nuclear instrumentation and electronics, radiological safety and radiation protection, and on the use of computers in nuclear experiments.

186. A Secondary Standards Dosimetry Laboratory (SSDL) was established in Jakarta under a multi-year project initiated in 1980; it has since been appointed by the authorities as the National Calibration Facility in Indonesia. The Agency provided much of the specialized equipment, and expertise. The laboratory is now organized to cover the dose ranges of interest to the users of its calibration services in the country, for example hospitals and clinics, industry, and the various research centres of BATAN, on a routine basis. As a follow-up of this project, the Agency has also been providing assistance with the standardization of radionuclides, so that high accuracy radioactivity measurements and radionuclide determinations can be performed. The 30 MW(th) multi-purpose research reactor at Serpong was commissioned in July 1987. Agency experts made several visits during the period 1987-89 to advise BATAN on the technical aspects of reactor commissioning, and assisted with core measurements. The resulting record of this work and the evaluation of the results has enabled BATAN to assess whether the reactor is attaining the specified performance levels, and has permitted detailed plans to be made for the future operation of the reactor.

187. According to a Government decree, the authorities responsible for the construction of the above research reactor are obliged to submit details of a quality assurance programme covering the design, manufacture, construction and testing of structures, systems and components, pre-operational testing, initial fuel loading tests and initial criticality tests. The Agency assisted by providing experts in reactor safety who, during 1985-88, advised and trained counterpart staff on safety analysis of fuel behaviour, reviewed the proposed quality assurance programme and auditing requirements, and supported testing activities. A final mission on the surveillance of commissioning activities is scheduled for mid-1991, when the reactor is expected to attain full power. The Research Centre for Nuclear Techniques, Bandung, initiated a wide ranging programme of reactor physics investigations centered on the analysis of research reactor performance in connection with its 1 MW(th) reactor. The topics covered with Agency assistance included numerical reactor calculations, reactor kinetics, modelling and design of fuel assemblies, and thermohydraulic aspects of reactor safety.

188. Prospecting activities have been in progress for several years to assess the suitability of domestic uranium deposits for exploitation. The Agency provided expert services on different aspects of uranium exploration on the island of Kalimantan (Borneo) and in the Sibolga region of northern Sumatra. Some uranium ore deposits were identified in West Kalimantan; it is estimated that the reserve is sufficient to supply the domestic needs for yellow cake (uranium concentrate) for the nuclear power reactors being planned for the 21st century. The Agency is now providing expert assistance to advise on the classification of resources, on the choice of mining techniques appropriate to the character of the ore body, on uranium ore processing, and on evaluation and planning for exploitation of the reserves.

189. The Agency has also assisted the various centres operating research reactors in the management of radioactive wastes. In the future, the newly established Radioactive Waste Technology Centre will be responsible for handling the wastes deriving both from the establishments in the Serpong complex and from elsewhere in the country. Agency experts are now providing support in respect of the repository siting criteria and site survey studies, safety assessments for shallow land burial, and the modelling studies of radionuclide transport into the ecosystem and pathways to man. The national authorities have established a laboratory as part of the Centre for Standardization and Radiological Safety Research in Jakarta to carry out environmen-

tal radioactivity monitoring at national level. Agency assistance was directed to project planning and programming, natural radiation monitoring and analytical radiochemistry. The counterpart staff have now developed a capability for measuring environmental radioactivity at levels close to the detection limits. Foodstuffs and beverages are being analysed for radioactivity in support of export and import of these commodities.

190. In agriculture, under the first phase of a project supported by UNDP from 1982-88, facilities for undertaking isotope and radiation-aided research as applied to practical agricultural problems were strengthened at the Centre for the Application of Isotopes and Radiation (CAIR). Effective use has been made of these methodologies in support of plant breeding, of soil, fertilizer and crop management practices, of control of insect pests, including the effective and safe use of pesticides, and of animal nutrition and reproduction. Some of the results are already being used by farmers. For example improved varieties of wet-land rice, soybean, upland rice and mungbean are being cultivated, animal feed supplements in the form of solid molasses and mineral blocks made from agro-industrial by-products are being tested, better soil-moisture control and nitrogen-fertilizer practices as applied to multiple and sequential cropping routines under rain-fed conditions have been introduced, and Azolla is being used as a source of biologically fixed nitrogen in rice paddies. Entomological research has provided valuable dispersion data on rice insect pests, and rice and soybean varieties are being screened for insect-pest resistance. In these areas, effective co-operation has been established between CAIR, other national agricultural research institutes of the Ministry of Agriculture, and the universities. The second phase of the UNDP project started in 1988 with the aim of consolidating the achievements of the first phase, and of elaborating further on the animal production component of the project.

191. The demand for nuclear medicine services has been growing in Indonesia in the last few years. Although the Government provides nuclear medicine diagnostic equipment, progress is hampered by a shortage of manpower and inadequate infrastructure. The Agency has been providing assistance to the Fatmawati Hospital, Jakarta, since 1987. Particular emphasis has been placed on upgrading manpower. Under a project initiated in 1989, a cobalt-60 teletherapy unit and expert services in radiotherapy are being provided to the Semarang Hospital in Central Java. In a further project, work has been done on radiation grafting of polymers to produce artificial hydrogel dressings and production of slow-release drugs; BATAN is now co-operating with certain hospitals in Jakarta to realize the achievements in clinical practice.

192. With the technical assistance provided under a project on groundwater hydrology, the Centre for the Application of Isotopes and Radiation, Jakarta, has developed a well equipped laboratory and capability to carry out the analysis of both environmental and stable isotopes for hydrological application, especially for groundwater studies. The Institute is also participating in geothermal exploration on Java in co-operation with the national oil company (PERTAMINA).

193. Indonesia is already hosting a number of Agency-organized regional training courses and providing training to Agency fellows from developing Member States. The potential for increasing the number of fellows trained exists, particularly in the fields of radiation protection and personnel dosimetry, non-destructive testing, isotope production, uranium exploration, and on the utilization of research reactors and cyclotron accelerators. The particular relevance of such training in a number of fields for fellows from neighbouring countries and the TCDC aspects make it likely that the potential will be exploited.

194. With the Government intention to consider seriously the nuclear power option, the future trend in the Agency's technical co-operation assistance to Indonesia is likely to be oriented primarily towards nuclear power related projects, including the utilization or the three research reactors and related facilities, radiation protection and safety, and waste management.

REPUBLIC OF KOREA

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	46.8	46.8	0.0	9.0	8	1
1986	54.0	54.0	0.0	2.6	5	3
1987	68.0	68.0	0.0	24.8	7	26
1988	76.0	76.0	0.0	46.1	11	31
1989	84.0	84.0	0.0	71.6	6	14

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	396.9	0.0	396.9	7.1	457.1	0.0	116.8	15.4	140.0	729.3
1986	405.9	0.0	405.9	6.5	556.2	0.0	128.7	25.4	147.6	857.9
1987	449.8	0.0	449.8	6.2	628.1	0.0	169.6	132.8	208.4	1138.9
1988	384.9	0.0	384.9	5.6	429.5	0.0	116.6	125.8	186.0	857.9
1989	384.3	0.0	384.3	5.1	483.6	0.0	62.4	298.1	73.6	917.7

195. The Republic of Korea has an extensive nuclear programme involving power reactors, research reactors and nuclear fuel cycle facilities. Its first nuclear power plant came into operation in 1978 and it now has nine operational nuclear power plants with a total installed capacity of 7180 MW(e). Two more plants of about 1000 MW(e) each are planned and scheduled for operation by mid 1995 and 1996. During 1988, nuclear power contributed 46.9% of the total electricity generated in the country.

196. With the above background, it is natural that the Agency's technical co-operation has been oriented strongly towards the areas of nuclear engineering and safety, and radiation protection as well as towards public acceptance of nuclear energy.

197. The programme covers a broad range of peaceful applications of atomic energy. From the point of view of disbursements during the last five years, the central focus has been nuclear safety and radiation protection, followed by agriculture (largely due to a UNDP supported project), nuclear engineering and technology, and nuclear physics. For 1988-89, more than 90% of technical co-operation funding has been utilized for nuclear power related projects, in particular for manpower development, through provision of expert services and fellowship training, and with very little disbursed for equipment. This pattern is expected to continue in the coming years.

198. The technical co-operation projects are located all over the country, the main recipient being the Ministry of Science and Technology which operates two large research centres, namely, the Korea Advanced Energy Research Institute (KAERI) and the Korea Nuclear Safety Centre. The other major recipient institutes are the National Institute of Health, Seoul, the Radiation Standards Laboratory, Taejeon, the Korean Institute of Energy and Resources, Taejeon; and the Rural Development Administration, Suweon. The Ministry of Science and Technology co-ordinates all technical co-operation activities with the Agency in the country.

199. The Government is giving the highest priority to safety of nuclear power plants. The capability of the regulatory body for nuclear power plants, the Korea Nuclear Safety Centre, is being strengthened with Agency expertise. With the increasing share of Korean industry in the construction of the new reactors, the task of the licensing body in surveillance of construction and commissioning has increased. In

addition, the latest plants are of French design, and not all procedures and practices applicable to the previous United States designs could be directly transferred. A number of Agency experts from USA and France have assisted, therefore, in the preparation of revised procedures and in the conduct of commissioning tests.

200. Nuclear safety research was supported under a project initiated in 1986 that aims at developing a local capability in various aspects of nuclear power plant safety and accident analysis. In addition, Agency experts have advised on the licensing process and on fuel-cycle-facility regulations during 1988. Further projects are also helping to enhance the capability for administering development in the area of regulatory policy and to establish emergency response methodology.

201. The necessary infrastructure, including the national authorities and the regulations for the licensing, inspection and radiation protection services, are already well established in Korea. Under a project completed in 1989, local counterparts were trained in low-level counting, on effluent control, on regulatory aspects, and on methods of assessing radiation doses under normal operating as well as under accident conditions, as they relate to the operation of nuclear power plants. A national training course on radiological dose assessment was also organized, attended by personnel from research institutes, the electric utility, and the engineering and fuel companies of the Republic of Korea. Practical expertise in all aspects of radioactive waste management has been build up. There are excellent facilities both at the KAERI and Kori training centres, and the staff expertise and resources can meet the training needs for manpower development. To make full use of the training potential, there must be a proper overall managerial framework to identify the training needs in all the relevant organizations. To this effect, Agency experts evaluated the training policy of the Korea Electric Power Corporation as well as the training programme, staff and materials at the nuclear training centre at the Kori Nuclear Power Plant site. A further mission, reviewed the nuclear training programme of KAERI and provided advice on planning future training programmes, together with suggestions for co-ordination between KAERI and other Korean organizations to meet the objectives of the country's nuclear manpower development programme. The Agency also assisted with several training courses on specific topics in nuclear engineering and technology as relevant to the nuclear power programme.

202. The Government also has plans to assess the country's nuclear raw materials potential. Some intensive exploration, including drilling, has already been undertaken by the Korea Institute of Energy and Resources. In this connection, Agency experts advised on uranium exploration in relation to granite-associated deposits and sedimentary deposits during 1988-89. This followed on from Agency assistance to establish laboratory facilities for gamma-ray spectrometry which are now being used for analysis of uranium and thorium in radioactive minerals and rock samples.

203. In view of the increasing number of nuclear installations in the country, it is expected that the interest and concern of the general public in this area is likely to grow. The national authorities have sought to establish a long-term national public information programme to ensure better understanding of the use of nuclear energy for power generation and other purposes. At their request, an Agency expert advised on the different strategies that could be employed; further expert services to assist with aspects of the anti-nuclear movement and an opinion survey are scheduled for 1990.

204. The Department of Radiation Standards of the National Institute of Health under the Ministry of Health and Social Affairs decided to establish a secondary standards laboratory capable of providing calibration services at the therapy and radiation protection level. The Agency assisted with the provision of equipment, expert services and fellowship training. The Department is now providing: (a) calibration services for radiation measuring instruments; (b) quality control for radiation-generating systems used in medicine; and (c) personnel dosimetry services for radiation workers of the

Ministry. The Department is also participating in the Agency's high-dose intercomparison system and postal-dose intercomparison services for secondary standards dosimetry laboratories. The Government has already designated the Department as the National Calibration Laboratory.

205. Considerable support for the use of nuclear techniques in agriculture has been provided by and through the Agency. Under a UNDP-supported project established with the Rural Development Administration, the primary research institute in the country responsible for agricultural research. Experts advised on different aspects of plant breeding, on soil and its relationship to plant nutrition, and on pesticide use. Nineteen fellows were trained abroad, while eight senior scientists were provided with scientific visits to advanced laboratories. Research into 16 topics in the three fields referred to above were conducted at the six institutes of Rural Development Administration. The results are encouraging and are being transmitted to the farmers. An extension of the UNDP project is foreseen.

206. In animal husbandry, the Korea Advanced Institute for Science and Technology established a radioimmunoassay laboratory for progesterone assays relating to animal production. A straw-manure silage developed under the project is now being used on a trial basis by some 450 farmers as a winter feed with a view to improving milk and meat production. It was estimated that about 30% profit per head of native cattle and a 16% increased income per head of dairy cow are being achieved. Assistance was also given to the College of Agriculture, Chonnam National University, Kwangju, in support of its studies on reproductive performance and productivity of indigenous cattle.

207. Korea has now reached the stage where it can make a valuable contribution to training in nuclear power technology by sharing its remarkable experience and success in integrating this technology into the economic life of their country. In this context, it is already hosting a number of Agency-organized Regional training courses and providing training to Agency fellows from developing Member States; however, the potential for increasing this effort is very high, particularly in the fields of nuclear power, nuclear engineering and technology, nuclear medicine, radiation dosimetry, and agriculture.

208. It is also of interest to record that the Republic of Korea has become a donor country, contributing extrabudgetary funds for a footnote-a/ project in Egypt in 1988. It also donated to the Agency 30 personal computers in 1989 to support the management of the technical co-operation programme.

209. The future trend in technical co-operation with Korea is likely to continue as in the past, with emphasis on nuclear safety, on topics relating to nuclear power production and on agriculture.

MALAYSIA

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	23.4	23.4	0.0	4.8	10	1
1986	27.0	27.0	0.0	1.5	12	32
1987	34.0	34.0	0.0	0.0	11	31
1988	38.0	38.0	0.0	3.0	20	21
1989	42.0	42.0	0.0	6.0	12	64

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	463.7	30.0	493.7	8.8	370.7	66.3	78.3	0.0	0.0	515.3
1986	382.2	110.0	492.2	7.9	501.4	39.6	22.2	0.0	18.3	581.5
1987	463.8	70.0	533.8	7.4	576.1	10.3	105.9	0.0	16.2	708.5
1988	388.5	100.0	488.5	7.1	536.4	119.6	73.6	0.0	46.1	775.7
1989	477.9	10.0	487.9	6.5	529.7	89.7	238.5	0.0	15.6	873.5

210. Malaysia has a wide range of nuclear activities covering almost all fields of nuclear science and technology. Major facilities established by the country include a 1 MW(th) TRIGA Mark II research reactor with facilities for the production of radioisotopes, and a 340 kilocurie cobalt-60 irradiator. The research reactor was commissioned at the Tun Ismail Atomic Research Centre at Bangi, near Kuala Lumpur, in 1982. Agency assistance has primarily been provided to ensure effective utilization. A number of radioisotopes, notably iodine-131, technetium-99m, iridium-192, gold-198 and bromine-82, are being routinely produced for applications in medicine, agriculture, industry and research. In neutron activation analysis, elemental and trace-element determinations are being undertaken on a range of samples coming from different sectors. In the area of neutron scattering, the design of a small-angle neutron scattering spectrometer was completed with the advice of Agency experts and the facility is now being constructed by the counterparts, to be used for basic and applied materials research. Additional support for elemental analytical techniques came with the provision by the Agency, in 1980, to the National University of Malaysia, of a 14 MeV neutron generator, and this is being used for fast-neutron activation analysis.

211. Since the mid-1980s, the Agency has been assisting the Government in its assessment of a possible role for nuclear power in Malaysia. In this respect, a nuclear-option review, an energy and electricity demand study, and an assessment of local industrial capability have been concluded, while studies of both manpower and financial requirements are currently being completed. Studies using an Agency supported software package on energy and power evaluation are enabling the national authorities to plan requirements using a modern, proven planning tool. In parallel, problem areas in the public perception of the nuclear power option are being studied so that appropriate educational and awareness activities can be initiated in good time to ensure that public opinion is based on comprehensible, relevant and reliable information.

212. The Government has also been actively interested in making a sound technical assessment of the country's nuclear raw material potential. The Agency supported exploration for radioactive minerals under a number of projects since 1980. An aerial reconnaissance survey over 8000 square kilometres in Kelantan State indicated radiometric anomalies. A detailed investigation of these anomalies has been carried out through drilling and bore-hole logging to test for uranium mineralization.

213. The range of nuclear activities in the country require concomitant activities in the field of radiation protection and environmental monitoring, and Agency support has been given to upgrading these to match changing needs. Following the recommendations of an Agency RAPAT mission carried out in 1985, the Agency is assisting the Atomic Energy Licensing Board establish regulations, procedures and the technical infrastructure needed for a nation-wide radiation protection service. A national authority and regulations have been established and the regulatory organization is carrying out the functions relating to licensing and inspection. Additional expert support has been given in connection with biological dosimetry, monitoring of thorium and thoron daughters, and on the radiological hazards associated with the thorium

containing tailings deriving from the tin mining. In this context, equipment, including a radon-thoron measurement system, a continuous air monitoring system and an automatic gamma counter, were also supplied. Emphasis in this programme is now increasingly being placed on monitoring for compliance with regulations. A capability to monitor internal exposure of radiation workers has been established, and such monitoring is now routinely being undertaken using both bioassay techniques and a whole-body counter supplied. The capability to monitor environmental radioactivity, both base-line and operating levels has also been established, and routine monitoring of natural radioactivity in environmental samples is being carried out, especially at Tun Ismail Centre and in its environs.

214. In order to provide the requisite back-up services for calibration of dosimeters used in radiotherapy and radiation protection, a Secondary Standards Dosimetry Laboratory (SSDL) was set up at the Tun Ismail Centre. The Agency provided all major items of equipment. Agency experts trained counterpart staff on different aspects of dosimetry and in setting-up the equipment and undertaking calibrations. The SSDL is now fully operational and provides calibration services for the whole country. Recently, the counterparts additionally initiated a quality assurance service for diagnostic X-ray installations in the country. In 1987, an Agency-organized Regional workshop and seminar on calibration procedures in SSDLs was hosted by Malaysia at the Tun Ismail Centre. The twelve participating calibration laboratories in the Asia and Pacific Region brought their secondary standards for either comparison or recalibration against the Agency's own secondary standards.

215. Over the past years, the Agency has supported both therapeutic and diagnostic uses of ionizing radiation in Malaysia. Brief mention is made of two current activities. The Endocrine Unit of the Department of Medicine, National University of Malaysia, which is the reference centre for endocrinological disorders, has established a radioimmunoassay (RIA) facility for in-house assays. The Agency assisted with this project and prepared the way for purchase and use of bulk reagents for making the necessary assays kits locally. The Agency is also collaborating with the hospital of the University Sains Malaysia, Kelantan to set up nuclear medicine services, including teaching and research aspects to focus on diseases that are common on the east coast of West Malaysia.

216. As an important component of technical co-operation, assistance is being provided for the repair and maintenance of nuclear electronic equipment and for the development of some micro-processor based devices used in various research establishments and medical applications. Five pilot laboratories are participating in this project, and are already providing services to the Government agencies and to some private sector establishments.

217. Several Agency-supported projects have assisted Malaysia to increase agricultural production and reduce losses, through the application of isotope and radiation technology. Under the rice mutation-breeding programme, a new semi-dwarf variety has been developed which is being screened for early maturing, good yield, and resistance to the brown plant hopper pest. Fertilizer studies using nitrogen-15 labelled fertilizer have shown that the locally produced, formaldehyde-treated granular urea was up to 30% more efficient than imported ammonium sulphate and ammonium nitrate. Further studies using a phosphorus-32 labelling technique made it possible to show that oil palm can draw phosphate from distances as far away as 36 metres from its stem, suggesting the existence of an extensive network of fibrous roots encompassing a large surface area. This finding made application of fertilizer to oil palm trees by a broadcast method more meaningful than individual application to single trees. Studies are also under way to determine the fate, distribution and behaviour of pesticides in the soil/plant/water ecosystem in order to reduce the health hazards and to protect the environment. In the area of animal science, the Agriculture University of Malaysia was provided with assistance to establish for animal hormone measurement in connection with fertility, and to use nuclear and related techniques for studies on

the utilization of agro-industrial by-products as animal feed. The University has recently begun collaborating with the Department of Veterinary Services, principally through the Veterinary Research Institute at Ipoh, on a project to establish enzyme-linked immunosorbent assay (ELISA) techniques for diagnosing major diseases of livestock. The Agency is playing a role by providing some basic equipment and training of staff through experts' visits and fellowships.

218. Research has been carried out at different institutions in the country on the irradiation preservation of spices, vegetables and sea-food and on disinfestation of rice. A 340 kilocurie/cobalt-60 multi-purpose irradiator has since been commissioned by the Nuclear Energy Unit of the Prime Minister's Department, and this is now being utilized for the necessary applied research. In addition to food preservation, the newly-built irradiator is also being used for sterilization of medical supplies and the radiation curing of natural rubber latex on semi-commercial scale. This work derives from an Agency-assisted project initiated in 1984 for the development of manpower and the technology for improving the quality of wood and rubber products and for the sterilization of medical supplies. Experts advised on industrial process control for radiation preservation and sterilization, and curing processes, as well as on commercial synthesis of resins and their application to timber before curing. Further development in the surface coating of wood is dependent on the availability of an electron beam machine, the purchase of which is under active consideration by the Government. The other major area in which Malaysia has promoted the industrial application of isotopes and radiation technology is in non-destructive testing (NDT). Under several national and Regional projects supported by the Agency since 1981, equipment and expert services were provided which helped the national authorities to establish various NDT facilities and a national certification scheme that is in harmony with those of the other countries participating in the Regional NDT programme. Regular training is being given to NDT practitioners coming from various industries, and certificates awarded at the three different levels.

219. Silting up of harbours is a serious problem in Malaysia. The Agency provided assistance with the investigations of sediment transport in Port Kelang and Port Bintulu using isotope tracers. Useful data has been collected, and a similar study is scheduled to be carried out at Penang during 1990. In the related field of hydrology, the Agency is collaborating in studies aimed at assessing underground water reserves, in particular to determine interconnection and intermixing of water from different aquifers.

220. Malaysia is already hosting of Agency-organized Regional training courses and providing training to Agency fellows from other developing Member States. In view of the expertise and facilities available, a considerable potential for increasing the number exists and, because of the particular relevance of training received to the situation in many of the fellow's home countries, it is hoped that time will bring an increase in their number.

MONGOLIA

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	2.6	2.6	0.0	0.0	0	0
1986	3.0	3.0	0.0	0.0	0	0
1987	3.4	3.4	0.0	0.0	0	0
1988	3.8	3.8	0.0	0.0	0	0
1989	4.2	4.2	0.0	0.0	0	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	175.4	0.0	175.4	3.1	165.1	0.3	0.0	0.0	2.6	168.0
1986	97.6	0.0	97.6	1.6	137.6	6.8	0.0	0.0	4.4	148.8
1987	184.0	0.0	184.0	2.5	156.2	2.1	0.0	0.0	0.0	158.3
1988	289.6	25.0	314.6	4.6	116.3	24.2	0.0	0.0	0.0	140.5
1989	297.1	80.0	377.1	5.0	232.2	38.4	0.0	0.0	0.0	270.6

221. Mongolia has been a recipient of Technical Assistance since the mid-1970s, during which period Agency assistance has been provided under 21 projects, including 12 that are currently operational. In terms of disbursements, the technical assistance provided during the last five years has primarily been concentrated on the establishment of infrastructure, with emphasis on setting up laboratories that use nuclear analytical techniques for measurements on various ore samples mined in Mongolia. Other important fields of assistance have been the application of isotopes and radiation in agriculture, nuclear physics, radiation protection and hydrology. Technical assistance has been provided to many different organizations in the country. However, Mongolia's participation in Agency training courses, as well as in the fellowship training programme, has been rather modest.

222. Mongolia is rich in mineral resources. To support ore analysis, the Agency has assisted the Mongolian State University to set up a Nuclear Research Laboratory, where nuclear analytical methods are now used routinely. Data analysis of mineral ore samples is computerized and the Laboratory provides extensive services to the mineral exploration programme of the country.

223. Agency assistance has also helped the Nuclear Research Laboratory to develop a capability for repair and maintenance, as well as for small-scale design and construction of nuclear instruments. This has greatly facilitated the provision of analytical services to a number of organizations, including the mineral industry. A relatively large facility has been designed and constructed for fluorine analysis on fluoride ore samples. The first unit was designed for laboratory analysis of ore samples from the Berh fluoride mines. An improved version, capable of analysing the fluorine content directly in the truck carrying ore from the mine to the processing plant has also been developed; this is being employed at the ore enrichment plant at Bor Undur. Under a current project, an on-line analyser version of the unit, built directly on to the conveyor belt transporting ore to the processing plant, is being developed.

224. The Scientific Research Institute for Plant Breeding and Agriculture has been the recipient of technical assistance to support mutation breeding, soil science and plant nutrition studies. Mutation breeding has focused on producing varieties of plants, in particular of wheat and barley, which are early maturing, have a high-yield and are cold and drought resistant. One high-yield variety of wheat, suitable for high altitude cultivation, has been introduced. Three additional wheat mutants are ready for field tests. The soil science and plant nutrition studies have been primarily aimed at developing efficient fertilizer management practices. The project is expected to lead to better use of available soil-water resources and fertilizers.

225. Mongolia has one of the world's highest figures for the ratio of livestock to human population. The Agency has assisted the Scientific Research Institute for Animal Husbandry in Ulan Bator to introduce nuclear techniques in animal production and disease diagnostics. One project is aimed at determining the principal causes of infertility in cattle in large dairy farms around Ulan Bator and at developing methods for improving the reproductive behaviour and enhancing animal production. The Research Institute has been assisted in establishing a radioimmunoassay (RIA)

capability, in particular for the measurement of progesterone in blood and milk, and such assays are now being carried out routinely using the kits supplied by the Agency's Laboratory at Seibersdorf.

226. A further project for establishing RIA and ELISA (enzyme-linked immunosorbent assay) techniques, in this case for disease diagnostics, was started in 1989 at the Research Institute for Veterinary Science. Studies aim to establish relationships between disease and practices in animal husbandry, with a view to introducing improved methods of livestock management.

227. A project on groundwater hydrology was approved in 1989 by which the Water Economy Design and Survey Institute would establish an improved picture of groundwater resources to estimate the total water content of aquifers under the Gobi desert, which occupies one third of the country's territory. Appropriate equipment is being provided, and experts are assisting with the preparation and implementation of field sampling. Measurements on the chemistry and the isotopic composition of the samples are being made at the Agency's Seibersdorf Laboratory. Training for two staff members of the counterpart institute was arranged to enable them to undertake preliminary interpretation of the results obtained so far.

228. An appropriate infrastructure for radiation protection and the necessary services do exist in Mongolia. However, the existing regulations need to be updated and elaborated in the light of current safety standards. A high priority needs to be assigned to human resource development (both in quantity and quality) and upgrading of facilities, while an emergency preparedness capability needs to be introduced. These issues are being addressed in the technical co-operation programme being formulated for 1991-92 with the counterpart organization, the national Radiological Laboratory of the State Institute of Public Health, Epidemiology and Microbiology.

229. Future activities will continue to focus on the topics referred to above, since these are directly linked to boosting the national economy. However, shortage of trained manpower makes it impracticable to undertake some of the activities, which ideally would be decentralized to serve specific locations in the country, in anything but a centralized fashion, since manpower and other resources would be distributed too "thinly" to achieve a meaningful impact. Thus consolidation and upgrading of existing activities to create viable, stable nuclei of excellence in the various fields will probably characterize the Agency's co-operative programme with Mongolia in the coming years.

MYANMAR

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	2.6	0.0	0.0	0.0	0	0
1986	3.0	3.0	0.0	0.0	0	0
1987	3.4	0.0	0.0	0.0	0	0
1988	3.8	0.0	0.0	0.0	0	0
1989	4.2	0.0	0.0	0.0	0	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	177.6	15.0	192.6	3.4	131.3	60.5	0.0	0.0	0.0	191.8
1986	137.3	0.0	137.3	2.2	110.8	3.0	0.0	0.0	0.0	113.8
1987	174.6	10.0	184.6	2.5	106.4	0.0	0.0	0.0	0.0	106.4
1988	78.8	0.0	78.8	1.1	92.8	0.0	0.0	0.0	0.0	92.8
1989	215.9	0.0	215.9	2.9	71.2	22.9	0.0	0.0	0.0	94.1

230. Myanmar became a Member State of the Agency in 1957. It has made limited use of the Agency's Technical Co-operation Programme. At present, there are only six operational projects.

231. Assistance has been provided to the Department of Physics, Yangon Arts and Science University, to develop manpower for university-level teaching and research, to initiate research in nuclear physics, chemistry and radiochemistry, and to establish a good programme of academic training leading to a master's degree. A neutron generator laboratory was designed and built at the Department and this is being used for fast neutron activation analysis to determine minor and trace elements in archaeological samples, soils, fertilizers and food products. A 14 MeV neutron generator was also supplied late in 1988, but it has not yet been made operational as clearance could not be obtained for a visit by the supplier's engineer who was to carry out installation and commissioning.

232. Under the environmental radiation measurement programme, a well-equipped laboratory has been established at the Central Research Organization, Yangon. Gross-beta activities of rainwater and air samples are being measured routinely. Gross-beta activities of all imported milk and dairy products, are also being routinely monitored following the Chernobyl accident.

233. In the field of agriculture, the Agency has collaborated with the Agriculture Corporation of Myanmar in their studies of radiation-induced genetic changes to develop improved varieties of crop plants of economic importance, such as jute, sugar cane and sesame. The Agency provided a gamma-ray irradiator together with other related items of equipment and expert services. However, during the last two years the progress of the project has been hampered owing to non-clearance of experts by the governmental authorities.

234. The Agency assisted in establishing a well-equipped and functional department of nuclear medicine at Yangon General Hospital. The department is now capable of providing both in-vitro and in-vivo diagnostic services. About 10,000 radioimmunoassay tests, mainly for hormones and tumour markers, and about 4000 organ imaging studies, mainly of thyroid and liver, are carried out annually. Another nuclear medicine unit was to be set up at Mandalay General Hospital for the provision of in-vivo services. All equipment has been delivered, but several attempts to send experts to install the equipment and provide training have been unsuccessful. The Department of Medical Research, Ministry of Health, has collaborated with the Agency to establish a research laboratory with major a interest in bacterial and parasitic disorders and in the effects of snake bite. The staff of the laboratory have produced a large number of publications on research done. Under a current project, the Agency is providing equipment and chemicals as well as experts to undertake on-the-job training of local staff so that the use of bulk reagents for preparing kits for radioimmunoassay of non-thyroid hormones can be introduced.

235. A radiation sterilized human-tissue bank has been established at the Orthopaedic Hospital Kemmedine, Yangon. Sterilization of human tissue-grafts is carried out using a cobalt-60 source provided under another Agency project at the Agriculture Corporation. Expert services were provided to advise on tissue sterilization, tissue banking and radiation chemistry of bio-organic compounds.

236. With the growing use of radioactive sources and substances, Myanmar has sought Agency assistance to advise on establishing the legislation for a nation-wide radiation protection regime. An Agency expert undertook a mission in December 1987, and recommendations were put forward. Personnel dosimetry services have been established at a number of institutes; for example, the Yangon General Hospital is providing personnel dosimetry services to health institutions and to the University of Yangon. However, an overall national scheme for radiation protection has still to be established.

PAKISTAN

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	15.6	15.6	0.0	3.2	5	0
1986	18.0	18.0	0.0	0.0	7	0
1987	20.4	20.4	0.0	3.2	6	3
1988	22.8	22.8	0.0	0.0	9	16
1989	25.2	25.2	0.0	5.4	10	9

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	408.9	45.0	453.9	8.1	409.8	5.3	0.0	0.0	16.3	431.4
1986	416.0	45.0	461.0	7.4	547.6	14.1	0.0	0.0	27.3	589.0
1987	397.6	0.0	397.6	5.5	787.9	3.7	0.0	0.0	63.4	855.0
1988	366.7	45.0	411.7	6.0	318.1	-14.9	54.1	0.0	55.6	412.9
1989	338.3	130.0	468.3	6.2	427.0	12.8	29.5	0.0	11.8	481.1

237. Pakistan is one of the countries least endowed with conventional energy resources. It was estimated that by the turn of the century an installed capacity of 20,000 MW(e) would be required. Of that, 12,000 MW(e) could be generated through local hydroelectric, gas and coal resources, leaving a gap of more than 8000 MW(e). It was expected that half of that gap would have to be filled by nuclear power. The Government of Pakistan has, therefore, embarked on a vigorous nuclear power programme which includes co-operation with other countries in the construction of nuclear power plants to meet its short-term requirements.

238. Pakistan has been operating a 137 MW(e) nuclear power plant at Karachi since 1965. A research reactor at the Pakistan Institute of Nuclear Science and Technology (PINSTECH) near Islamabad has been operational since 1965, but has recently been redesigned to use low-enriched uranium. A miniature neutron source reactor supplied by China became operational in 1989. Agreement has already been reached with China for the supply of a 300 MW(e) nuclear power plant, the construction of which will start by the end of 1990 at Chashma, with commissioning scheduled for 1996. Negotiations are also under way for a further two 600 MW(e) units, one each from China and France, to be built at Chashma alongside the Chinese 300 MW(e) plant. A total of seven new nuclear power plants are foreseen.

239. The Pakistan Atomic Energy Commission also operates a number of nuclear research centres in addition to PINSTECH – at Islamabad, Lahore, Faisalabad, Tandojam and Peshawar. In addition, nine medical centres dedicated to the application of isotopes and radiation technology in medicine are operational in different parts of the country.

240. Pakistan became a Member State of the Agency in 1957 and it has since then been actively participating in the Agency's Technical Co-operation Programme, covering almost the entire spectrum of Agency activities. From the point of view of disbursements during the last five years, the focus has been on nuclear science and technology, followed by medicine and agriculture.

241. The Pakistan Research Reactor (PARR) at PINSTECH was originally designed to operate with 93% enriched uranium. A preliminary study was completed in 1986 for the necessary conversion of the core to use low enriched (20%) uranium and at the same time to upgrade the power level to 10 MW(th). Under a TC project initiated in 1987, an Agency expert advised on the core physics analysis, including the design of the fuel elements, and safety analysis. The design for the reactor conversion has been completed and the safety analysis report is being finalized.

242. The Karachi Nuclear Power Plant (KANUPP) reached its full power of 137 MW(e) in 1972 and is still being operated commercially, although at half capacity, by a well trained and experienced team. A microprocessor- based computer system and some test equipment as well as expert services were provided by the Agency over the period 1984-89, in order to facilitate local design and development of reactor control systems. A programme for upgrading the control and instrumentation equipment of the KANUPP was also undertaken in parallel by the Pakistan authorities, and two international companies have been awarded contracts for joint engineering studies on equipment replacement and KANUPP control room improvements. In this context, the Agency is providing expert services to help in independent evaluations at the different stages. The aging being experienced by the components of the reactor systems of the KANUPP has resulted in various problems that have necessitated its being operated at reduced power. At the request of the Government, an Agency Operational Safety Review Team (OSART) visited the plant in January 1989. As a follow up and to investigate and analyse the root cause of a thermal expansion problem, an Agency Assessment of Significant Safety Events Team (ASSET) visited KANUPP in September 1989 and recommended short-term and long-term actions for improving the safety of the plant. A project has been approved under the reserve fund that will provide experts to advise on a detailed inspection programme for all the 208 reactor fuel channels and, in particular, on the removal and examination of the defective G-12 reactor fuel channel, and on different aspects of operational safety. It may be noted that the plant, which was shut down in July 1988, has, on the basis of the recommendations of ASSET, been operating at 80 MW(e) power level since December 1989. In support of the overall nuclear power programme in the country, the Directorate of Scientific and Engineering Services under the Pakistan Atomic Energy Commission has established a non-destructive examination laboratory to support a quality assurance programme for nuclear power plants, in particular concerned with in service inspections of selected components of KANUPP. In an ongoing effort, the Agency has been supporting this activity with the provision of equipment and expert services relating to the application of various non-destructive testing techniques. A workshop on probabilistic safety analysis was organized in 1989, and a training course on quality assurance is scheduled.

243. The Atomic Energy Minerals Centre in Lahore is carrying out a country-wide survey for nuclear raw materials, which includes prospecting, exploration and mineralogy. Under a project initiated in 1977, the Agency provided expert services on project planning, and on different aspects of exploration and mining. Uranium

occurrences in the Siwalik Sandstone area have been developed into ore bodies that are already being mined. Other prospective areas are still under investigation by the Centre, with Agency assistance and support.

244. As part of Pakistan's emergency preparedness programme, and in line with recent Government legislation, PINSTECH has initiated a project to establish a mobile laboratory for collecting environmental samples, analysing them and performing dose assessments under emergency conditions. Apart from functioning as a stand-by facility for use in emergencies, the laboratory will be used for routine environmental radiological surveillance in the vicinity of the Pakistan Research Reactor at PINSTECH and to enhance radiation safety for the general population. To this end, the Agency provided various items of analysing and monitoring equipment for the mobile unit.

245. A secondary standards dosimetry laboratory (SSDL) was established at PINSTECH with Agency assistance over the period 1979-87. In addition to providing the usual range of equipment and expert services, a programme of fellowship training was also carried out. As a national standardizing laboratory, the SSDL is now regularly providing calibration and standardization services to all the radiotherapy institutes in the country, with the internationally recommended level of accuracy. To cover the high-dose level needed for the calibration of cobalt-60 sources used in medicine and industry, further Agency support is being provided.

246. PINSTECH is already providing personnel dosimetry services, including the use of thermoluminescence dosimetry (TLD), to about 2000 radiation workers in the country; this number is expected to reach 10,000 by 1990. In order to cope with the increasing work load, the Agency is helping to upgrade the dosimetry system with the provision of an automatic TLD system and ancillary equipment. Experts will provide on-the-job training in the use of the system.

247. To facilitate the establishment of a data base for management and dissemination of nuclear scientific and technical information, a computer system was supplied to PINSTECH by the Agency. This has enabled it to set up Selective Dissemination of Information services as well as an on-line searching capability from the Agency's INIS data base established there. In this way, the number of subject/user profiles processed every month has increased from about 100 to 450 during the last two years. Feedback from users is being used to continuously refine their search profiles.

248. Research carried out with the Agency assistance at the three specialized Atomic Energy Agricultural Research Centres in Tandojam, Faisalabad and Peshawar has enabled new varieties of rice and cotton to be obtained using mutation breeding. Some varieties have been introduced for general cultivation and have resulted in significant economic gains. For example, the development of the NIAB-78 cotton mutant has revolutionized national cotton production and has increased farmers' income by an estimated US $300 million annually. Studies have also been undertaken on nitrogen uptake from soils using nitrogen-15 labelled fertilizer. Research on intercropping of nitrogen-fixing and other crops has shown that the productivity of land can be increased by about 22% when soybean is intercropped with cotton.

249. Salination and waterlogging of large tracts of arable land are major problems in Pakistan and are mainly caused by seepage of water from rivers and canals. With Agency assistance, the Nuclear Institute for Agriculture and Biology, Faisalabad, is studying the process of salinization and attempting to work out biological methods for the utilization of salt-affected soils, including the identification of salt-tolerant plant species.

250. In the field of nuclear medicine, technical assistance is being provided to several Atomic Energy Medical Centres under the Pakistan Atomic Energy Commission. The Institute of Nuclear Medicine and Oncology, Lahore, is already in a position to produce bulk reagents for thyroid hormone and TSH radioimmunoassay, and is distributing them to various users in Pakistan as well as to some countries in the Asia

and Pacific Region. The Lahore Institute is also a regional centre for the External Quality Assessment Scheme (EQAS) being run as part of a Regional programme. It is worthy of note that nuclear medicine techniques were used in the investigation and treatment of more than 170,000 patients in Pakistan during 1988.

251. In hydrology, Agency assistance was provided to build up an analytical capability for carbon-14 measurement and tritium counting. PINSTECH is now fully capable of employing all the usual isotope techniques common in hydrology. It may be noted that the Institute has well trained professional staff working in isotope hydrology. It is hoped that the Institute will orient the use of the isotope techniques and of their facilities still further towards the practical hydrological problems of the country, working in close co-operation with the national water institutes.

252. Pakistan is already hosting Agency-organized regional training courses and providing training to Agency fellows from developing Member States. The potential for training is high, particularly in the fields of agriculture, nuclear medicine, radioimmunoassay, uranium exploration, non-destructive testing, and nuclear engineering and technology.

253. Requests received from Pakistan for co-operation in the 1991-92 biennium indicate that in the following years added emphasis will be placed on nuclear safety and radiation protection, on exploration for nuclear minerals and on the safe operation of KANUPP.

PHILIPPINES

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	23.4	7.9	0.0	3.2	4	14
1986	27.0	6.9	0.0	0.0	7	29
1987	34.0	6.9	0.0	0.0	4	1
1988	38.0	0.0	0.0	0.7	8	1
1989	42.0	0.0	0.0	0.0	4	9

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	267.3	0.0	267.3	4.8	437.3	1.1	190.6	241.8	92.9	963.7
1986	477.3	0.0	477.3	7.7	468.4	0.0	130.3	66.2	39.7	704.6
1987	427.8	0.0	427.8	5.9	423.9	0.0	54.0	14.2	192.8	684.9
1988	378.5	0.0	378.5	5.5	300.3	0.0	58.0	0.0	52.7	411.0
1989	405.4	20.0	425.4	5.7	434.6	1.7	51.0	0.0	86.2	573.5

254. The Philippines had embarked on a wide range of nuclear activities that ranged from plans for nuclear power, to varied applications of isotopes and radiation. The construction of the 620 MW(e) Philippine Nuclear Power Plant Unit No.1 (PNPP-1) was completed at Bataan in early 1986, but it was then mothballed in accordance with a decision of the Government. An aged 1 MW(th) research reactor designed for 93% enriched uranium fuel at the Philippine Nuclear Research Institute was converted into 3 MW Triga-type reactor using low-enriched 20% uranium in 1988 to make possible local radioisotope production, neutron activation analysis and research. A 30 kilocurie

cobalt-60 irradiation facility was installed at the Institute early in 1989 and is being used for small-scale radiation sterilization of medical products and other irradiation services.

255. The Philippine Nuclear Research Institute (PNRI – formerly the Philippine Atomic Energy Commission) in Quezon City, near Manila, has been given the mandate by the Government to undertake research and development relating to the application of atomic energy and radiation in support of the various sectors of the national economy. It operates the nuclear research reactor and other radiation facilities, and deals with licensing and regulatory activities relating to all aspects of the use of ionizing radiations and radioactive substances. The Institute is the national counterpart to the Agency in matters relating to technical co-operation and is, in fact, the main recipient of technical assistance.

256. A project on planning for a nuclear emergency was initiated in 1984 in parallel with the construction of the nuclear power plant. The Agency provided various items of equipment, and assisted the Institute by reviewing the national emergency plan and the emergency preparedness procedures. Several counterpart staff were granted fellowships for training abroad. With the mothballing of the nuclear power plant, the focus of this and related safety activities was changed to match the existing pattern of activities in the country, for example in relation to the facilities at PNRI.

257. In connection with the proposed conversion of the research reactor, a project on spent fuel management was initiated in 1983. Agency experts advised on the plan for the safe storage of the spent fuel and necessary facilities for fuel storage were built and put into service. Visual inspection for spent fuel and water coolant activities monitoring is being done regularly.

258. Considerable technical assistance has been provided to the country in the field of nuclear engineering and technology for several years. In support of the nuclear power programme, projects were initiated for developing manpower in this field by establishment of a training centre. These projects were terminated in 1988 due to the moratorium on Nuclear power. However, the personnel that was trained, for example in quality assurance and quality control, as well as in non-destructive testing, has been absorbed to a great extent by industry or PNRI.

259. As part of the environmental radiation monitoring programme, natural radon and thoron levels were determined by scientists PNRI as from 1986. The Agency provided some monitoring equipment, and Agency experts assisted with establishment of the project. Concentration data in dwelling places and at a geothermal power plant have been collected to serve as baseline data for establishing public health guidelines. Further work will be undertaken with respect to dwellings and to coal and uranium mines.

260. In order to cope with the wide range of dosimetry services needed in the country, two secondary standards dosimetry laboratories with different responsibilities have been established with Agency's assistance, one at PNRI and one at the Department of Health. A thermoluminescence dosimetry system for the personnel monitoring service for radiation workers has been established in the country, and calibration of radiation monitoring instruments used for radiation protection is being done routinely. Equipment for high dose measurement and calibration has also been provided. Quality assurance and quality control measurements on the nuclear medicine facilities are being conducted in Manila. In the field of nuclear medicine, the Philippine General Hospital of the University of the Philippines is developing improved methods for the prevention, diagnosis and treatment of cardiac complication in cases of diabetes mellitus and to facilitate the early detection of primary hepatoma. The Agency has assisted by providing a gamma camera with a data acquisition system and a liquid scintillation counter.

261. The Agency also supported the Graduate School at the University of Santo Tomas to cater for a shortage of medical physicists in hospitals and radiation protection services by helping to establish a post-graduate school of medical physics with all essential teaching facilities and equipment needed for a two-year post-graduate course (MSc). Twelve medical physicists graduated from the University since 1986, and most are now employed as medical physicists at hospitals, or at the Institute for Nuclear Medicine and Radiation Protection.

262. Iodine-131 is the most widely used radioisotope in nuclear medicine in the Philippines, with a requirement that exceeds 500 mCi/week. At present, the demand is being met by import. A project was initiated in 1989 to upgrade the existing radionuclide processing facility at the reactor to a level that will meet foreseeable demand.

263. In support of agriculture, technical assistance is being provided to two research institutes of the University of the Philippines for pesticide residue studies. The Natural Science Research Institute at Diliman and the National Crop Protection Centre at Los Banos. A well equipped laboratory has been established at Diliman to undertake work with radiotracers. The project will lead to better understanding of the kinds and levels of pesticide residues in food and water and will support studies on the metabolism and fate of pesticides in plants and animals. The Agency is also supporting a collaborative project in which PNRI, the Bureau of Animal Industry, and the College of Veterinary Medicine at Los Banos of the University of the Philippines are collaborating. The aim is to evaluate the productivity of village carabaos (swamp buffaloes) maintained under traditional conditions, and to monitor the effects of changes in management, nutritional supplementation and improved health care. The Agency has also supported PNRI in its aim to establish a pilot-scale irradiation facility. The construction of a shielded building and the installation of an irradiator, a 30 kilocurie cobalt-60 source, and the auxiliary equipment were completed in 1989. Currently studies of food irradiation, and the sterilization of medical products and tissue grafts are being carried out using the irradiation facility.

264. The Environmental Management Bureau in Quezon City is undertaking studies of groundwater movement and resources. Some equipment was provided for isotope tracing, while a local staff member has been trained in the appropriate techniques at the Agency's Isotope Hydrology laboratory. Water samples are being sent to the Agency's laboratory for analysis and assistance is being given with interpretation of the isotope data. Some assistance, to PNRI, is also being provided for uranium exploration activities.

265. Technical co-operation with the Philippines matches the PNRI Nuclear Science and Technology Plan (1989-1993) and is likely to continue as at present, with emphasis on radiation protection and nuclear safety, analytical services and radioisotope production.

SINGAPORE

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	23.4	1.8	0.0	1.5	2	4
1986	27.0	0.0	0.0	0.0	3	5
1987	34.0	0.0	0.0	0.0	0	2
1988	38.0	0.0	0.0	0.0	2	2
1989	42.0	0.0	0.0	0.0	1	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	137.6	0.0	137.6	2.5	101.0	0.0	0.0	0.0	6.4	107.4
1986	89.6	0.0	89.6	1.4	90.3	0.0	0.0	0.0	7.3	97.6
1987	87.1	0.0	87.1	1.2	151.5	0.0	0.0	0.0	0.0	151.5
1988	81.0	0.0	81.0	1.2	60.0	0.0	0.0	0.0	0.0	60.0
1989	72.3	0.0	72.3	1.0	34.0	0.0	0.0	0.0	0.0	34.0

266. Singapore became a Member State of the Agency in 1967 and has been a recipient of technical assistance since then. The focus of Agency assistance has been on nuclear physics, which accounted for some 50% of the disbursements during the last five years (1985-89). Applications of isotopes in industry and hydrology, and radiation protection are the other important areas of support. These three fields combined add up to over 90% of disbursements. The Singapore Institute of Standards and Industrial Research and the Port of Singapore Authority have been the main recipient organizations.

267. In the area of applied nuclear physics, Agency assistance has been used to establish a central nuclear analytical laboratory at the Department of Physics of the National University of Singapore. The main facility is a 2.5 MeV Van de Graaff accelerator. Three different kinds of X-ray analysis systems have been put into routine operation giving a broad range of techniques with which to analyse samples relating environmental, industrial and medical problems. The counterparts have also conducted studies on the composition of gemstones, particularly rubies, so that natural and artificial stones could be distinguished and, using fluorescence analysis, their origins could be identified. Thirty-nine research papers were published in national and international scientific journals. The facilities and the experience gained by the staff have benefitted their own nationals, as well as several Agency fellows who received training at the laboratory.

268. In the area of nuclear safety, assistance has been provided mainly to the national Radiation Protection Inspectorate (RPI), which is a section within the Ministry of Health. The Inspectorate was established in 1972 and serves as the controlling authority in Singapore. With Agency support, a national calibration laboratory for ionizing radiation was established at the Inspectorate, while its high-dose gamma dosimetry laboratory has been set up at the National University of Singapore. The Agency provided dosimeters to establish reliability in gamma dose measurements and irradiation techniques. The Inspectorate is currently providing personnel dosimetry monitoring services throughout Singapore and for some neighbouring countries. It also conducts radiation contamination tests for meat, fish and several other food items – about 2500 food samples have been tested each month since the Chernobyl accident. Calibration services for radiation monitoring instruments are likewise provided.

269. The application of nuclear techniques in industry has also been receiving Agency support. The Singapore Institute of Standards and Industrial Research is the main recipient and coordinator in this field. A well-equipped laboratory has been established at the Institute. Three national training courses have been held there. Agency experts provided training on the X-ray fluorescence system for the the staff of the Institute, who now undertake qualitative and quantitative elemental analysis on industrial samples. Computer software has been locally developed for evaluation of the analytical results. Further Agency assistance is being provided to develop advanced X-ray fluorescence techniques in order to extend the range of non-destructive elemental analysis to the lighter elements. Services to support industrial processes, including quality control, are being made available.

270. The Agency-supported project on the application of radioisotope techniques to hydrology with the Port of Singapore Authority has been a great success. With expert services, equipment and fellowships provided under the project, the Authority has been able to assess the stability of reclaimed land at Changi Airport. This work has resulted in savings estimated at around US $5 million by to reducing the amount of protective construction needed to safeguard the shore line. In addition, optimal sites for the dumping of dredged spoil were identified, and major decisions regarding coastal protection works and land reclamation projects in Singapore could be made. The most important accomplishments have been the transfer of radioisotope tracer technology and the creation of expertise within the Authority, which is now to a large extent self-reliant in such studies.

271. Singapore is a country that has reached a high level of development in various fields. Agency assistance in the future will tend to be very selective, leading into the technically more advanced areas of applied nuclear techniques, being used to support in particular hydrological studies, industry, and health and safety activities.

SRI LANKA

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	2.6	2.6	0.0	7.2	9	0
1986	3.0	3.0	0.0	0.6	9	13
1987	3.4	3.4	0.0	0.0	6	0
1988	3.8	3.8	0.0	1.0	11	9
1989	4.2	4.2	0.0	0.0	7	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	391.1	0.0	391.1	7.0	384.4	0.0	47.7	0.0	6.8	438.9
1986	244.5	60.0	304.5	4.9	270.7	0.0	143.6	0.2	88.0	502.5
1987	432.4	15.0	447.4	6.2	516.0	0.0	8.6	0.0	76.4	601.0
1988	364.0	35.0	399.0	5.8	536.5	9.8	13.1	0.0	14.6	574.0
1989	427.9	20.0	447.9	6.0	239.9	19.0	25.0	0.0	8.2	292.1

272. Sri Lanka became a Member State of the Agency in 1957 and it has since then been actively participating in the Agency's Technical Co-operation Programme. The Atomic Energy Authority is the Agency's national counterpart for all technical co-operation and has coordinated the introduction of nuclear techniques into Sri Lanka. The country has no reactors of any type, and priority has been given to the practical application of isotopes and radiation in medicine, in agriculture, in industry and in hydrology, these fields receiving about 70% of total technical assistance provided over the last five years.

273. In the field of nuclear medicine, technical assistance is being provided to several medical centres, including the Government Cancer Institute, the Department of Radiology of the General Hospital, Colombo, the Nuclear Medicine Unit of the University of Peradeniya and the Faculty of Medicine of Ruhuna University, to upgrade and modernize the existing nuclear medical facilities. Over the past five years, the Agency has supported several technical co-operation projects to develop radioimmunoassay (RIA) techniques, to establish computer supported gamma-camera facilities for medical diagnostic imaging, and to improve radiation therapy of cancer.

274. To lower the incidence of viral hepatitis following blood transfusion, a screening programme for hepatitis-B-positive blood that uses RIA for hepatitis-B surface antigen has been introduced with Agency assistance at the Central Blood Bank of the National Blood Transfusion Services at the General Hospital. Since then there is routine screening of donor blood at Central Blood Bank, with some 50,533 samples being tested between July 1985 and May 1988. Of these, 112 were confirmed as positive, or about 0.2% of donors, a high figure in terms of infection transmittal. No infected blood is now being transfused and prospective donors who are found to be positive for hepatitis-B are excluded from future blood donations. A considerable impact on public health has been achieved through this project.

275. The Agency is also providing technical assistance to Department of Pathology and Radiology of the General Hospital to introduce the in-vitro RIA technique in medical diagnosis. An RIA laboratory has been established and counterparts have been trained in RIA techniques, quality control procedures and evaluation of assay results. The General Hospital is now providing clinical diagnostic services for thyroid diseases to local patients. The use of RIA is to be gradually increased to meet the full demands made on the service. A further RIA project has also been supported by the Agency at the Faculty of Medicine of Ruhuna University in Galle, with similar results. In order to upgrade the existing nuclear medicine facilities at the General Hospital, and at the Faculty of Medicine of the University of Peradeniya, provision was made by the Agency to equip the hospitals with gamma cameras, the related computer systems and the necessary software. Agency support will facilitate the computerization of diagnostic data and increase the range of nuclear medicine studies. It will be possible to expand the number and kind of patient studies when the supply of radiopharmaceuticals improves. At the Government Cancer Institute at Maharagama, the Agency is supporting a radiation therapy project; radiotherapy and X-ray diagnostic equipment has been provided for therapy of uterine cancer.

276. Production-oriented research in agriculture is being carried out with Agency assistance at several institutions, and the Sri Lankan Government has accorded high priority to agricultural applications of nuclear techniques. The main topics being studied are plant/soil/water interactions in relation to crop production, plant nutrition and physiology, nitrogen fixation and mutation breeding. A few examples may illustrate the range of activities carried out in this field: A multi-disciplinary project for crop management that involves the Atomic Energy Authority in Colombo, the Coconut Research Institute in Lunuwila, the Tea Research Institute in Talawakalle and the Rubber Research Institute in Agalawatta has been active for many years and is nearing a successful conclusion. Through Agency support, an adequately equipped laboratory was established and staff was trained in the various techniques of analysis. Agency assistance was also provided to the Rubber Research Institute for studies on plant nutrition and physiology. Results are already improving tapping procedures, and work on selection of new clones of rubber plants suitable for plantations in Sri Lanka is proceeding. The Central Agricultural Research Institute in Peradeniya's studies in mutation breeding were aided by providing a cobalt-60 gamma irradiator as well as expert services and fellowship training. The project has been very successful. Six rice varieties which are popular among the farmers in low temperature areas in Sri Lanka were selected for the study, and several interesting high-yield rice mutants with tolerance to environmental stress have been obtained; final evaluation is in progress.

277. The Agency has assisted the Radioisotope Centre of the University of Colombo, the National Water Supply and Drainage Board and the Department of Meteorology to set up an environmental tritium laboratory and to develop the use of environmental isotope methods for groundwater studies. Piezometric and hydro-geological maps have been prepared by the geologists involved in the project, a hydrological and hydro-meteorological network has been set-up in the country, river flow measurements have been made and the details of river water leaking to recharge the groundwater have been clearly determined.

278. Considerable emphasis has been placed on support for industry. The Agency has provided assistance in non-destructive testing (NDT) to the Colombo Dockyard, to the Ceylon Petroleum Corporation, and to the Ceylon Bureau of Standards for onward dissemination of services and training. National training courses were held to train engineers in surface methods, and in radiographic, ultrasonic, eddy current and magnetic particle techniques. The Agency has also supported the Radioisotope Centre of the University of Colombo in its work on the application of radiotracer techniques to solve industrial problems. A project is being implemented at the Rubber Research Institute on radiation induced vulcanization of natural rubber latex, for which the Agency provided a cobalt-60 irradiator.

279. In order to develop a national dosimetry calibration and radiation protection service and to relate radiation measurements to internationally accepted primary dosimetry, the Atomic Energy Authority decided to set up a secondary standards dosimetry laboratory. The Agency provided dosimetry and calibration equipment and, in addition, a national training course and fellowship training were also supported.

280. In the field of nuclear science, nuclear techniques, nuclear engineering and instrumentation training, the Agency is providing assistance to three universities. At the University of Colombo, academic training was focused on nuclear physics, radiation and radio-chemistry and nuclear instrumentation. The main topic of nuclear training at Moratuwa University is nuclear engineering linked to the introduction of nuclear power; nuclear training at Peradeniya University is oriented toward neutron and nuclear physics. Training facilities are available, and training is proceeding on the scale required by the country.

281. The internal security situation has at various times impeded project implementation, and delays have been unavoidable. The Agency is working closely with the Government and the counterpart institutions to minimize these and to return to full implementation as the situation improves.

THAILAND

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	20.8	20.8	0.0	2.5	6	13
1986	24.0	24.0	0.0	1.9	8	40
1987	30.6	30.6	0.0	0.0	9	24
1988	34.2	34.2	0.0	4.2	21	21
1989	37.8	37.8	0.0	4.1	16	100

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	473.7	135.0	608.7	10.9	634.7	74.0	244.1	0.0	164.6	1117.4
1986	401.3	100.0	501.3	8.1	751.3	120.6	27.1	143.8	126.6	1169.4
1987	361.0	50.0	411.0	5.7	703.5	22.4	181.3	467.7	367.5	1742.4
1988	327.0	0.0	327.0	4.7	396.3	6.2	258.7	259.3	238.2	1158.7
1989	349.8	0.0	349.8	4.7	506.5	27.6	246.3	346.4	78.5	1205.3

282. A National Committee, the forerunner of present Thai Atomic Energy Commission for Peace, was established in November 1954. In 1961 the Atomic Energy for Peace Act was enacted and the Office of Atomic Energy for Peace (OAEP) came into being

as the operating arm of Thai Atomic Energy Commission. Since then, the OAEP has co-ordinated the widespread introduction of nuclear techniques in Thailand and is the national counterpart of Agency's technical co-operation and assistance. Thailand became a Member State of the Agency when it was established in 1957.

283. The Agency's technical co-operation activities in Thailand have contributed substantially to the development of a scientific and technical infrastructure capable of supporting a wide range of nuclear applications, with immediate and observable benefits in important areas of Thai economy and society. There is a broad-based programme of technical co-operation with Thailand; in the past five years, the Agency has collaborated in a total of 50 technical co-operation projects, of which 20 have been completed. The largest portion of Agency technical assistance has been provided in the field of nuclear techniques in agriculture, research reactor and isotope production, nuclear medicine, and nuclear safety.

284. The Ministry of Agriculture and Co-operatives, in particular the Department of Agriculture, Livestock Production and Fisheries has been the major recipient of Agency assistance pertaining to the agricultural sector. Other institutions involved include the OAEP, the Ministry of Public Health, the Universities of Chulalongkorn, Khon Kaen, Chiang Mai, and Kasetsart, and some field stations in 20 Thai provinces. Project objectives included optimizing fertilizer application, determining soil/water/nitrogen fixation relationships, improving animal health and reproduction, measurement of pesticide residues, appropriate food preservation techniques, and breeding plants for better yield and disease resistance. The nuclear techniques involved in achieving these objectives include the utilization of nitrogen-15 and phosphorus-32 labelled fertilizers, food irradiation, radioimmunoassay (RIA) tests, neutron activation analysis, breeding of plants using mutations produced by irradiation, and radiation attenuated vaccines. Agency backing for the considerable efforts of the Thai Government have resulted in the successful establishment of the infrastructure and training programmes necessary to support applications of nuclear techniques in agriculture. The most recent major effort in this basic-capability building exercise is the IAEA/UNDP project started in 1986. It is hoped that Agency assistance to be provided to the important agricultural sector will be geared even more towards problem-oriented applications, to ensure a real impact at farm level, with tangible benefits. In support of these activities, an expanded training effort will be required country-wide.

285. Government efforts were also aimed at upgrading research reactor use and the related production of radioisotopes. The Triga Mark II research reactor of the OAEP is the premier nuclear facility in Thailand and is operated for a 40-hour steady-state programme each week at a power level of 1 MW. The Agency has contributed to improving in the performance of the reactor by providing expert services on fuel management, safety analysis, spent fuel storage, measurement of the reactor-core parameters, and by providing assistance with the replacement of fuel elements. Support has also been given to the establishment of a prompt-gamma activation analysis facility and the conduct of neutron radiography studies. In the near future, it is planned to increase the reactor power to a steady-state level of 2 MW after upgrading the cooling system .

286. Agency assistance amounting to over US $1 million has been provided during the last eight years to establish and steadily enhance the radioisotope production facility to meet the increasing local demand for radioisotopes for medical applications. Iodine-131 and technetium-99m production lines have been installed and commissioned, and routine production and supply of these two radioisotopes to local hospitals and other users is ensured. A radioisotope quality control and monitoring system has been set-up and all batch samples are subject to quality assurance controls.

287. Agency assistance has contributed significantly to the early development of nuclear medicine in Thailand. The main recipient institutions are Ramathibodi Hospital, Siriraj Hospital and Chulalongkorn Hospital, where nuclear medical diagnostic centres have been established. Routine nuclear medical services are provided to the public to meet the large demand. It is clear that the primary phase of nuclear medicine in Thailand is almost complete and the second phase of increasing specialization is beginning. In-vitro capability for radioimmunoassay (RIA) studies and installation of gamma cameras for in-vivo diagnostics are well advanced. At this time, it would seem prudent to bring together in an effective manner all existing national expertise and to use all professional expertise in nuclear medicine, supported as necessary by the Agency to plan the longer-term development and expansion of nuclear medicine activities to ensure optimum utilization of facilities and manpower.

288. During the past five years, the Agency has assisted in the establishment of nuclear physics and chemistry laboratories at the Chiang Mai, Chulalongkorn and Prince of Songkla Universities. Agency support has been effective in transferring new skills and technologies and developing self-sustaining programmes. At the physics department of Chiang Mai University, the fast neutron research facility will allow original contributions to be made in the nuclear data field. X-ray fluorescence spectrometric techniques have been successfully transferred to the chemistry departments of the Chiang Mai and Prince of Songkla Universities where analysis of various types of samples are being undertaken. Neutron activation analysis facilities have been established at the OAEP with Agency support. At all the counterpart institutions, students can be given adequate training to match the future needs of Thailand for competence in nuclear science and technology.

289. Agency assistance to Thailand in the area of nuclear safety has primarily involved dosimetry related to radiotherapy, radiation protection and industrial processing, the management and disposal of low- and intermediate-level radioactive wastes and environmental monitoring. Two secondary standards dosimetry laboratories have been established. One based at the Division of Radiation Protection Services of the Department of Medical Science, Ministry of the Public Health, is oriented towards radiotherapy dosimetry and radiation protection for medical staff. The other is based at OAEP and is oriented toward radiation protection and industrial dosimetry.

290. There is great concern for environmental safety in Thailand, and the Agency is supporting programmes for monitoring airborne radionuclides and measuring the trace-element concentrations in the estuarine wastes in the gulf of Thailand. Maintenance of public and government confidence in the OAEP's ability to handle such issues effectively is essential if the full benefits of nuclear applications are to be enjoyed.

291. The Agency has also supported activities relating to prospecting for nuclear raw materials, to the application of nuclear techniques in industry, and general atomic energy development. Waste management concerns are bound to grow in importance in Thailand with the expansion of nuclear applications; a long-term plan for further Agency support is being formulated.

292. The fellowships and scientific visits that have been made available by the Agency to Thailand for training abroad have contributed markedly to the development of a broadly based group of professionals with considerable experience in various areas of nuclear science and its applications, and they are well able to provide the leadership and planning skills required for the further development of nuclear science and technology.

293. Indeed, the success of Agency's technical co-operation activities in Thailand can be attributed to two principal factors: firstly, the effective over-all national organizational structure that was created by Thailand from the beginning of the programme, and secondly, the emphasis placed in the programme on manpower development,

reflected in the high scientific level and technical skill of Thai scientists, doctors, engineers and technicians, and the competence of the civil servants involved in the programme.

294. It is clear that Thailand has achieved a high level of development in nuclear field, with a positive impact in the socio-economic advancement of the country and an improvement in the lives of its citizens. These accomplishments have led to greater expectations and into areas that are more complex and technically more demanding.

VIET NAM

A. CONTRIBUTIONS TO AND PARTICIPATION IN TECHNICAL CO-OPERATION ACTIVITIES

Year	TACF share	TACF pledged	Extrabudgetary funds	In-kind support	Experts from country	Persons trained in country
	$	$	$	$		
1985	5.2	0.0	0.0	0.0	1	0
1986	6.0	0.4	0.0	0.0	1	0
1987	3.4	0.0	0.0	0.0	2	0
1988	3.8	0.5	0.0	0.0	9	0
1989	4.2	2.3	0.0	4.0	4	0

B. ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	232.0	350.0	582.0	10.4	308.1	436.9	70.9	0.0	2.7	818.6
1986	203.8	600.0	803.8	12.9	286.1	300.3	25.9	0.0	61.7	674.0
1987	258.1	655.0	913.1	12.6	358.4	301.5	24.7	0.0	144.6	829.2
1988	363.8	214.0	577.8	8.4	317.1	153.3	-19.8	0.0	95.2	545.8
1989	479.4	50.0	529.4	7.0	369.4	145.3	0.0	0.0	61.3	576.0

295. Viet Nam became a Member State of the Agency in 1957 and was one of the first countries to engage in technical co-operation. There has been collaboration under some 150 projects, including the twenty that are currently operational. The main emphasis of technical assistance during the last five years has been on establishing multi-disciplinary laboratories for research and development of various aspects of nuclear science and technology at the Dalat Nuclear Research Centre. Considerable assistance has also been provided towards the establishment of a multi-purpose irradiation facility at the National Institute for Nuclear Research, Hanoi. The Viet Nam National Atomic Energy Commission in Hanoi, the Centre for Nuclear Techniques of the Viet Nam Atomic Energy Institute, Ho Chi Minh City, and several hospitals have also been major recipients of assistance. Viet Nam has been an active user of the Agency's fellowship training programme, but has not benefitted as much as perhaps it might from the training course programme.

296. The National Institute for Nuclear Research at Dalat has, as its central facility, a 500 kW research reactor that was originally built in 1963 as a 250 kW TRIGA reactor; it was subsequently upgraded in 1984, using Soviet VVR-M2 fuel. The reactor itself, together with its auxiliary systems, was constructed by the Government of Viet Nam. In 1989, an Agency mission, carried out an inspection of the reactor tank, the core components and the reactor structure using an under-water telescopic examination technique in order to identify and diagnose any corrosion problems, and to propose appropriate remedial measures. The report of the mission is currently being evaluated.

297. Agency assistance over the years has been instrumental in providing the means for efficient utilization of the reactor. It is used primarily for radioisotope production, neutron activation analysis and basic research. In respect of the first mentioned, the Institute produces regularly isotopes for use mainly in hospitals. Activation analysis is being used extensively for multi-elemental analysis of various kinds of ores; up to 3000 samples are analysed each year. This technique is complemented by X-ray fluorescence spectrometry, which is being used for analysis of a wide variety of materials, including pharmaceutical and biological samples.

298. Other activities include a routine environmental monitoring programme in the vicinity of the establishment, and a series of studies concerned with the radiosterilization of medical supplies and with various aspects of the radiation preservation of food using the Institute's small irradiation facility. The nuclear electronics unit has attained a high level of self-sufficiency in the repair and maintenance of nuclear electronic instrumentation, and in the design and construction of selected instruments. A few hundred specialized units, matched to the needs of various technical divisions of the Institute and, on demand, of local hospitals, have been built, mostly based on Eurocard and NIM standards. All of these programmes at the Dalat Institute have benefitted from Agency assistance both in terms of equipment supplied and expert services for on-the-job training.

299. To help Viet Nam establish facilities for semi-pilot scale studies to demonstrate the potential of food preservation using irradiation of agricultural products well as fish, assistance is being provided to the National Institute for Nuclear Research at Hanoi. Facilities incorporating a 220 kilocurie cobalt-60 source are being established. Assembly of irradiation equipment, loading of the cobalt source, adjustment and testing, trial runs and experimental operation are planned for early 1990, with expected commissioning of the facility in the second half of the year. In the meantime, the Ministry of Health has, by Ministerial Decree, given clearance for irradiation of seven food items: potatoes, onions, garlic, pulses, spices and dried sea foods. Adoption of the WHO/FAO Codex Alimentarius general standards for irradiated foods and adherence to the international code of practice recommended for the operation of a food irradiation facility are being pursued.

300. In Ho Chi Minh City, which is a major centre for food production, Agency assistance has been provided to the Centre for Nuclear Techniques of the Viet Nam Atomic Energy Institute in support of the use of isotope techniques in soil/plant studies. The laboratory has been provided with a liquid scintillation counter and an emission spectrometer to enable studies to be undertaken with phosphorus-32 and nitrogen-15 labelled fertilizers, which were also been supplied. Agency experts assisted with initiating field experiments for studying the effect of phosphate and nitrogen fertilizers on rice production with a view to improving the efficiency of fertilizer management practices.

301. In animal husbandry, a collaborative programme to strengthen the Institute for Agricultural Technology's capabilities in studies on the reproduction of cattle and buffaloes has been initiated. Equipment has been provided, and laboratories for radioimmunoassay techniques for hormone measurement have been established. Studies have been initiated to evaluate the reproductive efficiency in swamp river cross bred buffaloes and indigenous cattle crossed with European breeds. Assistance is also being provided to establish ELISA techniques for diagnosis of livestock diseases at two institutes, the National Institute for Veterinary Research in Hanoi, and the Institute for Veterinary Research in Ho Chi Minh City.

302. In the field of nuclear medicine, assistance has been provided to hospitals in Dalat, Hanoi, and Ho Chi Minh City, and to the Medical University at Hue. They have been helped to establish or upgrade facilities for organ imaging and radioimmunoassay for the diagnosis and treatment of diseases such as thyroid, blood, liver and kidney disorders.

303. The Agency has been collaborating with the National Institute for Nuclear Research (IRN) in Ho Chi Minh City on the application of nuclear techniques for groundwater resource investigations. A radiocarbon laboratory has been established and substantial knowledge of the hydrology of Mekong Delta has been acquired by the counterparts. The laboratory is capable of analysing over 200 samples per year and is also providing routine analyses to other national institutes for geological and archeological samples. The scope of activities within the project is to be enhanced to include artificial water tracing.

304. Assistance in non-destructive testing has been provided to the National Institute for Nuclear Research in Ho Chi Minh City. The Institute now has an established capability to apply radiographic and ultrasonic techniques to the quality control of welded joints in pressure vessels and related items used in ship building and other types of heavy engineering. Services are routinely provided to industry. Following the success of the project, the Agency has been requested to help establish similar facilities at the Laboratory of Industrial Applications of Nuclear Techniques, Viet Nam National Institute of Atomic Energy, to service the growing demand for non-destructive testing services for industry based in north Viet Nam.

305. Future collaborative activities between the Agency and Vietnam are expected to focus on strengthening the Nuclear Research Centre at Dalat, with particular emphasis on the facilities and services around the research reactor, on establishing a long-term programme for improving radiation protection in the country, and on the application of nuclear techniques in industry and hydrology.

REGIONAL ACTIVITIES

ASSISTANCE APPROVED AND PROVIDED

Year	Assistance approved from TACF				Total assistance provided from all sources					
	CC	NCC	Total	Region	TACF	TACF	Extra-budgetary	UNDP	In kind	Total
	$	$	$	%	CC $	NCC $	$	$	$	$
1985	206.0	0.0	206.0	3.7	154.4	0.0	213.1	329.1	86.3	782.9
1986	433.0	0.0	433.0	7.0	292.5	0.0	327.9	754.3	128.8	1503.5
1987	333.6	0.0	333.6	4.6	675.4	41.9	196.5	637.9	96.9	1648.6
1988	457.7	0.0	457.7	6.6	850.9	27.5	375.0	627.4	232.1	2112.9
1989	1120.7	168.0	1288.7	17.2	720.4	6.9	1086.1	542.7	260.2	2616.3

A. THE REGIONAL CO-OPERATIVE AGREEMENT FOR RESEARCH DEVELOPMENT AND TRAINING RELATED TO NUCLEAR SCIENCE AND TECHNOLOGY (RCA) OF 1987

306. The RCA programme in 1989 comprises about 18 Regional Asian projects incorporated into RCA in accordance with the provisions of the RCA Agreement. Decisions concerning the programme, and recommendations on all policy issues are made by the annual RCA Working Group Meeting and are put forward for endorsement by the General Conference Meeting of Representatives of RCA Member States. Both meetings serve to advise the Deputy Director General of the Department of Technical Co-operation.

307. Primary responsibility for administration of the programme rests with the RCA Co-ordinator, who is based at the Agency. Managerial overview is provided by the Agency's interdepartmental RCA Steering Committee. The RCA Co-ordinator corresponds principally with his designated national counterparts within Member States. However, in the case of the large-scale UNDP Regional Industrial Project, much of the day-to-day implementation is undertaken by the UNDP Project Co-ordinator who heads the Project Office in Jakarta.

308. The RCA Programme covers the application of nuclear techniques to agriculture, industry, medicine and biology, radiation protection, energy planning, research reactors and basic science. In several areas, the project activities are augmented by Agency Co-ordinated Research Programmes in which several Member States collaborate. A brief outline of project achievements is provided below.

Agriculture

309. Radiation induced mutation breeding projects have had a long history within RCA. The Co-ordinated Research Programme (CRP) on the improvement of grain legumes has resulted in the introduction of about 70 new varieties within the Region. This programme will receive a further impetus with the inception of a new UNDP Project on increasing the nitrogen fixation capabilities of common grain legumes.

310. The CRP on the application of nuclear techniques to buffalo studies provided, inter alia, the scientific basis for the development of a successful strategy to control a roundworm (toxocara utulorium) infection which at one stage resulted in the death of 30 to 35% of infected buffalo calves in Sri Lanka and elsewhere.

311. The Regional Project on Food Irradiation is entering a third phase. The principal aim is to increase food availability by reducing wastage, which can reach 50% in some cases, and to increase quality by controlling spoilage and infestation as well as premature sprouting. The three phases were funded respectively by Japan, Australia and UNDP/China. The current emphasis is on establishing a basis of process control, and on promoting the acceptance of irradiated foodstuffs as a commodity of regional trade.

Industry

312. The importance of the UNDP Regional Industrial Project to the development of RCA cannot be over-estimated. At one stage it accounted for 75% of the RCA budget and, even now, it accounts for about half of a much larger resource-base. Virtually from the beginning, major parallel funding has been provided by Australia and Japan. More recently, China has commenced funding project activities.

313. Four sub-project categories are supported: (a) tracer technology in industry; (b) non-destructive testing (NDT); (c) radiation technology; and (d) nucleonic control systems.

314. The tracer technology sub-project has concentrated on training and industrial demonstrations. Within the framework of the project, tracers have been used, inter alia, to measure the flow rate of natural gas in Thailand, the residence-time distributions in a cement factory in the Republic of Korea, and mercury inventories in Bangladesh.

315. The NDT sub-project has provided extensive regional and national training activities in all major NDT techniques. Japan has provided training in advanced or special methods. Particular emphasis is being placed on encouraging harmonization of the training and certification of NDT personnel according to a draft ISO standard.

316. Within the radiation technology sub-project, emphasis is being placed on: (i) the radiation sterilization of medical products, especially the various aspects of good manufacturing practice; (ii) the radiation curing of surface coatings of wood products, based especially on the electron beam facility at CAIR-BATAN, Jakarta; (iii) the radiation cross-linking of insulating materials for wire and cable sheathing, supported by UNDP and China; and (iv) the radiation vulcanization of natural rubber latex. The last mentioned technology, supported largely by Japan, is exciting regional and global interest. It has potential applications to the manufacture of medical products such as rubber gloves, because of the low level of nitrosamine residues in the product.

317. Nucleonic control systems have achieved wide application in the paper, mineral, coal (Australian funded) and civil engineering (Japanese funded) industries. A major demonstration facility for coal-ash and moisture measurement has recently been established at the Mae Moh Lignite Mine, Thailand.

Medical and biological applications of nuclear techniques

318. The climax of the Japanese funded CRP on evaluation of imaging procedures for the diagnosis of liver diseases has been the publication of an Atlas of Liver Images which is proving to be very useful for physicians in developing countries. The project is entering a second phases, with a comparative evaluation of ultra-sound and radionuclide techniques.

319. The CRP on the radio-aerosol imaging for the diagnosis of respiratory diseases addresses a particularly serious health problem in developing countries. Central to the programme are systematic clinical investigations using nebulizers supplied cost-free by India. It is planned to produce an Atlas of Lung Images based on this study.

320. The Australian funded technical co-operation project on the use of computers in technetium-99 imaging is designed to improve the standard of diagnosis in, inter alia, heart, brain and liver disease. Emphasis being is placed on quality control of equipment and software validation.

321. A large technical co-operation project on the radioimmunoassay (RIA) of thyroid related hormones has contributed to reducing the cost of a patient investigation by up to a factor of 10 by introducing bulk-reagent methodology. A regionally based external quality assessment scheme has been set up and regional sources of reagent supply are being organized. Plans are being made to extend the project to hepatitis-B diagnosis.

322. Within the framework of the project on the radiation sterilization of tissue grafts, all participating countries have now the capability of producing sterile, clinical-quality grafts for burn-wound dressings. Tissue sterilization and banking is now being carried out in seven of the developing RCA countries. Plans are at an advanced stage for the second phase of the Japanese funded project on the improvement of cancer therapy in Asian countries.

323. Within the project on the maintenance of nuclear medical instruments, which is being supported by India, increasing emphasis is being placed on computerized management and quality assurance. In addition, the Agency is assisting with the provision of a small spare-parts service.

324. In the field of public health, RCA is supporting a long-standing CRP on the measurement of the levels of toxic elements in foodstuffs. The data are being used to compare actual concentrations of toxic elements in individual foodstuffs and dietary intakes with provisional tolerable intakes as specified in national legislation and in international guidelines.

Radiation protection

325. Provision of technical assistance in radiation protection enjoys one of the highest priorities. RCA has responded with the establishment of a Japanese-initiated, Australian, Indian and Japanese funded project on the development of radiation protection infrastructures. There are three principal classes of activity: (1) an annual series of Regional training courses on radiation protection in Sydney and Tokyo/Tokai; (2) a series of regional workshops on personal and environmental dosimetry (Tokyo/Tokai), and environmental sampling and measurements (Kalpakkam); and (3) a CRP compilation of the anatomical, metabolic and physiological

characteristics of reference Asian man. The last-mentioned project is important as a supplement to the characteristics currently defined for the ICRP Reference Man, which is based on Caucasians.

Research reactors

326. India has traditionally supported a series of workshops and training courses with the general theme of basic science using research reactors. Over the years, such topics as neutron activation analysis, radioisotope production and the use of IBM-compatible computers as laboratory interfaces have been covered.

327. A Malaysian initiated project on research reactor utilization is now under way. The project is primarily directed towards supporting the infrastructure of those six RCA countries having only one research reactor each. A CRP on the application of personal computers to enhance operations and management of research reactors has been approved, while an Indian funded workshop on research reactor safety principles and a Chinese funded training course on research reactor utilization with emphasis on a miniature neutron-source reactor have been scheduled.

Energy and nuclear power planning

328. A rational basis for planning for expansion of national electricity systems is important to many RCA countries, since improving the energy-supply infrastructure is basic to improving the national economy where the lead sector is industry. The principal aim of one RCA project is to contribute to this process through an annual series of workshops and periodic training courses. Emphasis is being placed on the use of personal computer versions of the Agency's WASP (electrical generating system package) and MAED (model for analysis of energy demand) methodologies; support has been obtained from the Asian Development Bank, the World Bank and ESCAP.

B. OTHER REGIONAL ACTIVITIES

329. In addition to the RCA project, there are a number of other Regional Asia and the Pacific projects and activities.

330. Since virtually all participating countries have long coast lines, the United States of America funded project on marine contaminant and sediment transport is important for the Region. In addition, the Agency funds a regional group training programme comprising five or six courses annually.

331. The growth of regional co-operation in Asia was not a rapid progress. It commenced in about 1963 with the India/Philippines/Agency project, out of which evolved the more comprehensive Regional Co-operative Agreement in 1972. That the co-operation continues to flourish after 27 years is a good indication of the effectiveness of the regional approach in promoting of the benefits of nuclear technology to developing countries.

IV. PROJECTS CONCLUDED DURING 1989: ACHIEVEMENTS

332. In the following pages, brief accomplishment summaries are given for projects – excluding training courses – which were "operationally" completed during 1989. For the projects cancelled during this period, the reasons leading to cancellation are given.

333. A project is "operationally completed" when all experts have returned from 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.

334. 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. Whether the momentum leading to these accomplishments can be sustained and whether the project will have a continuing development impact over the longer term can only be ascertained through post-project evaluation. When specific expert recommendations are translated into practice, trained counterpart staff are retained for the activities involved and equipment is fully used and kept functioning, the benefits arising out of the project will obviously go well beyond the achievement of the immediate objectives.

■ ALG/0/006 ACTIVATION ANALYSIS

COMPLETED: **89-11-17** TOTAL COST: **$338,329**

OBJECTIVES:

TO STRENGTHEN THE ANALYTICAL CHEMISTRY LABORATORY'S CAPABILITY IN NEUTRON ACTIVATION ANALYSIS AND TO TRAIN LOCAL STAFF.

ACHIEVEMENTS:

This long-term project first received approval in 1980 with the aim of training scientists and technicians in undertaking activation analysis. The Agency was requested to provide a neutron generator and expert services. In the early 1980s, a laboratory for these studies was established, and, among other items, a liquid-nitrogen-cooled semi-conductor gamma spectrometer and ancillary equipment were provided, with further expert assistance for establishing measurement routines and training. By 1987, the laboratory was providing analytical services in connection with mining, agriculture and other fields, with two analytical chemistry research groups undertaking these services as well as research. The Agency was requested for 1988 to assist with upgrading the equipment for sample preparation, and to provide a spectrophotometer. Three counterpart staff received training abroad under project-related fellowships during the lifetime of the project, while six experts assisted with on-the-job training. The laboratory at the Centre for Nuclear and Solar Studies of the High Commissariat for Research is now able to process some 30,000 samples annually, using neutron and fast-neutron activation analysis, Moessbauer spectrometry and X-ray fluorescence spectrometry in support of national socio-economic development.

■ ALG/1/006 NUCLEAR TRACK DETECTOR LABORATORY

COMPLETED: **89-11-20** TOTAL COST: **$72,755**

OBJECTIVES: TO SET UP A NUCLEAR TRACK DETECTOR LABORATORY FOR NEUTRON AND RADON DETECTION AND FOR TRAINING.

ACHIEVEMENTS: The project enabled the Centre for Development of Radiation Protection and Safety Techniques to set up a nuclear track detection laboratory which is being used to monitor radon and neutrons, as well as to provide graduate training. A total of three months of expert services helped to establish the infrastructure, provided guidance on planning the programme of work and advised on the use of the equipment supplied. Two local staff were trained abroad on project-related fellowships and they now supervise experimental work being undertaken by Algerian students attending the MSc course at the University of Algiers.

■ ALG/6/003 RADIOPHARMACEUTICAL QUALITY CONTROL

COMPLETED: **89-08-15** TOTAL COST: **$181,926**

OBJECTIVES: TO ANALYSE AND STUDY IMPORTED RADIOPHARMACEUTICALS THAT ARE USED IN CLINICAL INVESTIGATIONS.

ACHIEVEMENTS: The Centre for the Development of Radiation Protection and Safety Techniques of the Commissariat for New Energies, which is responsible for the internal distribution of imported radiopharmaceuticals used in clinical investigations has, with Agency assistance, established a quality control laboratory for radiopharmaceuticals. Agency experts assisted in planning the laboratory, and with the technical specifications for the hot cell and equipment. Following delivery of various instruments, including a thin-layer chromatographic system, a sodium-iodide well-type crystal gamma-spectrometer system with data processing capability, an alpha/beta counter and a calibration source, further experts provided on-the-job training on preparation and quality control of radiopharmaceuticals and, more specifically, on preparation of technetium-99m labelled products. One long-term and two short-term project-funded fellowships were awarded for practical training, and the recipients are now working as staff of the laboratory. The project has paved the way for production of technetium-99m labelled radiopharmaceutical kits for distribution to hospitals for clinical studies, due to start in 1990. This is being supported from 1989 under a new project, ALG/6/005.

■ ALG/9/005 RADIOACTIVE WASTE PROCESSING

COMPLETED: **89-05-19** TOTAL COST: **$33,674**

OBJECTIVES: TO ESTABLISH A FACILITY FOR RADIOACTIVE WASTE MANAGEMENT.

ACHIEVEMENTS: A facility for treatment and disposal of solid and liquid low-level radioactive wastes has been established and is being used for storing radioactive wastes generated by research activities and in hospitals. Agency experts initially assisted with planning the waste management facility. Following the provision of a small compactor through the Agency and other facilities by the local authorities, a further expert gave on-the-spot instruction on decontamination

of liquid effluents and wastes and related topics. Advice and guidance were also provided by the experts to the authorities concerning discharge of radioisotopes into the environment.

■ BGD/1/007 NEUTRON DOSIMETRY

COMPLETED: **89-09-25** TOTAL COST: **$36,897**

OBJECTIVES:

TO ESTABLISH A PROGRAMME OF NEUTRON PERSONNEL MONITORING USING THE ETCHED-TRACK TECHNIQUE.

ACHIEVEMENTS:

The Bangladesh Atomic Energy Commission operates various facilities, including a TRIGA MK II research reactor, for which radiation protection monitoring for neutrons is required. This United Kingdom funded project established a programme to determine neutron dose using the etched-track technique with plastic foil. A neutron calibration source, a spark counter and related equipment were supplied, and an expert assisted with setting up the Nuclear Track Laboratory and the neutron dosimetry service. Macrofol KG used in combination with neptunium foil serves as the dosimeter which is now being used to provide personnel dosimetry to some 60 Atomic Energy Research Establishment, Savar, staff members.

■ BGD/4/007 REPAIR AND MAINTENANCE OF NUCLEAR INSTRUMENTS

COMPLETED: **89-09-25** TOTAL COST: **$94,389**

OBJECTIVES:

TO STRENGTHEN THE CAPABILITY OF THE INSTITUTE TO REPAIR AND MAINTAIN NUCLEAR ELECTRONIC EQUIPMENT AND TO MANUFACTURE SIMPLE INSTRUMENTS.

ACHIEVEMENTS:

In 1982, the Bangladesh Atomic Energy Commission, which had established an Institute of Electronics at Savar, sought Agency assistance to improve its capability for assembling simple nuclear electronic instruments and for serving as a maintenance and repair facility for the Commission and other national institutions. With initial funding of $69,000 provided by the United States of America, and supplementary funding from the Agency's Technical Assistance and Co-operation Fund, various items of equipment, such as single channel and multi-channel pulse height analysers, an oscilloscope, desk-top computers, and UNOLAB instrument kits and spares, were provided, while visiting experts undertook on-the-job training. This training was further supported by the award of seven project-related fellowships. Through this project, a modest capability has been acquired to keep instruments of the various institutes in good working condition. In addition, a number of simple items of equipment were developed and produced, including a hand-and-foot monitor, portable survey meters, scintillation and GM detectors, pH-meters and a nuclear counting and measuring system, underlining the effectiveness of the assistance provided under the project.

■ BGD/4/010 TRAINING OF MANPOWER FOR QUALITY ASSURANCE

COMPLETED: **89-12-04** TOTAL COST: **$12,453**

OBJECTIVES: TO IMPROVE QUALITY AND SAFETY RELATED TO THE CONSTRUCTION, COMMISSIONING, OPERATION AND MAINTENANCE OF NUCLEAR FACILITIES THROUGH THE ESTABLISHMENT OF AN EFFECTIVE QUALITY ASSURANCE PROGRAMME.

ACHIEVEMENTS: To support the Bangladesh Government's wish to establish a quality assurance programme for its nuclear installations, two experts on quality assurance (QA) conducted training courses, several workshops and seminars, and supported the Bangladesh Atomic Energy Commission's Quality Assurance Task Force in the formulation of QA documents relating to the existing research reactor and cobalt-60 irradiators, contractual documents for purchase of equipment, and the audit check-list for assessing the QA programme of an operational nuclear installation. The target of establishing some local manpower trained in QA techniques has also been accomplished.

■ BGD/9/004 RADIATION PROTECTION

COMPLETED: **89-09-25** TOTAL COST: **$118,834**

OBJECTIVES: TO INTRODUCE AN ENVIRONMENTAL MONITORING PROGRAMME AND TO ESTABLISH A WHOLE-BODY COUNTER SYSTEM FOR MEASURING BODY BURDENS.

ACHIEVEMENTS: The Bangladesh Atomic Energy Commission requested Agency assistance to set up its environmental monitoring programme, initially to determine base line radioactivity data and, after commissioning of the 3 MW research reactor and associated facilities, to undertake controlled monitoring. Eight project-related fellowships for training abroad were granted, including one funded by the United States of America, as were three scientific visits. To establish the programme, a range of low-level counting instruments were provided, including an alpha/beta counter and a gamma spectrometer. Progress was followed up by short consultant's visits, and an expert helped to initiate comprehensive programme design and undertook on-the-job training. The counterparts completed the pre-operational environmental survey in and around the research reactor site at Savar and at a proposed site for a nuclear power plant at Roopur, and are carrying out regular post-operational monitoring at Savar; in addition they are designing a whole-body counter for determining nuclide body burdens.

■ BGD/9/005 RADIOACTIVE WASTE MANAGEMENT

COMPLETED: **89-09-19** TOTAL COST: **$76,188**

OBJECTIVES: TO DEVELOP METHODS FOR HANDLING, TREATMENT, STORAGE AND DISPOSAL OF RADIOACTIVE WASTES AND TO CARRY OUT THE ASSOCIATED ENVIRONMENTAL MONITORING.

ACHIEVEMENTS: The Agency was asked to provide assistance with the Bangladesh Atomic Energy Commission's programme to handle, treat, store and dispose of radioactive wastes arising from operation of the research reactor and other

facilities at the Atomic Energy Research Establishment site at Savar. With the expert services and equipment provided, methods have been developed for handling, treating and storing radioactive wastes. An evaluation was made of the safety aspects of ground disposal of radioactive wastes from the 3 MW TRIGA MK II research reactor and the radioisotope production facilities. Sorption studies of selected radionuclides using the soil matrix technique have been initiated. Routine collection and storage of solid and liquid wastes are being made in accordance with international codes of practice.

■ BRA/0/009 TECHNICIAN TRAINING

COMPLETED: **89-10-30** TOTAL COST: **$55,020**

OBJECTIVES: TO TRAIN AND QUALIFY TECHNICIANS IN QUALITY ASSURANCE AND QUALITY CONTROL FOR THE BRAZILIAN NUCLEAR POWER PROGRAMME.

ACHIEVEMENTS: As a result of a UNDP-financed manpower development project, a need was identified to train and qualify technicians to support the national nuclear power programme. Provision was made to provide experts for national in-service training courses to be organized by NUCLEBRAS, the state-owned utility. A comprehensive programme on quality assurance and quality control, chemistry, electronics and fuel conversion and fabrication was designed. A manual was developed to provide detailed programmes and curricula for each area, with guidelines on academic standards and prerequisites for participants and instructors, and results expected. The project has contributed markedly to setting the foundation for in-service training, which has been continued and further developed by the national authorities.

■ BRA/1/021 LOW-LEVEL GAMMA SPECTROMETRY

COMPLETED: **89-10-30** TOTAL COST: **$106,031**

OBJECTIVES: TO ANALYSE GAMMA EMISSIONS AT VERY LOW LEVEL IN DIFFERENT MATRICES AND TO IDENTIFY CRITICAL RADIONUCLIDES AND THEIR PATHWAYS.

ACHIEVEMENTS: The National Nuclear Energy Commission's Institute for Radiation Protection and Dosimetry sought Agency assistance to increase its precision in undertaking low-level radiation dosimetry. The project has contributed significantly to strengthening Brazil's environmental and occupational safety programmes and the safe use of radiation in general. A Compton supression system and a gamma-spectrometer were provided and installed for routine and research activities, and increased accuracy is now possible in low-level radioactivity determinations. Expert services were provided to advise on cytogenetic dosimetry and on low-level precision measurement techniques to identify and qualify critical radionuclides and their pathways. In this context, a follow-up study related to the Goiania incident was successfully undertaken. Two project-related fellowships were granted to counterpart staff for training at the National Bureau of Standards in Washington, D.C.

■ BRA/4/034 NUCLEAR POWER PLANT COMMISSIONING AND OPERATIONAL TESTING

COMPLETED: **89-11-16** TOTAL COST: **$27,851**

OBJECTIVES: TO MAKE ACCURATE CALIBRATIONS OF PRESSURE, TEMPERATURE AND FLOW-RATE.

ACHIEVEMENTS: The Reactor Technology Department within the National Nuclear Energy Commission sought Agency assistance to upgrade its capabilities for reactor commissioning and operation. Advice and in-service training of staff were provided by experts on instrumentation and thermohydraulics, reactor physics, vibration technology and radiochemistry and materials analysis. This has proved very beneficial as a support for the Brazilian nuclear power programme.

■ BRA/4/035 NUCLEAR POWER PLANT SIMULATOR TRAINING

COMPLETED: **89-12-22** TOTAL COST: **$108,002**

OBJECTIVES: TO SET UP A NUCLEAR POWER PLANT SIMULATOR TRAINING CENTRE.

ACHIEVEMENTS: As a follow-up of a UNDP-financed manpower development project, Nuclebras, the State-owned utility, sought assistance with maintaining the nuclear power plant simulator up to date and with the training being given to nuclear power plant operators. The simulator, commissioned in 1985, was provided under another UNDP project (BRA/76/003) being executed by the Agency. Nine experts in eleven visits assisted with the planning of courses, provided training, assisted with installation, in 1988, of new software, and advised on maintenance of software, the computer system and interface equipment. Training abroad was supported by the granting of four project-funded as well as four project-related fellowships and one project-related scientific visit; these aimed at providing a cadre of staff competent in simulator software use, in safety and control training, and in the MPX-32 operating system. The assistance provided has enabled Brazil to establish a simulator centre for the training of Brazilian as well as foreign nuclear power plant operators and managers. The simulator's software and hardware is upgraded to the current status of the reference plant (Angra-2).

■ BRA/4/036 NUCLEAR POWER PLANT COMPONENT TESTING

COMPLETED: **89-12-22** TOTAL COST: **$30,290**

OBJECTIVES: TO FACILITATE THE QUALITY CONTROL OF NUCLEAR POWER PLANT COMPONENTS.

ACHIEVEMENTS: In 1985, Nuclebras, the State-owned utility, requested Agency assistance with the operation of a nuclear power plant component test loop and a testing facility that simulated accident conditions. The aim was to support local industry by providing quality assurance testing, thus opening a market for Brazilian component manufacturers. An Agency expert provided advice to improve the operation of the installations, to correct defects and imperfections of valves, and to define the concept for the test section measurements by means of strain gauges to allow standardization of transducers for measurements of physical quantities such as pressure, load, torque and displacement. He also developed a personnel training programme in laboratory test-

ing, and advised on the planning of the activities concerning future commissioning of the installations. Training abroad for one year was granted to a member of the counterpart staff under a project-related fellowship. The project also supported the visit of an Operational Review Team (OSART) mission in 1989, the recommendations of which are now being considered by the Government.

■ CMR/9/002 RADIOACTIVE WASTE MANAGEMENT

COMPLETED: **89-05-19** TOTAL COST: **$5,163**

OBJECTIVES: TO ESTABLISH NATIONAL POLICY AND PLANNING FOR A RADIOACTIVE WASTE MANAGEMENT PROGRAMME.

ACHIEVEMENTS: The project has provided mainly expert advice and guidance on how problems related to waste management and radiation protection should be dealt with. In line with the wishes of the Government, recommendations on topics such as training of manpower, designation of a national waste management authority and elaboration of radiation protection legislation were made to the authorities. As the implementation of such recommendations requires time, it is now premature to quantify the impact produced by the project.

■ COL/1/005 SECONDARY STANDARDS DOSIMETRY LABORATORY

COMPLETED: **89-06-06** TOTAL COST: **$369,115**

OBJECTIVES: TO ESTABLISH A NATIONAL DOSIMETRY SERVICE.

ACHIEVEMENTS: The use of ionizing radiation in governmental, educational and private sector institutions in Colombia has been steadily increasing, and there was a growing need to perform accurate dose measurements, both on radiation sources and to check dosimeters. The Institute of Nuclear Affairs established with Agency assistance a secondary standards dosimetry laboratory (SSDL) to serve as a focus for such standardizing measurements in the country. Since 1981, the Agency provided various types of X-ray sources, a cobalt-60 therapy-level source, X-ray calibration stands and carts, a dosimetric phantom, various classes of dosimeter, and accessories. In addition to a fellowship awarded for training in Argentina, Agency experts provided on-the-job training in calibration and dosimetry as well as in SSDL management. The laboratory is now fully operational, is appropriately staffed, and can handle the full range of calibrations needed in Colombia, from radiation protection and environmental levels to therapy level, with services being provided to various in-house (e.g. the personnel dosimetry group) and external users. A quality assurance programme has been initiated for radiotherapy departments throughout the country, as well as for diagnostic X-ray installations.

■ COL/4/006 RESEARCH REACTOR CONVERSION

COMPLETED: **89-06-29** TOTAL COST: **$154,248**

OBJECTIVES: TO EXAMINE THE PHYSICAL CONDITION OF AN OLD RESEARCH REACTOR AND TO INITIATE ITS CONVERSION FOR OPERATION WITH LOW-ENRICHED URANIUM-235 FUEL.

ACHIEVEMENTS: This project addressed the revitalization of the existing 25-year-old 30 kW pool-type research reactor IAN-R1 with the aim of converting it to use low-enrichment fuel. The Institute for Nuclear Affairs sought Agency collaboration to carry through the initial assessments and for a possible upgrading of the reactor and its control systems. Experts assisted with measurements on and analysis of the existing core, with estimations of additional cooling capacity and shielding required to support an increase in reactor flux and power and with studies of possible replacement cores. In addition to on-the-job training provided by the experts and at a workshop held in November 1986, five fellows were trained abroad using, in addition to Agency-funded fellowships, fellowships donated by Argentina, Italy, Spain and the United States of America. This has enabled the Institute to set up the appropriate infrastructure to carry out the project. In support of this work, the Agency provided inter alia a gamma spectrometry system suitable for analysing irradiated foils and reactor control equipment. For 1989, the United States is a major contributor for the follow-up project (COL/4/009) to upgrade reactor instrumentation.

■ COL/4/008 UPGRADING OF RESEARCH REACTOR

COMPLETED: **89-06-29** TOTAL COST: **$50,000**

OBJECTIVES: TO UPGRADE EXISTING ELECTRONIC CONTROL AND OPERATION SYSTEMS TO MATCH THE CONVERSION OF AN EXISTING RESEARCH REACTOR.

ACHIEVEMENTS: This project, funded by the United States of America, was used to provide items of reactor control equipment in support of activities initiated under the parallel-project COL/4/006. Details are reported there.

■ COL/5/011 TRAINING IN MEDITERRANEAN FRUIT FLY CONTROL

COMPLETED: **89-03-28** TOTAL COST: **$7,190**

OBJECTIVES: TO PROVIDE TRAINING IN CONTROL AND ERADICATION OF MEDITERRANEAN FRUIT FLIES.

ACHIEVEMENTS: Eighteen technicians from various Colombian research and plant health organizations that are trying to initiate fruit-fly control activities participated in the two-week training course. The experts were able to assist local staff to assess the infestation status and to recommend a preliminary insect control plan for Colombia.

■ COL/8/012 ISOTOPE-AIDED SEDIMENTOLOGY STUDIES

COMPLETED: **89-10-10** TOTAL COST: **$145,796**

OBJECTIVES: TO STUDY SEDIMENT TRANSPORT IN THE MAGDALENA RIVER.

ACHIEVEMENTS: The Magdalena River is the most important river transportation system in Colombia, including the harbour in the Bay of Buenaventura, and the Checua and Arauca rivers. Considerable costs are incurred in controlling silting up and sediment deposit to keep the river navigable. The Ministry of Public Works (Directorate for Ports and Navigation) sought Agency assistance to

carry out sedimentology studies using isotope tracer techniques. Five experts assisted with training, field experiment planning and assessment of results. Equipment provided included a sediment gauge that measured density and deposit thickness using backscattered gamma rays from a caesium-137, and americium-241 sources and related measuring elements so that two portable gauges for measuring suspended sediment could be locally constructed. One project-funded and one project-related fellowship (the latter funded by France), as well as one scientific visit to Brazil complemented the in-service training given by the experts. Considerable information has and is being collected and this is being used to modify harbour planning to reduce dredging costs. Plans are in hand to extend sediment transport studies to the country's reservoirs used for hydroelectric power generation. As a whole, the project enabled the necessary infrastructure in terms of manpower, equipment and know-how to be built up for the initiation of the continuation project COL/8/014 in 1989.

■ COS/3/004 STRENGTHENING NATIONAL CAPACITY FOR MINERAL PROSPECTION

COMPLETED: **89-11-23** TOTAL COST: **$608,136**

OBJECTIVES: TO PROVIDE TRAINING IN URANIUM EXPLORATION AND TO EVALUATE THE COUNTRY'S URANIUM RESOURCE POTENTIAL.

ACHIEVEMENTS: The project, fully financed by UNFSTD (United Nations Fund for Science and Technology for Development) based on a trust fund agreement with Italy, achieved its main objective, namely the formation of a nucleus of staff and the provision of adequate facilities to carry out normal exploration activities, particularly for radioactive minerals. A total of 21 staff underwent on-the-job training and courses were organized on uranium geology, geochemical exploration, automatic data processing and geochemical analytical techniques. Additionally, one fellowship and nine scientific visits abroad were granted. The 6000 km2 area covered by the pilot survey has, unfortunately, shown little potential for finding economic uranium deposits. However, gold and the associated base metals linked to the anomalies outlined by the survey may be of economic importance, but follow up is outside the scope of this project. The pilot survey carried out under this projects forms a part of the systematic assessment of the mineral resources of Costa Rica.

■ CPR/4/002 NUCLEAR POWER PLANT ENGINEERING

COMPLETED: **89-10-30** TOTAL COST: **$40,588**

OBJECTIVES: TO ADVISE AND TRAIN LOCAL ENGINEERING STAFF IN STRESS ANALYSIS AND TRANSIENT AND FATIGUE EVALUATION OF PIPING FOR THE 300 MW(E) NUCLEAR POWER PLANT NOW UNDER CONSTRUCTION IN QINSHAN.

ACHIEVEMENTS: With the technical assistance provided through the Agency's Reserve Fund under the project, three workshops on in-core fuel management, air cleaning systems, and on the design and commissioning of nuclear power plant instrumentation, control and electrical equipment were successfully organized. Five Agency experts delivered lectures; these workshops were attended by 102 scientists and engineers from the major nuclear-power-related institutes in China. The technical knowledge gained is being utilized in the design of nuclear power plants.

■ CPR/9/002 NUCLEAR SAFETY COURSE

COMPLETED: **89-10-30** TOTAL COST: **$58,625**

OBJECTIVES: TO ORGANIZE A TRAINING COURSE ON SAFETY ASSESSMENT OF NUCLEAR INSTALLATIONS.

ACHIEVEMENTS: The Nuclear Safety Regulatory Organization requested Agency assistance to hold a major national training course on safety analysis in connection with nuclear power plants. The two-month course involved 16 Agency experts, and it was attended by 55 senior scientists and engineers from 17 safety-related organizations and government departments in China. Further expert visits were included in the programme; one team considered application of the Agency's Nuclear Safety Standards (NUSS) Codes and Guides while, in 1988, an expert reviewed the draft National Atomic Energy Act and provided valuable suggestions which are being incorporated into the final document. In support of the general field of nuclear safety, two project-related fellowships were granted, as was an agency research contract.

■ CPR/9/010 PRE-OSART MISSION TO QINSHAN NUCLEAR POWER PLANT

COMPLETED: **89-12-22** TOTAL COST: **$33,647**

OBJECTIVES: TO REVIEW THE CONSTRUCTIONAL SAFETY OF THE 300 MW(E) NUCLEAR POWER PLANT UNDER CONSTRUCTION AT QINSHAN.

ACHIEVEMENTS: In this project funded from the Reserve Fund, nine Agency experts reviewed, in the period 3-21 April 1989, activities at the construction site of the 300 MW(e) Nuclear Power Plant at Qinshan, Zhejang, and the preparations for future plant operation. They also advised on project management, quality assurance, civil and engineering works, and preparations for start-up and plant operation. They further considered the training and qualification of personnel as they relate to the quality assurance and enhanced safety practices. Their recommendations are being considered by the national authorities.

■ CUB/0/003 NUCLEAR TRAINING

COMPLETED: **89-10-10** TOTAL COST: **$291,547**

OBJECTIVES: TO DEVELOP THE TRAINING INFRASTRUCTURE NEEDED BY THE GOVERNMENT'S DEVELOPMENT PROGRAMME IN NUCLEAR ENERGY.

ACHIEVEMENTS: By 1983, the Government had decided to launch an extensive manpower development plan to improve the application of nuclear techniques and prepare for the introduction of nuclear power. The Agency was asked to assist with setting up a nuclear training programme, complementing a UNDP project (CUB/77/001) that was concerned with the introduction of nuclear technology in the country. In addition to two planning visits made by the Agency Technical Officer, 17 experts gave courses in various aspects of nuclear science, applied as well as pure; they assisted with the establishment and organization of a Faculty of Nuclear Science and Technology (now Advanced Institute of Science and Nuclear Technology) in the University of Havana and with the preparation of courses and teaching material. They supervised installation and gave training on various items of laboratory equipment, including the use of a nuclear magnetic resonance spectrometer,

various radioisotope sources, and area monitoring equipment provided by the Agency. Two project-related fellowships for training abroad were granted, one of which was funded by Hungary. The project has established the infrastructure necessary to provide adequate training, at the university level, to personnel needed to meet the increasing manpower requirements of the nuclear energy programme in Cuba.

■ CUB/8/007 ISOTOPES IN HYDROLOGY

COMPLETED: **89-10-10** TOTAL COST: **$103,214**

OBJECTIVES: TO ESTABLISH AN ENVIRONMENTAL ISOTOPE HYDROLOGY LABORATORY.

ACHIEVEMENTS: The Government of Cuba had sought to evaluate the country's water resources and requested Agency assistance in 1982 to introduce isotope techniques in these studies. Particular areas of interest were the dynamic interchange of underground and surface waters, including sea water, in the karst formations and elsewhere. The main accomplishment of the project was the establishment, at the Cuban Institute of Hydroeconomy, of the first isotope hydrology laboratory in Cuba. It is now equipped to determine the concentration of environmental tritium in natural waters, which contributes a great deal to the study of the model of water circulation in zones of economic interest. Furthermore, a benzene line was set up in the laboratory for the processing of samples to determine carbon-14 concentrations in water samples. The Agency provided equipment and expert services in areas such as groundwater investigations, natural-level counting of tritium radiation, and dating of underground waters. Training abroad was granted through project-related fellowships and two scientific visits to six members of the counterpart staff. The work was supported by an Agency Research Contract with the principal counterpart for studies on the interaction between surface waters and ground waters.

■ CYP/5/013 NUCLEAR TECHNIQUES IN ANIMAL PRODUCTION

COMPLETED: **89-07-11** TOTAL COST: **$173,882**

OBJECTIVES: TO IMPROVE FORAGE PRODUCTION AND ANIMAL PRODUCTIVITY.

ACHIEVEMENTS: The counterpart institution for this project, commenced in 1983, was the Agricultural Research Institute, Nicosia. The initial efforts of the Institute focused on nutrition, reproduction and management of sheep, goats and dairy cows kept under experimental conditions, but in 1985 the work was extended to grazing animals. In support of these studies, the Agency provided inter alia an atomic absorption spectrophotometer, a Kjeldahl apparatus for nitrogen analysis, gas chromatography equipment for fatty acid determination, a beta/gamma counter and radioactive isotopes for tracer experiments. Four experts paid a total of nine visits to help set up equipment and provide training in its use, to assist with experiment planning, and to provide advice and training in radioimmunoassay for progesterone measurements connected with reproduction studies and in radioisotopic methods in animal nutrition. Three project-related fellowships totalling 14 months were granted; one was funded by the United Kingdom, and the two from the Agency general fellowship allocation provided 10 months of training at the Agency's Seibersdorf Laboratory. The project has enabled the Institute to

extend the scope of its studies. It received additional support through four related IAEA Research Contracts, one of which was within the framework of a multi-national coordinated research contract programme. The results obtained in respect of possible advances in animal husbandry were tested on the Institute's own farms, and the success of these field trials, undertaken in close co-operation with the farming community, has resulted in adoption of improved feeding and breeding practices. In the longer term, this will reduce the dependence of the country on imported feedstuffs and meat. The success of the project also reflects the support given by the Government of Cyprus.

■ ECU/5/007 NUCLEAR TECHNIQUES IN ANIMAL HEALTH AND PRODUCTION

COMPLETED: **89-11-17** TOTAL COST: **$67,210**

OBJECTIVES: TO USE NUCLEAR TECHNIQUES IN THE CONTROL OF PARASITISM, IN THE STUDY OF REPRODUCTIVE FUNCTIONS, AND IN EVALUATING NUTRITIONAL DEFICIENCIES IN DAIRY CATTLE.

ACHIEVEMENTS: The Government sought Agency assistance for its plans to use nuclear techniques to study problems of inadequate animal nutrition and poor animal health in the Andean region. Following a programming visit, five experts provided advice and training on animal nutrition, reproductive physiology, parasitology and related techniques. A computer system suitable for radioimmunoassay (RIA) data analysis, chemicals and isotopes were provided. These activities were funded extrabudgetarily by the United States of America. An RIA programme was established with four farms in the Cayambe area to identify the reproductive capacity of the cattle and to study problems affecting production. The farmers responded enthusiastically and with interest as they saw immediate economic advantages from the programme. The project has been particularly successful in diminishing the abortion rate in cattle and in controlling to a certain extent the nutritive value of animal feed. A summary of much of the work achieved under this project and its interaction with an Agency Research Contract (RB/3786) within the ARCAL III programme will be published in 1990 in the IAEA Panel Proceedings Series. A final report showing the results of the whole programme is to be produced as part of the continuation project ECU/5/011.

■ EGY/4/017 FUEL ELEMENT FABRICATION

COMPLETED: **89-06-23** TOTAL COST: **$80,638**

OBJECTIVES: TO ESTABLISH TRAINING FACILITIES FOR QUALITY ASSURANCE IN FUEL FABRICATION.

ACHIEVEMENTS: The Department of Metallurgy of the Nuclear Research Centre was provided with non-destructive testing equipment consisting of inter alia an ultrasonic flaw detector, a helium detector and an eddy current test unit. Two experts assisted in commissioning the equipment and training counterparts in its use. The experts also provided training by giving lectures and holding discussion sessions on the quality control and quality assurance requirements in respect of various reactor materials. Four counterpart staff from the Non-Destructive Testing and Quality Control Group and two from the Corrosion and Oxidation

Group were involved in the project. Eleven project-related fellowships were provided for training abroad, funded from the Agency's general fellowship allocation.

■ EGY/4/033 CALIBRATION AND COMMISSIONING OF A LINEAR ACCELERATOR

COMPLETED: **89-11-17** TOTAL COST: **$8,469**

OBJECTIVES: TO ASSIST IN THE CALIBRATION AND COMMISSIONING OF A LINEAR ACCELERATOR FOR MEDICAL PRACTICE.

ACHIEVEMENTS: Under this project, expert services were provided to assist in the commissioning of a 20 MeV linear accelerator already installed at the Kasr El-Einy Hospital (NEMROCK), Cairo. The experts assisted the NEMROCK physicists to calibrate the accelerator, provided training in the measurement and calculation techniques for accelerator treatment, and assisted in starting treatment of cancer patients using electrons or photons using the isocentric technique. As a result of this assistance, the experts concluded that the NEMROCK physicists were fully capable of assuming responsibility for calibration and dosimetry at the facility. The project was funded from the Agency's reserve fund.

■ EGY/5/019 NITROGEN FIXATION

COMPLETED: **89-11-21** TOTAL COST: **$16,459**

OBJECTIVES: TO CONDUCT STUDIES ON THE NITROGEN FIXING ABILITY OF CERTAIN LEGUMES WITH A VIEW TO REDUCING FERTILIZER REQUIREMENTS AND INCREASING AGRICULTURAL PRODUCTION.

ACHIEVEMENTS: The Faculty of Agriculture of Minia University has been carrying out isotope-aided studies to assess biological nitrogen fixation by legumes. Under the project, assistance was provided in the form of expert services and supplies of nitrogen-15 fertilizer. A project-related fellowship was granted, while another local staff member participated in an Agency training course. The assistance enabled the Faculty to carry out experiments on the faba bean using two reference crops, wheat and barley. The studies were successfully completed and samples were analysed at the Agency's Seibersdorf Laboratory. The project also catalysed the Faculty's participation in the Regional Africa project on nitrogen fixation.

■ ELS/5/002 ANIMAL DISEASES AND REPRODUCTION

COMPLETED: **89-09-28** TOTAL COST: **$68,517**

OBJECTIVES: TO INTRODUCE RADIOIMMUNOASSAY TECHNIQUES IN REPRODUCTION STUDIES AND IN THE DIAGNOSIS OF ANIMAL DISEASES.

ACHIEVEMENTS: The Department of Veterinary Research of the Ministry of Agriculture and Livestock, faced with a marked reduction with the cattle population, in part due to reduced productivity and increases parasitic diseases, sought Agency assistance to introduce radioimmunoassay (RIA) and related techniques to support studies on the various interacting factors. The Ministry constructed a building at the new Centre for Livestock Development where the laboratory is

now established. With extrabudgetary funding from the United States of America, a multiple-sample gamma counter with calibration source, a desk computer for data evaluation and other laboratory equipment were provided to permit the use of RIA techniques in the evaluation of progesterone profiles in cattle. In addition, from TACF funds, the Agency assisted during 1986 to 1988 by supplying iodine-131-labelled progesterone kits. Experts assisted by initiating the field procedures and laboratory techniques for solid and liquid progesterone analyses in blood and milk samples; trial analyses were also carried out for prostaglandin (2a) and gonadotrophin (6n RH) by RIA in liquid phase. Preliminary experiments were undertaken in connection with animal disease diagnosis using RIA and enzyme-linked immunosorbent assay techniques. A project-related fellowship was granted for training. The project provided the basis, in terms of facilities, manpower and know-how, to establish an expanded project which was initiated in the Agency's 1989-90 programme (ELS/5/005).

■ ELS/8/002 ISOTOPES IN GEOTHERMAL STUDIES

COMPLETED: **89-05-19** TOTAL COST: **$81,952**

OBJECTIVES:

TO STUDY GEOLOGICAL, PHYSICAL AND THERMODYNAMIC CHARACTERISTICS OF THE GEOTHERMAL FIELD AT AHUACHAPAN.

ACHIEVEMENTS:

The Hydroelectric Commission for the Rio Lempa sought Agency help with its studies of the geological, physical and thermodynamic characteristics of a geothermal field at Ahuachapan, for which the use of isotope techniques was considered necessary. The field provides over 40% of El Salvador's total electrical power generating capacity. A large sampling programme for the determination of naturally occurring isotopes oxygen-18, deuterium, tritium and carbon-13 in effluents from the Ahuachapan field was carried out, and the data obtained have permitted an overall picture of the geothermal characteristics of the reservoir to be obtained. In addition to that provided by two project-related scientific visits, experts provided training in and advice on data collection, project planning, use of nuclear techniques and re-injection methodology using iodine-131. The last mentioned studies will enable the newly established unit to specify the parameters needed to define a geothermal model of the reservoir on the basis of which decisions regarding improved utilization can be made. In support of this project, the Agency provided, in addition to payments for sample analysis, a survey meter and an automatic liquid scintillation counter as well as selected items of laboratory equipment and supplies. Continuation of this work is also being supported by the Agency, under project ELS/8/003 initiated in 1988.

■ ELS/9/006 TREATMENT OF OVEREXPOSED PERSONS

COMPLETED: **89-09-19** TOTAL COST: **$16,730**

OBJECTIVES:

TO ASSIST LOCAL INSTITUTIONS IN THE EVALUATION OF RADIATION DOSES RECEIVED BY THREE WORKERS AND IN THE MEDICAL TREATMENT OF OVEREXPOSED PERSONS.

ACHIEVEMENTS:

In February 1989, an irradiation accident occurred at an industrial irradiation plant for disposable medical supplies in El Salvador. As a consequence, three workers suffered radiation injuries. The Agency was requested to render assistance through its Emergency Response System and the project

was established to support this action. Funding was through the Agency's Technical Co-operation Reserve Fund. After the accident, the patients were transferred for specialized treatment to the Angeles de Pedragal Hospital in Mexico City. As a first action, a team of medical experts recruited by the Agency visited the Hospital, discussed treatment with the staff and interviewed the patients. Two members of the team then travelled to San Salvador to study the accident situation; from their observations and the cytogenetic studies, whole-body doses to the patients were estimated. In the case of two patients, the lower limbs had received very high doses. The patients were later transferred to the Social Security Hospital in San Salvador and a further Agency medical expert was sent to discuss follow-up treatment with local medical staff. In connection with radiation safety practices, the Agency responded by sending a group of experts to San Salvador to make a detailed evaluation of the accident and to make recommendations for improved safety measures and operational procedures. At this time, the Government also placed an urgent request for a RAPAT Mission to visit the country so that the question of radiation protection could be considered holistically, advising on infrastructure. It was fielded at short notice, funded under the interregional project INT/9/055. The prompt support provided by the Agency in this instance through the technical co-operation programme does exemplify the flexibility of the Agency's response to an urgent request for assistance from a Member State.

■ GRE/2/020 RADIOPHARMACEUTICALS

COMPLETED: **89-05-19** TOTAL COST: **$104,921**

OBJECTIVES:

TO DEVELOP NEW RADIOPHARMACEUTICALS, PARTICULARLY FOR BRAIN AND MYOCARDIAL IMAGING, THROUGH THE UPGRADING OF LABORATORY FACILITIES.

ACHIEVEMENTS:

Under this project, financed by the United States of America, equipment has been provided to assist the Radiopharmaceuticals Laboratory of the Demokritos Nuclear Research Center in expanding its capacity for the production of radiopharmaceuticals and to undertake research on new radiopharmaceutical products, in particular compounds labelled with technetium-99m for brain and myocardial imaging. The main items provided were an automatic gamma counter, accessories for the existing high-performance liquid chromatography system, an infra-red spectrophotometer and a microtome. Up to now the Laboratory has synthesized and tested in animals more than 30 new technetium-99m agents for brain imaging. Work has started on similarly labelled myocardial agents, and on the investigation of the chemical structures of technetium-99m complexes with a view to developing new radiopharmaceuticals. Co-operation has been established with national and foreign nuclear medicine and chemistry institutes.

■ GRE/5/014 ISOTOPE-AIDED CROP STUDIES

COMPLETED: **89-07-27** TOTAL COST: **$90,444**

OBJECTIVES:

TO STUDY FERTILIZER EFFICIENCY USING ISOTOPICALLY LABELLED FERTILIZERS.

ACHIEVEMENTS: The Laboratory of Soil Science and Plant Nutrition of the Democritos Nuclear Research Center is studying various aspects of soil fertility in connection with crops of economic importance, including citrus fruits, tomatoes and cucumbers. Of particular interest is the nitrogen cycle, the aim being to improve fertilizer management. In the course of this project, about one third funded by the United States of America, Agency experts assisted local staff to set up and calibrate a mass spectrometer, and to install a macro-Kjeldahl apparatus for total nitrogen determination and a sample preparation line. Instruction in all aspects of nitrogen-15 analytical techniques was given. In addition to the instrumentation referred to, the Agency also provided a considerable quantity of nitrogen-15 labelled fertilizer. The laboratory is now undertaking nitrogen analyses routinely as part of its continuing programme of studies.

■ GRE/5/015 NUCLEAR TECHNIQUES IN AGRICULTURE

COMPLETED: **89-01-12** TOTAL COST: **$25,425**

OBJECTIVES: TO OPTIMIZE THE USE OF LIMITED WATER RESOURCES FOR IRRIGATION IN ORDER TO INCREASE PRODUCTION AND IMPROVE THE QUALITY OF AGRICULTURAL CROPS (CITRUS FRUITS AND OLIVES).

ACHIEVEMENTS: The Agency provided the host institute with laboratory equipment, supplies and a soil-testing kit. One expert mission, with a duration of two months, was organized to assist the counterpart in the use of a neutron moisture meter, and on techniques to measure the hydraulic properties of soils. The objectives of the project have been met, and the counterparts are using neutron moisture measurements as supporting data to optimize the irrigation of fields being used for production of citrus fruits and olives.

■ GRE/5/017 NUCLEAR TECHNOLOGY IN ANIMAL SCIENCE

COMPLETED: **89-09-13** TOTAL COST: **$76,594**

OBJECTIVES: TO STUDY METHODS FOR CONTROLLING DICROCOELIUM INFECTION IN SHEEP USING RADIOISOTOPE TECHNIQUES.

ACHIEVEMENTS: Under this multi-year project, first approved in 1986 and aimed at controlling dicrocoelium infection in sheep in Greece, the Agency assisted the Department of Helminthology of the Aristotelian University of Thessaloniki by providing various items of equipment and laboratory supplies, including a beta/gamma counter and a UV-VIS spectrophotometer. Following the project planning mission in 1986, five experts undertook four missions to advise and train counterparts on isotope techniques in studies on the dicrocoelium dentriticum parasites. The Greek authorities finally approved funds to enable procurement of sheep for the continuation of experiments. The counterparts will continue with field studies to determine the economic effects of the parasitic infections when further funding from the Greek authorities is made available.

■ GUA/1/003 X-RAY FLUORESCENCE IN MINERAL ANALYSIS

COMPLETED: **89-03-01** TOTAL COST: **$336,110**

OBJECTIVES: TO SET UP A NUCLEAR ANALYTICAL LABORATORY FOR PRACTICAL WORK IN THE FIELDS OF INDUSTRY AND MINING.

ACHIEVEMENTS: This multi-year project originally aimed to introduce X-ray fluorescence analysis as a way of determining elements in geological samples, in support of the Government's mineral exploration programme. The Agency supplied equipment, and experts to provide on-the-job training; two fellowships were granted for more specialized studies, one in France, one in Singapore. Local interest grew and, by 1985, a laboratory for nuclear analytical techniques had been established and studies had been extended to include analysis of archeological and environmental samples. Further expert advice was provided on instrument maintenance and calibration, on the use of computers to obtain sample data, and to run a national training course (with 12 participants from universities and laboratories undertaking food and drug analysis). An IAEA Research Contract on determination of trace amounts of lead and arsenic in wheat fertilized with locally made mineral fertilizer was supported by the laboratory, which now also trains graduate and undergraduate students. An IAEA fellow from Ecuador has also received training. Though mainly funded from the Technical Assistance and Co-operation Fund, the United States of America assisted with a grant for equipment. The work started under this project is being continued (GUA/2/002 and GUA/2/003), at the same time expanding the laboratory facilities to measure radioactive contamination in foodstuffs. The laboratory now both undertakes applied research and provides analytical services to various users. The staff can modify and write computer programmes to suit local needs, and three members have served as IAEA experts on X-ray fluorescence analysis in other Latin American countries.

■ HOK/8/002 GROUNDWATER HYDROLOGY

COMPLETED: **89-07-27** TOTAL COST: **$21,172**

OBJECTIVES: TO INVESTIGATE THE INSTABILITY OF HILLSIDES AS A FUNCTION OF SOIL MOISTURE CONTENT.

ACHIEVEMENTS: Studies are being made by the Department of Geography and Geology of the University of Hong Kong at several sites on the lower slopes of the Victoria Peak in order to investigate the relationship between soil-water dynamics and landslides, which threaten public safety. To complement the neutron moisture probe supplied under a previous project, the Agency provided a transducer-tensiometer system as well as microcomputer hardware and appropriate software to enable the data to be analysed. An expert advised on project development and provided training. Results have been accumulated and these are being evaluated by the staff of the Department.

■ HUN/2/002 CHEMICAL AND BIOCHEMICAL RESEARCH

COMPLETED: **89-08-09** TOTAL COST: **$366,662**

OBJECTIVES: TO DEVELOP THE MULTIPLE MOLECULE LABELLING TECHNIQUE.

ACHIEVEMENTS: The Institute of Isotopes of the Hungarian Academy of Sciences was interested in introducing multiple labelling with stable isotopes in the fields of chemical and biochemical research. With funding from the Union of Soviet Socialist Republics, the Agency provided a combined high-performance gas chromatograph and mass spectrometer to the Institute. Since the arrival of the equipment in late 1987, staff of the Institute have been investigating oxygenated products in catalytic hydrocarbon reactions; they have also used

the instrument to measure the isotopic content of oxygen-18 labelled products. They are collaborating with other departments in various research projects for which the instrument is a necessary tool.

■ INS/0/003 NUCLEAR POWER PROGRAMME

COMPLETED: **89-06-15** TOTAL COST: **$134,493**

OBJECTIVES: TO ASSIST THE GOVERNMENT IN UNDERTAKING THE INITIAL STEPS REQUIRED FOR THE INTRODUCTION OF NUCLEAR POWER.

ACHIEVEMENTS: With the technical expertise provided under the project, the counterparts have prepared an energy projection which is being discussed by the national technical committee on energy resources. Specifically, the projections are being used to check on possible future supply constraints. The National Atomic Energy Agency (BATAN) has also set up a Nuclear Energy Studies Centre to be in charge of conducting all studies related to nuclear power development in the country. The work started under this project is being continued under project INS/0/007, which will facilitate such planning studies by providing expertise and other support to show how dedicated PC software can be used as a planning tool.

■ INS/0/008 NUCLEAR DATABASE DEVELOPMENT

COMPLETED: **89-10-30** TOTAL COST: **$14,811**

OBJECTIVES: TO INSTALL NUCLEAR DATA FILES AND COMPUTER CODES WITH A VIEW TO ESTABLISHING A NATIONAL NUCLEAR DATA BASE.

ACHIEVEMENTS: The National Atomic Energy Agency of Indonesia sought Agency assistance to introduce the use of computers to handle nuclear data to support work in the areas of research reactor operation, nuclear research and radiation safety. Two experts provided instruction on the use of nuclear data files and codes provided by the Agency's Nuclear Data Section. The counterparts have developed a capability to retrieve and use the contents of ENDF/B formatted data and pre-processing codes relevant to the establishment of a national nuclear data base.

■ INS/1/014 USE OF NEUTRON BEAM IN MATERIALS RESEARCH

COMPLETED: **89-10-30** TOTAL COST: **$218,118**

OBJECTIVES: TO ENHANCE THE CENTRE'S CAPABILITY IN MATERIALS RESEARCH USING ITS RESEARCH REACTOR.

ACHIEVEMENTS: The Research Centre for Nuclear Techniques, within the framework of its nuclear development programme, initiated materials research using its research reactor. Agency assistance was sought to expand the laboratory's programme by establishing a long-term strategy for research and development, in view of the expected commissioning of a 30 MW(th) multi-purpose research reactor at Serpong, and an expert visited the Centre for this purpose in 1984. A programme of five project-related fellowships funded, as was the expert, by extrabudgetary contributions from the Federal Republic of Germany, in addition to a further fellowship and a scientific visit funded from

the Agency's fellowship allocation, provided opportunities for advanced training abroad. Using the high-purity nickel supplied by USSR with funding from the Technical Assistance and Co-operation Fund, neutron guide tubes are being fabricated for studies of small-angle neutron scattering using the Serpong reactor. The extrabudgetary funds originally provided by the Federal Republic of Germany for the project have, at the request of the Indonesian Government and with the agreement of the donors, now been transferred to a broader-based project on the utilization of the Serpong reactor (INS/1/015).

■ INS/6/005 TRAINING COURSE ON RADIOIMMUNOASSAY

COMPLETED: **89-10-30** TOTAL COST: **$21,415**

OBJECTIVES: TO HOLD A NATIONAL TRAINING COURSE ON RADIOIMMUNOASSAY FOR KEY LABORATORY PERSONNEL.

ACHIEVEMENTS: Indonesia is a participant in the Regional project RAS/6/011 on radioimmunoassay (RIA). Its aim is to encourage local production of RIA kits for use in medical diagnostics and to improve standardization and quality control. The Government sought assistance to run a national training course for key laboratory personnel to complement Regional activities, with emphasis on beta/gamma counting and use of computer assistance in quality control and evaluation. The course was run by an Agency expert using equipment provided by the Agency. This manifestly assisted the counterpart organization, the Research Centre for Nuclear Techniques of the National Atomic Energy Agency, to initiate local production of some RIA reagents, in particular several needed for studies on thyroid function.

■ INS/8/011 GROUNDWATER HYDROLOGY

COMPLETED: **89-09-29** TOTAL COST: **$162,836**

OBJECTIVES: TO ESTABLISH A CAPABILITY FOR ANALYSIS OF ISOTOPES IN NATURAL GROUNDWATER SAMPLES.

ACHIEVEMENTS: Rapid economic and industrial development led to increased water requirements in large urban centres on Java. For 1983, the Centre for the Application of Isotopes and Radiation sought Agency assistance to establish a mass spectrometry laboratory for studies of groundwater hydrology and related studies. With extrabudgetary funds provided by the United Kingdom, a mass spectrometer was purchased and commissioned. An expert, in two missions, provided assistance with setting up the equipment and undertaking analyses. With further provision of a desk-top computer system, a second expert assisted counterparts to computerize data acquisition and elaboration. In connection with this project, training was provided under two project-related fellowships funded from the Agency's general fellowship allocation.

■ INS/8/016 RADIATION TECHNOLOGY IN PACKAGING

COMPLETED: **89-09-25** TOTAL COST: **$8,016**

OBJECTIVES: TO CONDUCT AN EXECUTIVE MANAGEMENT SEMINAR ON THE USE OF RADIATION TECHNOLOGY IN PACKAGING.

ACHIEVEMENTS: A national seminar on the utilization of radiation technology in connection with packaging to support the export of non-oil commodities was successfully organized in Jakarta from 29-30 May 1989. Two Agency experts delivered lectures. 150 participants, both executives and technical experts, from private companies, research organizations, universities and the government attended the seminar.

■ INS/9/008 ENVIRONMENTAL RADIOACTIVITY LABORATORY

COMPLETED: **89-10-30** TOTAL COST: **$159,157**

OBJECTIVES: TO STRENGTHEN AND EXPAND THE NATIONAL ENVIRONMENTAL MONITORING PROGRAMME.

ACHIEVEMENTS: The Government decided to reorganize environmental monitoring in the country. Responsibility was moved to the National Atomic Energy Agency, and a central laboratory was established at Jakarta. The aim was to establish base line data for environmental isotopes to provide improved surveillance possibilities in connection with expanding activities in atomic energy. The Agency was requested to assist in providing equipment and training. An expert initially assisted with project planning, subsequent experts provided on-the-job-training in monitoring of natural radiation and analytical radiochemistry. Equipment provided included a low-level alpha/beta counter, various types of radiation detectors, a gamma spectrometer and calibration sources. Training abroad for one counterpart was provided through a project-funded fellowship. The team at the laboratory is well able to determine environmental radioactivity at very low levels and, in addition, foodstuffs and beverages are being monitored in support of the import and export trade. Since 1987, the team has collaborated with the Australian Radiation Laboratory in an intercomparison programme on radon and radon daughters occurring naturally in the environment. The research work pursued under the project has resulted in the publication of eleven scientific papers.

■ INT/0/037 ENERGY AND NUCLEAR POWER PLANNING

COMPLETED: **89-07-21** TOTAL COST: **$284,057**

OBJECTIVES: TO ASSIST DEVELOPING MEMBER STATES IN CARRYING OUT PLANNING STUDIES TO ASSESS ELECTRIC POWER NEEDS AND THE ROLE OF NUCLEAR POWER IN MEETING THESE NEEDS, AND TO TRAIN NATIONAL EXPERTS IN MAKING SUCH ASSESSMENTS.

ACHIEVEMENTS: Seventeen missions were realized to assist developing Member States in carrying out planning studies to assess electric power needs and the economic role of nuclear power in meeting these needs. MAED/WASP and TUV computer-based models were used, and the expert services provided by the Agency helped the countries to implement them. Seventeen countries participated in the project. Detailed studies were performed for Indonesia, Malaysia, Portugal, Thailand, Turkey and Yugoslavia.

■ INT/1/014 SECONDARY STANDARDS DOSIMETRY LABORATORIES

COMPLETED: **89-05-23** TOTAL COST: **$414,719**

OBJECTIVES: TO SUPPORT THE IAEA/WHO NETWORK OF SECONDARY STANDARDS DOSIMETRY LABORATORIES; TO LINK TO THE PRIMARY STANDARDS SYSTEM BY CALIBRATION AND PERIODIC DOSE INTERCOMPARISONS.

ACHIEVEMENTS: Between 1979 and 1984, seven calibration missions were undertaken to 32 different countries in all four geographic regions, by various IAEA experts and staff members. Calibration measurements were performed in all operational SSDLs, members or affiliated members of the IAEA/WHO network. During these missions, the experts also gave advice on on-going problems in operational or planned SSDLs, and in hospitals and other related institutions. In 1984 it was decided to promote regional co-operation by organizing intercomparison exercises. Between 1985 and 1988, four regional workshops and seminars, held at established SSDLs and conducted by Agency experts and lecturers, provided the contacts, the theoretical background and the practical know-how that should enable SSDLs in each geographic region to continue these activities on their own. For example, another intercomparison exercise was organized in 1989 in Latin America under the ARCAL programme.

■ INT/4/054 NUCLEAR INSTRUMENT MAINTENANCE

COMPLETED: **89-08-23** TOTAL COST: **$899,201**

OBJECTIVES: TO IMPROVE MAINTENANCE AND REPAIR SERVICES WHICH SHOULD LEAD TO MORE EFFECTIVE USE OF NUCLEAR INSTRUMENTS.

ACHIEVEMENTS: It has long been recognized that effective maintenance and repair of nuclear and related electronic instruments and assured supplies of spare parts play an important role in ensuring a proper return on investments in these instruments and improve the effectiveness of the laboratories in which they are used. There are several problems common to developing countries, for example poor stability or continuity of power supplies, lack of air conditioning under dusty, hot or humid conditions, shortage of foreign currency to purchase spare parts, complex administrative import procedures that introduce delays, with deterioration of parts because of poor storage conditions. These considerations reported by counterpart institutions in many Member States led the Agency to establish in 1981 this interregional project. Eight countries in Africa, eleven in Asia, and nine in Latin America joined the project in its first year and have been reaping continuing benefit. By 1984, Agency experts had already visited pilot laboratories in 17 of the countries, where they assisted in solving problems and defining the type of managerial assistance that could be formulated as a basis for practical operation of a maintenance and repair facility. Guidelines were developed for maintenance strategies, mainly preventive maintenance, and for spare parts policies that could be modified to suit typical local lead times for obtaining replacements. The success of the project can be gauged by the fact that several maintenance and repair laboratories have become to a great extent self-reliant, that the project is complemented by national projects that reinforce its specific local applicability, that decisions are being made as to organizational policy at national level, and that plans are under way for setting up national and regional training infrastructures for technical staff. In addition to the training provided by visiting experts, in the period 1983-84, local staff were granted 16 project-related fellowships for practical study abroad, when the

project was gaining momentum and there was a need for training of trainers. In addition, many national and other workshops or courses were assisted by Agency experts. Furthermore, in support of these efforts, some US$385,000 was disbursed for, inter alia, test and servicing equipment, spare parts, special tools, air conditioning equipment, temperature/humidity and power supply recorders, voltage stabilizers, and books and journals concerned with maintenance and repair. The project was assessed by an Agency expert in 1987 and its effectiveness in achieving its objectives were confirmed. However, for the future, it appears that a continuation on the basis of separate regional projects, supported where necessary by national ones, would prove to be more effective and rational, since this would provide improved response to specific local conditions.

■ INT/9/063 PROBABILISTIC SAFETY ANALYSIS

COMPLETED: **89-02-08** TOTAL COST: **$353,821**

OBJECTIVES: TO ESTABLISH A CAPABILITY FOR PROBABILISTIC SAFETY ASSESSMENT AND TO APPLY THE RESULTS IN NUCLEAR SAFETY DECISIONS.

ACHIEVEMENTS: The importance of probabilistic safety analysis in promoting reactor safety was enhanced in Member States as part of a programme for improving safety in nuclear installations. Member States sought Agency assistance to enable teams of nationals to perform this type of analysis for local nuclear power plants or research reactors. Carefully planned expert missions were prepared to provide training in this methodology in workshops and training courses. Several fellowship and scientific visits relating to this subject were awarded. A software program was developed to do probabilistic safety analysis using a personal computer. This permits the application of this technique to the revision of technical specifications and to the operation and maintenance of nuclear reactors. Countries participating were Brazil, Bulgaria, Chile, China, Czechoslovakia, Egypt, Hungary, India, Indonesia, Islamic Republic of Iran, Iraq, Republic of Korea, Mexico, Peru, Philippines, Poland, Romania, Spain, Turkey and Yugoslavia. Several of the countries also participated in Agency Research Contracts that complemented work done under this project. The project has led to improvement in safety analysis reports, and the work initiated is being continued under national projects and on a regional basis.

■ INT/9/064 RADIATION PROTECTION SERVICES

COMPLETED: **89-07-21** TOTAL COST: **$516,688**

OBJECTIVES: TO IMPROVE THE RADIATION PROTECTION OF RADIATION WORKERS AND OF THE PUBLIC IN GENERAL.

ACHIEVEMENTS: Fifteen missions were realized to improve radiation protection practices in respect of radiation workers and of the public in general in developing Member States. Included in this project were: a meeting in Vienna on radiation protection services in connection with research reactors (involving participants from Egypt, Pakistan, Viet Nam and Yugoslavia); and advice on licensing of a medical linear accelerator in Jordan, on selection of equipment for radionuclide determination in foodstuffs for the United Arab Emirates, on environmental monitoring for Turkey and Yugoslavia, and on determination of internal contamination for Spain. Some equipment and accessories were also

provided (TLD cards, gamma reference sources, an X-ray tube, a set of calibration filters, dosimeters and manuals relating to radiation protection practices in hospitals).

■ IRA/9/010 NUCLEAR TECHNIQUES IN ENVIRONMENTAL STUDIES

COMPLETED: **89-09-13** TOTAL COST: **$83,254**

OBJECTIVES: TO STUDY VARIOUS POLLUTANTS IN IRAN BY MEANS OF TRACE METAL ANALYSIS AND TO IDENTIFY MAJOR SOURCES OF INDUSTRIAL POLLUTION IN WATER BODIES.

ACHIEVEMENTS: Under this project, a nuclear analytical laboratory for the measurement of trace elements in environmental samples was established at the Gamma Irradiation Centre of the Atomic Energy Organization of Iran. The counterparts utilize a research reactor for neutron activation analysis of the environmental samples. The Agency provided the Centre with various items of analytical equipment, including a high-purity germanium detector, a computer-based multichannel analyser and an atomic absorption spectrophotometer, as well as with the Agency's chemical standard reference materials. An expert mission was organized to assist the counterparts to choose the most appropriate techniques for analysis of the various types of sample. The staff of the Centre are continuing with their activities, mainly concentrating on a work plan that was drawn up with the expert's assistance, and which includes the measurement of trace metal concentrations in the coastal waters of the southern Caspian Sea.

■ IRQ/4/010 CORE CONVERSION

COMPLETED: **89-05-19** TOTAL COST: **$7,421**

OBJECTIVES: TO PERFORM THE ANALYSIS OF NUCLEAR SAFETY ASPECTS OF CORE CONVERSION FROM HIGH TO LOW ENRICHMENT URANIUM.

ACHIEVEMENTS: The project, financed from the reserve fund, provided experts to advise the Government regarding what assistance the country would need in support of local capability to perform an analysis of the nuclear safety aspects of the proposed core conversion of the existing 5 MW research reactor from high- to low-enrichment. They also advised on the methodology, codes and data which are necessary for the analysis.

■ LIB/4/004 RADIATION SHIELDING MATERIALS

COMPLETED: **89-05-10** TOTAL COST: **$51,248**

OBJECTIVES: TO CONDUCT STUDIES ON SHIELDING MATERIAL PROPERTIES.

ACHIEVEMENTS: The Tajoura Nuclear Research Centre, Tripoli, has established a facility to study radiation shielding, particularly concrete shielding produced from locally available materials. The project used facilities already available at the Centre, while the Agency provided a neutron source, a multi-channel analyser and some items of ancillary equipment, as well as components and spares. In addition, an expert assisted with installation and calibration of the equipment – including a computer tomography system (not provided by the

Agency) to be used for materials testing. Six project-related fellowships were awarded for training abroad, funded by the Agency's general fellowship allocation. Areas of training included shielding methodologies and neutron/gamma spectroscopy. Data obtained for physical, chemical and mechanical properties of local ores are being used by the Industrial Research Centre and the Faculty of Engineering of the University in connection with shielding design. The staff of the Radiation Shielding Group are capable of continuing these studies and making related investigations with minimal assistance.

■ LIB/4/006 FLUORIDE CHEMISTRY

CANCELLED: **89-01-09** TOTAL COST: **$607**

OBJECTIVES: TO PROVIDE TRAINING IN FLUORIDE CHEMISTRY.

REASON FOR CANCELLATION: The project was accorded low priority by the national authorities and was cancelled with the agreement of the Government.

■ LIB/5/002 RADIOISOTOPES IN AGRICULTURE

COMPLETED: **89-05-31** TOTAL COST: **$73,784**

OBJECTIVES: TO START A PROGRAMME OF PLANT BREEDING USING RADIATION-INDUCED MUTATION.

ACHIEVEMENTS: Approval was given in 1987 for a project to assist the Department of Agriculture to set up at the Tajoura Nuclear Research Centre a small irradiation facility with which a mutation breeding programme could be initiated. A small cobalt-60 irradiator (about 1250 Ci) was delivered in 1979 but was not installed because two large irradiators were subsequently acquired by the Government for the major new facility at the Centre that became operational in 1980. The plans to initiate the programme had been held in abeyance, but were revitalized in 1983. A fellow was given training at the Agency's Laboratory at Seibersdorf in 1983/4, and plans for a project to establish a research team at the Centre capable of undertaking such applied research were formulated: the project, LIB/5/006, received approval in 1989.

■ LIB/5/004 FERTILIZER STUDIES

COMPLETED: **89-01-09** TOTAL COST: **$97,500**

OBJECTIVES: TO STUDY THE USE OF UREA AS A SUBSTITUTE FOR IMPORTED NITROGEN FERTILIZERS IN WHEAT CULTIVATION.

ACHIEVEMENTS: The Department of Agriculture of the Tajoura Nuclear Research Centre is undertaking studies on the use of urea as a substitute for imported nitrogen fertilizers, especially in relation to wheat cultivation. In 1985, an Agency expert assisted in planning greenhouse and field experiments, giving training on soil/fertilizer/plant interrelationships and the use of nitrogen-15 as tracer. The soil samples were analysed at the Agency's Laboratory at Seibersdorf. In addition to the nitrogen-15 labelled fertilizer supplied in connection with the above, the Agency also provided a spectrometry system to analyse for nitrogen-15. Delivered in 1988, it was installed by a further expert, who gave

instruction in its use. One staff member was granted a fellowship for training abroad in analytical techniques, and the Department is now self-reliant in conducting stable nitrogen isotope studies relating to fertilizer management. It is expected that, in addition to reducing reliance on imports, the increased fertilizer use efficiency will enhance yields.

■ MAL/1/003 SECONDARY STANDARDS DOSIMETRY LABORATORY

COMPLETED: **89-09-19** TOTAL COST: **$388,696**

OBJECTIVES: TO ESTABLISH AN SSDL FOR ENSURING PROPER DOSIMETRY IN ALL FIELDS OF APPLICATION OF IONIZING RADIATION IN THE COUNTRY.

ACHIEVEMENTS: The Malaysian Government established a Secondary Standards Dosimetry Laboratory (SSDL) at the Tun Ismail Atomic Research Centre, Bangi. Since 1980, equipment has been provided to enable the Centre to undertake neutron, alpha, beta, gamma and X-ray dosimetry. It has included sources, calibration equipment and dosimeters. The neutron dosimetry is related to the operation of the Triga Mark II research reactor. In addition to radiation protection level dosimetry, calibrations of radiotherapy-level sources and sources used by industry in Malaysia are being undertaken. To assist with setting up the facility and providing training, seven experts undertook 12 visits during the course of eight years. In addition, there were four project-related fellowships for training abroad. As a reflection of the good facilities and infrastructure, the Agency was able to sponsor a regional workshop and seminar on SSDL calibration procedures at the Centre. The project has contributed to the safe application of ionizing radiations in the country by providing for an accurate dosimetry service for users; in addition, the Centre supports an effective national personnel dosimetry service.

■ MAL/3/006 RADIOACTIVE MINERALS SURVEY

COMPLETED: **89-09-19** TOTAL COST: **$186,003**

OBJECTIVES: TO ASSESS URANIUM AND OTHER MINERAL RESOURCES IN THE SARAWAK REGION.

ACHIEVEMENTS: An aerial reconnaissance survey undertaken by the Geological Survey of Malaysia indicated the existence of radiometric anomalies in various regions of Malaysia. In particular, the radiometric survey that covered an area of over 8000 km^2 in the west of Sarawak indicated possibilities of finding noteworthy uranium deposits in the Temudok sandstone that forms part of the Silantek formation. The Agency assisted by providing 18 months of expert assistance to train local staff to plan and undertake follow-up surveys and to evaluate the results. Some selected items of equipment, such as gamma spectrometers and radon detectors, were also provided. A detailed ground survey was carried out, with investigation of the anomalies. The work included exploratory drillings with bore-hole logging to test for the presence of uranium minerals, this being supported by geophysical and geochemical studies that included neutron activation analysis. The project has enhanced the capability of the institution to undertake geological surveys, making possible an improved technical assessment of the country's nuclear and other raw materials potential.

■ MAL/5/014 PESTICIDE RESIDUES

COMPLETED: **89-09-19** TOTAL COST: **$55,770**

OBJECTIVES: TO ESTABLISH PROCEDURES FOR IDENTIFYING THE FATE AND MAGNITUDE OF CONTAMINANTS IN FOOD.

ACHIEVEMENTS: In the Agency's technical co-operation programme for 1979, the Malaysian Agricultural Research and Development Institute sought assistance to determine the amounts and fates of pesticide residues in foods, including fish and agricultural products. Following recommendations of two technical missions, this project was initiated in 1983 to support research aimed at assessing the quality and wholesomeness of domestic food products, since Malaysia had relied heavily on using chemical agents to combat agricultural pests, weeds and plant diseases. Some US $45,000 of extrabudgetary funding for this project were donated by the United States of America. The Agency provided thin-layer and high-pressure liquid chromatographic equipment for this work, and an expert provided training on nuclear and chromatographic techniques in support of these studies. The project suffered delays because of constant shifting of project personnel, with no permanent staff appointed. Although the Pesticide Residue Laboratory was established, progress on research was very slow. With new initiatives on the part of the national authorities, it is proposed to transfer all the inputs of this project to a new project MAL/5/020, which is being managed by consensus under a National Working Committee composed of representatives of participating institutes doing relevant work on pesticides.

■ MAL/6/010 RADIOISOTOPES IN BIOCHEMISTRY

COMPLETED: **89-09-25** TOTAL COST: **$7,218**

OBJECTIVES: TO ESTABLISH A COURSE ON THE APPLICATION OF RADIOISOTOPE TECHNIQUES IN BIOCHEMISTRY.

ACHIEVEMENTS: In addition to its teaching responsibilities, the Biochemistry Unit of the Faculty of Science of the National University of Malaysia, Kuala Lumpur, undertakes research involving the use of radioisotope techniques. It sought Agency assistance to obtain lecturers in radiopharmacy and related fields. The footnote-a/ project was initiated by a gift in kind of 12 months of lecturers' services offered by Japan. Regrettably, only a small part of the offer was delivered despite follow-up requests from the counterpart institute. The project had, therefore, to be terminated.

■ MEX/2/010 RADIOPHARMACEUTICAL PRODUCTION

COMPLETED: **89-10-30** TOTAL COST: **$30,941**

OBJECTIVES: TO INCREASE PRODUCTION OF RADIOPHARMACEUTICALS AND TO DEVELOP KITS FOR RADIOIMMUNOASSAY.

ACHIEVEMENTS: The Radioactive Materials Directorate of the National Institute for Nuclear Research sought Agency help in training personnel to produce locally radiopharmaceuticals used for diagnostic procedures such as radioimmunoassay, thereby saving on imports and improving control of product quality. While initially, efforts focused on radioisotope production for phar-

maceuticals in the Triga research reactor, with emphasis on molybdenum-99 as a precursor for technetium-99m used in diagnostic imaging, the work with these radioisotopes was transferred to a specialized project MEX/4/035. Attention was then focused on radioimmunoassay for thyroid function. With the visit of three experts and the provision of specialist training to the main counterpart under a short-term fellowship abroad, a group has been formed of staff members well able to take over local kit production and quality assurance in connection with radioimmunoassay of T3 and T4 as well as for TSH. It is expected that this group, if supported in their future efforts by the authorities, will be able to continue to reduce the need for imports of these kits (at present about US $300,000 annually), essential for the evaluation of thyroid-hormone-related diseases in Mexico. The work has already improved the diagnostic services available.

■ MEX/4/031 FUEL ELEMENTS

COMPLETED: **89-11-13** TOTAL COST: **$199,020**

OBJECTIVES: TO DEVELOP QUALITY CONTROL METHODS FOR FUEL PELLETS AND RODS.

ACHIEVEMENTS: For 1981, the National Institute for Nuclear Research sought help in developing control techniques in connection with fabrication of fuel pellets and fuel rods. Quality control of end-plugs and other welds were of particular interest. With the Federal Republic of Germany funding expert's visits and the Agency's Technical Assistance and Co-operation Fund being used for equipment purchases, the Nuclear Fuels Department has built up competence in non-destructive testing and quality control as they relate to manufacture of fuel elements for experimental reactors and prototypes for power reactors. The experience of the 10-person team was broadened by granting three scientific visits in the period 1985 through 1987. The project has also provided a basis for a quality control and assurance service relating to the Laguna Verde Nuclear Power Plant.

■ MLI/5/010 RADIOISOTOPES IN AGROMETEOROLOGY

COMPLETED: **89-11-17** TOTAL COST: **$12,851**

OBJECTIVES: TO IMPROVE THE MONITORING OF SOIL MOISTURE AND THE DETERMINATION OF WATER REQUIREMENTS OF CROPS.

ACHIEVEMENTS: The Agrometeorological Division of the National Directorate of Meteorology provides services to the agricultural sector by monitoring water balance, studying water requirements of crops and forecasting yields based on models. The project provided the necessary additional equipment for improving the monitoring of soil moisture and the determination of water requirements of crops. One counterpart was trained abroad in 1988 under a project-related fellowship in the use of the equipment, and he was able to undertake the tasks originally to have been assigned to an Agency expert.

■ MLI/8/002 RADIOISOTOPES IN HYDROLOGY

COMPLETED: **89-11-21** TOTAL COST: **$328,498**

OBJECTIVES:

TO APPLY NUCLEAR TECHNIQUES TO HYDROGEOLOGICAL PROBLEMS AND TO ESTABLISH A WATER RESOURCES DEVELOPMENT PROGRAMME.

ACHIEVEMENTS:

As one of the Sahelian countries, Mali suffers severely from water shortages and drought. In 1979, the National Directorate of Water and Energy sought Agency assistance to establish a programme that uses isotopic methods to study groundwater and surface-water dynamics. The aim was to improve water-use effectiveness and to conserve resources. In the course of this long-term project, ten experts undertook eighteen missions to provide training, to assist in developing a research programme, and to advise on interpretation of results. Equipment was provided for the water chemistry laboratory established under the project as well as for field work. Ten fellowships were awarded for training abroad and four scientific visits were arranged. The assistance provided has permitted the National Directorate to define the characteristics of aquifers and their recharge mechanics, and to define a water management programme for arid and semi-arid regions where shortage of water inhibits development. The results achieved under this project have complemented work done under a major UNDP project that dealt exclusively with non-isotopic methods of study; it also provided Mali with the necessary infrastructure and personnel to enable it to collaborate in the Regional hydrology project (RAF/8/012) involving the three Sahelian countries.

■ MON/0/003 TRAINING IN ENGLISH FOR NUCLEAR SCIENCE FELLOWS

COMPLETED: **89-09-25** TOTAL COST: **$31,658**

OBJECTIVES:

TO PROVIDE A CRASH COURSE IN THE ENGLISH LANGUAGE FOR NUCLEAR SCIENTISTS IDENTIFIED FOR AGENCY FELLOWSHIPS AND TO ESTABLISH A LOCAL CAPABILITY FOR FUTURE LANGUAGE TRAINING.

ACHIEVEMENTS:

Certain types of advanced training in nuclear engineering are available at only a limited number of establishments throughout the world. Several nuclear scientists and engineers had been identified for Agency fellowship nominations for placement in institutions in English-speaking countries, but to render such training effective, it was determined that an intensive course in English would first be required. With funding from the Agency's Reserve Fund, a three-month course was held by an Agency expert, and some language laboratory equipment was supplied. At the same time, capability was established for conducting such courses locally for future nuclear science fellowship nominees.

■ MON/1/003 MOESSBAUER SPECTROMETRY

COMPLETED: **89-09-25** TOTAL COST: **$107,669**

OBJECTIVES:

TO ESTABLISH MOESSBAUER SPECTROMETRY FOR MATERIALS RESEARCH.

ACHIEVEMENTS: The Institute of Physics and Engineering of the Mongolian Academy of Sciences, Ulan Bator, sought Agency assistance to expand its use of analytical techniques into the field of Moessbauer spectrometry. Following provision of the necessary equipment, two Agency experts assisted in establishing the laboratory. The project has strengthened local capability for materials research, in particular in studies of molecular structure of biological specimens and of elemental composition of mineral samples.

■ NER/5/006 RADIOISOTOPES IN AGRICULTURE

COMPLETED: **89-11-21** TOTAL COST: **$75,821**

OBJECTIVES: TO STUDY THE EFFECT OF NODULATION AND SYMBIOTIC NITROGEN FIXATION IN LOCAL CROPS.

ACHIEVEMENTS: The Faculty of Agronomy of the University of Niamey sought Agency assistance to set up a plan of work to study nodulation and symbiotic nitrogen fixation in various local crops of economic importance, in particular the cowpea, the most widely cultivated leguminous crop, in order to improve fertilizer use efficiency. Two Agency technical staff visited the country in 1986 and, on the basis of their recommendations, equipment was provided in 1987 to enable the Department to undertake nitrogen-15 analysis; nitrogen-15 fertilizers were also provided. The emission spectrometer was installed by an Agency expert, who also trained the staff in its use, while another expert assisted the staff in designing field experiments using labelled fertilizers. The emission spectrometer is now used on a routine basis for plant sample analysis and the Radioisotope Institute has become self-reliant in such studies. The Institute is now collaborating in the Regional project on biological nitrogen fixation (RAF/5/010).

■ NIC/8/002 ISOTOPES IN HYDROLOGY

COMPLETED: **89-09-28** TOTAL COST: **$250,550**

OBJECTIVES: TO UNDERTAKE STUDIES ON POLLUTION IN ASOSOSCA LAKE AND ON THE HYDROLOGICAL CHARACTERISTICS OF THE SEBACO VALLEY AQUIFER.

ACHIEVEMENTS: The Nicaraguan Institute of Territorial Studies sought Agency assistance in its studies of the hydrodynamics of Asososca Lake, a small volcanic water body that provides 30% of Managua's potable water. A further aim was to define the characteristics of the aquifer under the Sebaco Valley, the country's most important agroindustrial region, for which an agricultural development programme has been initiated. The Government established a laboratory, which became fully operational in 1987, to undertake water analysis, and other forms of chemical, physical and physico-chemical analysis. The Agency supplied equipment both for the laboratory and for field work, including drilling equipment and a portable water analysis unit. An expert paid three visits to advise on the lake and aquifer studies. Despite suggestions that fellowship training would provide valuable support to the project, no such training could be initiated, since the only fellowship proposal received from the Government was subsequently withdrawn. It was confirmed that no connection exists between Asososca Lake and the polluted water of Managua Lake. Any future intrusion of polluted water could be determined by a monitoring programme in sufficient time to alert the authorities, whether this

derived from Managua Lake or wastes produced by an industrial complex located between the two lakes. At the same time, possible new sources of potable water for Managua are being sought. In respect of the Sebaco Valley study, the aquifer has been determined to contain 740 million cubic metres of water but its average annual recharge is only one tenth of this volume. This low rate of recharge would not permit the expansion of agricultural production as at present envisaged. Subsequently, in 1988, expert support was also given to studies on hot water flooding of the "El Limon" Gold Mine, the most productive in Nicaragua. The origin of the hot water has been determined and studies to solve the problem are continuing.

■ NIR/1/004 APPLICATION OF NUCLEAR TECHNIQUES

COMPLETED: **89-01-09** TOTAL COST: **$68,897**

OBJECTIVES: TO PROVIDE TRAINING IN THE APPLICATION OF NUCLEAR TECHNIQUES.

ACHIEVEMENTS: The Department of Physics of Ahmadu Bello University, Zaria, established a centre for nuclear technology with the aim of providing training in the application of nuclear techniques. The Agency was requested to provide short-term experts to assist in programme planning and to give on-the-spot training, including advice on radiation protection. Some items of equipment were, on the recommendation of the experts, provided, namely a semi-conductor gamma spectrometry system with cryogenic cooling and spare parts for an existing neutron generator, thus making possible the teaching of neutron activation analytical techniques. One project-related fellowship and a scientific visit were also awarded. In 1987, the Government decided to establish an energy research centre at Zaria to serve as one of two centres in the country specializing in nuclear science, and this has incorporated the centre for nuclear technology, taking over its expertise, equipment and training responsibilities. This project has therefore been closed, and some remaining activities have been included in the programme of a new project NIR/0/003 with the new Centre for Energy Research and Training, while the radiation protection aspects are being supported within a further project (NIR/9/004) with the Centre.

■ NIR/1/006 REPAIR OF A NEUTRON GENERATOR

COMPLETED: **89-07-17** TOTAL COST: **$11,237**

OBJECTIVES: TO PROVIDE ASSISTANCE RELATED TO THE REPLACEMENT AND TESTING OF A NEUTRON GENERATOR TUBE.

ACHIEVEMENTS: The reserve fund allocation was established in 1987 to facilitate purchase and replacement of a sealed neutron generator tube in support of project NIR/1/003 concerned with establishment of teaching and training facilities for neutron activation analysis. The generator was shipped to the project in February 1989.

■ NIR/5/013 BIOLOGICAL NITROGEN FIXATION (IBADAN)

COMPLETED: **89-06-15** TOTAL COST: **$133,307**

OBJECTIVES: TO STUDY BIOLOGICAL NITROGEN FIXATION.

ACHIEVEMENTS: The primary objectives of the project have been met. The optimal time for nitrogen fertilizer application has been determined for maize and other crops in the low-rain forest zones of Nigeria, resulting in improved agricultural practices by local farmers, and the main source of nitrogen (atmospheric) has been confirmed for cowpea and other legumes grown in Nigeria, and their nitrogen fixing capability determined. The laboratory at the Agricultural Research Institute, Ibadan, has been well equipped, and this has enabled the Institute's scientists to continue the investigations without further assistance from the Agency.

■ NIR/5/016 OIL PALM PRODUCTION

COMPLETED: **89-01-09** TOTAL COST: **$20,239**

OBJECTIVES: TO STUDY PLANT/WATER RELATIONSHIPS USING NEUTRON PROBES WITH A VIEW TO DEVELOPING METHODS FOR INCREASING OIL PALM PRODUCTION.

ACHIEVEMENTS: The Department of Agronomy of the University of Ibadan, in collaboration with the Nigerian Institute of Oil Palm Research, is studying soil and irrigation as factors affecting the yield of oil palm, an important crop. While expertise was locally available, some items of equipment were lacking. With funding from the United States of America, the Agency was able to provide two soil-moisture probes. These are now being used in the on-going programme.

■ PAR/1/003 ACCELERATOR LABORATORY

COMPLETED: **89-08-14** TOTAL COST: **$25,360**

OBJECTIVES: TO UTILIZE A VAN DE GRAAFF ACCELERATOR FOR PARTICLE-INDUCED X-RAY EMISSION ANALYTICAL TECHNIQUES.

ACHIEVEMENTS: The Department of Physics of the National University of Paraguay sought Agency assistance to identify, recondition and install a used Van de Graaff accelerator with which the Department intended to introduce particle-induced X-ray emission and related techniques for analysis of biological, environmental and aerosol samples. An expert undertook a training mission on nuclear instrumentation as applicable in accelerator technology, while some minor equipment support was approved, including repair of a Si(Li) detector and provision of a Moessbauer source. Since a suitable used accelerator could not be identified and since priorities for the Department have changed, it was agreed to close this project and concentrate related activities in the new nuclear instrumentation project (PAR/4/002) approved in 1989.

■ PAR/5/003 MUTATION BREEDING

COMPLETED: **89-04-25** TOTAL COST: **$100**

OBJECTIVES: TO TRAIN LOCAL STAFF IN RADIATION-INDUCED MUTATION BREEDING.

ACHIEVEMENTS: This project was to be primarily concerned with mutation breeding of wheat varieties. A shortage of counterpart staff caused the Government to request cancellation of the project, and the transfer of funds to project PAR/4/002.

■ PAR/6/006 NUCLEAR MEDICINE

COMPLETED: **89-09-28** TOTAL COST: **$265,457**

OBJECTIVES: TO ESTABLISH A NATIONAL NUCLEAR MEDICINE CENTRE.

ACHIEVEMENTS: The project was originally approved in 1982 to assist Paraguay in the establishment of a Nuclear Medicine Centre at the Institute of Research in Health Sciences, as well as to improve the maintenance of electronic equipment in the field of nuclear medicine. A delay in setting up a Nuclear Cardiology Service within the Centre, as well as the need, determined later, for a computer adapted to the existing gamma camera required extension of the project, with additional funding being approved up to 1987. The originally foreseen expert services were postponed and finally cancelled, since the project received considerable expert assistance under a related regional project RLA/6/006. Two project-funded and nine project-related fellowships (with an emphasis on training in gamma camera utilization) were awarded. Of these eleven, three were provided by Brazil and the United States of America. With only one exception, the trainees are all working with the project, at either the Institute of Research in Health Sciences or at the National Cancer Institute (associated to the project at a later stage and whose staff were trained at the former institute). By assisting in the establishment of the Nuclear Medicine Centre, the project has successfully contributed to launching research programmes in various applied fields of nuclear medicine, including the study of Chagas' disease, and has made it possible for the country to provide a range of diagnostic services for which patients had previously to be sent abroad.

■ PAR/9/003 RADIATION PROTECTION

COMPLETED: **89-03-17** TOTAL COST: **$5,193**

OBJECTIVES: TO IMPROVE RADIATION PROTECTION BY ESTABLISHING A NATIONAL RADIATION PROTECTION SERVICE.

ACHIEVEMENTS: In 1982, The National Atomic Energy Commission instituted a radiation protection system including personnel monitoring for personnel occupationally exposed to ionizing radiations, covering the National University, governmental institutions and certain industries. Feeling that services should be expanded and that procedures for licensing and for notification and registration of users should be improved, the Government requested the Agency to provide expert services to review the existing regulations and to advise on possible lines for future expansion. In the course of two missions: (i) the existing radiation protection regulations and the system of notification, registration and authorization, as well as the provision of services, were evaluated; (ii) a reorganization of the National Radiation Protection Authority was recommended and planned and this is now in progress under the co-ordination of a Technical Secretary. This has allowed responsibilities for protection of occupationally exposed persons and for protection of patients to be appropriately assigned to the corresponding government authorities; and (iii) a series of technical regulations, basic norms and forms were reviewed to facilitate future radiation protection activities. Through this project, a basis has been established for a national radiation protection regulatory system. However, in order to reinforce what has been accomplished, it is essential that work continues within the recommended framework.

■ PER/1/004 ACTIVATION ANALYSIS

COMPLETED: **89-01-09** TOTAL COST: **$141,517**

OBJECTIVES: TO ESTABLISH A FAST NEUTRON ACTIVATION LABORATORY FOR NON-DESTRUCTIVE ANALYSIS.

ACHIEVEMENTS: The Instituto Peruano de Energia Nuclear has been assisted to establish facilities for fast-neutron activation analysis to upgrade its non-destructive analytical capability. The project included the acquisition, installation and testing of a 14 MeV neutron generator, the installation of a pneumatic transfer system and the provision of a semi-conductor Ge(Li) detector coupled to a multi-channel analyser. Experts assisted in setting up the generator and associated equipment and provided training in its operation. Additional training was provided through two project-related fellowships totalling 13.5 months. The system has been successfully used for fast-neutron activation analysis of oxygen, silicon and iron in coal samples, which led to finding a statistical correlation between "organic" oxygen and volatile matter as well as to the development of procedures to characterize the chemical nature of various coals. This technique, when associated with thermal neutron activation analysis of titanium, vanadium, manganese and sodium, has also permitted prediction of the amount of ash in the coal samples. These and similar studies are continuing, while the neutron generator is also being used for neutron cross- section measurements.

■ PER/4/007 NUCLEAR ELECTRONICS

COMPLETED: **89-12-04** TOTAL COST: **$56,474**

OBJECTIVES: TO STRENGTHEN MAINTENANCE AND CALIBRATION OF NUCLEAR ELECTRONIC INSTRUMENTS.

ACHIEVEMENTS: In 1983, the Peruvian Nuclear Energy Institute (IPEN) requested Agency assistance to improve nuclear electronic instrument maintenance by training technicians and providing selected items of test equipment. Since its inception, the project, funded by an extrabudgetary contribution from the Federal Republic of Germany, has made possible the planning and gradual establishment of a comprehensive servicing and repair service, able to undertake maintenance and calibration of equipment used in nuclear medicine and agriculture. In addition to the laboratories of IPEN, other institutions such as the Universities of San Marcos and La Molina are already being served. In particular, the expert assisted local staff in making the gamma cameras at the Nuclear Medicine Pilot Centre operational. The project has formed the basis of a long-term activity, expected to have additional personnel and a bank of spare parts, for which support from the Agency is being sought in the 1991-92 programme. Two staff were trained by means of project-related fellowships.

■ PER/5/017 MEDFLY ERADICATION IN SOUTHERN PERU

COMPLETED: **89-10-30** TOTAL COST: **$177,221**

OBJECTIVES: TO ERADICATE THE MEDITERRANEAN FRUIT FLY IN VALLEYS OF THE DEPARTMENTS OF TACNA AND MOQUEGUA.

ACHIEVEMENTS: Under the Agency's project PER/5/012, Phase I of a programme aimed at studying the Mediterranean fruit fly in the Valley of Tacna, Southern Peru, was initiated with a view to long term eradication and control. The Government approached UNDP to support activities related to Phase II of this programme. This UNDP-funded project has provided for a long-term resident expert, and administrative and logistic support required for field operations and air-borne release of sterile insects. The expert assisted in outlining an overall national programme for Mediterranean fruit fly eradication and, together with the counterpart staff, upgraded the laboratory for the production and sterilization of insects, increasing the production of viable larvae to 6 million sterile insects per week. Based on this experience, a new manual for the production/sterilization of insects was printed. Instruction material for the farmers, including several TV videos with wide national dissemination were produced. The field operations were so successful that the Olive Fruit Producers Association have accepted paying a levy in order to support the insect control and eradication programme. Negotiations for the export of sterile insects to other countries are in progress; meanwhile the production of 1 million sterile flies per week permits the maintenance of the colony and provides for weekly field releases of insects for specific studies. The project has also assisted in initiating preliminary rearing experiments for parasites against the fruit fly in order to support the sterile-insect technique with biological control measures.

■ PER/9/012 NUCLEAR POWER PLANT SITING

COMPLETED: **89-05-19** TOTAL COST: **$32,073**

OBJECTIVES: TO MAKE SITE APPRAISAL STUDIES FOR A NUCLEAR POWER REACTOR, INCLUDING GEOTECTONICS, SEISMOLOGY, NUCLEAR SAFETY AND RADIOLOGICAL PROTECTION.

ACHIEVEMENTS: The project aimed to study potential sites for possible future nuclear power plants in support of a national assessment of energy requirements. In the course of four expert missions, studies of the micrometeorological aspects in relation to radiological environmental protection were carried out, together with studies of geotectonics and seismology at each of the selected sites. The project also assisted in initiating studies in structural seismotectonics connected with the installation of a 10 MW research reactor at Huarangal.

■ PHI/6/010 MEDICAL PHYSICS TRAINING

COMPLETED: **89-10-30** TOTAL COST: **$260,548**

OBJECTIVES: TO ESTABLISH A POST-GRADUATE SCHOOL OF MEDICAL PHYSICS.

ACHIEVEMENTS: In 1980, the Philippine Government sought Agency assistance to establish a Medical Physics School at the University of the Philippines, Manila. An Agency expert assisted in planning the course. In 1982, it was decided that it would be more rational to transfer the activity to the University of Santo Tomas, where a post-graduate school of medical physics was set up. By decree of the Minister of Health in 1983, a Master's Degree in Applied Physics was established and, with support of Agency experts and provision of essential teaching and laboratory equipment, including dosimeters, a phantom and calibration items, a local training capability was initiated that can meet the country's manpower requirements for hospital physicists and

radiological safety experts. The immediate outputs of the project were the following: (1) the two-year post-graduate MSc course in Medical Physics has resulted, since 1986, in 12 graduates; most are now employed as medical physicists at hospitals or at institutes that use radioisotopes and radiation in medicine, or in radiation protection; (2) research has been undertaken by graduates as Msc thesis projects and four research papers were accepted for the World Congress on Medical Physics and Biomedical Engineering held in 1988 in the United States of America; (3) the availability of manpower made possible the creation of a Medical Physics Division in the Radiation Health Service of the Department of Health in 1988. Its main function is to provide medical physics services to the Department's hospitals. It is expected that a number of medical physicist posts can be increased in the near future. Six project-related fellowships, with five being funded by the United States of America, were granted. Regrettably, two fellows did not return to the Philippines.

■ PHI/9/011 SPENT FUEL MANAGEMENT

COMPLETED: **89-07-27** TOTAL COST: **$11,850**

OBJECTIVES: TO DEVELOP A PLAN FOR THE SAFE STORAGE OF SPENT FUEL IN RELATION TO THE TRIGA CONVERSION OF THE PHILIPPINE RESEARCH REACTOR.

ACHIEVEMENTS: The Philippines research reactor PRR-1 is being converted into a Triga-type reactor. In this connection, the Agency was requested to provide expert services to assist in designing a facility for the long-term storage of spent fuel. Specific accomplishments were: (i) one unit of the in-pool storage rack for non-defective fuel was fabricated and put into service; (ii) construction of the A-beam structure for hoisting the heavy reactor pool dividing gate for repair was completed. This structure will also be used for segregating spent fuels into the low-power section of the reactor pool; (iii) a plan was drawn up for making periodic visual inspections of the spent fuels and for monitoring the activity of the water coolant, and it is now being implemented. This includes maintenance of coolant conditions to limit corrosion of fuel cladding to ensure its continuing integrity; (iv) the conceptual designs for a transfer cask and a multi-storage cell dry-well facility were completed.

■ POL/1/006 MASS SPECTROMETRY

COMPLETED: **89-09-01** TOTAL COST: **$344,825**

OBJECTIVES: TO ANALYSE ENVIRONMENTAL SAMPLES.

ACHIEVEMENTS: The Department of Chemistry of Warsaw University sought Agency assistance with its proposed environmental studies programme, which aimed to determine the concentration of tritium in water and to study organic compounds of biological interest. One twelve-month project-related fellowship was granted for training in nuclear analytical techniques at the Agency's Laboratories at Seibersdorf. A mass spectrometer (MX-1321, USSR) equipped with a gas chromatograph was procured and was interfaced with one of the Department's desk-top computers. Some two-thirds of the funding derived from an extrabudgetary contribution of the Union of Soviet Socialist Republics. The equipment is now fully operational and is being used for a wide range of studies.

■ POL/4/003 ELECTRON BEAM RADIATION PROCESSING

COMPLETED: **89-09-01** TOTAL COST: **$1,185,616**

OBJECTIVES: TO ESTABLISH A PILOT ACCELERATOR FACILITY FOR ELECTRON BEAM PROCESSING.

ACHIEVEMENTS: In this multi-year project, the Agency assisted the Department of Radiation Chemistry at the Institute of Nuclear Chemistry and Technology, Warsaw, by providing a pilot electron accelerator (ILU-6, USSR) facility and some auxiliary equipment, including a UV-VIS spectrophotometer. Two fellowships and one scientific visit were awarded to train counterpart staff. The accelerator is being used for the pilot production of heat shrinkable tubes and tapes. PVC foil dosimetry, polyethylene heat shrinkable dosimetry and water calorimeter dosimetry were developed at the Institute for high-dose determination with the aid of the accelerator. Investigations on the electron-beam processing of various materials are continuing; sterilization of pharmaceutical products is also being undertaken.

■ POL/4/004 USE OF A LINEAR ACCELERATOR

COMPLETED: **89-11-15** TOTAL COST: **$169,855**

OBJECTIVES: TO INSTALL AN 8 MEV LINEAR ACCELERATOR AND TO PROMOTE ITS EFFECTIVE USE.

ACHIEVEMENTS: The Institute of Applied Radiation Chemistry of Lodz Technical University sought Agency assistance to upgrade its applied research capabilities in polymer chemistry, synthesis of labelled compounds, work with biological and bioactive materials, and industrial activities such as sterilization for medical purposes. The Agency provided two storage oscilloscopes for use at the centre which houses the 8 MeV linear accelerator purchased by the Institute, a twin-channel recorder and an advanced high-pressure liquid chromatography system. Three expert's visits assisted with installation of equipment and training in certain applied techniques such as measuring molecular weights of polymers and pulse spectroscopy. One fellow was given an eight-month project-funded fellowship to study the radiation processing of bioactive and biocompatible materials. In addition, one project-funded and three project-related scientific visits were granted. The laboratory is now suitably staffed and equipped for work in the technical areas mentioned above; inter alia experimental production of special burn dressings has been initiated.

■ POL/5/006 PLANT BREEDING USING INDUCED MUTATIONS

COMPLETED: **89-08-09** TOTAL COST: **$311,405**

OBJECTIVES: TO INCREASE AGRICULTURAL PRODUCTION THROUGH MORE PRODUCTIVE, HIGHER QUALITY AND MORE RESISTANT CROP CULTIVARS.

ACHIEVEMENTS: The Polish authorities have been giving high priority to increasing agricultural production. A caesium-137 gamma irradiator was provided to the Central Botanical Gardens of the Polish Academy of Sciences. It is available to all plant breeding institutions in the country with the aim of encouraging the search for improved cultivars arising from breeding using radiation-induced mutations. Various items of agricultural equipment suitable for field trials were

also provided, as well as laboratory equipment, two microscopes and spare parts for several laboratories. An expert assisted with installation of the irradiator, while others served as lecturers at a training course given in 1986; a further course on plant breeding was given in 1989. A series of semidwarf (short straw) mutants was established; these are being used in a cross-breeding programme. Furthermore, mutant strains with high albumen and strains resistant to powdery mildew (Erysiphe graminis) were developed. Plans are being made for expanding the area under cultivation of one mutant that is particularly suited to local soil characteristics – sandy, acidic and with aluminium toxicity. Eight fellows received training abroad and one scientific study tour was granted. Experiments in plant breeding are continuing, and the technique of inducing mutations has been supported in all seven participating institutes, giving a broad experimental base for this work.

■ POR/3/008 LEACHING OF ORE FROM THE AZERE REGION

COMPLETED: **89-07-10** TOTAL COST: **$40,439**

OBJECTIVES: TO ENHANCE ANALYTICAL AND PROCESSING CAPABILITY AND PROMOTE THE EXPLOITATION OF INDIGENOUS URANIUM RESERVES.

ACHIEVEMENTS: In 1985, the uranium ore processing plant situated near the Urgeirica mine was operating at below capacity, since the mine was exhausted in terms of traditional mining operations, though residual uranium was still being recovered by in-situ leaching. In order to determine optimum treatment conditions for these and other ores, the Agency was asked to provide the National Uranium Company with an atomic absorption spectrophotometer, which was made possible with funding provided by the Federal Republic of Germany. The plant has been able to double its capacity, while 60% of the ore processed now comes from the Azere Region. As a result of work done on the uranium recovery process, recovery is better than 90%. Under this project, the Company's analytical and processing capability were markedly enhanced.

■ RAF/8/007 WATER RESOURCES IN NORTH AFRICA

COMPLETED: **89-03-14** TOTAL COST: **$207,558**

OBJECTIVES: TO ASSESS THE GROUNDWATER RESOURCES OF THE ARID AND SEMI-ARID AREAS OF ALGERIA, MOROCCO AND TUNISIA.

ACHIEVEMENTS: Algeria, Morocco and Tunisia are collaborating in a large UNDP-financed project to assess the groundwater resource potential in the Sahara. The Agency was requested to assist by providing expert services, as well as sampling and analytical support for the use of isotope techniques to obtain data unavailable using non-nuclear methods. The ultimate aim of the studies was to make possible improved water management and to provide data necessary for assessing methods of undertaking artificial recharge of aquifers. The project was extended to include studies of erosion phenomena in some of the arid regions of the three countries. Seven experts provided training on various aspects of these studies (dating of very old waters, artificial recharge experiments, sedimentology studies, etc.), two co-ordination meetings were held (one in Vienna in 1984, one in Tunis in 1986), and a seminar was convened in Morocco in 1986. Several items of hydrology equipment were provided for the field work: of some US $140,000 allocated to the equipment

and services component, over $55,000 were used to pay for analyses undertaken at the Agency's Hydrology Laboratory and at the Universite de Paris-Sud and $33,000 for isotopes used in the studies. Several items of hydrology equipment were provided for the field work. Sampling programmes were successfully carried out in the north Sahara in Algeria, continuing in the central west and south along the Hoggar basement, answering many questions concerning recharge characteristics. The feasibility of artificial recharge of aquifers in Tunisia and Morocco was confirmed. In addition to work continuing in hydrology, sediment deposition is being monitored in reservoirs and dams. Three project-related fellowships abroad were completed, and a fourth has been granted for 1989. One Agency Research Contract for studies of water movement in south Tunisia has been agreed. This project is complemented by national projects in hydrology and/or sedimentology in the respective countries.

■ RAS/6/004 QUALITY CONTROL OF NUCLEAR MEDICINE PROCEDURES IN VIVO

COMPLETED: **89-03-14** TOTAL COST: **$186,086**

OBJECTIVES:

TO DEVELOP QUALITY CONTROL CAPABILITY OF AT LEAST ONE CENTRE IN EACH PARTICIPATING COUNTRY AND TO PROMOTE MORE EFFICIENT UTILIZATION OF NUCLEAR MEDICINE EQUIPMENT.

ACHIEVEMENTS:

In 1981, the Agency initiated, in collaboration with WHO, a regional project for countries of the Asia and Pacific Region that aimed at improving the quality control of in vivo nuclear medical procedures and promoting the more efficient utilization of equipment, in particular gamma cameras and rectilinear scanners. A major objective was to develop in each participating country one nuclear medicine centre capable of undertaking quality control and to establish mechanisms for transferring such a capability to other centres in the respective countries. Under the regional project, one regional seminar and seven national workshops were held. The equipment allocation was used in support of these, the nuclear medicine centres being provided with smaller test and calibration sources, phantoms and publications. The regional project was complemented by national projects in the participating countries (Bangladesh, Burma, Indonesia, Republic of Korea, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam) under which any major items of equipment and various expert services were provided. Fellows were trained abroad in quality control procedures, either funded by the Agency's general fellowship allocation or under national projects. The regional project was also complemented by a co-ordinated research contract programme "Establishing national programmes on instrument quality control" in the field of nuclear medicine, under which five research contracts were allocated to countries participating in the project. At a final research contract programme meeting held in conjunction with a nuclear medicine symposium in August 1988, counterpart staff reported a significant improvement in the quality of nuclear medical diagnostic procedures in their respective countries with, overall, a more appropriate use of equipment and methods. It appears that the frequency of calibrations and the quality of the results have all definitely improved. This project is now being followed up by project RAS/6/016 of which the immediate objective is to enhance the value of the gamma camera technique by showing how improved diagnostic performance, especially sensitivity, can be obtained using computer-aided diagnosis with technetium-99m as diagnostic tracer.

■ RER/0/004 SCIENCE AND TECHNOLOGY (OPS CONSULTANCY)

CANCELLED: **89-03-14** TOTAL COST: **$0**

OBJECTIVES: TO MAKE AVAILABLE THE SERVICES OF A CO-ORDINATOR FOR THE TASK FORCE ON SCIENCE AND TECHNOLOGY FOR THE UNDP MID-TERM PROGRAMME REVIEW OF THE FOURTH CYCLE REGIONAL PROGRAMME FOR EUROPE.

REASON FOR CANCELLATION: Project cancelled due to last moment unavailability of designated consultant.

■ ROK/4/013 NUCLEAR POWER PLANT QUALITY ASSURANCE AND START-UP TESTING

COMPLETED: **89-10-30** TOTAL COST: **$169,790**

OBJECTIVES: TO DEVELOP CAPABILITIES IN THE INSPECTION AND SURVEILLANCE OF MECHANICAL COMPONENTS DURING CONSTRUCTION, START-UP AND COMMISSIONING OF NUCLEAR POWER PLANTS.

ACHIEVEMENTS: The Nuclear Safety Centre of the Korea Advanced Energy Research Institute, Taejeon, is responsible for quality assurance and quality control of mechanical equipment and components for nuclear power plants. The Agency was asked to assist in broadening the expertise in quality control and start-up inspections available at the Centre. Two national training courses were organized, one on mechanical systems and components, and the other on inspection and testing of electrical equipment, instrumentation and control. About 90 scientists and engineers from the utilities, research organizations, regulatory bodies and industry related to the nuclear power programme in Korea participated. Three Agency experts as well as cost-free experts from France and the United States of America delivered lectures. In addition, one expert under long-term assignment assisted the counterparts on developing a systematic approach to the utilization of Korean experience on operating nuclear power reactors and suggested amendments to the initial start-up test programme for the reactors KNU 5 to 8, which are now successfully connected to the national grid.

■ ROK/4/016 TRAINING COURSE ON STRESS ANALYSIS

COMPLETED: **89-10-30** TOTAL COST: **$26,706**

OBJECTIVES: TO DEVELOP MANPOWER FOR THE STRESS ANALYSIS OF NUCLEAR POWER PLANT COMPONENTS.

ACHIEVEMENTS: The Korea Advanced Energy Research Institute requested the Agency to organize a training course on stress analysis with a view to consolidating local expertise in design and architect-engineering. About 25 participants from the Korea Advanced Energy Research Institute, the Korea Power Engineering Company, and the Korea Heavy Industries and Construction Company, as well as from other nuclear-related engineering companies participated in the two-week training course run by five Agency experts. Participants were provided with the specific concept and practical technology on stress analysis methods and tools associated with components, piping and supporting structures in nuclear power plants.

■ ROK/4/018 TRAINING IN LOAD-FOLLOWING TECHNOLOGY FOR POWER REACTORS

COMPLETED: **89-09-25** TOTAL COST: **$20,860**

OBJECTIVES: TO HOLD A TRAINING SEMINAR ON LOAD-FOLLOWING TECHNOLOGY.

ACHIEVEMENTS: In response to a government request, a seminar on load-following technology was successfully organized. Five Agency experts delivered the lectures. Sixty-two persons participated, 29 from the Korea Electric Power Corporation, two from the Korea Electric Power Engineering Company, and 31 from the Korea Advanced Energy Research Institute.

■ ROK/5/019 SOIL/WATER RELATIONSHIP STUDIES

COMPLETED: **89-06-01** TOTAL COST: **$86,623**

OBJECTIVES: TO DEVELOP RATIONAL LAND-USE PRACTICES, AND TO PROMOTE MORE EFFICIENT WATER USE AND ADEQUATE SOIL/WATER CONSERVATION MEASURES.

ACHIEVEMENTS: The Institute of Agricultural Sciences, Suweon, is undertaking studies to develop more efficient water use by defining appropriate irrigation schedules with emphasis on soil, fertilizer and water conservation. The Agency provided inter alia a neutron moisture meter and nitrogen-15 labelled fertilizer to assist with these studies, and two experts provided training and planning support for the irrigation experiments. The Institute has been able to establish irrigation schedules for obtaining good vegetable production with spring and autumn cultivation. The Institute's staff are now engaged in establishing a "soil erodibility factor" and an isoerodent map for the recommended cropping system in sloping farm land, and are also in a position to continue other related studies independently. Of the funds allocated to the project, some 75% were provided by the United States of America.

■ ROK/9/018 RADIATION SAFETY OF NUCLEAR POWER PLANTS

COMPLETED: **89-09-25** TOTAL COST: **$12,984**

OBJECTIVES: TO ADVISE ON REGULATORY ASPECTS OF RADIATION SAFETY AND ENVIRONMENTAL PROTECTION.

ACHIEVEMENTS: The Radiation Safety Division of the Atomic Energy Bureau sought expert assistance on the regulatory aspects of radiation safety and environmental protection. With extrabudgetary funding from the United States of America, an Agency expert made two visits, and counterpart staff were given training on various aspects connected with radiological safety at nuclear power plants, including considerations of waste disposal, health physics, environmental monitoring and emergency sampling. The expert's recommendations regarding draft regulations and technical aspects of radiation protection are under consideration by the Ministry of Science and Technology and the Korea Electric Power Company.

■ ROK/9/026 ENVIRONMENTAL RADIATION PROTECTION

COMPLETED: **89-09-25** TOTAL COST: **$183,131**

OBJECTIVES:

TO SURVEY ENVIRONMENTAL RADIATION ARISING FROM THE OPERATION OF NUCLEAR POWER PLANTS AND RADIOACTIVE CONTAMINATIONS.

ACHIEVEMENTS:

The Republic of Korea has an extensive nuclear energy programme, and radioisotopes are widely used in medicine, industry and agriculture. The Agency was requested to assist the Nuclear Safety Centre of the Korea Advanced Energy Research Institute with reviewing its environmental monitoring programme, and to provide training for local staff. Of the total funding, $65,000 were provided by the United States of America in addition to funding for one fellowship; the remainder, including a project-related fellowship, was funded from the Agency's Technical Co-operation and Assistance Fund. With the assistance provided under the project, which included provision of a low-level alpha/beta counter and a gamma spectrometer, the counterparts were trained in low-level counting, in effluent control, in regulatory aspects and in methods of assessing radiation doses under normal operating as well as accident conditions of a nuclear power plant. A national training course on radiological dose assessment was also organized, with the assistance of nine Agency experts. It was attended by 29 personnel, coming from the research institutes, from the electric utility, and from engineering and fuel companies of Korea. The knowledge gained is being utilized by the counterparts to improve environmental monitoring and the impact study being undertaken in connection with nuclear power stations.

■ ROM/4/012 NUCLEAR POWER

COMPLETED: **89-01-18** TOTAL COST: **$199,597**

OBJECTIVES:

TO DEVELOP APPROPRIATE TEST PROGRAMMES AND PROCEDURES FOR A FUELLING MACHINE.

ACHIEVEMENTS:

The activities under this project were planned with the help of an Agency expert, following which a two-week probabilistic safety analysis workshop was held in October 1987. This was run by three further experts, and had reference to the Cernovoda Nuclear Power Plant. Then, early in 1988, a team of experts assisted in elaborating a programme of training on commissioning of PHWR-type reactors which is being implemented since 1988 in the nuclear safety project ROM/9/003. Technical assistance also included development of test programmes and procedures for a fuelling machine, in support of which certain items of reactor hardware were supplied.

■ SEN/5/017 RADIOISOTOPES IN AGRICULTURE

COMPLETED: **89-08-15** TOTAL COST: **$175,776**

OBJECTIVES:

TO INCREASE CROP PRODUCTION THROUGH MORE EFFICIENT WATER UTILIZATION AND CROP MANAGEMENT METHODS.

ACHIEVEMENTS:

Inadequate rainfall and nutrient-deficient soils limit agricultural production in Senegal. The Senegal Agricultural Research Institute is conducting research on rain-fed and irrigated farming with the aim of improving water use efficien-

cy by developing appropriate crop management methods. The Agency has, since 1984, been assisting the Institute to establish a well-equipped isotope laboratory, and radioactive and stable isotopes have been supplied for laboratory, greenhouse and field investigations. Among the instruments supplied have been soil-moisture meters, soil density probes and a film dosimetry system. Experts provided training on various aspects of soil/water/plant relationships, including dynamics of cations in soil, soil hydrodynamics, soil-moisture/nutrient interaction and characterization of root systems. Results of these studies have been used to define cultivation techniques and water management methods which are now being applied in three regions of central-northern Senegal.

■ SEN/8/003 ISOTOPE HYDROLOGY

COMPLETED: **89-11-17** TOTAL COST: **$48,422**

OBJECTIVES: TO CARRY OUT HYDROLOGICAL STUDIES IN THE CASAMANCE BASIN AND TO EVALUATE GROUNDWATER RESOURCES.

ACHIEVEMENTS: The Department of Geology of the University of Dakar, in collaboration with the National Organization of Hydraulics, has been carrying out a hydrological study of the Casamance Basin, southern Senegal, as part of the national plan for the management of groundwater resources. Over the period 1985-88, four experts paid six visits to assist with training, programme planning and groundwater and peat-moor dating. The project was supported by a project-related fellowship funded by France and an Agency research contract. In addition to small equipment items, the Agency funded analysis of water samples. The information obtained is being used by the Ministry of Water Resources to develop a national water management programme.

■ SIL/6/003 RADIOISOTOPES IN MEDICINE

COMPLETED: **89-06-29** TOTAL COST: **$295,881**

OBJECTIVES: TO UPGRADE AND EXPAND THE RADIOISOTOPE UNIT AT CONNAUGHT HOSPITAL AND INTRODUCE RADIOIMMUNOASSAY.

ACHIEVEMENTS: The Radioisotope Unit at the Connaught Hospital was established with Agency assistance in 1972 and is the only medical isotope unit in the country. The Agency was requested to help upgrade the work of the Unit to include a wider range of diagnostic services, including scanning and radioimmunoassay (RIA). Following delivery of the scanner and associated equipment, an expert assigned for two years assisted in reorganizing the unit and training staff. In vivo and in vitro laboratories were established with the necessary ancillary equipment, including that required for RIA. A second expert gave training aimed at improving RIA techniques and quality control. Three project-related fellowships of one year each provided selected staff with advanced training abroad. Services to patients are now provided on a routine basis for scans of brain, thyroid, liver and kidneys; dynamic studies of kidney function are also undertaken. Laboratory serum samples of patients are assayed by means of RIA, in particular for assessment of thyroid function.

■ SRL/5/019 RADIOISOTOPES IN PLANT NUTRITION AND PHYSIOLOGY

COMPLETED: **89-08-29** TOTAL COST: **$98,431**

OBJECTIVES: TO SET UP A RADIOISOTOPE LABORATORY FOR PRODUCTION-ORIENTED RESEARCH ON THE NUTRITION AND PHYSIOLOGY OF RUBBER TREES.

ACHIEVEMENTS: The Rubber Research Institute of Sri Lanka is responsible for all research dealing with natural rubber production. They requested Agency assistance to set up an isotope laboratory with a view to using radiotracers to study nutrition and fertilizer use, root development, biosynthesis of latex and metabolic pathways. In 1984, an Agency expert advised on establishment of the laboratory, and equipment, including a liquid scintillation counter, an ultracentrifuge, an osmometer, and a chromatographic system, were provided. Two subsequent expert missions in 1988 provided on-the-job training in plant physiology and biochemistry. The principal counterpart was granted a 14-month fellowship for specialized training abroad, and the research programme has benefited accordingly. New techniques for studying water and nutrient transport, assimilative translocation and the biochemistry of latex synthesis are being applied, and the results of the studies are expected to help production, for example by improving tapping procedures and identifying the more efficient varieties for cloning.

■ SRL/6/012 RADIOIMMUNOASSAY IN BLOOD SAMPLE ANALYSIS

COMPLETED: **89-09-13** TOTAL COST: **$51,901**

OBJECTIVES: TO INTRODUCE REGULAR RADIOIMMUNOASSAY-BASED SCREENING OF DONOR BLOOD SAMPLES FOR HEPATITIS-B SURFACE ANTIGEN.

ACHIEVEMENTS: Following random screening of blood donors in Sri Lanka, the National Blood Transfusion Service of the Central Blood Bank decided that testing all blood for viral hepatitis was essential. Since the haemagglutination test was too slow for such mass control, and the Agency was requested to assist by helping to introduce radioimmunoassay (RIA) techniques. Counting equipment, RIA kits and supplies were provided, and an Agency expert assisted with the introduction of a screening programme for hepatitis-B-positive blood at the Central Blood Bank, General Hospital, Colombo. Two project-related fellowships, one of which was funded by the United States of America, gave opportunities for practical training abroad. The programme is fully operational, no infected blood is being transfused, and prospective donors who are found positive for hepatitis-B are excluded from future blood donations.

■ SUD/1/004 LIQUID NITROGEN PLANT

COMPLETED: **89-08-11** TOTAL COST: **$13,432**

OBJECTIVES: TO INSTALL AND SET UP A LIQUID NITROGEN PLANT AND TRAIN LOCAL PERSONNEL.

ACHIEVEMENTS: A cryogenic system was required for making gamma spectrometric measurements with a semi-conductor detector. The objectives of this project have been met: the liquid nitrogen plant has been installed and local personnel have been trained in its operation.

■ SUD/3/003 URANIUM GEOLOGY AND EXPLORATION METHODS

COMPLETED: **89-06-01** TOTAL COST: **$105,389**

OBJECTIVES: TO UPGRADE TEACHING AND TRAINING IN URANIUM GEOLOGY AND EXPLORATION METHODS.

ACHIEVEMENTS: Applications of nuclear techniques in exploration for minerals and studies of water resources initiated at the University of Khartoum led to development of a formal curriculum and training programme in uranium geology and exploration methods, prepared with Agency support. Scientific and technical staff from the University and the National Geological Survey were given on-the-job training by Agency experts in the techniques of preparing rock samples for geochemical analysis, while two fellowships were granted for training abroad in geophysical survey methodology. Equipment provided to support the work included a gamma spectrometric system, a fluorimeter and a radon detector. An interesting outcome of the field exploration experiments was the serendipitous detection and identification of the presence of radon in the water supply system in the arid areas of Sudan, which poses a potential health hazard. The problem is being assessed by the Government with Agency assistance.

■ THA/5/029 FOOD IRRADIATION

COMPLETED: **89-10-10** TOTAL COST: **$94,239**

OBJECTIVES: TO INVESTIGATE THE EFFICACY OF IRRADIATION IN COMBINATION WITH OTHER TREATMENTS AS A METHOD FOR DISINFESTING TROPICAL FRUITS.

ACHIEVEMENTS: The Department of Agriculture sought Agency assistance in 1984 in its efforts to develop food irradiation as a means of reducing post-harvest losses. This project, funded by an extrabudgetary contribution from the United States of America, provided expert services and equipment, including a generator unit and laboratory equipment, to enable the scientists of Department to gain research experience on the use of radiation on fruits and vegetables. Of four project-related fellowships provided for training abroad, one was funded by the United States of America. Investigations were eventually focused on the use of irradiation as a quarantine treatment of tropical fruits for export, which is of particular importance to Thailand. Two experts gave guidance on this topic, including the various aspects of commercial viability. Experiments on the use of radiation to disinfest, inter alia, mangoes, longan, mangosteen and guava showed good results. In the studies, the vapour heat-treatment used for the same purpose proved to be less effective than radiation. Thus radiation treatment appears to be the method of choice to satisfy quarantine regulations in fruit-importing countries.

■ THA/6/021 DIGOXIN RADIOIMMUNOASSAY QUALITY CONTROL

COMPLETED: **89-09-13** TOTAL COST: **$28,379**

OBJECTIVES: TO CONDUCT QUALITY CONTROL IN THE RADIOIMMUNOASSAY OF DIGOXIN FOR CARDIOVASCULAR THERAPY.

ACHIEVEMENTS: Mortality among heart patients is known to be high in Thailand, and the Department of Medical Sciences, Bangkok, sought Agency support in applying quality control procedures to the use of radioimmunoassay (RIA) of digoxin as a tool in cardiovascular therapy. Assisted by an expert's visit and provision of some items of laboratory equipment, it proved possible to initiate: (1) establishment of an in-house radioimmunoassay service for serum digoxin using locally produced reagents; (2) distribution of reagents for digoxin RIA to peripheral laboratories; (3) establishment of an external quality assessment scheme in which the National Institute of Health, Nonthanburi, served as a reference centre; (4) extension of reagent production to substances needed for assay of thyroid hormones, especially monoclonal antibodies for TSH.

■ THA/9/009 RADIOACTIVE WASTE MANAGEMENT

COMPLETED: **89-09-13** TOTAL COST: **$23,724**

OBJECTIVES: TO MANAGE AND DISPOSE OF LOW- AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE.

ACHIEVEMENTS: Faced by an increasing amount of radioactive waste resulting from the growing use of nuclear techniques in various fields, the Office of Atomic Energy for Peace sought Agency assistance regarding the management of low- and intermediate-level radioactive wastes. Experts advised on incineration practices and underground disposal. The training activities abroad comprised two project-related fellowships, one of which was funded by the United States of America, and a scientific visit. An incinerator has been put into operation, the current status of radioactive accumulation in Thailand has been investigated, and draft regulations for waste management have been drawn up. The activities initiated under the project are now being continued under project THA/9/013.

■ UGA/5/010 ERADICATION OF THE TSETSE FLY

COMPLETED: **89-01-09** TOTAL COST: **$12,084**

OBJECTIVES: TO ERADICATE AND CONTROL TSETSE FLIES AND CONTROL ANIMAL TRYPANOSOMIASIS.

ACHIEVEMENTS: This project primarily was intended to fund an Agency pre-project planning mission undertaken to Uganda in 1987 to assist the Government to initiate a tsetse-fly control programme aimed at reducing animal trypanosomiasis, which seriously affects livestock production. In addition, two Ugandan tsetse workers were granted project-related fellowships for training at the IAEA's Laboratory at Seibersdorf, while a senior staff member of the Tsetse Control Department was awarded a scientific visit to the IAEA Laboratory and the Nigerian BICOT tsetse control project; this staff member is now the Ugandan counterpart officer to the full-scale tsetse control project UGA/5/012, which has resulted from the recommendations of the planning mission.

■ URU/1/004 SECONDARY STANDARDS DOSIMETRY LABORATORY

COMPLETED: **89-10-30** TOTAL COST: **$54,950**

OBJECTIVES: TO ENHANCE CNEA'S DOSIMETRY SERVICES AND PREPARE THE INSTALLATION OF AN SSDL.

ACHIEVEMENTS: The Radiological Protection and Nuclear Safety Department of the National Atomic Energy Commission sought Agency assistance to establish a Secondary Standards Dosimetry Laboratory (SSDL) to enable effective dosimetry services to be provided to a broader group of radiation workers in the country – a group at present limited to personnel working within the Commission and some hospital technicians working with ionizing radiation. A panoramic irradiator with a low-intensity source for standardizing radiation doses in connection with a personnel thermoluminescence dosimetry system was provided, as was a dosimetry calibration device for determining radiation doses delivered by radiotherapy machines. However, the high turnover of counterpart personnel made it difficult to complete the project as planned. The first item of equipment was never installed and the related expert mission was cancelled. The second item is being used for calibration of radiotherapy equipment in the country. The counterpart organization has not sought further support from the Agency.

■ URU/5/014 NITROGEN FERTILIZER USE EFFICIENCY

COMPLETED: **89-05-10** TOTAL COST: **$54,147**

OBJECTIVES: TO INCREASE PRODUCTIVITY OF WINTER CEREALS THROUGH NUCLEAR TECHNIQUES.

ACHIEVEMENTS: The Faculty of Agronomy of the University of the Republic launched, in collaboration with the National Atomic Energy Commission (CNEA), a project to study problems affecting productivity of winter cereal crops. The Agency was asked to assist the Faculty with respect to nuclear techniques. An expert lectured on use of nitrogen-15 as a stable isotopic tracer in laboratory and field experiments, and a soil-moisture meter, nitrogen-15 labelled fertilizer and some laboratory supplies were provided. The studies showed that the best timing for nitrogen fertilizer application was at emergence instead of at tillering of winter wheat, confirmed that crop rotation with legumes gave a green manure that improved the following cereal crop, and indicated that red clover was the most useful "nitrogen provider" in crop rotation, with some 30% of nitrogen deriving from this source. This project, funded by the United States of America, has paved the way for continuing studies; at present, rice and soybean are being investigated.

■ URU/5/015 ASSESSMENT OF SOIL EROSION LOSSES

COMPLETED: **89-10-30** TOTAL COST: **$63,627**

OBJECTIVES: TO STUDY SOIL EROSION LOSSES USING RADIOISOTOPE TECHNIQUES AND TO ESTIMATE DROUGHT AND FROST HAZARDS.

ACHIEVEMENTS: The project was made operational through an extrabudgetary contribution of around US$50,000 from the Federal Republic of Germany, the balance coming from the Agency's Technical Assistance and Co-operation Fund. Four

experts paid six visits to assist with experiment planning, data analysis and evaluation of the results in practical terms. Soil samples up to 30 cm deep were taken and the chemical, physical and caesium-137 determinations were made for uneroded and eroded soils. A workshop in data processing by computer permitted counterparts to establish the distribution of fall-out caesium-137 in uneroded soils in Uruguay, and this, when compared with data from eroded soils, enabled a rate of erosion in certain parts of the country to be established. It was shown that erosion rates could be kept under control if linked to an acceptable agricultural land-use programme while preserving agricultural productivity. For the second objective, a water balance for selected crops had first to be determined according to soil characteristics, and this was carried out using neutron moisture gauges provided by the project. It was demonstrated that the reduced effects of rainfall and evapotranspiration on the water content in the lower soil horizon results from poorly saturated as well as unsaturated hydraulic conductivity; work on estimating drought and frost hazards is continuing.

■ URU/6/013 RADIOPHARMACOLOGY (DR)

COMPLETED: **89-05-19** TOTAL COST: **$137,786**

OBJECTIVES:

TO INTRODUCE THE THEORETICAL ASPECTS OF RADIOPHARMACOLOGY AND RELATED RESEARCH.

ACHIEVEMENTS:

The Department of Radiochemistry of the University of the Republic started a postgraduate course in biopharmacy. The Agency was requested to assist with the part dealing with radiopharmacology, where emphasis was to be on uptake and metabolic studies and tracer applications. An expert was requested to train faculty staff in radiopharmacokinetics, and some equipment was to be provided in support of the courses and related research. By 1984, work in this field had developed significantly, and a second collaborating institute, the Nuclear Research Centre of the University, joined the project. As a continuation of work initiated in 1982, the aim was now to assess the value of, inter alia, lyophilization to extend the shelf-life of reagent kits used for diagnostic studies with patients in order to reduce costs and increase availability. A further extension in 1985 was designed to help the Radiochemistry Department to develop sensitive techniques to determine optimum doses for radiopharmaceuticals and other drugs having critical drug-dose-dependent properties. Visits by four experts supported work on radiopharmacokinetics, autoradiography and optimization in radiopharmacy, as well as from three project-related fellowships for practical training abroad (one of which was funded by Spain) and a scientific visit. Equipment supplied at various times in support of the expanding programme included a spectrophotometer, an isotope calibrator, data processing support for a high-pressure liquid chromatograph (the instrument itself having been purchased in a parallel project URU/6/017 in 1986 with funding from the United States of America), and thin-layer chromatographic and electrophoresis equipment as well as labelled compounds. An Agency Research Contract on the preparation of technetium-99m radiopharmaceuticals for brain and heart studies additionally supported original applied research being done at the University. The project has made possible local design of radiopharmaceuticals for diagnosis and kinetic studies using carbon-14, tritium and technetium-99m as tracers. The basis for future self-reliant work has been well founded, and a particular benefit of the project is to be seen in the continuing strong collaboration with scientists and organizations outside Uruguay in this field.

■ URU/9/003 RADIOLOGICAL PROTECTION

COMPLETED: **89-05-10** TOTAL COST: **$42,323**

OBJECTIVES: TO FORMULATE NATIONAL LEGISLATION ON CONTROL OF THE USE OF IONIZING RADIATION.

ACHIEVEMENTS: In 1982, the National Atomic Energy Commission of Uruguay asked the Agency for assistance in reviewing radiation protection and safety aspects of its five-year plan. Experts were requested to advise on organizational and technical matters and safety-related legislation so that future licensing, regulation and supervision would be on a proper basis. A paper on "Basic Features of Proposed Legislation for Control of the Uses of Radioactive Materials and other Ionizing Radiation Sources in Uruguay" was prepared for the Government by an IAEA expert; the follow-up actions can be summarized as follows. A Presidential Decree (No.519/84) was issued on 21 November 1984 on the safe use of radioactive materials and ionizing radiation that assigned the responsibility for radiation protection and the nuclear safety programme to the National Atomic Energy Commission. Regulations for the safe transport of radioactive materials were published as part of Decree 158/985, "Reglamento de Operaciones y Transporte de Mercaderias Peligrosas". A draft for the regulation of commercial use and production of radioactive materials was prepared and submitted for review. The two latest drafts together with other regulatory proposals were extensively discussed with a second IAEA expert. Following a further request for support for personnel monitoring services, some equipment, including thermoluminescence dosimetry cards, and accessories were provided. However, all further developments seem to have come to a standstill owing to delayed governmental approval of the basic legal framework to regulate radiation protection and, as a result, to a lack of sufficient staff and of a proper infrastructure to carry out the regulatory activities. The Agency has strongly recommended that the Uruguayan authorities give these matters their urgent attention. An Agency RAPAT mission is now programmed for early 1990 to assist Uruguay with the planning of a comprehensive national programme for radiation protection, including plans for an appropriate national infrastructure.

■ VEN/0/004 ENERGY AND NUCLEAR POWER PLANNING

COMPLETED: **89-06-29** TOTAL COST: **$52,524**

OBJECTIVES: TO USE COMPUTER CODES IN ENERGY AND NUCLEAR POWER PLANNING.

ACHIEVEMENTS: The Ministry of Energy and Mines has conducted an assessment of national energy requirements. The Agency was asked to assist in the analysis of the potential for nuclear power by providing training on the use of MAED and WASP energy-planning computer codes. Following a visit by two experts to advise on project design, several Venezuelan experts from various organizations and representing several disciplines were given hands-on training at the Agency (November 1986 and August 1987). These nationals were responsible for conducting the study, including production of a report. At the same time, Agency experts provided continuing support by reviewing progress (March 1987 and April 1988). The draft report was presented for discussion by three of the national experts at a meeting in Vienna in July 1988. The

multi-disciplinary and inter-organizational effort initiated by the project will undoubtedly enhance energy demand forecasting and power system planning in Venezuela.

■ VEN/1/004 SECONDARY STANDARDS DOSIMETRY LABORATORY

COMPLETED: **89-06-06** TOTAL COST: **$218,279**

OBJECTIVES: TO ESTABLISH A DOSIMETRY LABORATORY FOR THE CALIBRATION OF X-RAY UNITS AND COBALT-60 THERAPY SOURCES.

ACHIEVEMENTS: The Venezuelan Government sought Agency assistance to establish a secondary standards dosimetry laboratory (SSDL). Following a programming mission in 1980 by an Agency staff member to assist the national authorities in project planning, the project itself was initiated in 1982 with a national counterpart who had received fellowship training in the intervening period at the Agency's Seibersdorf Laboratory. The Government decided to establish the SSDL at the Venezuelan Institute of Scientific Research (IVIC) and construction of the facility itself, started in 1983, was completed during 1985. The major items of calibration equipment, provided by the Agency, were installed during 1986-87, and comprised inter alia, a cobalt-60 therapy-level gamma irradiator, an orthovoltage X-ray system and standard ionization chambers. Experts attended to assist with establishment of the laboratory and installation of the equipment. A project-related scientific visit was arranged for one of the national staff in 1984. The calibration laboratory is now fully operational and calibration services on clinical dosimetry (cobalt-60 and X-rays) are being provided to all radiotherapy departments in Venezuela, as far as the present manpower and budget allow. However, assignment of additional qualified national staff to the laboratory is necessary if it is to be able to undertake its tasks fully.

■ VEN/5/008 IMPROVEMENT OF LEGUMINOUS AND OIL SEED CROPS

COMPLETED: **89-06-15** TOTAL COST: **$293,414**

OBJECTIVES: TO IMPROVE CROPS THROUGH RADIATION INDUCED MUTATIONS.

ACHIEVEMENTS: The objective was to improve crops of economic importance by testing radiation-induced mutants. The project was completed successfully. It yielded valuable sorghum mutants, widely accepted by local farmers. Good results were also obtained with sesame mutants. Expert services were the most important component of the project. An Agency expert assisted for about two and a half years to develop methods for mutation breeding of both crops. This work is being continued, and related support is being given under Agency projects VEN/5/009 AND VEN/5/011. Material obtained by the expert is also being used for research on disease resistance in sorghum by local counterparts under an Agency Research Contract.

■ VEN/5/010 COMMERCIAL SCALE FOOD IRRADIATION (STUDY)

COMPLETED: **89-06-15** TOTAL COST: **$13,947**

OBJECTIVES: TO DETERMINE TECHNOLOGICAL AND ECONOMIC FEASIBILITY OF INTRODUCING COMMERCIAL-SCALE FOOD IRRADIATION AND A LOCATION FOR THE PILOT IRRADIATION PLANT.

ACHIEVEMENTS: This project only consisted of provision of expert services, which was successfully completed. The Agency expert was to pave the way for a large-scale UNDP project (VEN/86/008) to be concerned with food irradiation on a commercial scale. His report formed the basis for a follow-up mission under an Agency interregional project (INT/0/045). Further action depends upon the response of the Venezuelan authorities.

■ VIE/0/003 NUCLEAR INFORMATION CENTRE

COMPLETED: **89-09-25** TOTAL COST: **$32,416**

OBJECTIVES: TO ESTABLISH A CENTRE FOR THE DISSEMINATION OF SCIENTIFIC INFORMATION ON THE PROGRESS OF NUCLEAR TECHNOLOGY (INIS SYSTEM).

ACHIEVEMENTS: Two experts were sent to the Viet Nam National Atomic Energy Institute to assist counterparts in setting up the Agency's INIS data base on Agency-supplied equipment. A short INIS training course was conducted for local staff. The project has greatly improved the library services and documentation at the research centre, and it has led to routine dissemination of scientific information regarding recent advances in nuclear technology.

■ VIE/0/004 PREPARATORY STUDIES FOR A NUCLEAR POWER PROJECT

COMPLETED: **89-09-28** TOTAL COST: **$26,227**

OBJECTIVES: TO INITIATE PREPARATORY STUDIES FOR THE ESTABLISHMENT OF A NUCLEAR POWER PROGRAMME WITH SPECIAL REFERENCE TO ORGANIZATION, INFRASTRUCTURE, LEGAL FRAMEWORK AND NUCLEAR REGULATIONS.

ACHIEVEMENTS: In 1986, a pre-project mission visited Viet Nam to study the energy situation, the feasibility of introducing nuclear power, to apprise the authorities regarding manpower development, and to make recommendations for future action. In line with these, in 1987, funded from the Reserve Fund, an expert mission was sent to initiate studies for the establishment of a nuclear power programme, focusing on organizational aspects, infrastructure, legal framework and regulations. Computers were provided for the studies started by the expert missions. A further mission in 1988 was concerned with the regulatory framework for nuclear safety in connection with the above. National authorities have now requested the continuation of manpower training in allied fields of nuclear power.

■ VIE/1/005 NUCLEAR PHYSICS (DALAT UNIVERSITY)

COMPLETED: **89-09-25** TOTAL COST: **$44,107**

OBJECTIVES: TO ESTABLISH A NUCLEAR PHYSICS LABORATORY WITH EMPHASIS ON TRAINING MANPOWER.

ACHIEVEMENTS: The University of Dalat, situated near the Dalat Nuclear Research Centre, requested the Agency to assist it in establishing a nuclear physics teaching laboratory to upgrade its nuclear physics programme. Expert services and appropriate equipment for the conduct of experimental work in nuclear

physics, both at the graduate and undergraduate levels, and three project-related fellowships for training abroad were granted. Collaboration with the Atomic Research Centre subsequently allowed some cooperative projects to be undertaken by students.

■ VIE/1/007 EXPERIMENTAL NUCLEAR PHYSICS

COMPLETED: **89-09-25** TOTAL COST: **$14,185**

OBJECTIVES: TO ORGANIZE A PROGRAMME OF ACADEMIC TRAINING IN NUCLEAR SCIENCE AND ENGINEERING.

ACHIEVEMENTS: The Agency has been supporting training in nuclear disciplines in Viet Nam at three academic institutions for some years. In view of the expected expansion of nuclear activities in the country, a three-member planning mission was sent to Hanoi to recommend and organize an intensified programme of academic training in the field of nuclear science and engineering. The strategy involved planning the upgrading of facilities for experimental nuclear physics at the universities offering the degree studies. In the light of the subsequent cancellation of the preparatory studies for nuclear power, the time-table for implementation of the recommendations is at present in abeyance.

■ VIE/2/003 RADIATION POLYMERIZATION

COMPLETED: **89-09-25** TOTAL COST: **$22,047**

OBJECTIVES: TO DEVELOP RADIATION POLYMERIZATION TECHNIQUES AND TO TRAIN RESEARCH STAFF.

ACHIEVEMENTS: The National Institute for Nuclear Research set up a radiation chemistry laboratory to undertake research on radiation-induced polymerization with a view to promoting industrial uses of this technique. The Institute has a cobalt-60 irradiation facility set up under a previous project VIE/5/008. Advanced training abroad was provided to two local staff under project-related fellowships, following an Agency expert visit to initiate the programme. The group has studied polymerization of methyl methacrylate, methylacrylate, styrene, and mixtures containing various unsaturated polyesters. Modification of synthetic and natural products was investigated (polyethylene and radiation-induced vulcanization of natural rubber latex). The work on wood/polymer composites to make durable wood-based products using cheaper varieties of timber (e.g. soft woods) is being applied in the production of durable loom shuttles that are being used in the textile factories in Ho Chi Minh City.

■ VIE/6/011 RADIOISOTOPES IN MEDICINE

COMPLETED: **89-09-28** TOTAL COST: **$61,531**

OBJECTIVES: TO INITIATE ACTIVITIES IN RADIOPHARMACY, INCLUDING THE PREPARATION OF LOCALLY MADE KITS.

ACHIEVEMENTS: The Nuclear Medicine Department at the Bachmai Hospital, Hanoi, sought Agency assistance to improve its therapeutic services by initiating local preparation of radiopharmaceuticals, including production of radioimmunoassay kits. An Agency expert assisted in setting up the programme, including the use of technetium and indium generators and in-vivo kits for scintigraphy using the rectilinear scanner. With equipment and supplies provided under this project, a radioimmunoassay laboratory was established for hormone assay using locally produced isotopes. A quality control programme for nuclear medical instruments and radiopharmaceuticals was also initiated. Local training in nuclear medicine via special courses and national seminars was given to personnel from Hanoi, Hue, Ho Chi Minh and other provincial hospitals.

■ VIE/6/013 NUCLEAR MEDICINE (DALAT)

COMPLETED: **89-09-25** TOTAL COST: **$3,876**

OBJECTIVES: TO ASSIST IN ESTABLISHING A NUCLEAR MEDICINE LABORATORY.

ACHIEVEMENTS: A planning mission was undertaken to help establish a nuclear medicine laboratory at the Lam Dong Provincial Hospital in Dalat. Other medical centres in Hanoi, Hue and Ho Chi Minh City were later visited to study the feasibility of initiating activities in nuclear medicine there also. The recommendations of the planning and review mission are incorporated in several projects, viz. VIE/6/015 (Dalat), VIE/6/011 (Hanoi) and VIE/6/012 (Hue).

■ YUG/4/024 NUCLEAR POWER PLANT IN-SERVICE INSPECTION

COMPLETED: **89-08-15** TOTAL COST: **$498,197**

OBJECTIVES: TO INTRODUCE COMPUTER-CONTROLLED TECHNIQUES FOR IN-SERVICE INSPECTIONS.

ACHIEVEMENTS: The Institute for Electricity Generation Development and Research (Elektroprivredu) in Zagreb sought Agency assistance to develop its capability for in-service inspection of pressurized components, in particular welds, in nuclear power plants. An advanced computer system for data acquisition and signal processing was provided to support the in-service inspection programme, as was a remote-controlled manipulator for undertaking steam generator in-service inspections. Training and qualification of personnel has been one of the big achievements of the project, for which five project-funded fellowships were awarded. One project-funded and one project-related scientific visit were also made available. Periodic in-service inspections are now routinely being undertaken at the Krsko Nuclear Power Plant.

■ YUG/6/006 NUCLEAR TECHNIQUES IN MEDICINE

COMPLETED: **89-09-13** TOTAL COST: **$15,026**

OBJECTIVES: TO UPGRADE FACILITIES TO IMPROVE DIAGNOSTIC PROCEDURES FOR CARDIOVASCULAR DISORDERS.

ACHIEVEMENTS: The Department of Nuclear Medicine of the Institute of Oncology and the Institute of Cardiovascular Diseases, Novi Sad, have for several years been collaborating in the study of cardiovascular diseases. The Agency was requested to assist in upgrading the Department's capability in non-invasive methods of diagnosis. With extrabudgetary funding provided by the Federal Republic of Germany, the Institutes were provided with a Vanderbilt Dynamic Cardiac Phantom and a computer system for biomedical analysis. These items have made it possible for the two Institutes to use advanced diagnostic techniques to evaluate patients suffering coronary heart disease.

■ ZAI/1/002 ANALYTICAL SUPPORT

COMPLETED: **89-08-16** TOTAL COST: **$35,109**

OBJECTIVES: TO STRENGTHEN THE CAPABILITY OF THE LABORATORY FOR SAMPLE PREPARATION AND SAMPLE ANALYSIS.

ACHIEVEMENTS: The Central Analytical Laboratory of the Kinshasa Regional Nuclear Centre provides a variety of analytical services in support of various regional activities. The Agency was requested to assist it to upgrade its facilities by providing equipment and spare parts, in particular to strengthen its capability for sample preparation and sample analysis. The equipment is being fully utilized in the course of routine analytical services being provided to the various departments of the Centre.

■ ZAI/6/005 NUCLEAR MEDICINE

COMPLETED: **89-11-17** TOTAL COST: **$9,372**

OBJECTIVES: TO UPGRADE AND REPLACE DEFECTIVE NUCLEAR MEDICAL EQUIPMENT.

ACHIEVEMENTS: The project provided the Department of Nuclear Medicine of the Kinshasa Regional Nuclear Research Centre with spare parts and electronic components to upgrade various items of medical equipment available to the Department. In addition, a calibrator to replace an old one that did not function was also provided. The project has permitted the Department to improve the quality and to increase the number of assays performed on a routine basis for thyroid and thyroid-related diseases.

■ ZAM/5/016 FOOD PRESERVATION TO REDUCE POST-HARVEST LOSSES

COMPLETED: **89-09-13** TOTAL COST: **$57,227**

OBJECTIVES: TO REDUCE POST-HARVEST LOSSES OF LOCAL CROPS AND TO EXTEND THE SHELF-LIFE OF FOODSTUFFS BY MEANS OF GAMMA IRRADIATION.

ACHIEVEMENTS: The Government of Zambia has invested in a gamma irradiation facility for pilot-scale studies on food preservation, on sterilization of pharmaceutical products and on the production of radiation-vulcanized natural latex for the manufacture of surgical rubber gloves. In support of the national programme in food preservation, the Agency has provided the Food Technology Research Unit of the National Council for Scientific Research with equipment and expert services for pilot-scale studies on food irradiation by gamma ir-

radiation. Parameters being studied include radiation resistance of insect pests and microorganisms. The local team comprises a food chemist, a biochemist, two microbiologists and a physicist trained in radiation safety. The team is undertaking pilot-scale experiments on the use of gamma irradiation to prolong the shelf-life of perishable foods such as strawberries, potatoes and onions, and to disinfest maize and beans. Potential commercial users of food irradiation are being advised on the economic feasibility of the various technologies.

■ ZIM/9/002 FELLOWSHIP TRAINING IN RADIATION PROTECTION

COMPLETED: **89-09-07** TOTAL COST: **$17,981**

OBJECTIVES: TO PROVIDE TRAINING IN RADIATION PROTECTION IN PREPARATION FOR THE ESTABLISHMENT OF A RADIATION PROTECTION SERVICE.

ACHIEVEMENTS: In response to a Government request, three fellowships were provided for advanced training in radiation protection. Two Zimbabweans were trained in radiation protection at the Agency's Radiation Protection Services Section, Vienna, while the national co-ordinator for IAEA matters in Zimbabwe had one month of training in Vienna, familiarizing himself with radiation protection and related procedures, including matters pertaining to "overall" programming. This training provided manpower support for the current Radiation Protection project ZIM/9/003.

IMPLEMENTATION SUMMARY I
ALL FUNDS *

	Adjusted programme	Share of total programme	New obligations	Implementation rate	Earmarkings
	($)	(%)	($)	(%)	($)
Current year					
Area breakdown					
Africa	12,722,890	19.1	6,799,901	53.4	5,922,989
Asia & Pacific	19,083,751	28.6	10,740,207	56.3	8,343,544
Latin America	15,155,980	22.7	10,116,309	66.7	5,039,670
Middle East & Europe	14,222,118	21.3	6,568,815	46.2	7,653,303
Interregional	4,618,602	6.9	2,718,211	58.9	1,900,390
Global	916,611	1.4	728,880	79.5	187,732
Total	**66,719,952**	**100.0**	**37,672,323**	**56.5**	**29,047,628**
Component breakdown					
Experts	16,101,763	24.1	7,768,737	48.2	8,333,025
Equipment	30,532,933	45.8	17,607,301	57.7	12,925,631
Fellowships	9,598,595	14.4	5,988,424	62.4	3,610,171
Training Courses	8,291,586	12.4	4,994,245	60.2	3,297,342
Sub-contracts	1,654,629	2.5	806,811	48.8	847,818
Miscellaneous	540,446	0.8	506,805	93.8	33,641
Total	**66,719,952**	**100.0**	**37,672,323**	**56.5**	**29,047,628**
Fund breakdown					
TACF	48,867,916	73.2	28,320,331	58.0	20,547,585
UNDP	4,427,249	6.6	3,105,808	70.2	1,321,440
Extrabudgetary	12,510,654	18.8	5,842,863	46.7	6,667,791
Funds in trust	914,133	1.4	403,321	44.1	510,812
Total	**66,719,952**	**100.0**	**37,672,323**	**56.5**	**29,047,628**
Current and future years					
Current	66,719,952	62.6	37,672,323	56.5	29,047,628
Future	39,856,513	37.4	3,102,057	7.8	36,754,457
Total	**106,576,465**	**100.0**	**40,774,380**		**65,802,085**

* As at 31 December 1989.

IMPLEMENTATION SUMMARY II
TECHNICAL ASSISTANCE AND CO-OPERATION FUND *

	Adjusted programme	Share of total programme	New obligations	Implementation rate	Earmarkings
	($)	(%)	($)	(%)	($)
Current year					
Area breakdown					
Africa	10,383,864	21.2	5,950,411	57.3	4,433,454
Asia & Pacific	13,134,511	26.9	6,987,522	53.2	6,146,989
Latin America	9,669,090	19.8	6,792,994	70.3	2,876,096
Middle East & Europe	10,489,171	21.5	5,273,513	50.3	5,215,657
Interregional	4,346,958	8.9	2,598,901	59.8	1,748,057
Global	844,322	1.7	716,990	84.9	127,332
Total	**48,867,916**	**100.0**	**28,320,331**	**58.0**	**20,547,585**
Component breakdown					
Experts	11,592,696	23.7	5,636,417	48.6	5,956,280
Equipment	22,303,736	45.7	13,306,913	59.7	8,996,823
Fellowships	7,978,457	16.3	4,981,507	62.4	2,996,949
Training courses	6,123,485	12.5	3,633,577	59.3	2,489,908
Sub-contracts	382,926	0.8	279,835	73.1	103,090
Miscellaneous	486,616	1.0	482,082	99.1	4,535
Total	**48,867,916**	**100.0**	**28,320,331**	**58.0**	**20,547,585**
Currency breakdown					
Convertible	38,847,697	79.5	23,778,572	61.2	15,069,125
Non-convertible	10,020,219	20.5	4,541,759	45.3	5,478,460
Total	**48,867,916**	**100.0**	**28,320,331**	**58.0**	**20,547,585**
Current and future years					
Current	48,867,916	55.7	28,320,331	58.0	20,547,585
Future	38,894,263	44.3	2,924,636	7.6	35,969,627
Total	**87,762,179**	**100.0**	**31,244,967**		**56,517,212**

* As at 31 December 1989.

IMPLEMENTATION SUMMARY IIIA
ALL FUNDS BY DEPARTMENT AND DIVISION *

	Adjusted programme	Share of total programme	New obligations	Implementation rate	Earmarkings
	($)	(%)	($)	(%)	($)
Current year					
DEPARTMENT OF RESEARCH AND ISOTOPES					
Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture	10,761,415	16.1	5,965,074	55.4	4,796,341
Division of Life Sciences	8,515,120	12.8	4,971,604	58.4	3,543,517
Division of Physical and Chemical Sciences	21,557,782	32.3	11,137,600	51.7	10,420,181
The Agency's Laboratories	3,712,870	5.6	2,052,981	55.3	1,659,889
Sub-total	**44,547,187**	**66.8**	**24,127,259**	**54.2**	**20,419,928**
DEPARTMENT OF NUCLEAR ENERGY AND SAFETY					
Division of Nuclear Safety	10,215,090	15.3	5,392,220	52.8	4,822,869
Division of Nuclear Power	3,424,448	5.1	1,801,150	52.6	1,623,299
Division of Scientific and Technical Information	246,656	0.4	125,618	50.9	121,037
Division of Nuclear Fuel Cycle and Waste Management	3,172,656	4.7	1,971,837	62.2	1,200,820
Sub-total	**17,058,850**	**25.5**	**9,290,825**	**54.5**	**7,768,025**
DEPARTMENT OF ADMINISTRATION					
Legal Division	19,654	0.0	8,433	42.9	11,220
DEPARTMENT OF SAFEGUARDS					
Division of Operations A	99,352	0.2	81,650	82.2	17,703
Division of Development and Technical Support	8,464	0.0	7,923	93.6	540
Sub-total	**107,816**	**0.2**	**89,573**	**83.1**	**18,243**
DEPARTMENT OF TECHNICAL CO-OPERATION					
Department of Technical Co-operation	350,058	0.5	205,182	58.6	144,875
Division of Technical Co-operation Programmes	3,719,776	5.6	3,222,171	86.6	497,606
Sub-total	**4,069,834**	**6.1**	**3,427,353**	**84.2**	**642,481**
GLOBAL					
Not distributed by Department	916,611	1.4	728,880	79.5	187,731
GRAND TOTAL	**66,719,952**	**100.0**	**37,672,323**	**56.5**	**29,047,628**

* As at 31 December 1989

IMPLEMENTATION SUMMARY IIIB
IMPLEMENTATION AGAINST FUTURE YEARS
ALL FUNDS BY DEPARTMENT AND DIVISION *

	Adjusted programme	Share of total programme	New obligations	Implementation rate	Earmarkings
	($)	(%)	($)	(%)	($)
Future years					
DEPARTMENT OF RESEARCH AND ISOTOPES					
Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture	6,032,266	15.1	155,429	2.6	5,876,837
Division of Life Sciences	4,584,887	11.5	524,362	11.4	4,060,525
Division of Physical and Chemical Sciences	14,261,561	35.8	1,194,022	8.4	13,067,539
The Agency's Laboratories	1,586,341	4.0	47,446	3.0	1,538,895
Sub-total	**26,465,055**	**66.4**	**1,921,259**	**7.3**	**24,543,796**
DEPARTMENT OF NUCLEAR ENERGY AND SAFETY					
Division of Nuclear Safety	4,475,581	11.2	324,598	7.3	4,150,983
Division of Nuclear Power	2,007,992	5.1	3,408	0.2	2,004,584
Division of Scientific and Technical Information	121,100	0.3	2,657	2.2	118,443
Division of Nuclear Fuel Cycle and Waste Management	1,687,862	4.2	121,127	7.2	1,566,735
Sub-total	**8,292,535**	**20.8**	**451,790**	**5.4**	**7,840,745**
DEPARTMENT OF ADMINISTRATION					
Legal Division	80,000	0.2	0	0.0	80,000
DEPARTMENT OF SAFEGUARDS					
Division of Operations A	71,550	0.2	0	0.0	71,550
Sub-total	**71,550**	**0.2**	**0**	**0.0**	**71,550**
DEPARTMENT OF TECHNICAL CO-OPERATION					
Department of Technical Co-operation	340,000	0.9	0	0.0	340,000
Division of Technical Co-operation Programmes	4,607,373	11.6	729,008	15.8	3,878,365
Sub-total	**4,947,373**	**12.4**	**729,008**	**14.7**	**4,218,365**
GRAND TOTAL	**39,856,513**	**100.0**	**3,102,057**	**7.8**	**36,754,457**

* As at 31 December 1989.

Explanatory Notes to Figures

Figure 1. Resources available for Agency technical co-operation programmes: 1983-1989

This figure shows all resources made available to the Agency for technical co-operation activities from all funds for the programme years 1983-89. Amounts given for UNDP resources correspond to total claims against UNDP resources for projects implemented 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 1983-89 include resources made available by the UNDP-administered United Nations Fund for Science and Technology for Development and, starting in 1984, those for projects for which the IAEA acts as associated agency. Amounts shown as extrabudgetary funds refer to resources made available for activities planned for execution in the year shown. Adjustments to prior-year amounts can therefore take place in this category when planned activities are cancelled. 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 area: 1989

This figure shows, by component and by Agency programme area, the distribution of all assistance provided in 1989, 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 area and their costs are accounted for accordingly.

Figure 3. Disbursements by programme component: 1980-1989

The total assistance provided during the ten year period 1980-1989 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: 1989

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: 1989

Total disbursements for equipment, grouped by origin and recipient regions, are shown in this figure; individual recipient countries are shown in Table 7. The list at the bottom of the page excludes countries in which the total purchase volume was less than $20,000.

Figure 6. Summary data on training programmes: 1989

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: 1989

This figure, which refers only to the Technical Assistance and Co-operation Fund, gives total disbursements for 1989 broken down by region and for convertible and non-convertible currencies.

Figure 8. Distribution of technical co-operation disbursements by Agency programme area and region: 1989

The pie charts indicate the relative shares of each Agency programme area per region, while the table below the figure gives actual amounts.

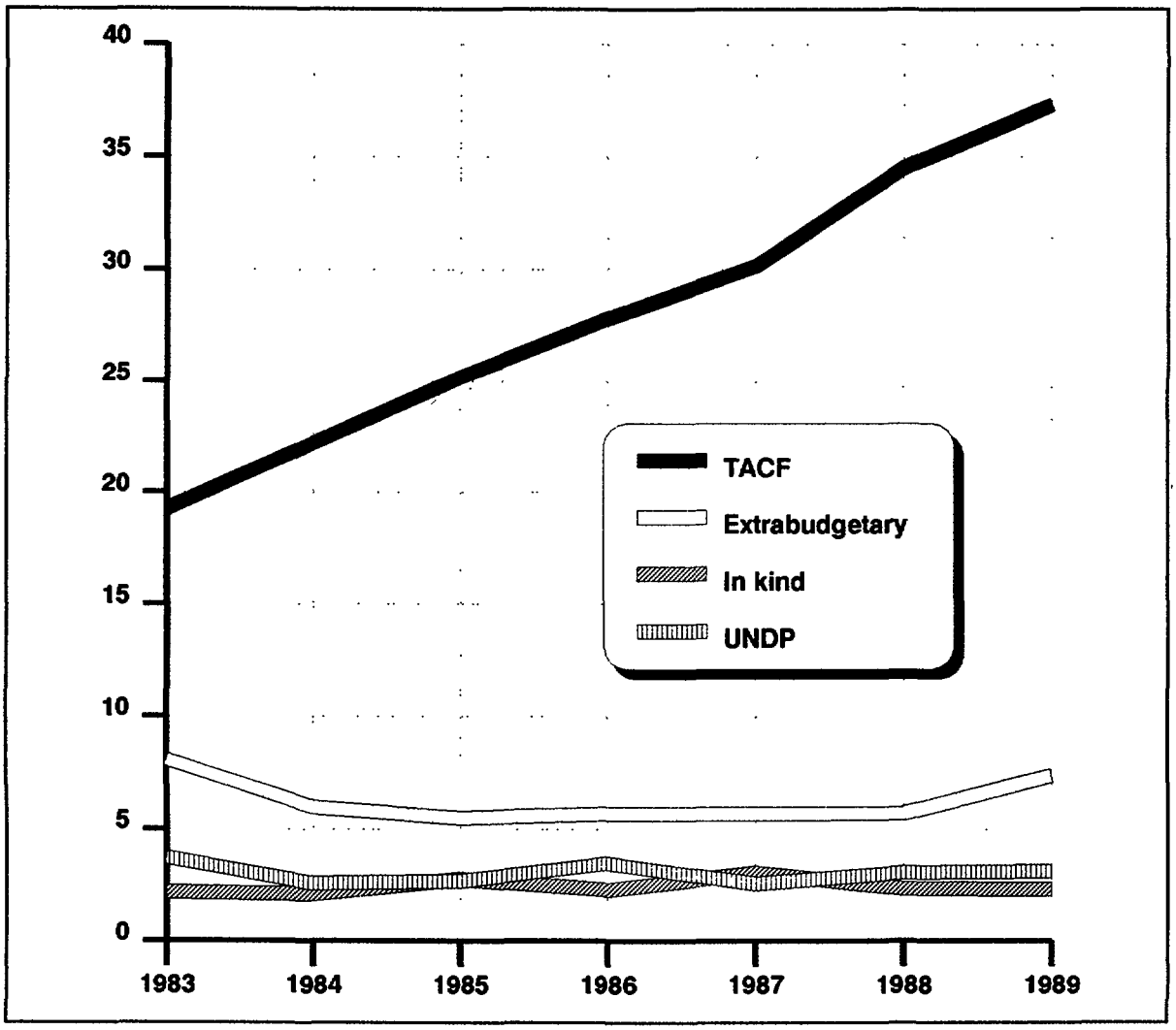
Figure 9. Distribution of technical co-operation disbursements by source and region: 1989

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

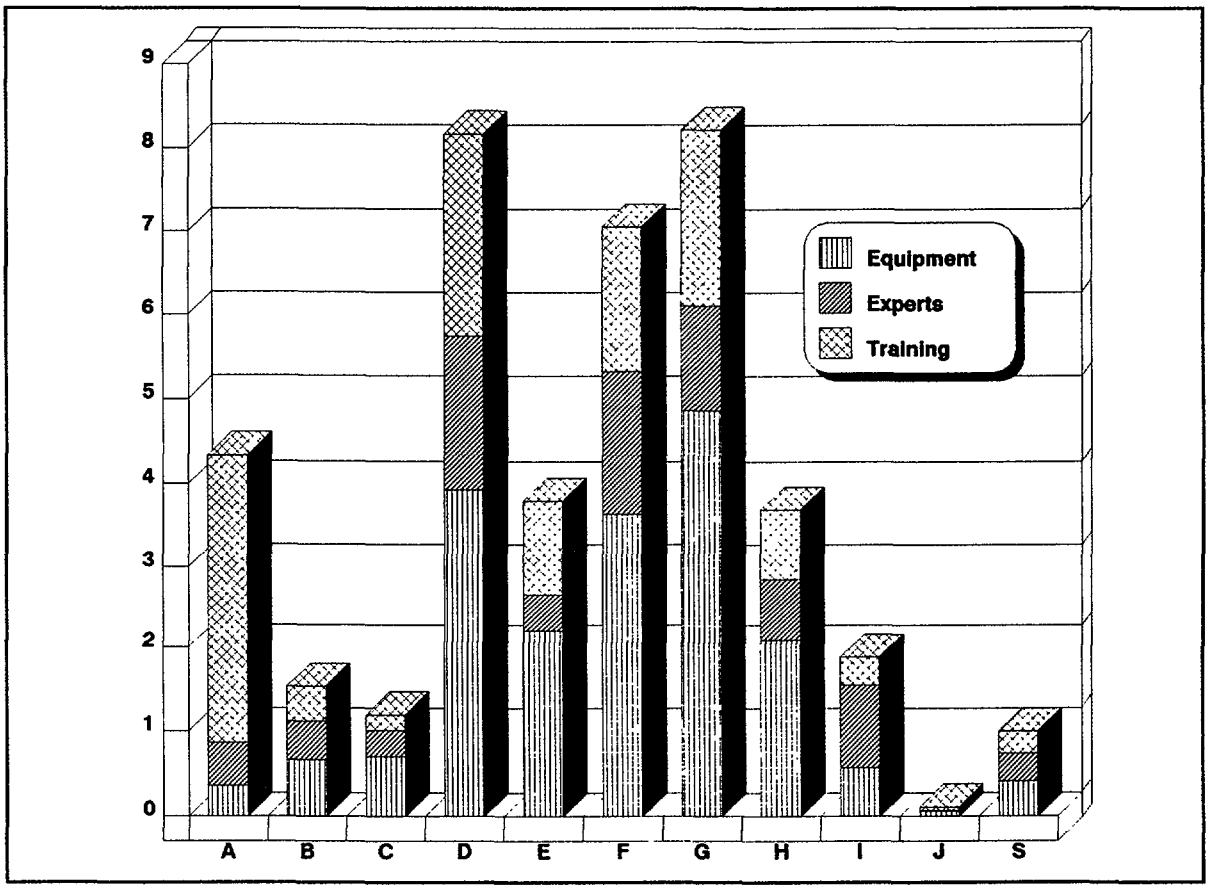
The bar chart shows, over a ten-year period, the total resources available to the Technical Assistance and Co-operation Fund year by year - each year including the unobligated and unspent funds of prior years - as well as the disbursements and obligations incurred against these resources as at 31 December of each year. Obligations incurred against future years for approved multi-year projects are shown separately, reflecting the status at the end of 1989. 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
(in millions of dollars)



TACF	19.241	22.232	25.197	27.860	30.153	34.510	37.312
Extra-budgetary funds	8.101	5.964	5.484	5.702	5.700	5.710	7.375
Assistance in kind	2.172	2.066	2.765	2.282	3.066	2.322	2.295
UNDP	3.706	2.541	2.654	3.480	2.568	3.051	3.106
TOTAL	33.220	32.803	36.100	39.324	41.487	45.593	50.088

FIGURE 2
DISBURSEMENTS BY AAPC: 1989
(in millions of dollars)



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

FIGURE 3
DISBURSEMENTS BY COMPONENT: 1980-1989
(in millions of dollars)

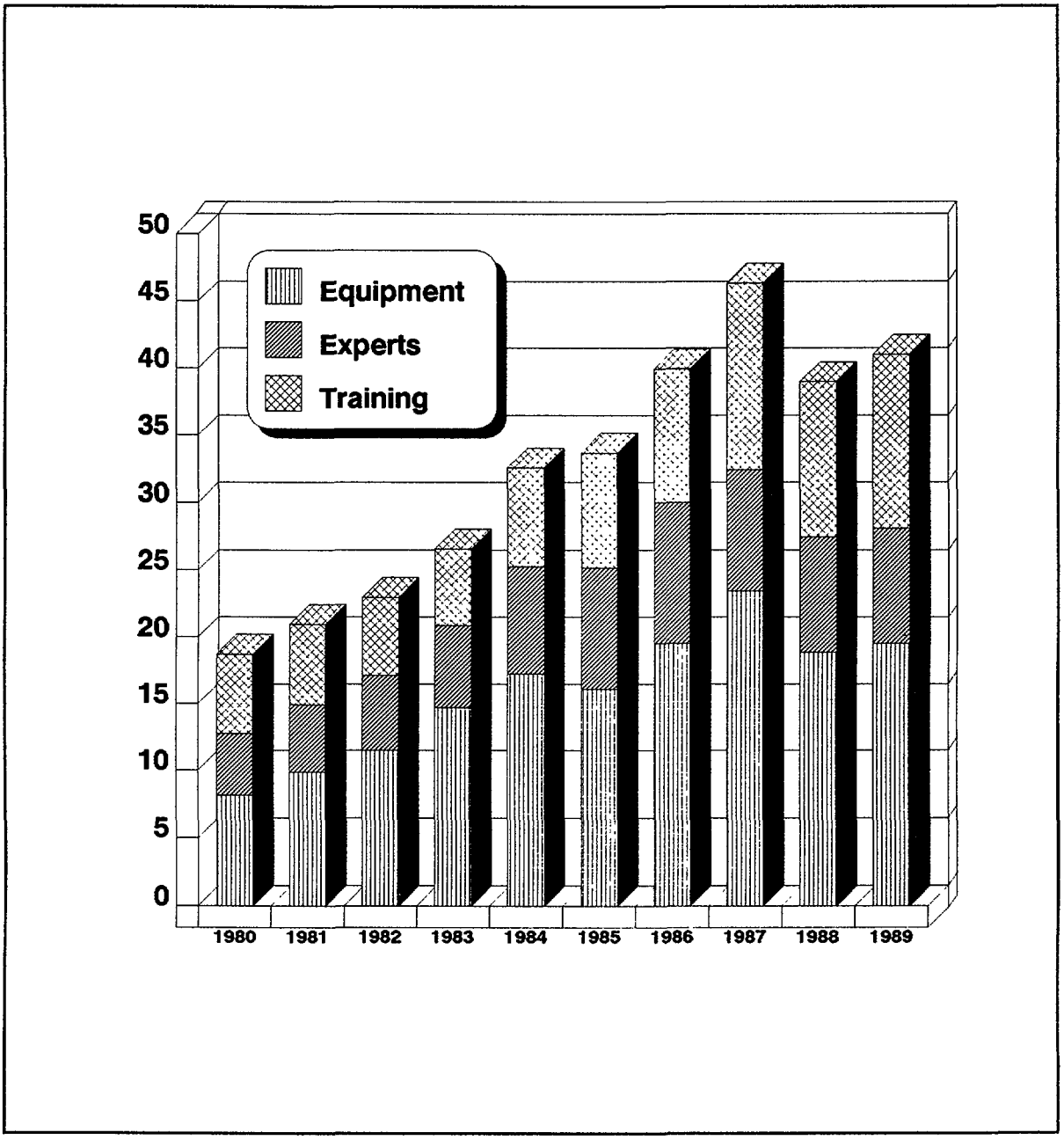


FIGURE 4
TECHNICAL CO-OPERATION
PERSONNEL SERVICES BY REGION: 1989

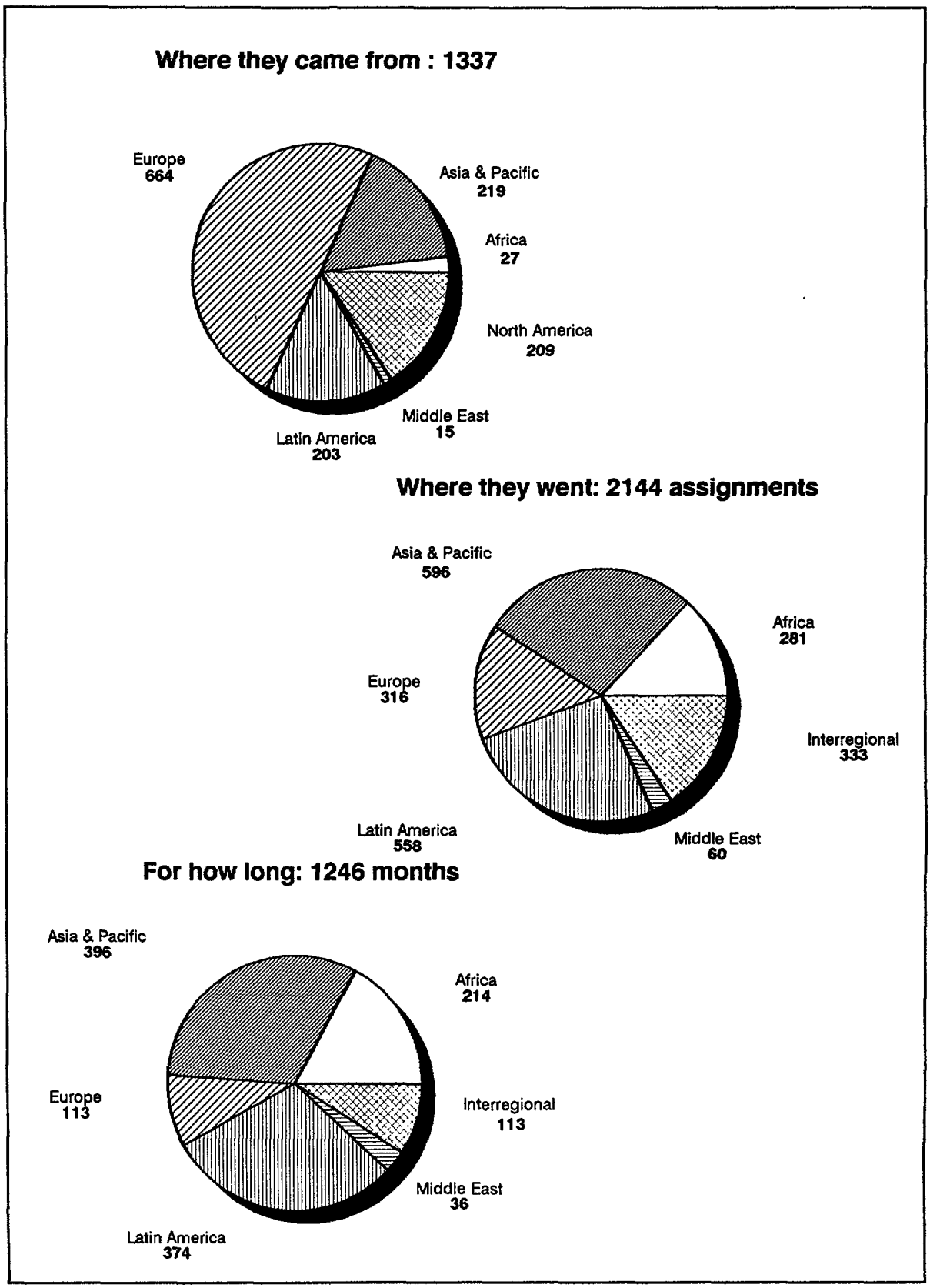
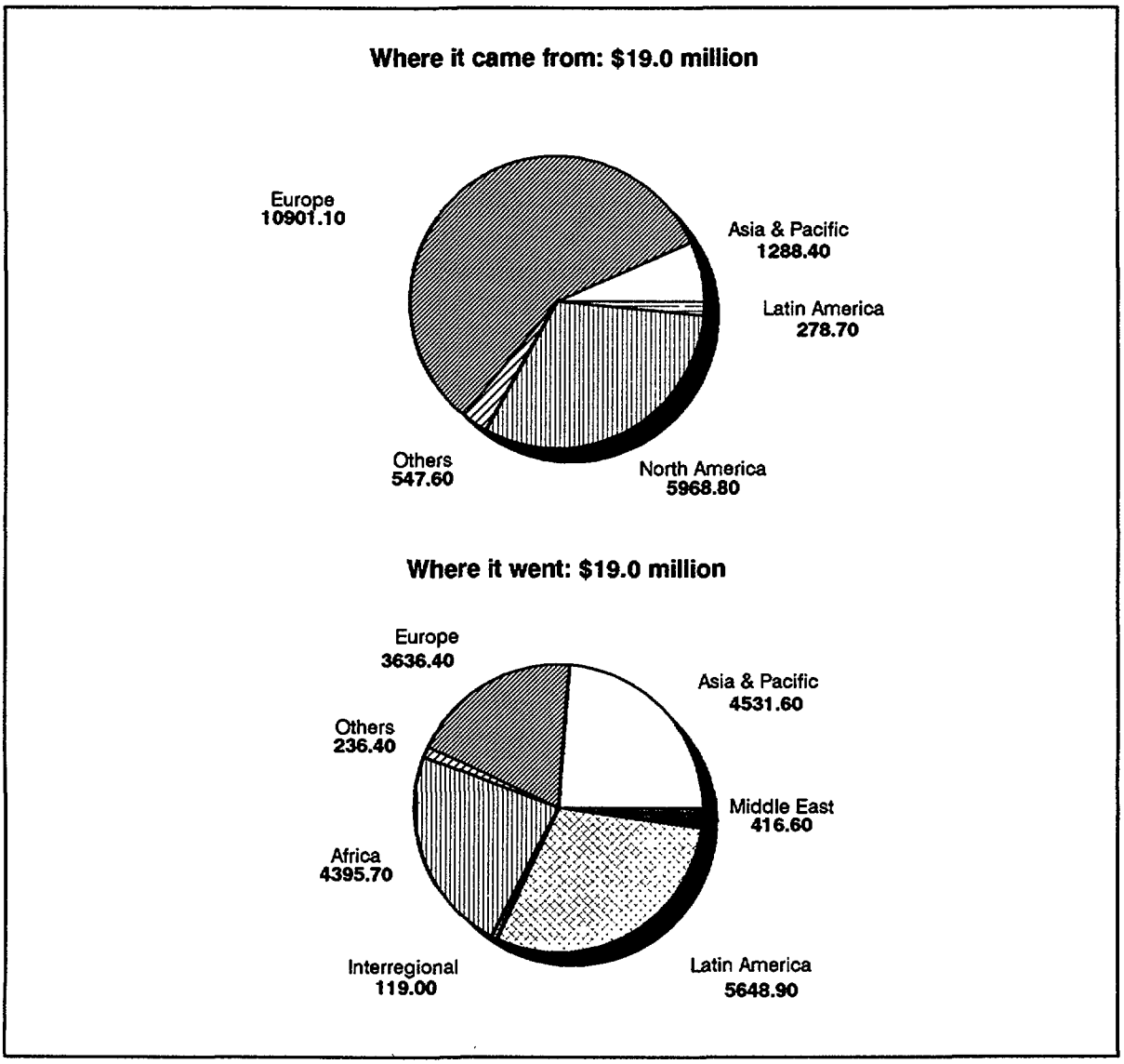


FIGURE 5
DISTRIBUTION OF EQUIPMENT DISBURSEMENTS
BY REGION: 1989
(in thousands of dollars)



Where equipment was purchased:

Australia	222	**Hungary**	475
Austria	699	**Italy**	68
Brazil	234	**Japan**	428
Canada	198	**Luxembourg**	192
China	363	**Netherlands**	138
Czechoslovakia	286	**Poland**	210
Denmark	196	**Spain**	67
Finland	151	**Sweden**	90
France	730	**UK**	2,323
German D.R.	568	**USA**	5,771
Germany, F.R.	2,434	**USSR**	2,106
Hong Kong	71		

FIGURE 6
SUMMARY DATA ON TRAINING PROGRAMMES: 1989

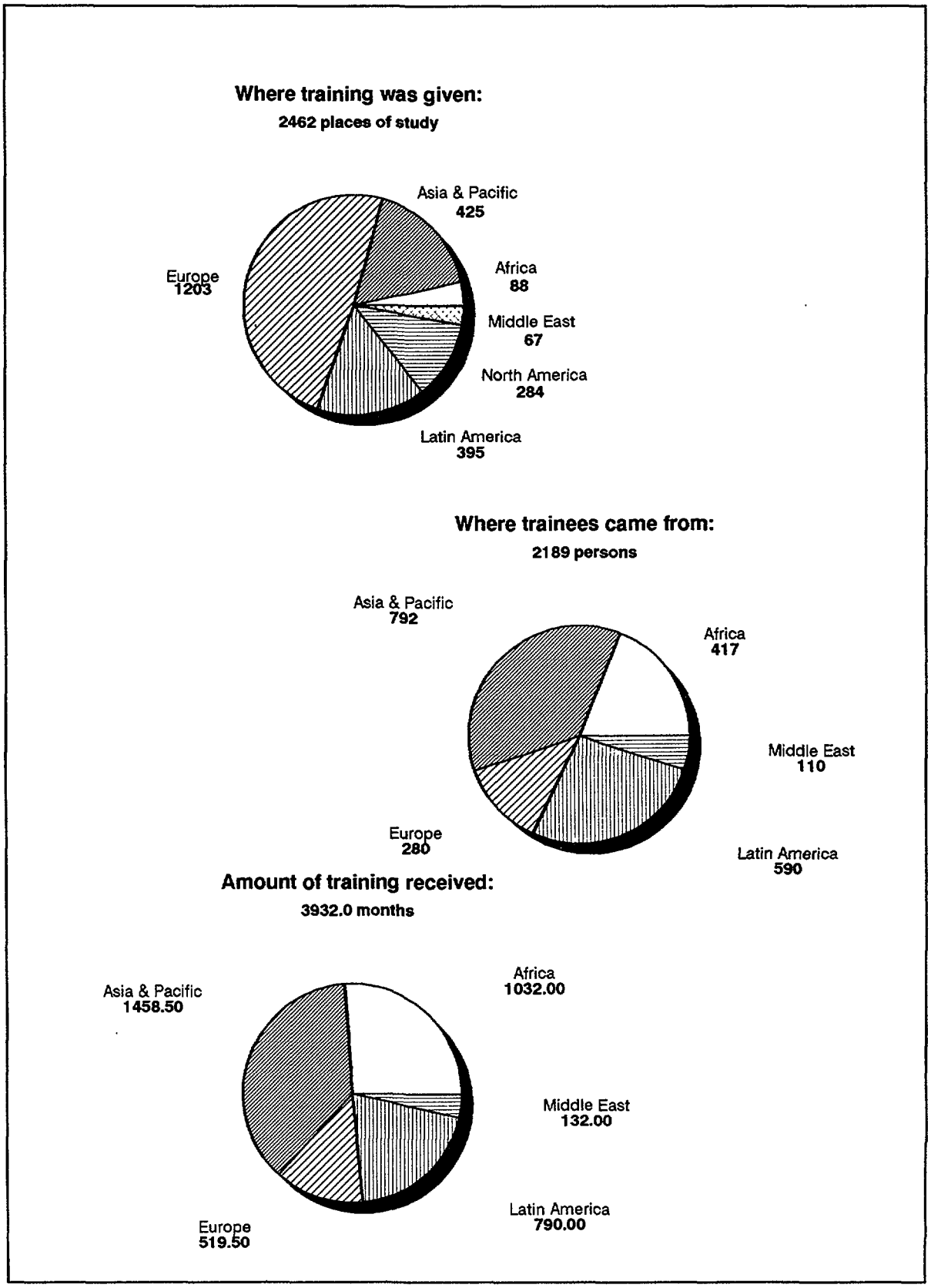
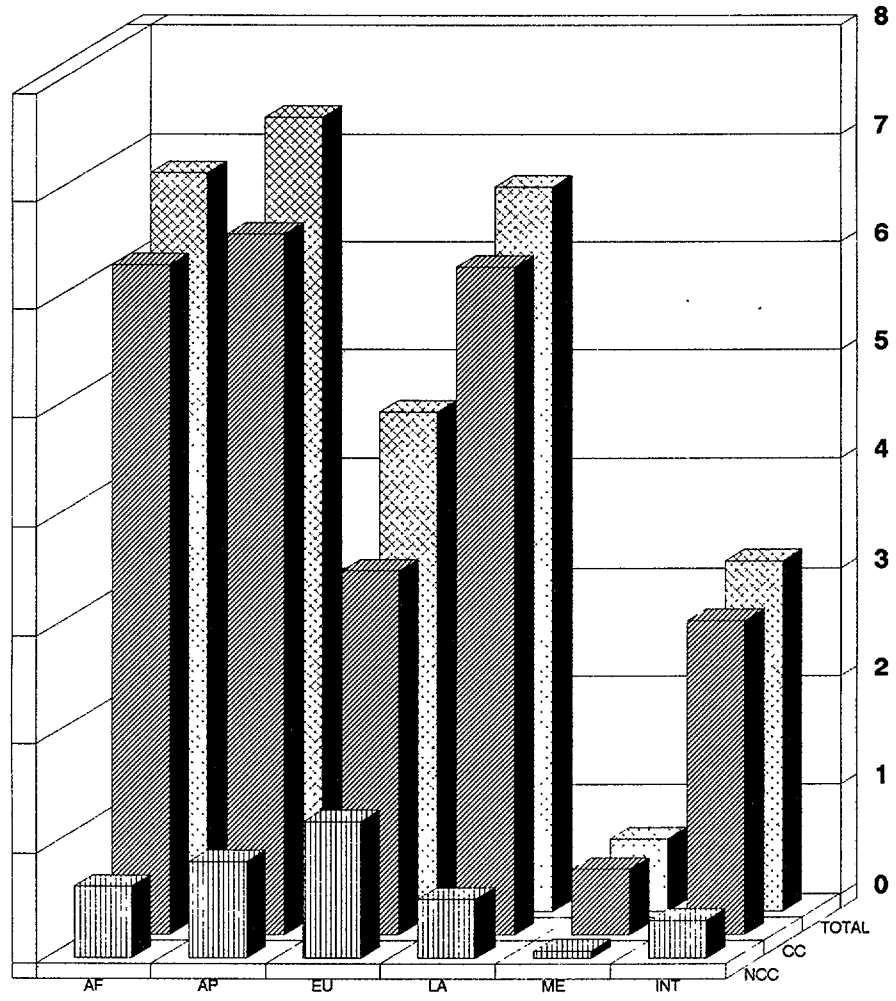
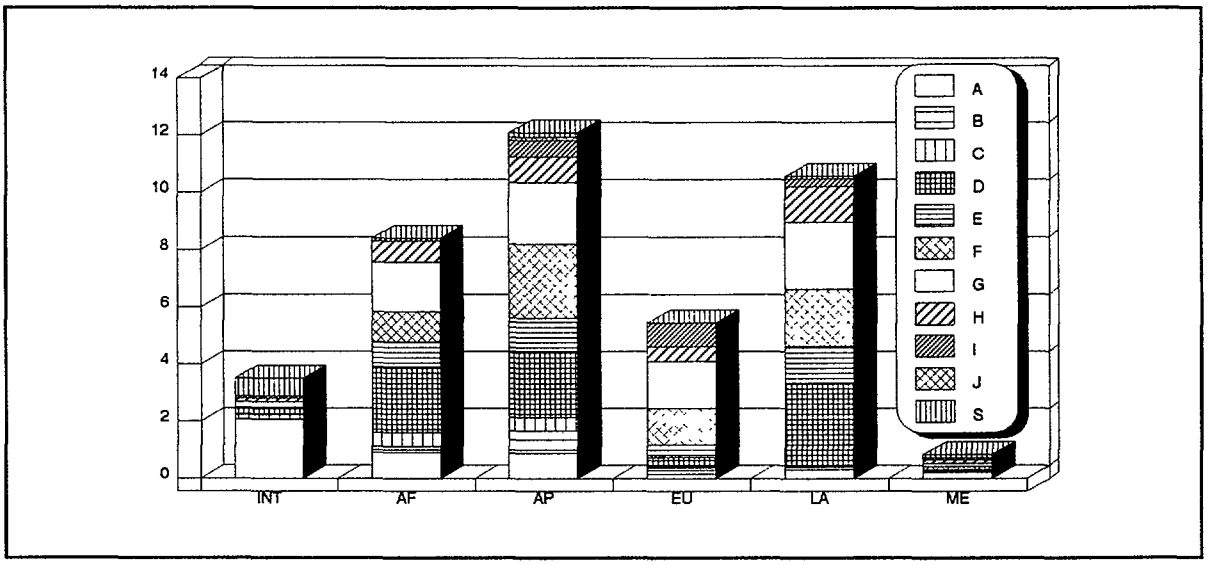


FIGURE 7
TECHNICAL ASSISTANCE AND CO-OPERATION FUND DISBURSEMENTS BY TYPE OF CURRENCY AND REGION: 1989



AF = Africa
AP = Asia and the Pacific
EU = Europe
LA = Latin America
ME = Middle East
INT = Interregional

FIGURE 8
TECHNICAL ASSISTANCE AND CO-OPERATION
DISBURSEMENTS BY AAPC: 1989



AAPC	Interregional	Africa	Asia & Pacific	Europe	Latin America	Middle East
A	2,077.8	910.8	879.5	159.7	316.6	1.2
B	0.0	201.7	804.7	225.2	82.7	224.0
C	158.5	503.3	461.5	28.9	42.7	0.0
D	218.4	2,322.2	2,313.2	351.7	2,929.2	35.3
E	2.8	878.5	1,170.4	435.0	1,265.5	57.1
F	40.8	1,045.4	2,571.8	1,285.8	2,018.8	100.8
G	205.7	1,727.0	2,172.2	1,659.7	2,327.9	130.9
H	133.2	746.7	895.3	521.9	1,267.6	135.2
I	76.5	83.0	581.9	827.8	263.0	65.3
J	0.0	0.0	112.7	0.0	0.1	0.0
S	625.4	6.8	165.5	1.5	95.3	113.3

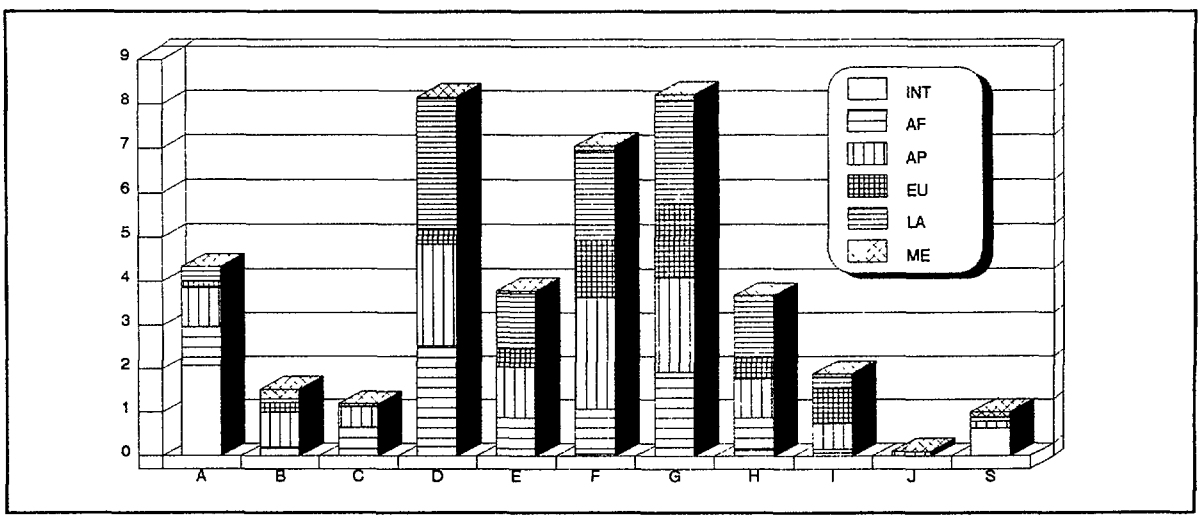


FIGURE 9
DISTRIBUTION OF TECHNICAL CO-OPERATION DISBURSEMENTS BY SOURCE AND REGION: 1989
(In thousands of dollars)

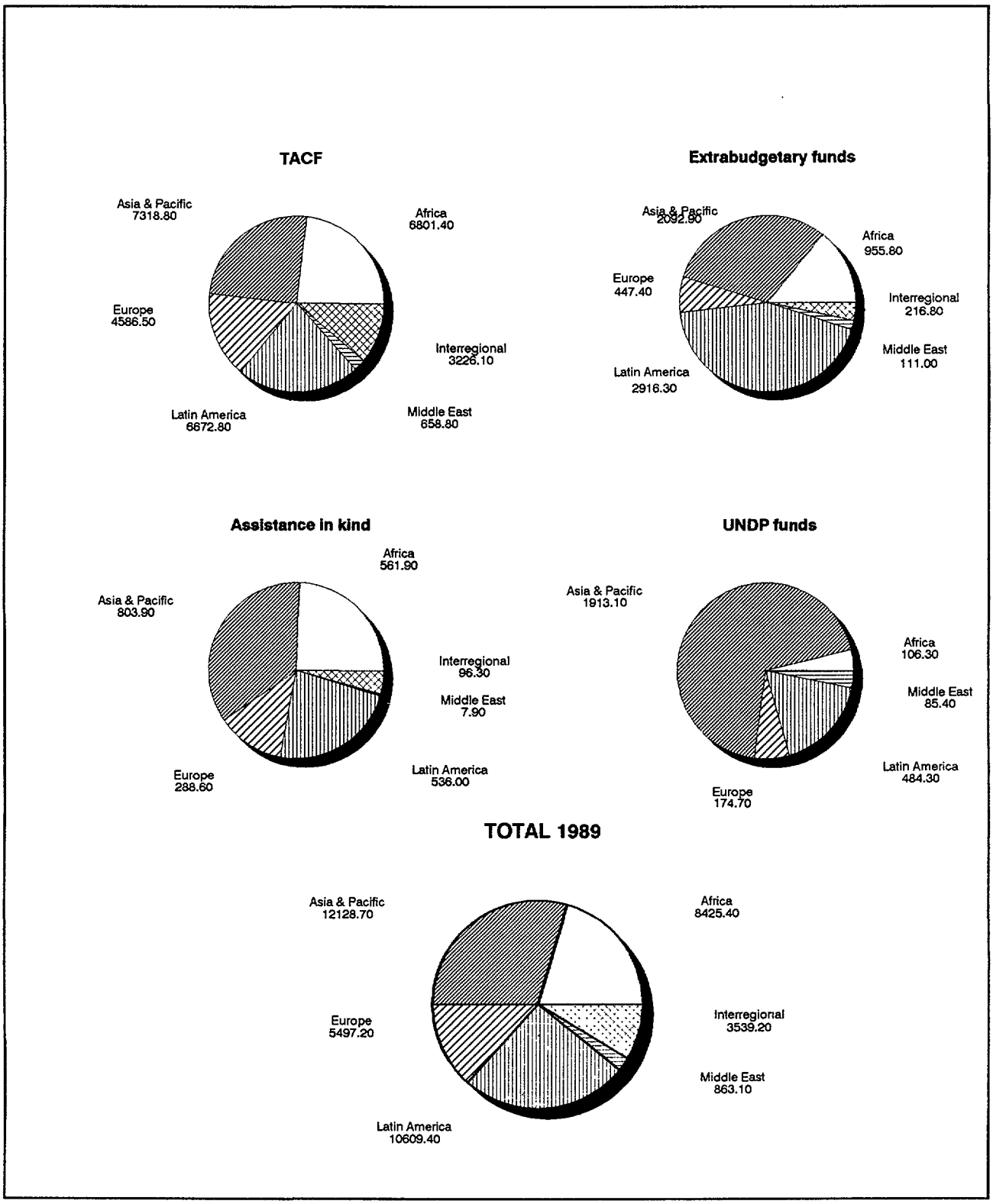
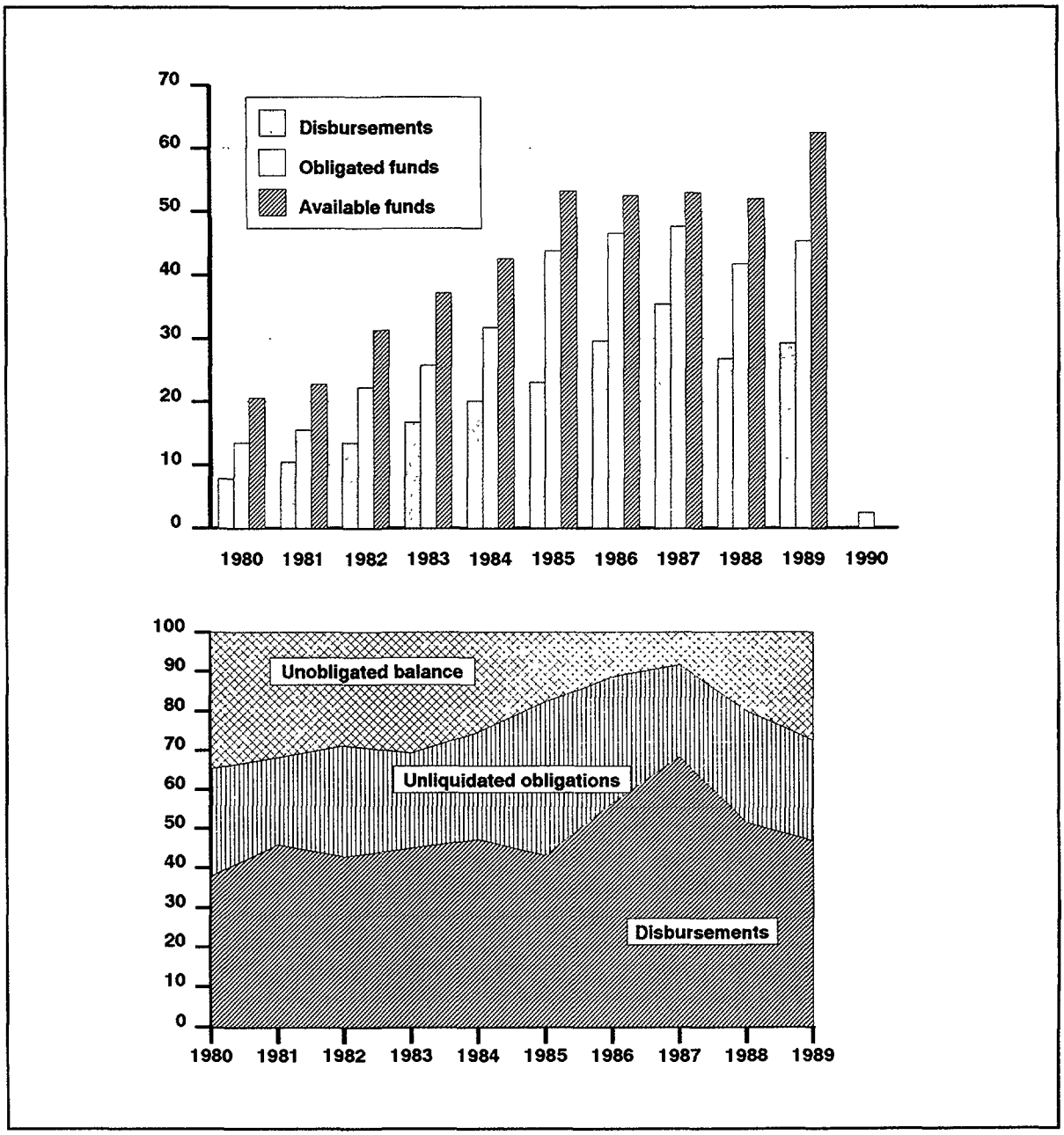


FIGURE 10
UTILIZATION OF THE TECHNICAL ASSISTANCE AND CO-OPERATION FUND
(status at year-end)



Values in upper figure expressed in millions of dollars.
Values in lower figure expressed in per cent.

Explanatory Notes to Tables

Table 1. Available resources: 1980-1989

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.

Table 2. Technical Assistance and Co-operation Fund: 1980-1989

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 1989). It should be noted that, in this table, voluntary contributions are shown not by the year in which they became available but for the programme year for which they are pledged. The graphic presentation below it shows, for a ten-year period, the percentages 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: 1989

This table shows the number of individuals, both international and national, who undertook technical co-operation assignments during 1989. They came from 81 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 number of such staff involved are given in the footnote.

Table 3B. Trainees in the field by place of study: 1989

A breakdown is given for trainees (fellows, training course participants and visiting scientists) based on the place of study. There were 69 places of study involved.

Table 4. Distribution of technical co-operation disbursements by type: 1985-1989

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 (in column 10) the balance for assistance in kind. This balance represents the estimated value of man-months of training beyond the end of 1989 for fellows who had already started their studies in 1989. "Miscellaneous" refers to disbursements in all components for telex charges, health insurance, copying fees and for other minor items or services. In 1989, it also included a charge for radiation protection services.

Table 5. Extrabudgetary funds for technical co-operation activities by donor as at 31 December 1989

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.

Table 6A. Technical co-operation personnel services: 1989

A list is given of 79 recipient countries showing the number of assignments undertaken and man-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: 1989

The list shows the 91 recipient countries, number of trainees and the total man-months of training received in 1989.

Table 7. Financial summary: 1989

This major table shows, by type of assistance and by source, the total technical assistance furnished to 81 countries as well as to intercountry projects and training courses.

Table 8. Financial summary: 1958-1989

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 1988 and 1989.

TABLE 1

AVAILABLE RESOURCES: 1980-1989
(in thousands of dollars)

Year	Technical Assistance and Co-operation Fund				Other resources				Grand total (1 + 5)
	Voluntary contributions		Miscellaneous income	Sub-total	Extrabudgetary funds	Assistance in kind	UNDP	Sub-total	
	Convertible currency	Non-convertible currency							
	(1a)	(1b)	(1c)	(1)	(2)	(3)	(4)	(5)	(6)
1980	7,977	2,083	572	10,632	2,669	2,628	5,018	10,315	20,947
1981	9,873	2,181	902	12,956	3,519	2,788	5,186	11,493	24,449
1982	12,112	2,789	1,102	16,003	4,413	2,493	4,631	11,537	27,540
1983	14,169	3,447	1,625	19,241	8,101	2,172	3,706	13,979	33,220
1984	17,213	3,524	1,495	22,232	5,964	2,066	2,541	10,571	32,803
1985	19,282	3,976	1,939	25,197	5,484	2,765	2,654	10,903	36,100
1986	21,348	5,431	1,081	27,860	5,702	2,282	3,480	11,464	39,324
1987	24,571	5,178	404	30,153	5,700	3,066	2,568	11,334	41,487
1988	26,889	5,854	1,767	34,510	5,710	2,322	3,051	11,086	45,593
1989	29,223	6,458	1,631	37,312	7,375	2,295	3,106	12,776	50,088
1980-1989	**182,657**	**40,921**	**12,518**	**236,096**	**54,637**	**24,877**	**35,941**	**115,455**	**351,551**

TABLE 2

TECHNICAL ASSISTANCE AND CO-OPERATION FUND: 1980-1989

Programme year	Target for voluntary contributions to the Technical Assistance and Co-operation Fund	Amount pledged	Per cent of target pledged	Income available for technical co-operation programmes	Income as per cent of target
1980	10,500,000	10,059,733	95.8	10,632,033	101.3
1981	13,000,000	12,054,910	92.7	12,956,894	99.7
1982	16,000,000	14,901,346	93.1	16,003,198	100.0
1983	19,000,000	17,621,272	92.7	19,246,803	101.3
1984	22,500,000	20,735,931	92.2	22,231,347	98.8
1985	26,000,000	23,311,501	89.7	25,250,382	97.1
1986	30,000,000	26,732,785	89.1	27,813,735	92.7
1987	34,000,000	29,768,762	87.6	30,172,431	88.7
1988	38,000,000	32,710,534	86.1	34,478,116	90.7
1989	42,000,000	35,680,915	85.0	37,308,905	88.8

PLEDGES AND INCOME TO THE TACF: 1980 -1989

(in per cent)

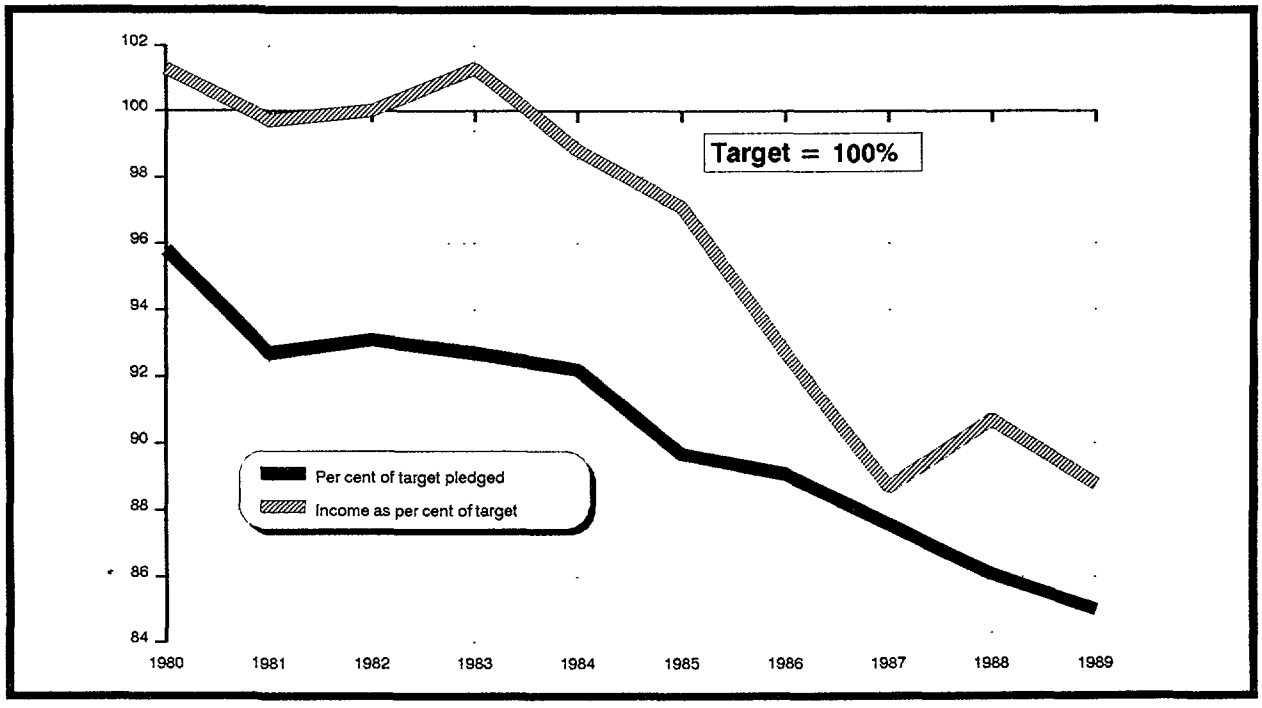


TABLE 3A
PROJECT PERSONNEL BY PLACE OF ORIGIN: 1989

Place of origin	Total individuals [a]	Assignments				
		International experts [b]	National experts	Lecturers [c]	Other project personnel	Total
Albania	3	-	6	-	-	6
Argentina	60	43	-	70	5	118
Australia	30	30	-	9	-	39
Austria	44	47	-	22	7	76
Bangladesh	7	10	-	2	-	12
Barbados	1	1	-	-	-	1
Belgium	21	30	-	1	-	31
Bolivia	4	8	-	7	-	15
Brazil	39	31	1	24	5	61
Bulgaria	11	4	12	1	-	17
Canada	42	57	-	12	-	69
Chile	14	9	-	10	-	19
China	24	27	-	6	-	33
Colombia	6	4	-	4	-	8
Côte d'Ivoire	1	1	-	-	-	1
Costa Rica	5	5	-	-	-	5
Cuba	3	3	-	-	-	3
Czechoslovakia	19	13	10	2	-	25
Denmark	11	21	-	2	-	23
Dominican Republic	3	2	1	-	-	3
Ecuador	6	11	-	1	-	12
Egypt	9	8	1	3	-	12
Finland	10	13	-	1	-	14
France	70	76	-	23	-	99
German D.R.	12	11	-	5	-	16
Germany, F.R.	92	106	-	35	-	141
Ghana	5	11	-	2	-	13
Greece	2	3	-	-	-	3
Guatemala	3	2	-	2	-	4
Guyana	1	1	-	-	-	1
Hungary	46	38	21	13	-	72
Iceland	1	1	-	-	-	1
India	51	80	-	16	-	96
Indonesia	11	11	-	4	1	16
Iran, Islamic Rep.	5	7	5	-	-	12
Iraq	3	2	-	1	-	3
Ireland	4	1	-	2	1	4
Israel	8	3	-	5	-	8
Italy	18	27	-	4	-	31
Jamaica	3	3	-	-	-	3
Japan	28	18	-	18	-	36

Place of origin	Total individuals [a]	Assignments				
		International experts [b]	National experts	Lecturers [c]	Other project personnel	Total
Jordan	1	1	-	-	-	1
Kenya	1	1	-	-	-	1
Korea, Rep.	6	4	-	3	-	7
Kuwait	1	-	-	1	-	1
Lebanon	1	-	-	1	-	1
Libyan Arab J.	1	2	-	-	-	2
Malaysia	12	9	1	3	-	13
Mexico	23	21	1	13	-	35
Morocco	3	3	1	-	-	4
Netherlands	11	30	-	3	-	33
New Zealand	3	3	-	1	-	4
Nigeria	3	5	-	1	-	6
Norway	5	10	-	3	-	13
Pakistan	10	8	-	2	-	10
Paraguay	3	3	-	1	-	4
Peru	12	12	1	4	1	18
Philippines	4	3	-	1	-	4
Poland	33	49	15	1	-	65
Portugal	4	-	-	5	-	5
Romania	2	-	2	-	-	2
Singapore	1	1	-	-	-	1
Spain	45	59	-	14	-	73
Sri Lanka	7	38	-	5	-	43
Sudan	1	-	-	1	-	1
Sweden	15	15	-	7	-	22
Switzerland	8	9	-	2	-	11
Syrian Arab Rep.	1	1	-	-	-	1
Thailand	16	25	1	3	4	33
Trinidad and Tobago	1	1	-	-	-	1
Tunisia	1	2	-	-	-	2
Turkey	10	42	2	1	-	45
USSR	20	16	-	14	-	30
UK	110	130	-	28	1	159
USA	167	177	-	42	-	219
Uganda	1	-	1	-	-	1
Uruguay	7	5	-	3	-	8
Venezuela	9	12	1	4	-	17
Viet Nam	4	3	1	-	-	4
Yugoslavia	37	58	-	23	-	81
Zaire	1	-	-	1	-	1
TOTAL	1,337 [a]	1,537 [b]	84	498 [c]	25	2,144

[a] Includes 163 IAEA staff members and 4 other international organization members. [b] Includes 336 assignments of IAEA staff members as international experts. [c] Includes 108 assignments of IAEA staff members as lecturers and 5 assignments of other international organization members as lecturers.

TABLE 3B
TRAINEES IN THE FIELD BY PLACE OF STUDY: 1989

Place of study	Fellows	Training course participants	Visiting scientists	Total
Algeria	1	8	-	9
Argentina	9	35	7	51
Australia	19	13	6	38
Austria	16	-	6	22
Belgium	17	-	12	29
Brazil	16	77	5	98
Bulgaria	7	9	-	16
Burkina Faso	-	-	1	1
Canada	27	-	17	44
Chile	3	49	5	57
China	2	33	5	40
Colombia	-	21	-	21
Costa Rica	-	24	1	25
Cuba	7	17	-	24
Czechoslovakia	15	34	8	57
Denmark	4	-	7	11
Ecuador	1	-	-	1
Egypt	2	-	-	2
Fiji	-	-	1	1
Finland	4	-	10	14
France	42	37	14	93
German D.R.	14	22	6	42
Germany, F.R.	61	97	38	196
Ghana	1	-	-	1
Greece	2	-	-	2
Guatemala	-	12	7	19
Hungary	27	14	13	54
India	13	28	9	50
Indonesia	-	11	4	15
Iraq	-	5	-	5
Ireland	-	24	1	25
Israel	2	-	-	2
Italy	18	24	3	45
Japan	13	66	4	83
Jordan	-	18	-	18
Kenya	2	-	-	2
Korea, Republic of	-	13	1	14

Place of study	Fellows	Training course participants	Visiting scientists	Total
Kuwait	-	14	-	14
Malaysia	-	58	6	64
Mali	-	5	-	5
Mexico	4	36	2	42
Monaco	2	-	2	4
Netherlands	17	18	19	54
New Zealand	1	-	1	2
Nigeria	-	-	1	1
Norway	2	-	1	3
Pakistan	-	9	-	9
Paraguay	-	24	-	24
Philippines	1	8	-	9
Poland	14	10	8	32
Qatar	-	12	-	12
Saudi Arabia	-	-	1	1
Senegal	-	22	-	22
Spain	7	37	6	50
Sudan	-	12	-	12
Sweden	8	-	9	17
Switzerland	1	-	1	2
Thailand	3	95	2	100
Tunisia	-	8	-	8
Turkey	1	-	1	2
U.R. Tanzania	-	9	-	9
USSR	48	58	6	112
UK	79	-	24	103
USA	97	109	34	240
Uruguay	5	31	1	37
Yugoslavia	7	11	8	26
Zambia	-	16	-	16
IAEA	115	38	36	189
European Nuclear Res. Center	3	-	-	3
TOTAL	760	1,331	360	2,451

[a] The difference between the number of trainees (2,189) and the number of places of study (2,451) is due to the fact that a number of fellows, training course participants and visiting scientists went to more than one country/place.

TABLE 4

DISTRIBUTION OF TECHNICAL CO-OPERATION DISBURSEMENTS BY TYPE: 1985-1989

Year	Source	Experts		Equipment		Fellowships		Scientific visits		Training courses		Sub-contracts		Miscellaneous		TOTAL		Unliquidated obligations	In-kind balance	TOTAL
		$	%	$	%	$	%	$	%	$	%	$	%	$	%	$	%	$	$	$
1985	UNDP funds	877.2	34.2	1,101.9	43.0	141.2	5.5	91.1	3.6	218.3	8.5	99.9	3.9	32.9	1.3	2,562.5	100.0	0.0	0.0	2,562.5
	Agency funds	5,032.7	21.8	10,448.2	45.3	3,153.9	13.7	448.1	1.9	3,447.2	15.0	370.8	1.6	161.4	0.7	23,062.3	100.0	0.0	0.0	23,062.3
	Extrabudgetary funds	1,581.2	29.7	2,887.5	54.2	125.6	2.3	2.4	0.1	158.1	3.0	570.9	10.7	0.0	0.0	5,325.7	100.0	0.0	0.0	5,325.7
	Assistance in kind	501.9	18.1	0.0	0.0	1,484.7	53.7	2.7	0.1	776.1	28.1	0.0	0.0	0.0	0.0	2,765.4	100.0	0.0	0.0	2,765.4
	Total	7,993.0	23.7	14,437.6	42.8	4,905.4	14.6	544.3	1.6	4,599.7	13.6	1,041.6	3.1	194.3	0.6	33,715.9	100.0	0.0	0.0	33,715.9
1986	UNDP funds	940.7	31.4	1,285.1	43.0	160 7	5.4	49.0	1.6	426.4	14.3	71.1	2.4	57.6	1.9	2,990.6	100.0	0.0	0.0	2,990.6
	Agency funds	6,437.0	21.7	14,068.9	47.4	4,060.1	13.7	728.0	2.4	3,831.9	12.9	410.7	1.4	146.0	0.5	29,682.6	100.0	0.0	0.0	29,682.6
	Extrabudgetary funds	1,459.4	29.1	2,759.1	54.9	131.8	2.6	1.4	0.0	338.4	6.7	335.1	6.7	0.0	0.0	5,025.2	100.0	0.0	0.0	5,025.2
	Assistance in kind	427.3	18.7	0.0	0.0	1,504.5	65.9	0.0	0.0	350.1	15.4	0.0	0.0	0.0	0.0	2,281.9	100.0	0.0	0.0	2,281.9
	Total	9,264.4	23.2	18,113.1	45.3	5,857.1	14.7	778.4	1.9	4,946.8	12.4	816.9	2.0	203.6	0.5	39,980.3	100.0	0.0	0.0	39,980.3
1987	UNDP funds	983.8	29.5	1,423.7	42.7	319.4	9.6	127.1	3.8	292.3	8.8	182.0	5.5	3.5	0.1	3,331.8	100.0	0.0	0.0	3,331.8
	Agency funds	6,746.7	19.0	18,518.5	52.2	5,904.3	16.7	369.6	1.0	3,539.0	10.0	212.0	0.6	170.1	0.5	35,460.2	100.0	0.0	0.0	35,460.2
	Extrabudgetary funds	954.8	21.3	3,043.4	67.8	89.9	2.0	8.5	0.2	288.7	6.4	101.9	2.3	0.0	0.0	4,487.2	100.0	0.0	0.0	4,487.2
	Assistance in kind	171.5	5.6	0.0	0.0	2,514.6	82.0	0.0	0.0	376.8	12.3	2.9	0.1	0.0	0.0	3,065.8	100.0	0.0	0.0	3,065.8
	Total	8,856.8	19.1	22,985.6	49 6	8,828.2	19.0	505.2	1.1	4,496.8	9.7	498.8	1.1	173.6	0.4	46,345.0	100.0	0.0	0.0	46,345.0
1988	UNDP funds	855.7	34.7	664.3	26.9	327.4	13.3	128.9	5.2	324.8	13.2	123.0	5.0	42.3	1.7	2,466.4	100.0	0.0	0.0	2,466.4
	Agency funds	6,077.3	22.7	11,948.8	44.6	4,049.2	15.1	405.2	1.5	3,663.9	13.6	262.7	1.0	403.2	1.5	26,810.3	100.0	0.0	0.0	26,810.3
	Extrabudgetary funds	1,077.3	20.0	3,391.8	62.9	(38.4)	(0.7)	9.8	0.2	554.8	10.3	391.8	7.3	0.0	0.0	5,387.1	100.0	0.0	0.0	5,387.1
	Assistance in kind	290.0	12.5	55.7	2.4	1,542.5	66.4	0.0	0.0	434.3	18.7	0.0	0.0	0.0	0.0	2,322.5	100.0	0.0	0.0	2,322.5
	Total	8,300.3	22.4	16,060.6	43.4	5,880.7	15.9	543.9	1.5	4,977.8	13.5	777.5	2.1	445.5	1.2	36,986.3	100.0	0.0	0.0	36,986.3
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	2,763.8	100.0	1,872.9	0.0	4,636.7
	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	19,231.2	0.0	48,495.6
	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	4,652.2	0.0	11,392.4
	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	337.9	2,632.5
	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	25,756.3	337.9	67,157.2
1985-1989	UNDP funds	4,486.0	31.8	5,298.3	37.5	1,606.2	11.4	501.9	3.6	1,569.4	11.1	492.3	3.5	161.0	1.1	14,115.1	100.0	1,872.9	0.0	15,988.0
	Agency funds	30,288.5	21.0	69,048.4	47.9	21,113.7	14.6	2,722.3	1.9	18,194.5	12.6	1,548.3	1.1	1,364.1	0.9	144,279.8	100.0	19,231.2	0.0	163,511.0
	Extrabudgetary funds	6,293.6	23.3	15,900.0	59.0	529.0	2.0	60.1	0.2	2,419.1	9.0	1,763.6	6.5	0.0	0.0	26,965.4	100.0	4,652.2	0.0	31,617.6
	Assistance in kind	1,704.6	13.4	73.7	0.6	8,483.1	66.6	16.5	0.1	2,449.4	19.3	2.9	0.0	0.0	0.0	12,730.2	100.0	0.0	337.9	13,068.1
	Total	42,772.7	21.6	90,320.4	45.6	31,732.0	16.0	3,300.8	1.7	24,632.4	12.4	3,807.1	1.9	1,525.1	0.8	198,090.5	100.0	25,756.3	337.9	224,184.7

TABLE 5

EXTRABUDGETARY FUNDS FOR TECHNICAL CO-OPERATION ACTIVITIES BY DONOR (as at 31 December 1989)

Donor	Funds available 1 January 1989	New funds in 1989	Total funds available	Disbursements in 1989	Unliquidated obligations at year-end	Unobligated balance
Part A: Funds for activities where donor is not recipient						
Australia	17,612	677,520	695,132	396,561	114,248	184,323
Asian Dev. Bank	0	90,000	90,000	92,443	0	(2,443)
Belgium	116,012	51,948	167,960	63,286	12,395	92,279
Canada	1,510	0	1,510	0	0	1,510
Chile	0	11,200	11,200	6,000	0	5,200
Colombia [a]	0	3,250	3,250	3,250	0	0
CEC	106,654	129,654	236,308	220,647	10,614	5,047
Finland	275	174,101	174,376	0	0	174,376
France	0	496,400 [b]	496,400	94,243	83,192	318,965
Germany, F.R.	1,983,531	868,929	2,852,460	1,221,991	721,186	909,283
IFFIT [a]	0	6,000	6,000	6,000	0	0
Italy	630,233	877,400	1,507,633	712,632	170,839	624,162
Japan	392,647	398,000 [c]	790,647	561,125	0	229,522
Korea, Rep. of	70,000	80,000 [d]	150,000	0	0	150,000
Kuwait	96,507	0	96,507	84,930	7,340	4,237
Norway	15,263	0	15,263	14,758	0	505
Saudi Arabia	4,229	0	4,229	0	0	4,229
Spain	0	92,005	92,005	0	0	92,005
Sweden	327,481	279,938	607,419	353,627	44,413	209,379
UNESCO [a]	0	6,000	6,000	6,000	0	0
USSR	3,125,502	692,088 [e]	3,817,590	203,930	2,150,555	1,463,105
UK	1,709,980	775,973 [f]	2,485,953	832,595	184,087	1,469,271
USA	3,369,651	1,530,000	4,899,651	1,718,595	840,549	2,340,507
Sub-total	11,967,087	7,240,406	19,207,493	6,592,613	4,339,418	8,275,462
Part B: Funds for activities where donor is recipient						
Chile	22,239	0	22,239	20,395	0	1,844
Colombia	3,284	0	3,284	2,770	0	514
Ecuador	4,879	0	4,879	2,252	1,800	827
Ghana	0	50,000	50,000	6,213	0	43,787
Hungary	7,632	9,000	16,632	7,339	0	9,293
Iceland	8,500	0	8,500	8,500	0	0
Iran, Islamic Rep.	3,822	0	3,822	0	0	3,822
Ireland	0	10,000	10,000	0	0	10,000
Libyan Arab J.	8,276	15,184	23,460	24,119	0	(659)
Malaysia	570	0	570	0	0	570
Mexico	8,483	0	8,483	8,368	0	115
Nigeria	4,730	(1)	4,729	4,729	0	0
Pakistan	(120)	33,045	32,925	29,516	0	3,409
Panama	2,480	(2,480)	0	0	0	0
Poland	26,281	0	26,281	0	0	26,281
Portugal	20,000	0	20,000	16,870	0	3,130
Syrian Arab Rep.	105,620	0	105,620	25,260	0	80,360
Thailand	1,983	0	1,983	0	0	1,983
U.A. Emirates	0	542,888	542,888	842	292,029	250,017
Yugoslavia	99,970	0	99,970	5,616	18,980	75,374
Sub-total	328,629	657,636	986,265	162,789	312,809	510,667
TOTAL	12,295,716	7,898,042	20,193,758	6,755,402	4,652,227	8,786,129

[a] Included under the TACF in the Agency's Accounts and in this report (Figures 7, 9, 10 and Tables 4, 7 and 8). [b] Includes receiveable of $101,197. [c] Additional funds provided under non-TC programmes for the RCA project in Asia. [d] Includes $50,000 as future-year project provisions. [e] Consists of receiveable of $705,330 for future-year project provisions and loss on exchange of $13,242 for funds received in earlier years. [f] Includes receiveable of $391,513 and exchange adjustment of $17,737 against 1988 receiveable.

TABLE 6A

TECHNICAL CO-OPERATION PERSONNEL SERVICES: 1989

Recipient	Number of assign-ments	Number of months
Albania	23	9.0
Algeria	12	6.0
Argentina	8	16.5
Bangladesh	14	11.0
Bolivia	5	2.0
Brazil	47	45.5
Bulgaria	7	2.0
Cameroon	3	2.5
Chile	20	12.5
China	51	26.5
Colombia	14	10.5
Costa Rica	5	4.0
Côte d'Ivoire	8	3.5
Cuba	13	11.5
Cyprus	2	0.5
Czechoslovakia	13	8.5
Dem. P.R. Korea	5	5.0
Dominican Republic	4	2.5
Ecuador	17	11.5
Egypt	41	22.5
El Salvador	13	6.0
Ethiopia	4	1.0
Ghana	13	8.0
Greece	4	2.0
Guatemala	9	8.0
Haiti	3	1.0
Hungary	7	1.0
Iceland	1	0.5
Indonesia	62	63.0
Iran, Islamic Rep.	34	20.5
Iraq	19	6.0
Jamaica	2	0.5
Jordan	20	20.0
Kenya	10	34.5
Korea, Rep.	59	42.0
Libyan Arab J.	4	1.5
Madagascar	4	3.0
Malaysia	23	15.0
Mali	4	3.0
Mauritius	1	0.5
Mexico	23	19.5
Mongolia	4	3.0
Morocco	28	11.0
Nicaragua	7	6.0
Niger	3	3.0
Nigeria	8	6.5
Pakistan	9	5.5
Panama	6	3.5
Paraguay	4	2.5
Peru	24	22.0
Philippines	16	8.5
Poland	21	10.0
Portugal	11	3.0
Romania	32	11.0
Saudi Arabia	3	1.0
Senegal	3	1.5
Spain	1	0.5
Sri Lanka	3	1.0
Sudan	9	7.0
Syrian Arab Rep.	21	9.5
Thailand	58	67.0
Tunisia	16	6.5
Turkey	28	12.5
Uganda	9	3.0
United Arab Emirates	2	1.0
UK (Hong Kong)	3	2.0
United Rep. Tanzania	7	9.5
Uruguay	9	7.0
Venezuela	28	29.0
Viet Nam	7	5.0
Yugoslavia	16	3.5
Zaire	1	0.5
Zambia	13	12.0
Zimbabwe	6	3.5
Sub-total	1,047	748.0
Intercountry projects	599	355.0
Training courses	498	142.5
Sub-total	1,097	497.5
TOTAL	2,144	1,245.5

TABLE 6B

RECIPIENTS OF TRAINING ABROAD: 1989

Recipient	Fellows		Visiting scientists		Training course participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Afghanistan	-	-	1	0.5	2	2.0	3	2.5
Albania	7	26.5	2	1.5	2	2.5	11	30.5
Algeria	12	46.0	4	2.0	14	14.5	30	62.5
Argentina	4	9.5	-	-	37	26.5	41	36.0
Bangladesh	18	50.0	8	3.5	29	21.5	55	75.0
Barbados	-	-	-	-	7	2.5	7	2.5
Bolivia	-	-	1	0.5	23	29.5	24	30.0
Brazil	19	43.5	16	10.0	39	34.0	74	87.5
Bulgaria	20	59.5	6	3.5	26	34.5	52	97.5
Burkina Faso	-	-	-	-	1	1.5	1	1.5
Burundi	-	-	-	-	2	2.0	2	2.0
Cameroon	2	5.0	-	-	3	2.5	5	7.5
Chile	18	66.0	3	2.0	29	33.0	50	101.0
China	39	148.5	23	19.0	50	35.5	112	203.0
Colombia	7	28.5	2	2.0	26	19.0	35	49.5
Costa Rica	6	15.5	1	0.5	20	19.0	27	35.0
Cote d'Ivoire	2	2.5	1	0.5	4	4.5	7	7.5
Cuba	18	43.0	3	1.5	22	33.0	43	77.5
Cyprus	-	-	-	-	1	1.0	1	1.0
Czechoslovakia	5	27.0	2	2.0	22	21.0	29	50.0
Dem. P.R. Korea	13	64.5	6	7.0	3	2.5	22	74.0
Dominican Republic	3	7.0	1	1.0	8	3.0	12	11.0
Ecuador	16	62.0	4	2.0	24	14.5	44	78.5
Egypt	34	122.0	5	3.0	43	37.5	82	162.5
El Salvador	3	5.5	1	0.5	6	5.0	10	11.0
Ethiopia	7	31.0	-	-	3	4.0	10	35.0
Gabon	-	-	-	-	3	3.0	3	3.0
German D.R.	-	-	-	-	1	1.0	1	1.0
Ghana	14	80.0	1	1.0	10	12.0	25	93.0
Greece	2	3.0	4	2.0	2	2.0	8	7.0
Guatemala	14	40.5	1	0.5	18	12.5	33	53.5
Guinea-Bissau	-	-	-	-	1	1.0	1	1.0
Guyana	-	-	-	-	5	2.0	5	2.0
Haiti					1	1.0	1	1.0
Honduras	-	-	-	-	1	1.0	1	1.0
Hungary	3	7.0	7	3.5	28	32.0	38	42.5
India	1	1	-	-	40	24.0	41	25.0
Indonesia	15	69.0	9	7.5	39	28.5	63	105.0
Iran, Islamic Rep.	16	49.0	1	0.5	7	7.0	24	56.5
Iraq	7	21.0	-	-	24	18.0	31	39.0
Jamaica	-	-	-	-	10	6.0	10	6.0
Jordan	5	22.0	-	-	18	12.0	23	34.0
Kenya	10	61.0	-	-	9	11.0	19	72.0
Korea, Republic of	25	105.0	6	3.5	25	14.5	56	123.0
Kuwait	-	-	-	-	4	1.5	4	1.5
Libyan Arab J.	16	85.0	-	-	10	9.0	26	94.0
Madagascar	8	27.5	1	1.5	1	1.0	10	30.0

Recipient	Fellows		Visiting scientists		Training course participants		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Malaysia	19	56.5	10	5.5	37	23.0	66	85.0
Mali	7	21.0	1	0.5	5	4.5	13	26.0
Mauritius	1	0.5	1	0.5	2	1.5	4	2.5
Mexico	13	38.0	2	1.5	41	30.0	56	69.5
Mongolia	8	37.0	1	1.0	1	1.0	10	39.0
Morocco	3	12.0	4	2.0	12	10.0	19	24.0
Myanmar					2	1.0	2	1.0
Nepal					1	1.0	1	1.0
Nicaragua	-	-	-	-	1	1.0	1	1.0
Niger	4	15.0	-	-	5	2.0	9	17.0
Nigeria	26	122.0	1	0.5	14	18.0	41	140.5
Pakistan	19	81.0	5	3.5	39	32.5	63	117.0
Panama	1	7.0	-	-	5	4.0	6	11.0
Paraguay	3	9.0	1	1.0	14	9.0	18	19.0
Peru	1	3.0	3	2.0	28	30.5	32	35.5
Philippines	24	85.5	2	1.5	33	36.5	59	123.5
Poland	25	77.0	9	4.0	30	28.0	64	109.0
Portugal	2	7.0	1	0.5	4	4.0	7	11.5
Romania	1	1.5	2	1.5	8	8.0	11	11.0
Rwanda	-	-	-	-	1	1.0	1	1.0
Saudi Arabia	2	6.0	-	-	7	4.0	9	10.0
Senegal	2	3.0	-	-	7	4.0	9	7.0
Sierra Leone	2	5.5	-	-	2	1.5	4	7.0
Singapore	2	6.0	-	-	9	4.5	11	10.5
Solomon Islands					2	2.5	2	2.5
Spain	-	-	-	-	1	1.0	1	1.0
Sri Lanka	9	49.0	1	1.0	27	20.0	37	70.0
Sudan	16	77.0	-	-	11	12.5	27	89.5
Syrian Arab Rep.	12	30.0	2	1.0	22	14.5	36	45.5
Thailand	35	136.0	12	9.0	37	28.0	84	173.0
Trinidad and Tobago	-	-	-	-	10	4.5	10	4.5
Tunisia	7	14.0	1	0.5	8	5.0	16	19.5
Turkey	19	84.0	4	2.0	10	14.0	33	100.0
Uganda	1	2.5	1	1.0	2	1.5	4	5.0
U. Arab Emirates	-	-	-	-	7	2.0	7	2.0
U.K. (Hong Kong)	1	3.0	1	0.5	2	2.0	4	5.5
U.R. Tanzania	8	32.0	-	-	6	9.0	14	41.0
Uruguay	5	15.5	2	2.0	19	19.0	26	36.5
Venezuela	5	13.0	-	-	19	16.5	24	29.5
Viet Nam	37	136.5	4	3.5	36	26.0	77	166.0
Yugoslavia	10	40.0	-	-	14	16.5	24	56.5
Zaire	5	22.5	-	-	13	20.5	18	43.0
Zambia	2	9.5	1	0.5	4	4.0	7	14.0
Zimbabwe	6	21.0	-	-	4	4.5	10	25.5
TOTAL	732	2,713.0	192	129.0	1,265	1,090.0	2,189	3,932.0

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

TABLE 7

FINANCIAL SUMMARY: 1989

(in thousands of dollars)

Recipient	Assistance provided, by type						Assistance provided, by source						Unliquid. oblig.	TOTAL
	Experts	Equipment	Fellowships	Group training	Subcontracts	Total	UNDP	TACF CC	TACF NCC	Extrabud.	In kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
AFGHANISTAN	0.0	0.0	3.6	0.0	0.0	3.6	0.0	0.0	3.6	0.0	0.0	3.6	0.0	3.6
ALBANIA	70.2	191.0	60.4	26.5	0.0	348.1	51.9	204.0	83.9	0.0	8.3	348.1	24.8	372.9
ALGERIA	28.9	211.5	97.5	0.0	0.0	337.9	0.0	244.3	36.6	0.0	57.0	337.9	314.0	651.9
ARGENTINA	71.8	67.9	27.4	0.0	0.0	167.1	161.9	0.0	5.2	0.0	0.0	167.1	41.0	208.1
BANGLADESH	83.7	345.4	194.0	0.0	0.0	623.1	0.0	399.7	103.2	90.4	29.8	623.1	899.1	1,522.2
BOLIVIA	19.6	124.6	3.8	0.0	0.0	148.0	0.0	93.3	4.7	48.6	1.4	148.0	124.1	272.1
BRAZIL	398.2	488.6	209.7	0.0	0.0	1,096.5	0.0	487.1	12.3	512.4	84.7	1,096.5	431.0	1,527.5
BULGARIA	21.0	147.8	115.6	0.0	0.0	284.4	0.0	80.7	23.2	151.6	28.9	284.4	1,368.0	1,652.4
CAMEROON	20.1	94.3	31.1	0.0	0.0	145.5	0.0	118.7	3.9	10.7	12.2	145.5	28.5	174.0
CHILE	105.4	588.2	100.1	0.0	0.0	793.7	0.0	732.4	24.5	20.4	16.4	793.7	199.3	993.0
CHINA	298.7	612.6	631.0	0.0	0.0	1,542.3	488.1	763.3	104.9	117.7	68.3	1,542.3	959.5	2,501.8
COLOMBIA	78.7	431.8	83.3	0.0	0.0	593.8	0.0	378.9	19.5	167.5	27.9	593.8	339.7	933.5
COSTA RICA	33.8	71.5	29.2	0.0	0.0	134.5	0.0	122.0	9.4	0.0	3.1	134.5	43.6	178.1
COTE D'IVOIRE	25.7	75.7	16.2	0.0	0.0	117.6	0.0	86.6	4.8	22.8	3.4	117.6	47.5	165.1
CUBA	96.9	520.9	80.1	0.0	0.0	697.9	168.4	479.4	44.7	0.0	5.4	697.9	683.1	1,381.0
CYPRUS	3.2	72.1	0.0	0.0	0.0	75.3	0.0	75.3	0.0	0.0	0.0	75.3	37.0	112.3
CZECHOSLOVAKIA	16.3	45.1	50.6	0.0	0.0	112.0	0.0	107.0	0.0	0.0	5.0	112.0	10.8	122.8
DEM. P.R. KOREA	32.4	180.3	126.5	0.0	0.0	339.2	0.0	200.6	135.1	0.0	3.5	339.2	1,809.6	2,148.8
DOMINICAN REP.	20.9	69.8	20.5	0.0	0.0	111.2	0.0	110.6	0.6	0.0	0.0	111.2	48.1	159.3
ECUADOR	85.2	491.4	138.4	0.0	8.1	723.1	0.0	381.4	130.1	168.8	42.8	723.1	148.5	871.6
EGYPT	182.6	901.3	282.5	71.1	67.5	1,505.0	106.3	747.8	243.1	319.6	88.2	1,505.0	520.2	2,025.2
EL SALVADOR	51.2	199.5	14.3	0.0	0.0	265.0	0.0	194.7	22.4	44.7	3.2	265.0	63.9	328.9
ETHIOPIA	11.3	71.6	71.3	0.0	0.0	154.2	0.0	116.2	4.7	0.0	33.3	154.2	58.3	212.5
GABON	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.6
GHANA	47.5	335.0	157.7	0.0	0.0	540.2	0.0	310.8	103.8	71.5	54.1	540.2	154.1	694.3
GREECE	14.6	301.1	23.2	0.0	0.0	338.9	0.0	300.1	8.3	30.5	0.0	338.9	153.5	492.4
GUATEMALA	34.9	394.5	77.1	0.0	63.3	569.8	0.0	308.1	5.9	246.7	9.1	569.8	153.0	722.8
HAITI	19.4	16.0	0.0	0.0	0.0	35.4	0.0	33.7	1.7	0.0	0.0	35.4	6.3	41.7
HUNGARY	8.5	142.5	52.1	0.0	0.0	203.1	2.8	165.3	7.1	27.9	0.0	203.1	260.3	463.4
ICELAND	3.9	55.2	0.0	0.0	0.0	59.1	0.0	50.6	0.0	8.5	0.0	59.1	0.0	59.1
INDIA	0.0	0.0	12.1	0.0	0.0	12.1	0.0	0.0	7.8	4.3	0.0	12.1	11.6	23.7
INDONESIA	384.0	357.0	250.9	7.2	0.0	999.1	190.3	476.2	98.3	141.7	92.6	999.1	776.5	1,775.6
IRAN, I.R.	207.5	272.9	144.3	0.0	0.0	624.7	47.5	502.7	60.2	0.0	14.3	624.7	361.9	986.6
IRAQ	65.0	7.9	35.8	0.0	0.0	108.7	0.0	91.5	17.2	0.0	0.0	108.7	13.2	121.9
IRELAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.9	21.9
JAMAICA	10.5	20.9	0.0	0.0	0.0	31.4	0.0	26.3	0.0	5.1	0.0	31.4	0.0	31.4
JORDAN	118.7	89.6	50.1	0.0	0.0	258.4	0.0	236.5	21.9	0.0	0.0	258.4	65.6	324.0
KENYA	72.9	68.7	129.5	0.0	0.0	271.1	0.0	172.1	0.0	53.0	46.0	271.1	111.7	382.8
KOREA, R.	528.9	80.1	308.7	0.0	0.0	917.7	298.1	483.6	0.0	62.4	73.6	917.7	234.7	1,152.4
LIBYAN A.J.	9.9	42.4	243.5	0.0	0.0	295.8	0.0	137.4	88.5	55.9	14.0	295.8	224.5	520.3
MADAGASCAR	23.0	129.5	75.3	0.0	0.0	227.8	0.0	210.6	2.0	0.0	15.2	227.8	53.7	281.5
MALAYSIA	123.4	578.1	172.0	0.0	0.0	873.5	0.0	529.7	89.7	238.5	15.6	873.5	151.1	1,024.6
MALI	38.6	185.5	53.9	0.0	0.0	278.0	0.0	228.1	15.5	14.7	19.7	278.0	17.2	295.2
MAURITIUS	0.0	27.0	8.3	0.0	0.0	35.3	0.0	25.0	10.3	0.0	0.0	35.3	0.0	35.3
MEXICO	185.4	224.8	107.8	0.0	72.4	590.4	0.0	348.1	12.4	169.5	60.4	590.4	234.5	824.9
MONGOLIA	24.6	179.4	66.6	0.0	0.0	270.6	0.0	232.2	38.4	0.0	0.0	270.6	107.2	377.8
MOROCCO	81.2	132.3	51.0	0.0	0.0	264.5	0.0	179.7	17.5	48.7	18.6	264.5	111.8	376.3
MYANMAR	0.0	94.1	0.0	0.0	0.0	94.1	0.0	71.2	22.9	0.0	0.0	94.1	27.6	121.7
NICARAGUA	17.6	249.3	6.4	0.0	0.0	273.3	0.0	97.1	176.2	0.0	0.0	273.3	100.9	374.2
NIGER	33.0	166.8	32.4	0.0	0.0	232.2	0.0	189.6	27.1	0.0	15.5	232.2	19.7	251.9
NIGERIA	54.4	427.1	230.0	0.0	0.0	711.5	0.0	369.9	21.6	242.6	77.4	711.5	596.9	1,308.4
PAKISTAN	34.2	260.3	186.6	0.0	0.0	481.1	0.0	427.0	12.8	29.5	11.8	481.1	637.1	1,118.2

Recipient	Assistance provided, by type						Assistance provided, by source						Unliquid. oblig.	TOTAL
	Experts	Equipment	Fellowships	Group training	Subcontracts	Total	UNDP	TACF CC	TACF NCC	Extrabud.	In kind	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
PANAMA	33.9	139.3	21.9	0.0	0.0	195.1	0.0	153.3	3.5	17.1	21.2	195.1	56.8	251.9
PARAGUAY	25.1	209.2	13.9	0.0	0.0	248.2	0.0	191.1	10.9	46.2	0.0	248.2	95.1	343.3
PERU	123.3	186.1	28.7	0.0	11.0	349.1	9.3	263.7	0.9	75.2	0.0	349.1	558.8	907.9
PHILIPPINES	78.9	283.7	210.9	0.0	0.0	573.5	0.0	434.6	1.7	51.0	86.2	573.5	291.4	864.9
POLAND	78.4	410.4	160.5	0.0	0.0	649.3	0.0	460.9	100.0	0.0	88.4	649.3	2,074.3	2,723.6
PORTUGAL	28.1	927.6	19.3	0.0	0.0	975.0	0.0	143.1	626.5	205.4	0.0	975.0	170.2	1,145.2
ROMANIA	126.4	511.7	9.8	0.0	0.0	647.9	38.5	452.4	154.3	0.0	2.7	647.9	416.0	1,063.9
SAUDI ARABIA	6.9	0.0	12.6	0.0	0.0	19.5	0.0	19.5	0.0	0.0	0.0	19.5	0.0	19.5
SENEGAL	14.8	65.8	2.4	0.0	0.0	83.0	0.0	69.3	13.7	0.0	0.0	83.0	27.4	110.4
SIERRA LEONE	7.2	6.1	14.0	0.0	0.0	27.3	0.0	27.3	0.0	0.0	0.0	27.3	18.5	45.8
SINGAPORE	0.0	12.6	21.4	0.0	0.0	34.0	0.0	34.0	0.0	0.0	0.0	34.0	71.3	105.3
SPAIN	0.3	10.3	0.0	0.0	0.0	10.6	0.0	10.6	0.0	0.0	0.0	10.6	52.0	62.6
SRI LANKA	5.4	171.0	115.7	0.0	0.0	292.1	0.0	239.9	19.0	25.0	8.2	292.1	102.9	395.0
SUDAN	54.1	144.1	171.8	0.0	2.5	372.5	0.0	256.8	1.1	51.5	63.1	372.5	101.0	473.5
SYRIAN A.R.	90.3	250.6	60.0	0.0	0.0	400.9	85.4	174.3	23.1	110.2	7.9	400.9	89.4	490.3
THAILAND	361.0	453.8	384.7	5.8	0.0	1,205.3	346.4	506.5	27.6	246.3	78.5	1,205.3	411.7	1,617.0
TUNISIA	40.1	423.9	29.0	0.0	0.0	493.0	0.0	439.4	5.1	29.2	19.3	493.0	67.5	560.5
TURKEY	118.1	263.7	212.9	0.0	0.0	594.7	81.5	365.2	42.2	0.0	105.8	594.7	693.0	1,287.7
UGANDA	24.2	146.3	7.8	0.0	0.0	178.3	0.0	176.9	1.4	0.0	0.0	178.3	33.2	211.5
UK (HONG KONG)	23.5	14.3	12.6	0.0	0.0	50.4	0.0	50.4	0.0	0.0	0.0	50.4	0.0	50.4
URUGUAY	46.9	137.8	52.0	0.0	0.0	236.7	0.0	176.6	35.4	24.7	0.0	236.7	186.3	423.0
U.A.EMIRATES	7.1	68.5	0.0	0.0	0.0	75.6	0.0	74.8	0.0	0.8	0.0	75.6	292.1	367.7
U.R. TANZANIA	61.3	58.9	55.2	0.0	0.0	175.4	0.0	169.4	3.8	2.2	0.0	175.4	94.0	269.4
VENEZUELA	124.2	346.0	19.1	5.3	0.0	494.6	135.3	284.9	14.6	59.8	0.0	494.6	579.5	1,074.1
VIET NAM	33.6	308.8	233.6	0.0	0.0	576.0	0.0	369.4	145.3	0.0	61.3	576.0	1,691.2	2,267.2
YUGOSLAVIA	27.1	191.5	96.2	0.0	0.0	314.8	0.0	165.7	107.9	23.5	17.7	314.8	3,013.8	3,328.6
ZAIRE	2.6	109.7	47.3	0.0	0.0	159.6	0.0	120.4	7.1	12.5	19.6	159.6	56.6	216.2
ZAMBIA	132.2	201.7	25.6	0.0	0.0	359.5	0.0	327.1	32.4	0.0	0.0	359.5	60.3	419.8
ZIMBABWE	34.3	129.8	49.7	0.0	0.0	213.8	0.0	203.0	5.5	0.0	5.3	213.8	24.6	238.4
SUB-TOTAL	5,606.7	17,024.7	6,951.0	115.9	224.8	29,923.1	2,211.7	18,688.2	3,270.5	4,106.8	1,645.9	29,923.1	24,135.0	54,058.1
Intercountry projects														
INTERREGIONAL	784.2	119.0	10.8	2,112.1	29.7	3,055.8	0.0	2,403.9	338.8	216.8	96.3	3,055.8	389.6	3,445.4
REGIONAL AFRICA	414.3	240.1	53.3	518.1	20.0	1,245.8	0.0	1,224.5	0.4	20.9	0.0	1,245.8	285.5	1,531.3
REGIONAL ASIA & PACIFIC	691.0	327.2	137.3	1,460.8	0.0	2,616.3	542.7	720.4	6.9	1,086.1	260.2	2,616.3	355.6	2,971.9
REGIONAL EUROPE	156.4	366.4	1.6	189.4	170.2	884.0	0.0	763.5	88.7	0.0	31.8	884.0	150.7	1,034.7
REGIONAL LATIN AMERICA	705.6	670.8	35.6	1,215.0	227.6	2,854.6	9.4	1,275.2	0.0	1,309.6	260.4	2,854.6	439.9	3,294.5
SUB-TOTAL	2,751.5	1,723.5	238.6	5,495.4	447.5	10,656.5	552.1	6,387.5	434.8	2,633.4	648.7	10,656.5	1,621.3	12,277.8
MISCELLANEOUS	100.5	236.4	79.3	62.4	4.8	483.4	0.0	482.9	0.5	0.0	0.0	483.4	0.0	483.4
TOTAL	8,458.7	18,984.6	7,268.9	5,673.7	677.1	41,063.0	2,763.8	25,558.6	3,705.8	6,740.2	2,294.6	41,063.0	25,756.3	66,819.3

TABLE 8

FINANCIAL SUMMARY: 1958-1989

(in thousands of dollars)

Recipient	Assistance provided, by type						Assistance provided, by source				
	Experts	Equip-ment	Fellow-ships	Group training	Sub-con-tracts	Total	UNDP	Agency	Extra-bud. a)	In kind	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
AFGHANISTAN	384.0	441.5	136.2	0.0	0.0	961.7	92.9	787.0	0.0	81.8	961.7
ALBANIA	191.5	1,780.8	222.0	26.5	0.0	2,220.8	171.1	2,012.1	0.0	37.6	2,220.8
ALGERIA	500.6	1,641.4	426.1	0.0	0.0	2,568.1	21.7	2,398.2	0.0	148.2	2,568.1
ARGENTINA	3,430.7	2,520.1	1,276.1	0.0	0.0	7,226.9	4,994.8	1,676.5	17.5	538.1	7,226.9
BANGLADESH	1,107.8	4,612.3	2,787.8	0.0	0.0	8,507.9	63.8	5,705.0	1,270.6	1,468.5	8,507.9
BOLIVIA	600.3	1,742.4	439.2	5.7	0.0	2,787.6	159.5	1,982.5	468.4	177.2	2,787.6
BRAZIL	5,965.9	6,367.2	2,507.7	0.0	0.0	14,840.8	5,660.4	6,467.2	1,885.8	827.4	14,840.8
BULGARIA	160.5	3,754.3	2,561.2	0.0	0.0	6,476.0	543.9	4,958.2	312.6	661.3	6,476.0
CAMEROON	456.0	365.9	76.7	0.0	0.0	898.6	297.3	519.4	62.9	19.0	898.6
CAPE VERDE	3.5	0.1	0.0	0.0	0.0	3.6	3.6	0.0	0.0	0.0	3.6
CHAD	116.3	30.6	0.0	0.0	0.0	146.9	146.9	0.0	0.0	0.0	146.9
CHILE	2,834.4	3,276.4	1,664.7	0.0	0.0	7,775.5	3,615.1	3,638.9	23.0	498.5	7,775.5
CHINA	1,281.0	1,461.2	1,833.1	0.0	8.1	4,583.4	1,349.3	2,696.0	347.7	190.4	4,583.4
COLOMBIA	1,453.2	3,116.9	1,087.6	0.0	0.0	5,657.7	1,693.6	2,864.1	391.1	708.9	5,657.7
COSTA RICA	933.3	1,203.7	314.3	0.0	7.0	2,458.3	618.1	1,413.3	234.3	192.6	2,458.3
COTE D'IVOIRE	453.1	841.3	167.4	0.0	0.0	1,461.8	73.4	1,279.3	78.9	30.2	1,461.8
CUBA	679.6	5,647.6	444.7	0.0	0.0	6,771.9	1,903.3	4,683.1	39.2	146.3	6,771.9
CYPRUS	126.0	715.3	202.3	0.0	0.0	1,043.6	24.1	819.2	34.6	165.7	1,043.6
CZECHOSLOVAKIA	16.8	149.9	1,122.1	0.0	0.0	1,288.8	6.2	893.1	12.9	376.6	1,288.8
DEM. P.R. KOREA	193.1	2,956.0	771.9	0.0	0.0	3,921.0	0.0	3,390.0	52.6	478.4	3,921.0
DOMINICAN REP.	189.7	688.9	192.9	0.0	0.0	1,071.5	0.0	1,035.4	3.9	32.3	1,071.6
ECUADOR	1,442.3	3,779.3	710.6	0.0	8.1	5,940.3	547.5	4,123.5	862.8	406.5	5,940.3
EGYPT	3,640.5	11,307.0	4,110.6	71.1	1,100.3	20,229.5	1,783.5	8,316.8	7,549.2	2,580.0	20,229.5
EL SALVADOR	240.4	688.8	192.2	0.0	0.0	1,121.4	14.1	791.2	138.3	177.8	1,121.4
ETHIOPIA	536.6	840.9	461.1	0.0	0.0	1,838.6	437.5	1,294.3	0.0	106.8	1,838.6
GABON	57.0	86.3	29.3	0.0	0.0	172.6	0.0	160.0	0.0	12.6	172.6
GHANA	753.8	2,360.3	2,491.0	0.0	0.0	5,605.1	354.5	3,405.4	424.5	1,420.7	5,605.1
GREECE	1,958.0	1,991.8	1,242.0	0.0	0.0	5,191.8	1,561.9	2,511.7	473.5	644.7	5,191.8
GUATEMALA	377.9	1,491.4	270.7	0.0	83.3	2,223.3	56 2	1,669.6	379.9	117.6	2,223.3
HAITI	29.3	60.1	11.6	0.0	0.9	101.9	0.9	101.0	0.0	0.0	101.9
HONDURAS	0.0	0.0	0.7	0.0	0.0	0.7	0.0	0.7	0.0	0.0	0.7
HUNGARY	118.3	7,775.7	1,852.4	0.0	0.0	9,746.4	696.2	7,952.9	787.1	310.2	9,746.4
ICELAND	70.8	731.0	152.3	0.0	0.0	954.1	0.0	818.5	8.5	127.1	954.1
INDIA	1,015.8	3,801.6	2,693.6	0.0	0.0	7,511.0	2,920.3	1,292.3	2,136.2	1,162.2	7,511.0
INDONESIA	3,298.9	4,064.0	2,270.9	7.2	25.0	9,666.0	2,273.8	5,306.0	1,092.7	993.5	9,666.0
IRAN	I.R.	1,091.4	2,361.9	1,299.3	0.0	131.5	4,884.1	2,124.8	2,082.9	351.3	325.1
IRAQ	759.0	1,237.2	955.0	0.0	18.3	2,969.5	242.5	2,269.2	25.0	432.8	2,969.5
IRELAND	0.0	0.0	9.7	0.0	0.0	9.7	0.0	9.7	0.0	0.0	9.7
ISRAEL	257.8	819.8	438.7	0.0	0.0	1,516.3	170.9	900.6	18.0	426.8	1,516.3
JAMAICA	242.2	671.5	61.4	0.0	55.0	1,030.1	15.3	835.7	108.3	70.8	1,030.1
JORDAN	599.6	932.3	289.8	0.0	0.0	1,821.7	89.3	1,527.2	100.6	104.6	1,821.7
KENYA	910.6	1,442.0	1,016.6	0.0	0.0	3,369.2	33.2	2,148.2	728.2	459.6	3,369.2
KOREA	R.	3,554.0	2,087.9	3,970.7	0.0	0.0	9,612.6	1,164.3	4,928.1	1,317.0	2,203.2
LEBANON	248.5	298.4	129.7	0.0	0.0	676.6	139.3	482.7	31.4	23.2	676.6
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.	346.9	557.9	830.4	0.0	0.0	1,735.2	7.3	1,643.9	16.2	67.8	1,735.2
MADAGASCAR	1,334.2	1,626.7	273.5	0.0	0.0	3,234.4	1,436.6	1,486.3	244.2	67.3	3,234.4
MALAWI	5.1	0.0	0.0	0.0	0.0	5.1	5.1	0.0	0.0	0.0	5.1
MALAYSIA	1,602.5	3,335.4	1,265.4	0.0	0.0	6,203.3	1.6	4,565.6	1,070.7	565.4	6,203.3
MALI	772.2	1,176.6	328.7	0.0	0.0	2,277.5	13.4	2,031.9	143.4	88.8	2,277.5
MAURITIUS	109.1	231.0	41.0	0.0	0.0	381.1	0.0	377.3	3.8	0.0	381.1
MEXICO	2,861.3	1,432.7	1,432.4	0.0	569.5	6,295.9	419.3	3,973.8	1,071.8	831.0	6,295.9
MONGOLIA	370.1	1,305.2	103.6	0.0	0.0	1,778.9	0.0	1,754.7	10.6	13.6	1,778.9

Recipient	Assistance provided, by type						Assistance provided, by source				
	Experts	Equip-ment	Fellow-ships	Group training	Sub-con-tracts	Total	UNDP	Agency	Extra-bud. a)	In kind	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
MOROCCO	1,827.3	1,649.0	496.9	0.0	18.0	3,991.2	909.6	2,450.2	364.8	266.6	3,991.2
MYANMAR	804.6	1,599.9	238.4	0.0	0.0	2,642.9	537.0	2,002.3	0.0	103.6	2,642.9
NICARAGUA	108.6	530.1	84.9	0.0	0.0	723.6	0.0	723.6	0.0	0.0	723.6
NIGER	365.7	725.7	125.0	0.0	0.0	1,216.4	0.0	1,157.9	0.0	58.5	1,216.4
NIGERIA	2,994.3	2,876.2	1,376.1	0.0	30.4	7,277.0	980.9	2,195.8	3,299.8	800.5	7,277.0
PAKISTAN	1,862.5	3,562.7	3,784.7	0.0	5.2	9,215.1	1,842.0	5,783.8	174.2	1,415.1	9,215.1
PANAMA	395.2	1,135.2	255.2	0.0	0.0	1,785.6	4.1	1,448.6	191.8	141.1	1,785.6
PARAGUAY	268.8	1,171.7	299.9	0.0	0.0	1,740.4	0.0	1,495.4	140.3	104.7	1,740.4
PERU	3,657.0	6,295.6	1,408.7	2.7	58.6	11,422.6	3,907.2	3,925.0	2,772.4	818.0	11,422.6
PHILIPPINES	2,435.0	3,715.9	3,775.0	0.0	90.8	10,016.7	1,964.4	4,500.4	1,299.0	2,252.9	10,016.7
POLAND	220.4	3,457.5	3,056.3	0.0	0.0	6,734.2	202.9	5,652.2	240.3	638.8	6,734.2
PORTUGAL	372.2	3,375.1	411.2	0.0	0.0	4,158.5	0.0	3,099.6	883.3	175.6	4,158.5
ROMANIA	1,018.2	4,888.0	927.6	0.0	134.5	6,968.3	2,800.7	3,859.4	52.2	256.0	6,968.3
SAUDI ARABIA	73.7	11.9	25.4	0.0	0.0	111.0	0.0	104.0	0.0	7.0	111.0
SENEGAL	461.0	1,249.1	222.3	0.0	0.0	1,932.4	345.8	1,359.6	154.7	72.3	1,932.4
SIERRA LEONE	437.0	268.8	200.8	0.0	0.0	906.6	174.5	603.4	12.4	116.3	906.6
SINGAPORE	424.4	1,043.5	141.4	0.0	0.0	1,609.3	0.0	1,439.5	103.3	66.5	1,609.3
SPAIN	382.6	10.3	98.4	0.0	0.0	491.3	0.0	412.2	56.0	23.1	491.3
SRI LANKA	1,024.0	2,901.6	1,797.0	0.0	0.0	5,722.6	307.9	4,221.9	583.0	609.8	5,722.6
SUDAN	870.7	2,183.8	1,976.7	0.0	13.4	5,044.6	296.7	3,499.0	570.3	678.6	5,044.6
SYRIAN A.R.	775.6	1,920.1	649.5	0.0	208.9	3,554.1	675.2	2,285.2	499.9	93.8	3,554.1
THAILAND	2,734.7	4,804.4	5,088.0	14.2	3.8	12,645.1	1,762.7	6,068.5	2,100.8	2,713.1	12,645.1
TUNISIA	749.8	1,431.2	372.2	0.0	0.0	2,553.2	141.2	1,967.1	291.8	153.1	2,553.2
TURKEY	2,213.0	2,773.2	3,415.6	0.0	22.2	8,424.0	1,789.4	4,542.9	130.8	1,960.9	8,424.0
UGANDA	350.2	499.4	404.9	0.0	0.0	1,254.5	131.0	1,068.3	0.0	55.2	1,254.5
U.A.EMIRATES	49.5	125.2	15.9	0.0	0.0	190.6	0.0	189.8	0.8	0.0	190.6
UK (HONG KONG)	97.8	128.9	38.7	0.0	0.0	265.4	0.0	256.4	0.0	9.0	265.4
U.R. TANZANIA	591.6	1,336.6	731.1	0.0	0.0	2,659.3	9.6	2,456.5	61.3	131.9	2,659.3
URUGUAY	836.1	2,385.4	511.7	0.0	0.0	3,733.2	193.1	2,449.4	769.4	321.2	3,733.1
VENEZUELA	1,287.3	1,323.1	387.7	6.2	0.0	3,004.3	311.2	2,353.1	157.6	182.4	3,004.3
VIET NAM	429.1	3,674.1	1,758.8	0.0	0.0	5,862.0	31.4	4,990.7	139.5	700.4	5,862.0
YUGOSLAVIA	1,353.0	5,351.5	2,663.8	0.0	37.3	9,405.6	3,061.7	4,305.4	1,196.0	842.5	9,405.6
ZAIRE	701.7	1,839.5	848.8	0.0	0.0	3,390.0	578.8	2,210.7	204.7	395.8	3,390.0
ZAMBIA	1,398.8	2,591.8	733.7	0.0	0.0	4,724.3	152.5	4,118.7	180.9	272.2	4,724.3
ZIMBABWE	38.2	186.8	69.4	0.0	0.0	294.4	0.0	289.1	0.0	5.3	294.4
OTHER COUNTRIES b)	477.5	235.6	1,468.3	0.0	0.0	2,181.4	418.6	902.4	8.5	851.9	2,181.4
SUB-TOTAL	83,885.8	175,095.9	87,028.9	133.6	2,630.1	348,774.3	61,538.6	208,398.0	40,969.0	37,868.7	348,774.3
Intercountry projects											
REGIONAL AFRICA	1,749.6	1,355.0	348.3	983.7	40.0	4,476.6	332.8	3,944.3	135.3	64.2	4,476.6
REGIONAL ARAB STATES	22.9	0.0	33.8	7.0	0.0	63.7	63.7	0.0	0.0	0.0	63.7
REGIONAL ASIA & PACIFIC	5,709.9	3,896.8	2,467.6	3,409.7	81.1	15,565.1	6,905.7	4,410.6	2,813.5	1,435.3	15,565.1
REGIONAL EUROPE	628.8	521.2	70.4	260.0	1,134.7	2,615.1	59.5	2,487.7	10.0	57.9	2,615.1
REGIONAL LATIN AMERICA	5,029.2	4,228.5	1,340.1	2,982.3	665.0	14,245.1	2,991.4	6,703.0	2,702.0	1,848.7	14,245.1
REGIONAL MIDDLE EAST	5.8	1.2	5.3	0.0	0.0	12.3	12.3	0.0	0.0	0.0	12.3
INTERREGIONAL	11,785.0	5,064.2	17,041.9	7,309.6	482.1	41,682.8	1,790.5	33,286.1	3,856.6	2,749.6	41,682.8
SUB-TOTAL	24,931.2	15,066.9	21,307.4	14,952.3	2,402.9	78,660.7	12,155.9	50,831.7	9,517.4	6,155.7	78,660.7
MISCELLANEOUS	545.3	855.4	331.8	136.7	21.2	1,890.4	23.2	1,867.2	0.0	0.0	1,890.4
TOTAL	109,362.3	191,018.2	108,668.1	15,222.6	5,054.2	429,325.4	73,717.7	261,096.9	50,486.4	44,024.4	429,325.4

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

b) Includes the following countries which have not received technical assistance during the last ten or more years: Austria, Democratic Kampuchea, Denmark, Finland, France, the Federal Republic of Germany, 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			1988			1989		
	Total	of which women	% of women	Total	of which women	% of women	Total	of which women	% of women
Fellows	570	97	17.0	682	146	21.4	732	161	22.0
Visiting scientists	65	7	10.8	156	12	7.7	192	34	17.7
Training course participants	519	64	12.3	1,109	179	16.1	1,265	212	16.8
Project counterparts	511	46	9.0	1,119	124	11.1	1,208	127	10.5
International experts	319	7	2.2	938	56	6.0	948	61	6.4
National experts	12	0	0.0	89	11	12.4	49	5	10.2
Lecturers	119	2	1.7	221	20	9.0	322	19	5.9
Other project personnel	11	9	81.8	15	11	73.3	17	13	76.5
TC Professional staff [a]	34	5	14.7	59	16	27.1	50 [b]	15	30.0
TC General services staff [a]	54	48	88.8	81	78	96.3	86	81	94.2

[a] Excluding the staff of Printing Section and Publishing Section.

[b] The reduction in professional manpower is due to fewer cost-free experts and manning table vacancies on 31 December.

Explanatory Notes to Annexes

Annex I. Disbursement of extrabudgetary and in-kind contributions

Related to Table 5, this Annex shows, by donor and by type, the technical assistance disbursements made during 1989 utilizing extrabudgetary resources and, separately, contributions in kind. In many cases, the Agency must depend on donor countries for information about the value of in-kind inputs that have been provided.

Annex II. Training courses: 1989

All courses organized by the Agency in 1989 are listed together with the numbers 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. National courses are not inlcuded in this summary.

Annex III. Published reports: 1989

Technical co-operation project reports published in 1989 are listed by country.

Annex IV. Voluntary contributions pledged and paid to the Technical Assistance and Co-operation Fund for 1989

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 1989.

Annex V. Cost-free fellowships offered and awarded: 1989

Information is made available in this table on the number of cost-free fellowships offered by Member States and the number of awards.

Annex VI. Approved and on-going UNDP projects

This table includes one project being implemented for the United Nations Fund for Science and Technology for Development. Those projects for which IAEA acts only as an associated agency are shown separately.

Annex VII. Footnote-a/ projects made operational or extended during 1989

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 1989

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

Annex IX. Net programme changes by recipient

The Secretariat is obliged to furnish information on changes to approved projects under the provisions of the Revised Guiding Principles. As over five hundred projects 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. Projects rephased during 1989

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 or future years. 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 1989.

ANNEX I

DISBURSEMENTS OF EXTRABUDGETARY AND IN-KIND CONTRIBUTIONS

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

Donor	Extrabudgetary						In kind					Total
	Experts	Equip-ment	Fellow-ships	Group training	Sub-con-tracts	Sub-total	Experts	Equip-ment	Fellow-ships	Group training	Sub-total	
COUNTRIES												
Argentina	0.0	0.0	0.0	0.0	0.0	0.0	19.0	0.0	0.6	106.2	125 8	125.8
Australia	56.2	176.1	36.9	127.4	0.0	396.6	5.9	0.0	0.0	25.2	31.1	427.7
Austria	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	14.3	4.9	21.2	21.2
Bangladesh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	1.3
Belgium	48.9	14.4	0.0	0.0	0.0	63.3	3.6	0.0	110.5	0.0	114.1	177.4
Bolivia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0
Brazil	0.0	0.0	0.0	0.0	0.0	0.0	16.2	0.0	7.6	48.3	72.1	72.1
Bulgaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.3	2.3
Canada	0.0	0.0	0.0	0.0	0.0	0.0	41.2	0.0	0.0	7.8	49.0	49.0
Chile	0.0	0.0	0.0	6.0	0.0	6.0	4.1	0.0	0.4	8.8	13.3	19.3
China	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	27.9	29.7	29.7
Colombia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	6.8	6.8
Côte d'Ivoire	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	2.2	2.2
Cuba	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	3.8	3.8
Czechoslovakia	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	3.1	0.0	3.8	3.8
Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.8	0.0	18.8	18.8
Ecuador	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0
Finland	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	5.5	5.5
France	50.5	43.7	0.0	0.0	0.0	94.2	15.2	0.0	87.0	7.1	109.3	203.5
German D.R.	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	3.6	1.0	4.9	4.9
Germany, F.R.	188.2	680.6	0.0	294.5	58.7	1,222.0	35.4	0.0	299.1	11.2	345.7	1,567.7
Guatemala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	2.9	2.9
Hungary	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	85.9	1.2	92.6	92.6
India	0.0	0.0	0.0	0.0	0.0	0.0	3.7	18.0	51.8	72.6	146.1	146.1
Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1
Ireland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9
Israel	0 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.2	10.2	10 2
Italy	183.3	129.6	0.0	171.5	228.3	712.7	10.8	0.0	74.8	1.3	86.9	799.6
Japan	179.5	77.5	0.0	304.1	0.0	561.1	7.5	0.0	0.0	12.4	19.9	581.0
Kuwait	0.0	84.9	0.0	0.0	0.0	84.9	0.0	0.0	0.0	2.0	2 0	86.9
Korea, R.	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	64.6	71.6	71.6
Malaysia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.0	6.0
Mexico	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	17.2	18.9	18.9
Netherlands	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	24.8	0.0	28.0	28.0
New Zealand	0.0	0 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9
Norway	0 0	10.9	3.9	0.0	0.0	14.8	0 0	0.0	0.0	0.0	0.0	14.8
Pakistan	0 0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	2.0	5 4	5.4
Panama	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9
Paraguay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9
Poland	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	11.2	0.0	16.0	16.0
Spain	0.0	0.0	0.0	0.0	0.0	0.0	19.8	0.0	7.5	0.3	27.6	27.6
Sudan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	3.6	3.6
Sweden	159.0	158.0	36.6	0.0	0.0	353.6	4.6	0.0	1.2	1.2	7.0	360.6
Switzerland	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	2.9	2.9
Thailand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	4.1	4.1
UK	110.3	636.7	85.6	0.0	0.0	832.6	21.1	0.0	79.2	4.5	104.8	937.4
USSR	0.0	172.1	31.8	0.0	0.0	203.9	1.2	0.0	0.0	7.0	8.2	212.1
USA	231.6	1,381.8	0.0	28.3	76.9	1,718.6	49.6	0.0	555.4	18.3	623.3	2,341.9
Uruguay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	4.4	4.4
Viet Nam	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	4.0	4.0

Donor	Extrabudgetary						In kind					Total
	Experts	Equip-ment	Fellow-ships	Group training	Sub-con-tracts	Sub-total	Experts	Equip-ment	Fellow-ships	Group training	Sub-total	
Yugoslavia	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	8.0	18.0	18.0
ORGANIZATIONS												
Asian Dev. Bank	0.0	0.0	0.0	92.4	0.0	92.4	0.0	0.0	0.0	0.0	0.0	92.4
EEC	13.4	113.2	39.2	54.9	0.0	220.7	0.0	0.0	0.0	0.0	0.0	220.7
IBRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	10.8	10.8
Sub-total	1,220.9	3,679.5	234.0	1,079.1	363.9	6,577.4	313.9	18.0	1,450.6	512.1	2,294.6	8,872.0
Additional extrabudgetary disbursements included in the Agency's Accounts under TACF as Miscellaneous Income												
Colombia	0.0	0.0	0.0	3.3	0.0	3.3	0.0	0.0	0.0	0.0	0.0	3.3
IFFIT	0.0	0.0	0.0	6.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	6.0
UNESCO	0.0	0.0	0.0	6.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	6.0
Sub-total	0.0	0.0	0.0	15.3	0.0	15.3	0.0	0.0	0.0	0.0	0.0	15.3
TOTAL	1,220.9	3,679.5	234.0	1,094.4	363.9	6,610.7	313.9	18.0	1,450.6	512.1	2,294.6	8,887.3

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

Donor	Project title	Project code	Equipment	Fellowships	Total
Chile	Impurities in uranium compounds	CHI/3/008	1.8	0.0	1.8
Chile	Research reactor core conversion (RECH-1)	CHI/4/013	18.5	0.0	18.5
Colombia	Isotopes in hydrology	COL/8/010	2.8	0.0	2.8
Ecuador	Nuclear medicine services	ECU/6/009	2.3	0.0	2.3
Ghana	Training in nuclear instrumentation	GHA/4/008	6.2	0.0	6.2
Hungary	Procurement assistance for Hungary	HUN/4/008	7.3	0.0	7.3
Iceland	Radiation protection	ICE/9/002	8.5	0.0	8.5
Libyan A.J.	*Eradication of Mediterranean Fruit Fly*	LIB/5/003	0.0	24.1	24.1
Mexico	Ecological modelling	MEX/9/028	8.4	0.0	8.4
Nigeria	Nuclear physics	NIR/1/003	4.7	0.0	4.7
Pakistan	Control and instrumentation	PAK/4/027	0.9	0.0	0.9
Pakistan	Quality assurance (Phase II)	PAK/4/032	28.6	0.0	28.6
Portugal	Research reactor modernization	POR/4/012	16.9	0.0	16 9
Syrian A.R.	Procurement assistance	SYR/0/005	25.3	0.0	25.3
U.A. Emirates	Radioactive environmental and food contamination	UAE/9/003	0.8	0.0	0.8
Yugoslavia	Radiation protection	YUG/9/022	5.6	0.0	5.6
Yugoslavia	Procurement assistance	YUG/9/023	0.1	0.0	0.1
TOTAL			138.7	24.1	162.8

ANNEX II

TRAINING COURSES: 1989

Project title and code	Place(s) and dates	Source of funds	Participation[a]			Amount(s) expended[b] ($)	
			(1)	(2)	(3)		
INTERREGIONAL TRAINING COURSE ON ELECTRIC SYSTEM EXPANSION PLANNING (WASP), INT/0/047/001	ARGONNE, IL, USA 18 SEPTEMBER - 17 NOVEMBER	AGENCY	30	1	0	84,647	(CC)
INTERREGIONAL TRAINING COURSE ON THE TECHNOLOGY AND APPLICATION OF NEUTRON GENERATORS, INT/1/045/001	LENINGRAD, USSR 25 SEPTEMBER - 27 OCTOBER	AGENCY	15	0	0	30,898	(CC)
INTERREGIONAL TRAINING COURSE ON NUCLEAR MEASUREMENTS AND METHODS IN REACTOR AND PERSONAL NEUTRON DOSIMETRY, INT/1/046/001	RIGA AND MOSCOW, USSR 15 MAY - 9 JUNE	AGENCY	20	0	0	62,860 11,910	(CC) (NCC)
ADVANCED INTERREGIONAL TRAINING COURSE ON SAMPLING, SAMPLE PREPARATION AND DATA EVALUATION FOR MULTI-ELEMENT AND RADIONUCLIDE ANALYSIS BY NUCLEAR AND INSTRUMENTAL METHODS, INT/2/006/001	JUELICH, GERMANY, F.R. 6 NOVEMBER - 1 DECEMBER	AGENCY	26	0	0	50,592	(CC)
ADVANCED INTERREGIONAL TRAINING COURSE ON NUCLEAR ELECTRONICS, INT/4/098/001	ARGONNE, IL, USA 9 JANUARY - 31 MARCH	AGENCY	20	0	0	100,500	(CC)
INTERREGIONAL TRAINING COURSE ON INTERFACING IN NUCLEAR EXPERIMENTS, INT/4/100/001	CHIANG MAI, THAILAND 16 OCTOBER - 8 DECEMBER	AGENCY GERMANY, F.R.	18	0	2	125,307 12,072	(CC) (CC)
INTERREGIONAL TRAINING COURSE ON THE INDUCTION AND USE OF MUTATIONS IN PLANT BREEDING, INT/5/116/001	SEIBERSDORF, AUSTRIA 29 MARCH - 12 MAY	AGENCY	18	0	0	123,518	(CC)
INTERREGIONAL TRAINING COURSE ON THE USE OF ISOTOPES AND RADIATION TECHNIQUES IN STUDIES ON SOIL/PLANT RELATIONSHIPS, INT/5/117/001	SEIBERSDORF, AUSTRIA 23 MAY - 30 JUNE	AGENCY	20	2	0	114,791	(CC)
INTERREGIONAL TRAINING COURSE ON MODERN ASPECTS IN RADIOPHARMACY, INT/6/037/001	REZ, CZECHOSLOVAKIA 21 AUGUST - 15 SEPTEMBER	AGENCY	17	0	0	44,583 47,469	(CC) (NCC)
INTERREGIONAL TRAINING COURSE ON NUCLEAR MEDICINE, INT/6/038/001	BERLIN, GERMAN D.R. 12 SEPTEMBER - 5 OCTOBER	AGENCY	22	0	0	67,239 80,978	(CC) (NCC)
INTERREGIONAL TRAINING COURSE ON SAFETY AND REGULATION OF SEALED SOURCES OF RADIOACTIVE MATERIAL, INT/9/093/001	ARGONNE, IL, USA 10 APRIL - 12 MAY	AGENCY	34	1	0	83,901	(CC)
INTERREGIONAL TRAINING COURSE ON ACCIDENT MANAGEMENT IN NUCLEAR POWER PLANTS, INT/9/094/001	ARGONNE, IL, USA 22 MAY - 16 JUNE	AGENCY	25	2	0	51,282	(CC)
INTERREGIONAL TRAINING COURSE ON SAFETY IN NUCLEAR POWER PLANT OPERATION WITH PWR/WWER, INT/9/095/001	TRNAVA, CZECHOSLOVAKIA 25 SEPTEMBER - 27 OCTOBER	AGENCY	17	0	0	49,831	(CC)
INTERREGIONAL TRAINING COURSE ON PROBABILISTIC SAFETY ASSESSMENT IN NUCLEAR POWER PLANT OPERATION, INT/9/096/001	MADRID, SPAIN 20 SEPTEMBER - 27 OCTOBER	AGENCY	14	0	0	31,160	(CC)
INTERREGIONAL TRAINING COURSE ON RADIATION PROTECTION, INT/9/097/001	BUENOS AIRES, ARGENTINA 3 APRIL - 30 NOVEMBER	AGENCY	12	0	0	42,096	(CC)
INTERREGIONAL TRAINING COURSE ON SAFETY AND REGULATION OF UNSEALED SOURCES OF RADIOACTIVE MATERIAL, INT/9/098/001	DUBLIN, IRELAND 19 JUNE - 14 JULY	AGENCY	24	0	0	75,258	(CC)
INTERREGIONAL TRAINING COURSE ON MANAGEMENT OF RADIOACTIVE WASTES WITH REGARD TO RADIOISOTOPE APPLICATIONS, INT/9/099/001	KARLSRUHE, GERMANY, F.R. 18 SEPTEMBER - 13 OCTOBER	AGENCY	30	0	0	107,597	(CC)

Project title and code	Place(s) and dates	Source of funds	Participation[a]			Amount(s) expended[b] ($)	
			(1)	(2)	(3)		
INTERREGIONAL TRAINING COURSE ON RADIOACTIVITY MEASUREMENTS FOR ENVIRONMENTAL MONITORING PURPOSES, INT/9/100/001	GIF-SUR-YVETTE, FRANCE 16 OCTOBER - 17 NOVEMBER	AGENCY	23	0	0	35,669	(CC)
INTERNATIONAL TRAINING COURSE ON SAFETY IN NUCLEAR POWER PLANT OPERATION, INT/9/101/001	GIF-SUR-YVETTE, FRANCE 5 JUNE - 30 JUNE	AGENCY	9	0	0	21,437	(CC)
INTERREGIONAL TRAINING COURSE ON PROBABILISTIC SAFETY ASSESSMENT (PSA) FOR NUCLEAR POWER PLANT SAFETY, INT/9/102/001	MOSCOW, USSR 13 NOVEMBER - 8 DECEMBER	AGENCY	15	0	20	35,163 158	(CC) (NCC)
REGIONAL TRAINING COURSE ON PREVENTIVE MAINTENANCE AND QUALITY CONTROL OF NUCLEAR AND RELATED EQUIPMENT IN MEDICINE, RAF/4/005/001	ALGIERS, ALGERIA 7 OCTOBER - 26 OCTOBER	AGENCY	8	0	0	39,251	(CC)
REGIONAL TRAINING COURSE ON NUCLEAR INSTRUMENTATION MAINTENANCE, RAF/4/006/001	LUSAKA, ZAMBIA 22 MAY - 30 JUNE	AGENCY	16	0	5	85,206	(CC)
FIRST RESEARCH CO-ORDINATION MEETING OF THE REGIONAL PROJECT RAF/5/010, RAF/5/010/002	TUNIS, TUNISIA 15 MAY - 19 MAY	AGENCY	8	2	5	15,189	(CC)
REGIONAL GROUP TRAINIG COURSE ON MEDFLY STERILE INSECT TECHNIQUE, RAF/5/013/001	ROME, ITALY 6 NOVEMBER - 17 NOVEMBER	AGENCY	9	0	0	17,901	(CC)
REGIONAL TRAINING COURSE ON THE USE OF ISOTOPES AND RADIATION TECHNIQUES IN STUDIES OF BIOLOGICAL NITROGEN FIXATION AND SOIL/PLANT NUTRITION, RAF/5/016/001	BAMBEY, SENEGAL 21 AUGUST - 15 SEPTEMBER	AGENCY	11	0	4	72,950	(CC)
REGIONAL TRAINING COURSE ON BASIC NUCLEAR MEDICINE, RAF/6/003/001	KHARTOUM, SUDAN 22 JULY - 16 AUGUST	AGENCY	12	0	4	76,499 347	(CC) (NCC)
FIRST RESEARCH CO-ORDINATION MEETING OF THE REGIONAL PROJECT RAF/8/012, RAF/8/012/002	BAMAKO, MALI 20 NOVEMBER - 22 NOVEMBER	AGENCY	5	0	0	6,185	(CC)
REGIONAL TRAINING COURSE ON THE APPLICATION OF ISOTOPE TECHNIQUES IN WATER RESOURCES DEVELOPMENT, RAF/8/013/001	DAKAR, SENEGAL 5 JUNE - 30 JUNE	AGENCY	11	0	4	74,447	(CC)
MEETING ON REGIONAL CO-OPERATION IN RADIATION PROTECTION IN AFRICA, RAF/9/005/002	ARUSHA, U.R. TANZANIA 12 SEPTEMBER - 14 SEPTEMBER	AGENCY	9	0	1	10,000	(CC)
REGIONAL TRAINING COURSE ON ELECTRIC SYSTEM EXPANSION PLANNING, RAS/0/013/002	KUALA LUMPUR, MALAYSIA 15 MAY - 23 JUNE	AGENCY ASIAN DEV BANK	24	1	6	72,177 92,443	(CC) (CC)
REGIONAL TRAINING COURSE ON NUCLEAR POWER PROJECT PLANNING AND IMPLEMENTATION, RAS/0/013/003	TAEJEON, CHUNG-NAM, KOREA, R. 23 OCTOBER - 10 NOVEMBER	AGENCY	13	0	1	19,774	(CC)
THIRD REGIONAL WORKSHOP ON ENERGY, ELECTRICITY AND NUCLEAR POWER PLANNING, RAS/0/013/004	BEIJING, CHINA 4 SEPTEMBER - 8 SEPTEMBER	AGENCY RESERVE (CC)	6	4	2	8,491 5,292	(CC) (CC)
REGIONAL WORKSHOP ON ENVIRONMENTAL SAMPLING AND MEASUREMENTS OF RADIOACTIVITY FOR MONITORING PURPOSES, RAS/0/015/001	KALPAKKAM, INDIA 9 OCTOBER - 12 OCTOBER	AGENCY	7	5	0	4,381	(CC)
REGIONAL TRAINING COURSE ON RESEARCH REACTOR OPERATORS, RAS/4/009/001	BANGKOK, THAILAND 27 NOVEMBER - 22 DECEMBER	AGENCY	14	0	2	25,436	(CC)
UNIDO/WHO ASIA REGIONAL TRAINING COURSE ON MANAGEMENT AND MAINTENANCE OF BIOMEDICAL EQUIPMENT, RAS/4/010/001	PARIS, FRANCE 6 MARCH - 24 MARCH	AGENCY	5	0	0	1,327	(CC)
REGIONAL TRAINING COURSE ON THE USE OF ISOTOPES AND RADIATION TECHNIQUES IN STUDIES ON SOIL/PLANT RELATIONSHIPS WITH SPECIAL EMPHASIS ON TREES, RAS/5/018/001	BANGI, MALAYSIA 6 NOVEMBER - 8 DECEMBER	AGENCY	9	3	6	51,916	(CC)

Project title and code	Place(s) and dates	Source of funds	Participation[a]			Amount(s) expended[b] ($)
			(1)	(2)	(3)	
REGIONAL TRAINING COURSE ON EXTERNAL QUALITY ASSESSMENT SCHEMES FOR RIA OF THYROID HORMONES, RAS/6/011/002	BANGKOK, THAILAND 9 JANUARY - 13 JANUARY	AGENCY	12	0	4	19,126 (CC)
REGIONAL TRAINING COURSE ON OPTIMIZATION OF PRODUCTION TECHNIQUES AND DISTRIBUTION SCHEMES FOR REAGENTS FOR RADIOIMMUNOASSAY, RAS/6/011/003	BANGKOK, THAILAND 9 OCTOBER - 20 OCTOBER	AGENCY	13	2	2	33,505 (CC)
REGIONAL TRAINING COURSE ON RADIATION DOSIMETRY, RAS/6/015/001	SHANGHAI, CHINA 9 OCTOBER - 4 NOVEMBER	AGENCY	18	2	4	80,703 (CC)
REGIONAL TRAINING COURSE ON USE OF COMPUTERS IN TECHNETIUM 99M IMAGING, RAS/6/016/001	CAMPERDOWN, AUSTRALIA 10 APRIL - 26 MAY	AUSTRALIA	13	0	0	126,737 (CC)
REGIONAL TRAINING COURSE ON RADIOTHERAPY FOR MEDICAL PHYSICISTS, RAS/6/017/001	LAHORE, PAKISTAN 16 OCTOBER - 27 OCTOBER	AGENCY	9	4	2	27,090 (CC)
REGIONAL WORKSHOP ON RADIATION AND NUCLEAR TECHNIQUES FOR STERILIZATION AND CLINICAL QUALITY CONTROL OF TISSUE GRAFTS IN TISSUE BANKING, RAS/7/003/002	BANGKOK, THAILAND 13 NOVEMBER - 22 NOVEMBER	AGENCY	13	1	4	19,325 (CC)
REGIONAL TRAINING COURSE ON INDUSTRIAL RADIATION STERILIZATION - QUALITY CONTROL AND STERILITY ASSURANCE, RAS/8/061/048	BANGKOK, THAILAND 13 FEBRUARY - 24 FEBRUARY	UNDP	11	0	3	45,147 (CC)
REGIONAL TRAINING COURSE ON THE USE OF TRACER TECHNOLOGY IN INDUSTRY, RAS/8/061/049	KUALA LUMPUR, MALAYSIA 9 OCTOBER - 27 OCTOBER	UNDP	12	0	2	36,266 (CC)
REGIONAL TRAINING COURSE ON NON-DESTRUCTIVE TESTING OF ULTRASONICS (LEVEL III), RAS/8/061/050	MANILA, PHILIPPINES 6 MARCH - 24 MARCH	UNDP	8	0	6	24,249 (CC)
REGIONAL TRAINING COURSE ON NON-DESTRUCTIVE TESTING OF RADIOGRAPHY (LEVEL III), RAS/8/061/053	KUALA LUMPUR, MALAYSIA 4 SEPTEMBER - 22 SEPTEMBER	UNDP	13	0	3	29,191 (CC)
REGIONAL EXECUTIVE MANAGEMENT SEMINAR ON NUCLEONIC CONTROL SYSTEMS IN PAPER INDUSTRY, RAS/8/061/055	BANGKOK, THAILAND 6 SEPTEMBER - 8 SEPTEMBER	UNDP	5	0	2	11,673 (CC)
REGIONAL WORKSHOP ON THE FABRICATION OF NDT TEST PIECES, RAS/8/061/059	BANDUNG, INDONESIA 6 NOVEMBER - 17 NOVEMBER	UNDP	11	0	1	34,292 (CC)
REGIONAL TRAINING COURSE ON FORMULATION TECHNOLOGY FOR RADIATION CROSSLINKING APPLICATIONS, RAS/8/061/070	SHANGHAI, CHINA 18 SEPTEMBER - 29 SEPTEMBER	UNDP	9	0	4	13,806 (CC)
REGIONAL TRAINING COURSE ON RADIOISOTOPE PRODUCTION IN RESEARCH REACTORS, RAS/8/062/005	BOMBAY, INDIA 9 JANUARY - 20 JANUARY	RESERVE (CC)	9	0	1	2,913 (CC)
REGIONAL TRAINING COURSE ON NEUTRON ACTIVATION ANALYSIS FOR MINERAL RESOURCE PROSPECTING AND MINERALS CHARACTERIZATION, RAS/8/062/006	BOMBAY, INDIA 6 FEBRUARY - 24 FEBRUARY	INDIA	12	3	1	GIFT IN KIND
REGIONAL WORKSHOP ON NEUTRON RADIOGRAPHY, RAS/8/062/010	OSAKA, JAPAN 15 MAY - 19 MAY	JAPAN	9	0	0	7,169 (CC)
REGIONAL EXECUTIVE MANAGEMENT SEMINAR ON NUCLEONIC CONTROL SYSTEMS IN THE STEEL INDUSTRY, RAS/8/062/011	TOKYO, JAPAN 17 MAY - 24 MAY	JAPAN	8	0	0	60,043 (CC)
REGIONAL EXECUTIVE MANAGEMENT SEMINAR ON THE USE OF NUCLEONIC INSTRUMENT TECHNIQUES IN CIVIL ENGINEERING, RAS/8/062/014	TOKYO, JAPAN 5 SEPTEMBER - 13 SEPTEMBER	JAPAN	12	0	0	68,044 (CC)
REGIONAL WORKSHOP ON RADIATION ENGINEERING - ELECTRON BEAM FACILITIES, RAS/8/062/015	TAKASAKI, GUNMA, JAPAN 6 NOVEMBER - 17 NOVEMBER	JAPAN	11	0	0	45,532 (CC)

Project title and code	Place(s) and dates	Source of funds	Participation[a]			Amount(s) expended[b] ($)	
			(1)	(2)	(3)		
REGIONAL WORKSHOP ON NON-DESTRUCTIVE EXAMINATION ON NON-METALLIC MATERIALS, RAS/8/062/017	TOKYO, JAPAN 25 SEPTEMBER - 29 SEPTEMBER	JAPAN	12	0	0	9,913	(CC)
REGIONAL WORKSHOP ON THE USE OF LOW-COST NUCLEONIC CONTROL SYSTEMS IN REGIONAL PAPER INDUSTRY, RAS/8/062/021	OSAKA AND TOKYO, JAPAN 14 MARCH - 20 MARCH	JAPAN	6	0	0	16,101	(CC)
REGIONAL TRAINING COURSE ON THE APPLICATION OF NUCLEONIC CONTROL SYSTEMS TO COAL PROCESSING OPERATIONS, RAS/8/064/001	BANGKOK, MAE MOH AND CHIANG MAI, THAILAND 20 NOVEMBER - 22 DECEMBER	AUSTRALIA	4	0	2	60	(CC)
REGIONAL EXECUTIVE MANAGEMENT SEMINAR ON THE APPLICATION OF NUCLEONIC CONTROL SYSTEMS TO COAL PROCESSING OPERATIONS, RAS/8/064/004	MAE MOH, THAILAND 1 NOVEMBER - 3 NOVEMBER	AUSTRALIA	3	0	2	1,364	(CC)
REGIONAL WORKSHOP ON THE APPLICATION OF NUCLEONIC CONTROL SYSTEMS TO COAL PROCESSING OPERATIONS, RAS/8/064/005	MAE MOH, THAILAND 6 NOVEMBER - 17 NOVEMBER	AUSTRALIA	4	0	2	2,640	(CC)
REGIONAL TRAINING COURSE ON RADIATION PROTECTION, RAS/9/006/002	TOKYO, JAPAN 16 OCTOBER - 27 OCTOBER	AGENCY JAPAN	14	0	0	549 42,678	(CC) (CC)
REGIONAL TRAINING COURSE ON RADIOISOTOPE TECHNIQUES IN MINERAL EXPLOITATION, RER/2/002/001	KRAKOW, POLAND 12 JUNE - 15 JULY	AGENCY	10	0	0	43,216 4,825	(CC) (NCC)
REGIONAL WORKSHOP ON ISI OF WWER-TYPE REACTORS, RER/4/002/001	BUDAPEST, HUNGARY 6 MARCH - 10 MARCH	AGENCY	9	0	3	5,930	(CC)
REGIONAL WORKSHOP ON IN-SERVICE INSPECTION STANDARDS PLUS QUALITY ASSURANCE, RER/4/002/002	MADRID, SPAIN 3 APRIL - 7 APRIL	AGENCY	14	0	0	18,261	(CC)
REGIONAL WORKSHOP ON EDDY CURRENT TECHNIQUES - PRACTICAL APPROACH, RER/4/002/003	ZAGREB, YUGOSLAVIA 15 MAY - 19 MAY	AGENCY	11	0	0	1,454	(CC)
REGIONAL WORKSHOP ON PRESSURE VESSEL EXAMINATION, RER/4/002/004	MADRID, SPAIN 10 JULY - 14 JULY	AGENCY	12	0	0	22,873	(CC)
REGIONAL ON-THE-JOB TRAINING COURSE IN EDDY CURRENT INSPECTION OF STEAM GENERATOR TUBES ON WWER-440 TYPE NPP, RER/4/002/005	KOZLODUY, BULGARIA 6 DECEMBER - 10 DECEMBER	AGENCY	9	0	3	1,800 2,100	(CC) (NCC)
REGIONAL WORKSHOP ON RADIOIMMUNOASSAY, RER/6/002/002	KUWAIT 27 MAY - 7 JUNE	AGENCY	14	0	0	23,233	(CC)
REGIONAL WORKSHOP ON QUALITY CONTROL IN HOSPITAL RADIOPHARMACY, RER/6/002/003	AMMAN, JORDAN 21 OCTOBER - 2 NOVEMBER	AGENCY	8	0	4	392	(CC)
REGIONAL CO-ORDINATION MEETING ON ISOTOPE HYDROLOGY, RER/8/002/001	AMMAN, JORDAN 19 MARCH - 20 MARCH	AGENCY	7	0	0	c	
REGIONAL WORKSHOP ON ISOTOPE HYDROLOGY, RER/8/002/002	AMMAN, JORDAN 21 MARCH - 26 MARCH	AGENCY	6	0	0	3,746	(CC)
SECOND REGIONAL CO-ORDINATION MEETING AND WORKSHOP, RER/8/002/003	DAMASCUS, SYRIAN ARAB REP. 10 DECEMBER - 14 DECEMBER	AGENCY	15	0	0	11,550	(CC)
REGIONAL WORKING GROUP ON SOURCE TERM CODE PACKAGE FOR WWER-TYPE REACTORS (STCP), RER/9/004/001	MOSCOW, USSR 20 MARCH - 7 JULY	AGENCY	8	3	0	1,677	(CC)
REGIONAL WORKSHOP ON PROBABILISTIC SAFETY ASSESSMENT, RER/9/005/001	BUDAPEST, HUNGARY 4 SEPTEMBER - 8 SEPTEMBER	AGENCY	5	5	3	1,241	(CC)
REGIONAL WORKSHOP ON RADIATION PROTECTION REGULATIONS AND THEIR IMPLEMENTATION, RER/9/007/001	DOHA, QATAR 4 MARCH - 15 MARCH	AGENCY	12	0	3	9,747	(CC)

Project title and code	Place(s) and dates	Source of funds	Participation[a]			Amount(s) expended[b] ($)	
			(1)	(2)	(3)		
REGIONAL WORKSHOP ON RADIATION PROTECTION IN INDUSTRIAL APPLICATION OF IONIZING RADIATION, RER/9/007/002	BAGHDAD, IRAQ 20 MAY - 31 MAY	AGENCY	5	0	3	30,135	(CC)
SECOND REGIONAL WORKSHOP ON NUCLEAR INFORMATION, RLA/0/009/004	HAVANA, CUBA 11 DECEMBER - 15 DECEMBER	AGENCY	6	0	3	5,258	(CC)
REGIONAL TRAINING COURSE ON THE APPLICATION OF NUCLEAR ANALYTICAL TECHNIQUES FOR MINERAL RESOURCES, RLA/2/003/002	SANTIAGO, CHILE 10 JULY - 4 AUGUST	AGENCY CHILE	16	0	4	44,232 6,000	(CC) (CC)
FIRST REGIONAL WORKSHOP ON NUCLEAR ANALYTIC TECHNIQUES, RLA/2/003/004	BOGOTA, COLOMBIA 6 MARCH - 10 MARCH	AGENCY	11	0	1	12,009	(CC)
REGIONAL TRAINING COURSE ON DETERMINATION OF RADIONUCLIDES IN FOOD AND ENVIRONMENTAL SAMPLES, RLA/2/005/001	RIO DE JANEIRO, BRAZIL 6 NOVEMBER - 1 DECEMBER	AGENCY	11	0	6	54,738	(CC)
REGIONAL TRAINING COURSE ON MAINTENANCE OF RADIATION PROTECTION EQUIPMENT, RLA/4/006/016	BOGOTA, COLOMBIA 10 JULY - 28 JULY	AGENCY	10	0	3	23,054	(CC)
REGIONAL TRAINING COURSE ON ADVANCED ASPECTS OF NUCLEAR SPECTROSCOPY, RLA/4/006/017	SAN LORENZO, PARAGUAY 5 JUNE - 23 JUNE	AGENCY	12	0	4	19,392	(CC)
REGIONAL TRAINING COURSE ON DESIGN AND PRODUCTION OF PRINTED BOARDS, RLA/4/006/018	HAVANA, CUBA 11 SEPTEMBER - 29 SEPTEMBER	AGENCY	11	0	7	30,069	(CC)
REGIONAL TRAINING COURSE ON RADIOISOTOPE PRODUCTION AND PROCESSING, RLA/4/007/006	MEXICO CITY, MEXICO 3 JULY - 21 JULY	AGENCY	12	0	1	30,318	(CC)
REGIONAL TRAINING COURSE ON SMALL COMPUTERS IN RESEARCH REACTOR OPERATION AND USE, RLA/4/007/007	MEXICO CITY, MEXICO 27 NOVEMBER - 8 DECEMBER	AGENCY GERMANY, F.R.	8	0	5	3,935 1,193	(CC) (CC)
REGIONAL WORKSHOP TO COMPARE BENCHMARK CALCULATIONS, RLA/4/007/008	SANTIAGO, CHILE 23 OCTOBER - 27 OCTOBER	GERMANY, F.R.	4	0	3	3,553	(CC)
REGIONAL TRAINING COURSE ON APPLICATON OF COMPUTER CODES TO CALCULATIONS RELATED TO RESEARCH REACTORS, RLA/4/007/009	SAN CARLOS DE BARILOCHE, ARGENTINA 30 OCTOBER - 10 NOVEMBER	AGENCY GERMANY, F.R.	7	0	6	2,674 4,872	(CC) (CC)
REGIONAL ADVANCED TRAINING COURSE ON THE USE OF MUTANTS FOR DIFFERENT CROSS-BREEDING PROGRAMMES, RLA/5/021/003	SAN JOSE, COSTA RICA 7 AUGUST - 25 AUGUST	AGENCY USA	7	1	2	21,573 4,135	(CC) (CC)
REGIONAL TRAINING COURSE AND SEMINAR ON THE STERILE INSECT TECHNIQUE FOR FRUIT FLY CONTROL OR ERADICATION, RLA/5/026/001	GUATEMALA CITY, GUATEMALA 27 MARCH - 21 APRIL	AGENCY	12	5	3	31,066	(CC)
REGIONAL WORKSHOP ON EXTERNAL QUALITY CONTROL, RLA/6/011/019	ASUNCION, PARAGUAY 10 APRIL - 21 APRIL	EEC	12	0	2	20,861	(CC)
SECOND REGIONAL TRAINING COURSE ON THE PREPARATION AND USE OF REGIONAL (LOCAL) BULK REAGENTS FOR RIA OF THYROID-RELATED HORMONES, RLA/6/011/020	SAO PAULO, BRAZIL 6 NOVEMBER - 24 NOVEMBER	EEC	15	0	4	13,531	(CC)
REGIONAL TRAINING COURSE ON PREPARATION AND CONTROL OF RADIOPHARMACEUTICALS, RLA/6/014/001	SANTIAGO, CHILE 12 SEPTEMBER - 6 OCTOBER	AGENCY	13	0	4	67,994	(CC)
INTERNATIONAL 12TH WORLD CONFERENCE ON NON-DESTRUCTIVE TESTING, RLA/8/013/009	AMSTERDAM, NETHERLANDS 23 APRIL - 29 APRIL	GERMANY, F.R. ITALY	18	0	0	10,465 61,533	(CC) (CC)
INTERNATIONAL WORKSHOP ON PROJECT ACHIEVEMENTS, RLA/8/013/010	HANNOVER, GERMANY, F.R. 1 MAY - 5 MAY	GERMANY, F.R. ITALY	18	0	0	35,988 2,630	(CC) (CC)
REGIONAL SEMINAR ON NDT ADVANCED TECHNIQUES, RLA/8/013/011	HANNOVER, GERMANY, F.R. 8 MAY - 12 MAY	GERMANY, F.R. ITALY	15	0	0	d	
REGIONAL SEMINAR ON NDT ADVANCED TECHNIQUES, RLA/8/013/012	MILAN, ITALY 15 MAY - 19 MAY	GERMANY, F.R. ITALY	15	0	0	e	

Project title and code	Place(s) and dates	Source of funds	Participation[a]			Amount(s) expended[b] ($)	
			(1)	(2)	(3)		
REGIONAL TRAINING COURSE ON ACOUSTIC EMISSION, RLA/8/013/018	BUENOS AIRES, ARGENTINA 19 JUNE - 30 JUNE	ITALY	16	0	0	24,518	(CC)
REGIONAL TRAINING COURSE ON TOMOGRAPHY, RLA/8/013/021	MONTEVIDEO, URUGUAY 7 AUGUST - 11 AUGUST	AGENCY ITALY	15	0	0	48 20,832	(CC) (CC)
REGIONAL TRAINING COURSE ON EDDY CURRENTS IN FERROMAGNETIC MATERIALS, RLA/8/013/023	SANTIAGO, CHILE 21 AUGUST - 25 AUGUST	GERMANY, F.R. ITALY	15	0	0	1,985 24,840	(CC) (CC)
REGIONAL TRAINING COURSE ON REAL TIME RADIOGRAPHY, RLA/8/013/024	SAO PAULO, BRAZIL 21 AUGUST - 1 SEPTEMBER	GERMANY, F.R.	15	0	0	32,303	(CC)
REGIONAL TRAINING COURSE ON VIBRATION MONITORING IN ROTATING MACHINERY, RLA/8/013/025	MEXICO CITY, MEXICO 28 AUGUST - 8 SEPTEMBER	GERMANY, F.R.	16	0	0	23,949	(CC)
REGIONAL WORKING GROUP MEETING, RLA/8/013/026	SAN JOSE, COSTA RICA 18 SEPTEMBER - 22 SEPTEMBER	GERMANY, F.R.	17	0	0	21,500	(CC)
REGIONAL TRAINING COURSE ON EDDY CURRENTS IN AIRCRAFT MAINTENANCE, RLA/8/013/031	MONTEVIDEO, URUGUAY 25 SEPTEMBER - 6 OCTOBER	GERMANY, F.R.	14	0	0	21,593	(CC)
REGIONAL TRAINING COURSE ON NDT IN QUALITY ASSURANCE, RLA/8/013/035	SAO PAULO, BRAZIL 2 OCTOBER - 13 OCTOBER	GERMANY, F.R.	13	0	0	24,427	(CC)
REGIONAL TRAINING COURSE ON CLINICAL AND RADIATION PROTECTION DOSIMETRY,RLA/9/009/041	RIO DE JANEIRO, BRAZIL 9 OCTOBER - 20 OCTOBER	AGENCY	13	0	4	16,927	(CC)
FIFTH REGIONAL WORKSHOP ON RADIATION PROTECTION, RLA/9/009/042	RIO DE JANEIRO, BRAZIL 8 MAY - 12 MAY	AGENCY	10	0	1	17,298	(CC)

[a] 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 or 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).

[b] The amounts expended (i.e. disbursements plus unliquidated obligations) do not include expenditures by host governments in respect of local lecturers, or expenditures for laboratory, lecture room and other facilities. They are also not representative of the final cost of the training courrse, since unobligated amounts may be disbursed in the following year.

[c] In connection with RER/8/002/002.

[d] In connection with RLA/8/013/010.

[e] In connection with RLA/8/013/009.

ANNEX III

PUBLISHED REPORTS

Recipient	Subject of report	Project code	Author(s)	Reference no.
ARGENTINA	THERMALHYDRAULICS (TWO-PHASE FLOW)	ARG/4/077	LAHEY, RICHARD THOMAS JR.	IAEA-TA-2438
	BURN-UP DETERMINATION OF SPENT FUEL ELEMENTS	ARG/4/077	PHILLIPS, JAMES	IAEA/UNDP-ARG/78/020-TR
	THERMOHYDRAULICS	ARG/4/077	BOURE, JEAN ALBERT	IAEA/UNDP-ARG/78/020-TR1
	COMPACT LATTICES	ARG/4/077	COCEVA, CLAUDIO	IAEA/UNDP-ARG/78/020-37
CHILE	STUDY OF SEEPAGE IN LAKE LAJA	CHI/8/016	PLATA BEDMAR, ANTONIO	IAEA-TA-2444
CHINA	PROBABILISTIC RISK ASSESSMENT	CPR/9/006	HANAN, NELSON ASSAYAG	IAEA/UNDP-CPR/85/067-01
	SEISMIC PROBABILISTIC SAFETY ASSESSMENT FOR NPPS.	CPR/9/006	LAPPA, DAVID ALLAN	IAEA/UNDP-CPR/85/067-02
	PROBABILISTIC RISK ASSESSMENT (GENERIC DATA)	CPR/9/006	VILLEMEUR, ALAIN BERGER, JEAN-PIERRE	IAEA/UNDP-CPR/85/067-03
	SAFETY REVIEW OF INITIAL TEST PROGRAMME OF NPP	CPR/9/006	ALMEIDA, CLAUDIO UBIRAJARA COUTO DE	IAEA/UNDP-CPR/85/067-04
	APPLICATION OF SOURCE TERM CODE PACKAGE	CPR/9/006	ERDMANN, WALTER	IAEA/UNDP-CPR/85/067-05
	SAFETY REVIEW OF MECHANICAL DESIGN FOR NPPS.	CPR/9/006	SHOU-NIEN HOU	IAEA/UNDP-CPR/85/067-06
	CURRENT PROCEDURES FOR STRESS ANALYSIS AND DESIGN OF MECHANICAL COMPONENTS IN NPPS.	CPR/9/006	STEVENSON, JOHN DAVID	IAEA/UNDP-CPR/85/067-07
	ACCIDENT AND TRANSIENT ANALYSIS RELEVANT TO REACTOR COOLING SYSTEMS	CPR/9/006	VANNI, ENIO ANTONIO	IAEA/UNDP-CPR/85/067-08
	CONTAINMENT SYSTEMS - THERMOHYDRAULIC ASPECTS	CPR/9/006	ROHDE, J.	IAEA/UNDP-CPR/85/067-09
	OPERATOR QUALIFICATION - SIMULATOR TRAINING	CPR/9/006	BUENAFLOR, MATTHEW TIMOTHY	IAEA/UNDP-CPR/85/067-10

Recipient	Subject of report	Project code	Author(s)	Reference no.
CHINA (cont'd)	WORKSHOP ON NUCLEAR SAFETY STANDARDS DESIGN	CPR/9/006	FISCHER, JOERG	IAEA/UNDP-CPR/85/067-11
	MANAGEMENT OF FACILITIES IN NUCLEAR FUEL CYCLE	CPR/9/006	ALONSO SANTOS, AGUSTIN	IAEA/UNDP-CPR/85/067-12
	OPERATOR QUALIFICATION - SIMULATOR TRAINING	CPR/9/006	JINQ, DERLIN	IAEA/UNDP-CPR/85/067-13
	REACTOR COOLING SYSTEM	CPR/9/006	PODOWSKI, MICHAEL ZBIGNIEW	IAEA/UNDP-CPR/85/067-14
COSTA RICA	STRENGTHENING THE NATIONAL CAPACITY FOR MINERAL PROSPECTION	COS/3/004	SCIVETTI, NICOLA EGIDIO VITRANI, FRANCO	IAEA/UNDP-COS/83/T02-TR
INDONESIA	SCREENING PLANTS FOR DISEASE RESISTANCE	INS/5/021	WAHAB, SHARIFUDDIN BIN ABDUL	IAEA/UNDP-INS/88/013-01
	NUTRITIONAL STUDIES OF RUMINANTS - ANIMAL EXPERIMENTATION AND LABORATORY METHODS	INS/5/021	NOLAN, JOHN VIVIAN	IAEA/UNDP-INS/88/013-02
	REVIEW OF ENTOMOLOGICAL RESEARCH	INS/5/021	BUTT, BILLY ARTHUR	IAEA/UNDP-INS/88/013-03
	NATIONAL TRAINING COURSE ON ELISA FOR THE SERODIAGNOSIS OF ANIMAL DISEASES (I)	INS/5/021	PATTEN, BARRY EDWARD	IAEA/UNDP-INS/88/013-04
	NATIONAL TRAINING COURSE ON ELISA FOR THE SERODIAGNOSIS OF ANIMAL DISEASES (II)	INS/5/021	EISLER, MARK	IAEA/UNDP-INS/88/013-05
	NATIONAL TRAINING COURSE ON ELISA FOR THE SERADIAGNOSIS OF ANIMAL DISEASES (III)	INS/5/021	SUTHERLAND, SHELLEY SUSAN	IAEA/UNDP-INS/88/013-06
INTERREGIONAL	RAPAT MISSION TO BANGLADESH	INT/9/055	MOISEEV, ALEXEIJ STROHAL, PETAR SKORNIK, KAROL	IAEA-TA-2430
	RAPAT MISSION TO VIET NAM	INT/9/055	STROHAL, PETAR MOISEEV, ALEXEIJ	IAEA-TA-2431
	RAPAT MISSION TO INDONESIA	INT/9/055	GONZALEZ, ABEL JULIO STROHAL, PETAR	IAEA-TA-2432
	REPORT OF THE RAPAT MISSION TO COTE D'IVOIRE	INT/9/055	WESTERLUND, ERIK-ANDERS BIANCO, ANDREA AUBERT, BERNARD ANGE	IAEA-TA-2433

Recipient	Subject of report	Project code	Author(s)	Reference no.
INTERREGIONAL (cont'd)	REPORT ON RAPAT MISSION TO SENEGAL	INT/9/055	WESTERLUND, ERIK-ANDERS	IAEA-TA-2434
	WAMAP MISSION TO CHINA	INT/9/081	THOMAS, KARYANIL THOMAS COOLEY, CARL NILSSON, LARS	IAEA-TA-2435
	RAPAT MISSION TO THE PHILIPPINES	INT/9/055	BUSH, WILLIMA R. INABA, JIRO STROHAL, PETAR BIANCO, ANDREA THOMAS, KARYANIL THOMAS	IAEA-TA-2436
	RAPAT MISSION TO THE REPUBLIC OF KOREA	INT/9/055	STROHAL, PETAR BIANCO, ANDREA THOMAS, KARYANIL THOMAS	IAEA-TA-2437
	RAPAT MISSION TO CAMEROON	INT/9/055	AUBERT, BERNARD ANGE FIEUW, GERARD WESTERLUND, ERIK-ANDERS	IAEA-TA-2440
	RAPAT MISSION TO MOROCCO	INT/9/055	AUBERT, BERNARD ANGE WESTERLUND, ERIK-ANDERS FIEUW, GERARD	IAEA-TA-2441
	RAPAT MISSION TO EL SALVADOR	INT/9/055	FLAKUS, FRANZ-NIKOLAUS STROHAL, PETAR MUNOZ RIBADENEIRA, FAUSTO JULIO SAENZ GANCEDO, RAFAEL	IAEA-TA-2443
KOREA, R.	CONTROLLED RELEASE PESTICIDES AND RESIDUE PROBLEMS	ROK/5/025	WILKINS, RICHARD MICHAEL	IAEA/UNDP-ROK/84/003-04
	PESTICIDE RESIDUE ANALYSIS	ROK/5/025	LORD, KENNETH ALAN	IAEA/UNDP-ROK/84/003-05
	PLANT PHYSIOLOGY	ROK/5/025	HETHERINGTON, SUZAN ELIZABETH	IAEA/UNDP-ROK/84/003-06
	OIL CROP BREEDING: GENETIC IMPROVEMENT OF SESAME AND PEANUT AND THE USE OF INDUCED MUTATIONS	ROK/5/025	ASHRI, AMRAM	IAEA/UNDP-ROK/84/003-07
	FUNGICIDE RESIDUES	ROK/5/025	HYLIN, JOHN WALTER	IAEA/UNDP-ROK/84/003-08
	PLANT NUTRITION	ROK/5/025	ABDUL RAHMAN, ZAHARAH	IAEA/UNDP-ROK/84/003-09
	STUDIES OF PESTICIDE RESIDUES	ROK/5/025	LORD, KENNETH ALAN	IAEA/UNDP-ROK/84/003-10

Recipient	Subject of report	Project code	Author(s)	Reference no.
KOREA, R. (cont'd)	THE PRESENT STATUS OF BIOTECHNOLOGICAL TECHNIQUES IN AGRICULTURE AND THEIR PRACTICAL APPLICATION	ROK/5/025	FOROUGHI-WEHR, BAERBEL	IAEA/UNDP-ROK/84/003-11
	OIL CROP BREEDING: GENETIC IMPROVEMENT OF SESAME AND PEANUT AND THE USE OF INDUCED MUTATIONS	ROK/5/025	ASHRI, AMRAM	IAEA/UNDP-ROK/84/003-12
	APPLICATION OF CELL AND PROTOPLAST CULTURE IN CROP IMPROVEMENT	ROK/5/025	OONO, KIYOHARU	IAEA/UNDP-ROK/84/003-14
	THE BREEDING OF MULBERRY FOR COLD TOLERANCE AND YIELD WITH THE AID OF NUCLEAR AND TISSUE CULTURE TECHNOLOGIES	ROK/5/025	THORPE, TREVOR ALLEYNE	IAEA/UNDP-ROK/84/003-15
	DEVELOPMENT OF SILKWORM STRAINS ADAPTED FOR ARTIFICIAL DIET THROUGH THE USE OF INDUCED MUTATIONS	ROK/5/025	GOLDSMITH, MARIAN RUTH	IAEA/UNDP-ROK/84/003-16
	SOIL NUTRIENT BALANCE STUDIES USING ISOTOPES OF NITROGEN AND PHOSPHORUS	ROK/5/025	CHO, CHAI MOO	IAEA/UNDP-ROK/84/003-17
	SOIL FERTILITY STUDIES	ROK/5/025	MISTRY, KEKHUSHROO BAMANSHAW	IAEA/UNDP-ROK/84/003-18
	ISOTOPE TECHNIQUES IN PLANT NUTRITION STUDIES	ROK/5/025	CHO, CHAI MOO	IAEA/UNDP-ROK/84/003-19
	UPGRADING QUALITY OF MULBERRY MORUS SPP. BY APPLICATION OF MUTATION BREEDING AND IN VITRO METHODS	ROK/5/025	DOUGLAS, GERARD CHRISTOPHER	IAEA/UNDP-ROK/84/003-20
	EVALUATION OF THE UTILIZATION AND THE EFFECTIVENESS OF RESIDUAL PHOSPHORUS IN HEAVILY FERTILIZED UPLAND SOILS	ROK/5/025	SHARPLEY, ANDREW NEVILLE	IAEA/UNDP-ROK/84/003-21
	CEREAL BREEDING	ROK/5/025	ULLRICH, STEVEN EDWARD	IAEA/UNDP-ROK/84/003-22
	ROOT ACTIVITY IN RELATION TO SOIL AND FERTILIZER PHOSPHORUS AND NITROGEN USE EFFICIENCY	ROK/5/025	HORST, WALTER JOHANNES	IAEA/UNDP-ROK/84/003-23

Recipient	Subject of report	Project code	Author(s)	Reference no.
KOREA, R. (cont'd)	ENVIRONMENTAL STRESSES AND CROP PRODUCTION IN KOREA	ROK/5/025	BLACK, CLANTON C. JR.	IAEA/UNDP-ROK/84/003-24
	RESEARCH PROGRAMME ON COLD AND OTHER ENVIRONMENTAL STRESSES ON THE BIOCHEMICAL MECHANISMS OF PHOTOSYNTHESIS	ROK/5/025	PAULL, ROBERT EDWIN	IAEA/UNDP-ROK/84/003-25
	SOIL FERTILITY	ROK/5/025	KELLEY, KENNETH RAY	IAEA/UNDP-ROK/84/003-26
	DEVELOPMENT OF SILKWORM STRAINS ADAPTED FOR ARTIFICIAL DIET THROUGH THE USE OF INDUCED MUTATIONS.	ROK/5/025	GOLDSMITH, MARIAN RUTH	IAEA/UNDP-ROK/84/003-27
	MOLECULAR GENETICS OF RICE	ROK/5/025	WU HSIN KAN	IAEA/UNDP-ROK/84/003-28
PERU	LABORATORY AND FIELD ACTIVITIES OF THE PERUVIAN PROJECT	PER/5/017	PERDOMO, EHLERS, ALBERTO JAVIER	IAEA/UNDP-PER/86/017-01
SYRIAN A.R.	AUTOMATIC DATA PROCESSING WITH PERSONAL COMPUTERS	SYR/3/004	STRUMBERGER, VELIZAR	IAEA/UNDP-SYR/86/005-02
THAILAND	ANIMAL PARASITOLOGY/FASCIOLIASIS-2	THA/5/031	PFISTER, KURT	IAEA/UNDP-THA/85/004-04
	RESEARCH ON BIOLOGICAL NITROGEN FIXATION	THA/5/031	GILLER, KENNETH EVELEIGH	IAEA/UNDP-THA/85/004-05
	NITROGEN-15 ANALYSIS BY MASS SPECTROMETRY (I)	THA/5/031	BINDER, NIKOLAUS F.	IAEA/UNDP-THA/85/004-06
	NITROGEN-15 ANALYSIS BY MASS SPECTROMETRY (II)	THA/5/031	BINDER, NIKOLAUS F.	IAEA/UNDP-THA/85/004-07
	NATIONAL TRAINING COURSE ON THE USE OF ISOTOPES AND RADIATION IN STUDIES OF SOIL-PLANT RELATIONSHIPS WITH EMPHASIS ON NITROGEN-15	THA/5/031	HAUCK, ROLAND DANIEL	IAEA/UNDP-THA/85/004-08
	RESEARCH ON IMPROVING THE EFFICIENCY OF SOIL WATER	THA/5/031	GREACEN, EMMET LEWIS	IAEA/UNDP-THA/85/004-09
	SCREENING PLANTS FOR DISEASE RESISTANCE	THA/5/031	STROBEL, GARY ALLAN	IAEA/UNDP-THA/85/004-10

Recipient	Subject of report	Project code	Author(s)	Reference no.
THAILAND (cont'd)	IMPROVING THE EFFICIENCY OF SOIL WATER USE	THA/5/031	GREACEN, EMMET LEWIS	IAEA/UNDP-THA/85/004-11
	MUTATION BREEDING AS A TOOL FOR FINDING RESISTANCE TO PLANT DISEASES OCCURRING IN THAILAND	THA/5/031	HINE, RICHARD BATES	IAEA/UNDP-THA/85/004-12
	NITROGEN-15 STUDIES IN SOIL-PLANT SYSTEMS	THA/5/031	KOYAMA, TAKEO	IAEA/UNDP-THA/85/004-13
VENEZUELA	SESAME PLANT BREEDING	VEN/5/011	ASHRI, AMRAM	IAEA/UNDP-VEN/86/007-11
	FERTILIZER USE EFFICIENCY	VEN/5/011	URQUIAGA, SEGUNDO	IAEA/UNDP-VEN/86/007-TR
YUGOSLAVIA	PROJECT FINDINGS AND RECOMMENDATIONS	YUG/8/009	JOVIC, DJORDJE M.	IAEA/UNDP-YUG/78/007-TR
	PROJECT FINDINGS AND RECOMMENDATIONS	YUG/8/010	JOVIC, DJORDJE M.	IAEA/UNDP-YUG/82/007-01

ANNEX IV
VOLUNTARY CONTRIBUTIONS PLEDGED AND PAID TO THE TECHNICAL ASSISTANCE AND CO-OPERATION FUND FOR 1989
(as at 31 December 1989)

Member State	Base rate %	Share of $42.0 million target for voluntary contributions for 1989 using base rate *	Pledged	Paid
AFGHANISTAN	0.01	4,200	0	0
ALBANIA	0.01	4,200	4,200	0
ALGERIA	0.14	58,800	0	0
ARGENTINA	0.61	256,200	50,000	0
AUSTRALIA	1.64	688,800	543,103	543,103
AUSTRIA	0.73	306,600	306,600	306,600
BANGLADESH	0.02	8,400	0	0
BELGIUM	1.17	491,400	106,667	0
BOLIVIA	0.01	4,200	0	0
BRAZIL	1.38	579,600	265,000	0
BULGARIA	0.16	67,200	67,200	67,200
BYELORUSSIAN SSR	0.34	142,800	143,008	143,008
CAMEROON	0.01	4,200	0	0
CANADA	3.03	1,272,600	1,005,004	1,005,004
CHILE	0.07	29,400	29,400	29,400
CHINA	0.78	327,600	327,600	327,600
COLOMBIA	0.13	54,600	49,400	0
COSTA RICA	0.02	8,400	0	0
COTE D'IVOIRE	0.02	8,400	0	0
CUBA	0.09	37,800	37,800	37,800
CYPRUS	0.02	8,400	8,400	8,400
CZECHOSLOVAKIA	0.69	289,800	289,800	289,800
DEM. KAMPUCHEA	0.01	4,200	0	0
DEM. P.R. KOREA	0.05	21,000	21,000	21,000
DENMARK	0.71	298,200	298,200	298,200
DOMINICAN REP.	0.03	12,600	0	0
ECUADOR	0.03	12,600	0	0
EGYPT	0.07	29,400	23,800	21,812
EL SALVADOR	0.01	4,200	0	0
ETHIOPIA	0.01	4,200	0	0
FINLAND	0.49	205,800	205,800	205,800
FRANCE	6.30	2,646,000	2,646,000	2,646,000
GABON	0.03	12,600	0	0
GERMAN D.R.	1.31	550,200	550,200	550,200
GERMANY, F.R.	8.17	3,431,400	3,431,400	3,431,400
GHANA	0.01	4,200	6,000	0
GREECE	0.43	180,600	180,600	0
GUATEMALA	0.02	8,400	8,000	0
HAITI	0.01	4,200	0	0
HOLY SEE	0.01	4,200	2,000	2,000
HUNGARY	0.22	92,400	79,365	79,365
ICELAND	0.03	12,600	12,600	12,600
INDIA	0.35	147,000	147,000	147,000
INDONESIA	0.14	58,800	39,000	39,000
IRAN, ISLAMIC REP.	0.62	260,400	0	0
IRAQ	0.12	50,400	50,400	0
IRELAND	0.18	75,600	0	0
ISRAEL	0.22	92,400	0	0
ITALY	3.75	1,575,000	0	0
JAMAICA	0.02	8,400	0	0
JAPAN	10.73	4,506,600	4,506,600	3,802,344
JORDAN	0.01	4,200	4,200	0
KENYA	0.01	4,200	0	0
KOREA, R.	0.20	84,000	84,000	84,000
KUWAIT	0.29	121,800	0	0

Member State	Base rate %	Share of $42.0 million target for voluntary contributions for 1989 using base rate *	Pledged	Paid
LEBANON	0.01	4,200	0	0
LIBERIA	0.01	4,200	0	0
LIBYAN A.J.	0.26	109,200	5,000	0
LIECHTENSTEIN	0.01	4,200	4,200	2,937
LUXEMBOURG	0.05	21,000	0	0
MADAGASCAR	0.01	4,200	0	0
MALAYSIA	0.10	42,000	42,000	42,000
MALI	0.01	4,200	0	0
MAURITIUS	0.01	4,200	0	0
MEXICO	0.88	369,600	369,600	369,600
MONACO	0.01	4,200	0	0
MONGOLIA	0.01	4,200	4,200	4,200
MOROCCO	0.05	21,000	0	0
MYANMAR	0.01	4,200	0	0
NAMIBIA	0.00	0	0	0
NETHERLANDS	1.72	722,400	722,400	722,400
NEW ZEALAND	0.24	100,800	0	0
NICARAGUA	0.01	4,200	0	0
NIGER	0.01	4,200	0	0
NIGERIA	0.19	79,800	79,800	0
NORWAY	0.53	222,600	222,600	222,600
PAKISTAN	0.06	25,200	25,200	25,200
PANAMA	0.02	8,400	0	0
PARAGUAY	0.02	8,400	0	0
PERU	0.07	29,400	0	0
PHILIPPINES	0.10	42,000	0	0
POLAND	0.63	264,600	264,600	264,600
PORTUGAL	0.18	75,600	75,600	75,600
QATAR	0.04	16,800	0	0
ROMANIA	0.19	79,800	0	0
SAUDI ARABIA	0.96	403,200	0	0
SENEGAL	0.01	4,200	0	0
SIERRA LEONE	0.01	4,200	0	0
SINGAPORE	0.10	42,000	0	0
SOUTH AFRICA	0.43	180,600	0	0
SPAIN	2.01	844,200	30,000	30,000
SRI LANKA	0.01	4,200	4,200	4,200
SUDAN	0.01	4,200	4,200	0
SWEDEN	1.24	520.800	520,800	520,800
SWITZERLAND	1.11	466,200	466,200	466,200
SYRIAN A.R.	0.04	16,800	0	0
THAILAND	0.09	37,800	37,800	37,800
TUNISIA	0.03	12,600	0	0
TURKEY	0.34	142,800	142,800	0
UGANDA	0.01	4,200	0	0
UKRAINIAN SSR	1.27	533,400	533,400	533,400
USSR	10.09	4,237,800	4,237,800	4,237,800
U.A. EMIRATES	0.18	75,600	0	0
UNITED KINGDOM	4.81	2,020,200	2,020,200	2,020,200
U.R. TANZANIA	0.01	4,200	0	0
USA	25.00	10,500,000	10,128,500	10,128,500
URUGUAY	0.04	16,800	15,000	0
VENEZUELA	0.59	247,800	0	0
VIET NAM	0.01	4,200	2,268	0
YUGOSLAVIA	0.45	189,000	189,000	0
ZAIRE	0.01	4,200	0	0
ZAMBIA	0.01	4,200	4,200	4,200
ZIMBABWE	0.02	8,400	0	0
TOTAL	100.00	42,000,000	35,680,915	33,810.873

* As recommended in GC(V)/RES/100 and amended in GC(XV)/RES/286.

ANNEX V

COST-FREE FELLOWSHIPS OFFERED AND AWARDED: 1989

Donor	Number of fellowships offered	Number of months offered	Number of fellowships awarded[a]	Number of months awarded[a]
ARGENTINA	6	72	-	-
AUSTRIA	1	12	1	3
BELGIUM	5	-	9	48
BRAZIL	10	-	-	-
CZECHOSLOVAKIA	9	-	2	7
CUBA	-	-	1	1
DENMARK	5	60	4	14
FRANCE	-	50	6	19
GERMANY, F.R.	-	105	35	187
HUNGARY	4	48	11	59
INDIA	10	-	13	81
ISRAEL	-	45	3	20
ITALY	25	200	13	74
JAPAN	5	45	-	-
NETHERLANDS	8	-	6	33
POLAND	10	-	2	13
SPAIN	5	60	6	18
UNITED KINGDOM	-[b]	-	5	55
UNITED STATES OF AMERICA	-[b]	-	42	241

[a] Awards less rejections and withdrawals as at 31 December 1989. [b] A specific amount of money was made available rather than a given number of fellowships.

ANNEX VI
APPROVED AND ON-GOING UNDP PROJECTS
(in thousands of dollars)

Recipient	Short title	Project code	Tot. approval	Prior to 1989	Approved budgets					
					1989	1990	1991	1992	1993	1994
A. Projects executed by the IAEA										
ALBANIA	STRENGTHENING OF NUCLEAR TECH. APPLIC. USING RESEARCH REACTOR	ALB/87/001	2,000	-	748	740	316	196	-	-
ARGENTINA	NUCLEAR ENGINEERING, PHASE II	ARG/89/012	274	-	129	145	-		-	-
CHINA	MANPOWER DEVELOPMENT FOR NUCLEAR POWER PROGRAMME	CPR/85/085	1,708	1,015	409	284	-	-	-	-
CHINA	USE OF RADIATION AND ISOTOPES IN FOOD AND AGRICULTURE	CPR/86/022	415	195	199	21	-	-	-	-
CUBA	EXTENSION OF THE APPLICATION OF NUCLEAR TECHNIQUES	CUB/86/018	600	258	338	4	-	-	-	-
EGYPT	NATIONAL CENTRE FOR RADIATION TECHNOLOGY, PHASE II	EGY/78/011	1,173	712	133	328	-	-	-	-
HUNGARY	STRENGTHENING OF AN ADVANCED AUTOMATED RADIATION LABORATORY	HUN/86/004	32	19	13	-	-	-	-	-
INDONESIA	AGRICULTURAL PRODUCTION, PHASE II	INS/88/013	471	110	107	227	27	-	-	-
IRAN, ISLAMIC R.	RADIATION TECHNOLOGY	IRA/82/003	1,561	1,543	18	-	-	-	-	-
PERU	MEDFLY ERADICATION IN SOUTHERN PERU	PER/86/017	193	193	-	-		-	-	-
KOREA, R.	ISOTOPES AND RADIATION IN AGRICULTURAL RESEARCH	ROK/84/003	634	347	287	-	-	-	-	-
ROMANIA	NUCLEAR SAFETY	ROM/87/002	640	-	204	397	39	-	-	-
SYRIAN A.R.	URANIUM EXPLORATION	SYR/86/005	464	396	58	10	-	-	-	-
THAILAND	IMPROVING FOOD AND AGRICULTURAL PRODUCTION	THA/85/004	1,515	1,003	344	168	-	-	-	-
TURKEY	DEVELOPMENT OF NDT AT NUCLEAR RESEARCH AND TRAINING CENTRE	TUR/87/016	239	98	102	39	-	-	-	-
TURKEY	INDUSTRIAL STERILIZATION OF MEDICAL SUPPLIES	TUR/88/040	700	-	230	386	74	10	-	-

Recipient	Short title	Project code	Tot. approval	Prior to 1989	Approved budgets					
					1989	1990	1991	1992	1993	1994
VENEZUELA	CENTRE FOR NUCLEAR AGRICULTURE	VEN/86/007	277	128	106	43		-	-	-
REGIONAL ASIA	FOOD IRRADIATION PROCESS CONTROL AND ACCEPTANCE	RAS/89/044	650	-	-	153	160	166	171	-
REGIONAL ASIA	INDUSTRIAL APPL. OF ISOTOPES AND RADIATION TECHNOLOGY (RCA)	RAS/86/073	3,270	1,299	570	832	569	-	-	-
REGIONAL ASIA	INCREASING THE CAPABILITIES OF COMMON GRAIN LEGUMES	RAS/89/045	970	-	60	243	224	245	167	31
REGIONAL LATIN AMERICA	NON-DESTRUCTIVE TESTING NETWORK	RLA/84/T01	1,611	1,580	31	-	-	-	-	-
SUB-TOTAL			19,397	8,896	4,086	4,020	1,409	617	338	31
B. Projects for which IAEA is associated agency										
CHINA	NUCLEAR SAFETY ADMINISTRATION	CPR/85/067	610	301	309	-	-	-		-
IRAN, ISLAMIC R.	STRENGTHENING THE WATER RESOURCES RESEARCH INSTITUTE	IRA/85/015	106	79	27	-	-	-	-	-
REGIONAL ARAB STATES	TRAINING OF TECHNICIANS IN WATER RESOURCES USE IN LDAC	RAB/86/008	22	-	5	17	-	-	-	-
SUB-TOTAL			738	380	341	17	-	-	-	-
TOTAL			20,135	9,276	4,427	4,037	1,409	617	338	31

ANNEX VII

FOOTNOTE-a/ PROJECTS MADE OPERATIONAL OR EXTENDED DURING 1989

Recipient	Project title and code	Expert services (months)	Equipment ($)	Fellowships ($)	Group training ($)	Sub-contracts ($)	Source [a]
BANGLADESH	UTILIZATION OF THE NEUTRON GENERATOR, BGD/1/011 [b]	3	31,000	0	0	0	FIN
	REPAIR AND MAINTENANCE OF NUCLEAR INSTRUMENTS DHAKA, BGD/4/013 [b]	1	25,000	0	0	0	USA
	AGROCHEMICAL RESIDUES, BGD/5/014 [b]	2	50,000	14,400	0	0	UK
BOLIVIA	IMPROVEMENT OF NUCLEAR MEDICINE, BOL/6/015 [b]	1	0	0	0	0	FRA
BRAZIL	RADIATION PROTECTION IN MEDICAL PRACTICE, BRA/9/035 [b]	16	228,000	0	0	0	GFR
BULGARIA	IRRADIATION FACILITY, BUL/8/011 [c]	0	155,600	0	0	0	USSR
CAMEROON	NUCLEAR ANALYTICAL LABORATORY, CMR/1/002	1	20,000	0	0	0	USA
CHINA	SEVERE ACCIDENT ANALYSIS AND MANAGEMENT, CPR/9/009 [b]	3	0	0	0	0	FRA
COLOMBIA	UPGRADING OF RESEARCH REACTOR INSTRUMENTATION, COL/4/009 [b]	0	92,000	0	0	0	USA
COTE D'IVOIRE	FUEL-WOOD PRODUCTION, IVC/5/018	1	15,000	0	0	0	USA
CYPRUS	RADIOISOTOPES IN AGRICULTURE, CYP/5/014 [b]	1	65,000	16,800	0	0	UK

Recipient	Project title and code	Expert services (months)	Equip-ment ($)	Fellow-ships ($)	Group training ($)	Sub-con-tracts ($)	Source [a]
ECUADOR	NUCLEAR ANALYTICAL TECHNIQUES (PHASE II), ECU/2/008 [b]	1	45,000	0	0	0	USA
	ADVANCED TRAINING IN MEDICAL PHYSICS, ECU/6/008	6	0	0	0	0	USA
	ISOTOPE APPLICATIONS IN HYDROL-OGY, ECU/8/012 [b]	1	55,400	0	0	0	GFR
EGYPT	QUALITY ASSURANCE, EGY/4/027	2	0	0	0	0	GFR
	FEASIBILITY STUDY FOR SMALL AND MEDIUM	12	0	0	0	0	USA
	NUCLEAR POWER PLANTS, EGY/4/029 [b]	12	0	0	0	0	FIN
	RADIOIMMUNOASSAY IN ANIMAL SCIENCE, EGY/5/018	1	7,500	0	0	0	USA
EL SALVADOR	NUCLEAR INSTRUMENTATION, ELS/4/003	5	35,000	0	0	0	USA
ETHIOPIA	NUCLEAR INSTRUMENTATION, ETH/4/002 [c]	3	40,000	0	0	0	UK
GREECE	ION IMPLANTATION USING A TANDEM ACCELERATOR, GRE/1/034 [b]	2	75,000	0	0	0	USA
GUATEMALA	DOSIMETRY LABORATORY (PHASE II), GUA/1/005 [b]	1	110.000	7,200	0	0	UK
	CONTROL OF THE MEDITERRANEAN FRUIT FLY, GUA/5/007	12	20,000	0	0	0	USA
HUNGARY	RADIOACTIVE CONTAMINATION AND FOOD CONTROL, HUN/5/012 [b]	1	90,000	0	0	0	FRA

Recipient	Project title and code	Expert services (months)	Equipment ($)	Fellowships ($)	Group training ($)	Sub-contracts ($)	Source [a]
INDONESIA	UNIVERSITY RESEARCH AND TEACHING, INS/0/011 [b]	6	60,000	0	0	0	USA
	URANIUM EXPLORATION, INS/3/008	3	30,000	0	0	0	FRA
	URANIUM EXPLORATION AND DEVELOPMENT, INS/3/009 [b]	4	10,000	0	0	0	FRA
JORDAN	FOOD IRRADIATION, JOR/5/004 [b]	1	0	0	0	0	FRA
KOREA, REPUBLIC OF	STANDARDIZATION OF NEUTRON MEASUREMENTS, ROK/1/007	1	40,000	0	0	0	USA
MALAYSIA	NUCLEAR INSTRUMENTATION CENTRE, MAL/4/006	3	0	0	0	0	USA
MEXICO	TRACE-ELEMENT ANALYSIS, MEX/2/012 [b]	1	42,000	7,200	0	0	UK
	CHARACTERIZATION OF GEOTHERMAL RESOURCES, MEX/8/017 [b]	2	50,000	0	0	0	USA
MOROCCO	ISOTOPES IN HYDROLOGY, MOR/8/004 [c]	2	60,000	0	0	0	FRA
NIGERIA	PREVENTING TSETSE FLY RE-INVASION (PHASE II), NIR/5/021 [b]	2	36,800	0	0	0	BEL
		12	175,000	14,400	0	65,000	UK
	NUCLEAR MEDICINE, NIR/6/005 [b]	3	30,000	0	0	0	USA
PORTUGAL	URANIUM EXPLORATION, POR/3/009 [b]	3	25,000	0	0	0	FRA
	NITROGEN FIXATION, POR/5/003 [b]	2	0	0	0	0	USA
SRI LANKA	NUCLEAR MEDICINE, SRL/6/010	1	102,000	0	0	0	USA
THAILAND	ANIMAL DISEASES, THA/5/036 [b]	1	25,000	0	0	0	USA

Recipient	Project title and code	Expert services (months)	Equipment ($)	Fellowships ($)	Group training ($)	Sub-contracts ($)	Source [a]
TUNISIA	ADVANCED NON-DESTRUCTIVE TESTING TECHNIQUES IN INDUSTRY, TUN/8/010 [b]	3	65,000	0	0	0	FRA
VENEZUELA	LOW-LEVEL RADIATION LABORATORY, VEN/9/005 [b]	2	55.000	0	0	0	USA
YUGOSLAVIA	NUCLEAR ANALYTICAL TECHNIQUES, YUG/1/012 [b]	1	35,000	0	0	0	GFR
	GROUP TRAINING IN NUCLEAR SAFETY, YUG/9/026 [b]	4	0	0	0	0	USA
REGIONAL ASIA AND PACIFIC	USE OF COMPUTERS IN TECHNETIUM-99M IMAGING, RAS/6/016	0	0	0	173,600	0	AUL
	RADIATION AND ISOTOPE APPLICATIONS IN INDUSTRY, RAS/8/064	16	365,800	55,000	0	0	AUL
	MARINE CONTAMINANT AND SEDIMENT TRANSPORT, RAS/8/065 [b]	5	20,000	0	0	0	USA
	STRENGTHENING OF RADIATION PROTECTION INFRASTRUCTURES, RAS/9/006	0	0	0	95,000	0	JPN
REGIONAL EUROPE	IN-SERVICE INSPECTION DESIGN, RER/4/003 [b]	0	0	0	0	92,000	SPA
REGIONAL LATIN AMERICA	NUCLEAR INSTRUMENTATION (ARCAL II), RLA/4/006	2	70,000	0	0	0	GFR
	RESEARCH REACTOR UTILIZATION (ARCAL V), RLA/4/007	2	25,000	0	60,000	0	GFR
	IMPROVEMENT OF CEREALS THROUGH MUTATION BREEDING (ARCAL VII), RLA/5/021	3	50,000	0	0	0	USA

Recipient	Project title and code	Expert services (months)	Equipment ($)	Fellowships ($)	Group training ($)	Sub-contracts ($)	Source [a]
REGIONAL LATIN AMERICA (cont'd)	RADIOIMMUNOASSAY OF THYROID-RELATED HORMONES (ARCAL VIII), RLA/6/011	1	20,000	0	45,000	0	CEC
	NON-DESTRUCTIVE TESTING TECHNIQUES, RLA/8/013 [b]	5	70,000	96,000	80,000	0	GFR
		2	313,000	0	435,900	260,000	ITA
	APPLICATION OF ISOTOPE TECHNIQUES IN HYDROLOGY, RLA/8/014 [b]	0	0	0	60,000	0	TACF
		7	100,000	0	35,000	0	GFR
	RADIATION PROTECTION (ARCAL I), RLA/9/009	0	0	0	55,000	0	TACF
		0	30,000	0	10,000	0	FRA

a) Explanation of abbreviations: AUL = Australia; BEL = Belgium; CEC = Commission of European; Communities; FRA = France; FIN = Finland; GFR = Federal Republic of Germany; ITA = Italy; JPN = Japan; SPA = Spain; TACF = Technical Assistance and Co-operation Fund; UK = United Kingdom; USA = United States of America; USSR = Union of Soviet Socialist Republics.

b) Project extended or made operational in 1989 and approved in that year by the Board.

c) Project extended or made operational in 1989 but approved in a prior year by the Board.

ANNEX VIII

APPROVALS AGAINST THE RESERVE FUND IN 1989

Recipient	Project title and number	Expert months	Expert $	Equip-ment $	Other $	Total $
A. New projects						
Algeria	Maintenance of nuclear instruments – ALG/4/003	1/00	8,100	15,000	-	23,100
Chile	Repair and upgrading of mass spectrometer – CHI/4/016	1/00	8,100	20,000	-	28,100
China	Pre-OSART mission to Qinshan nuclear power plant – CPR/9/010	7/06	32,400	-	-	32,400
Czechoslovakia	OSART mission to Dukovany nuclear power plant – CZE/9/002	8/15	20,869	-	-	20,869
Egypt	Calibration and commissioning of linear accelerator – EGY/4/033	0/28	15,660	-	-	15,660
El Salvador	Treatment of overexposed persons – ELS/9/006	1/22	16,500	-	-	16,500
Haiti	Radiation protection and therapy – HAI/9/002	4/00	32,400	17,000	-	49,400
Indonesia	Radiation technology in packaging – INS/8/016	1/00	8,100	-	-	8,100
Korea,, Rep. of	OSART mission to Wolsung nuclear power plant – ROK/9/033	7/21	35,640	-	-	35,640
Libyan A.J.	Eradication of screwworm – LIB/5/007	6/00	48,600	-	-	48,600
Pakistan	National workshop for evaluation of TC projects – PAK/0/004	1/00	10,000	-	-	10,000
Pakistan	Safe operation of the Karachi nuclear power plant – PAK/9/010	3/00	50,000	-	-	50,000
Poland	Pre-OSART mission to Zarnowiec nuclear power plant – POL/9/011	6/12	10,760	-	-	10,760
Uruguay	Radiation protection legislation – URU/9/004	1/00	8,100	-	-	8,100
Viet Nam	Underwater inspection of Dalat nuclear research reactor – VIE/9/005	3/00	24,300	6,000	-	30,300
Interregional	INIS group training – INT/0/049	2/00	14,500	1,000	-	15,500
Regional Africa	Establishment of radiometric calibration facilities – RAF/3/002	-	-	10,000	-	10,000
Sub-total		55/14	344,029	69,000	-	413,029
B. Supplemetary assistance to existing projects						
Brazil	Safety analysis: Angra units 2 & 3 – BRA/9/017	0/20	12,150	-	-	12,150
Chile	Research reactor core conversion – CHI/4/013	-	-	-	8,500[a]	8,500
Costa Rica	Mutation breeding of legumes – COS/5/009	-	-	-	5,370[a]	5,370
China	Tracer studies for monitoring potential zones in oil fields – CPR/8/004	-	-	-	10,600[a]	10,600
Philippines	Uranium exploration data bank – PHI/3/007	-	-	4,300	-	4,300
Turkey	Environmental monitoring – TUR/9/010	-	-	5,476	-	5,476
Uruguay	Radiocarbon dating – URU/8/006	0/15	4,050	-	-	4,050
Regional Asia & Pacific	Energy and nuclear power planning – RAS/0/013	-	-	-	30,000[b]	30,000
Sub-total		1/05	16,200	9,776	54,470	80,446
TOTAL		*56/19*	*360,229*	*78,776*	*54,470*	*493,475*

[a] Approval for fellowship. [b] Approval for training course.

ANNEX IX

NET PROGRAMME CHANGES BY RECIPIENT

Recipient	Component	Existing approval	Net change
AFGHANISTAN	Equipment (NCC)	50,000	-50,000
ALBANIA	Experts (months)	24/15	-0/05
	Equipment (CC)	219,650	8,700
	Equipment (NCC)	59,000	79,000
	Fellowships (CC)	13,500	-7,350
	Fellowships (NCC)	0	8,471
ALGERIA	Experts (months)	21/15	-2/21
	Equipment (CC)	1,035,440	46,335
	Fellowships (CC)	22,500	-7,200
BANGLADESH	Experts (months)	30/00	-1/15
	Equipment (CC)	827,849	-20,333
	Equipment (NCC)	1,085,500	9,000
	Fellowships (CC)	21,000	43,900
BOLIVIA	Experts (months)	25/12	-4/16
	Equipment (CC)	541,511	32,715
	Fellowships (CC)	78,930	-39,959
	Training courses (CC)	7,800	-500
BRAZIL	Experts (months)	167/18	3/23
	Equipment (CC)	591,198	37,272
	Equipment (NCC)	31,800	13,700
	Fellowships (CC)	320,276	-27,001
	Training courses (CC)	50,000	-14,850
	Sub-contracts (CC)	80,000	-40,000
BULGARIA	Experts (months)	4/00	-1/15
	Equipment (CC)	866,200	-10,000
	Equipment (NCC)	2,367,000	0
	Fellowships (CC)	12,000	21,250
CAMEROON	Experts (months)	22/16	-6/28
	Equipment (CC)	154,400	10,300
	Equipment (NCC)	65,000	-28,810
	Fellowships (CC)	87,300	-37,100
CHILE	Experts (months)	21/07	-3/10
	Equipment (CC)	860,730	45,296
	Fellowships (CC)	88,597	-10,647
CHINA	Experts (months)	19/25	-3/14
	Equipment (CC)	413,400	-8,111
	Fellowships (CC)	119,165	43,761
	Fellowships (NCC)	0	35,530
COLOMBIA	Experts (months)	51/29	-7/05
	Equipment (CC)	1,303,043	141,001
	Equipment (NCC)	50,000	26,900
	Fellowships (CC)	112,086	-14,566
	Fellowships (NCC)	0	2,400
COSTA RICA	Experts (months)	5/11	-0/20
	Equipment (CC)	90,835	31,289
	Equipment (NCC)	89,300	-7,500
	Fellowships (CC)	8,470	2,530

Recipient	Component	Existing approval	Net change
COTE D'IVOIRE	Experts (months)	14/04	-1/23
	Equipment (CC)	231,310	21,837
	Fellowships (CC)	84,918	-15,654
	Fellowships (NCC)	6,800	-3,219
CUBA	Experts (months)	8/00	1/15
	Equipment (CC)	719,406	171,100
	Equipment (NCC)	328,000	-119,221
	Fellowships (CC)	17,250	-9,600
	Fellowships (NCC)	0	3,000
	Sub-contracts (CC)	5,000	-5,000
CYPRUS	Experts (months)	15/28	-6/00
	Equipment (CC)	330,100	-33,800
	Fellowships (CC)	24,600	-24,600
CZECHOSLOVAKIA	Equipment (CC)	50,000	-2,742
DEM. P.R. KOREA	Experts (months)	11/00	-0/07
	Equipment (CC)	392,740	24,570
	Equipment (NCC)	2,593,737	135,365
	Fellowships (CC)	55,200	-30,050
	Fellowships (NCC)	0	35,250
DOMINICAN REPUBLIC	Experts (months)	14/23	-2/00
	Equipment (CC)	610,900	39,300
	Equipment (NCC)	92,625	3,600
ECUADOR	Experts (months)	69/00	-13/11
	Equipment (CC)	1,172,004	51,655
	Fellowships (CC)	26,609	5,060
	Sub-contracts (CC)	0	17,604
EGYPT	Experts (months)	77/07	-6/10
	Equipment (CC)	2,269,282	19,056
	Equipment (NCC)	0	22,000
	Fellowships (CC)	41,800	-30,002
	Sub-contracts (CC)	316,000	-33,500
EL SALVADOR	Experts (months)	16/22	-7/10
	Equipment (CC)	252,000	8,615
	Equipment (NCC)	70,000	-6,069
	Fellowships (CC)	43,200	-15,400
ETHIOPIA	Experts (months)	6/09	-1/00
	Equipment (CC)	83,200	8,100
	Equipment (NCC)	47,000	-9,920
GHANA	Experts (months)	26/10	-0/28
	Equipment (CC)	921,345	-6,146
	Fellowships (CC)	76,650	513
GREECE	Experts (months)	12/10	-2/15
	Equipment (CC)	619,975	20,696
	Equipment (NCC)	0	20,000
	Fellowships (CC)	0	14,600
GUATEMALA	Experts (months)	18/09	-14/17
	Equipment (CC)	562,921	39,921
	Equipment (NCC)	59,500	-27,282
	Fellowships (CC)	58,950	6,650
	Sub-contracts (CC)	115,065	110,000
HAITI	Experts (months)	3/08	0/07
	Fellowships (CC)	13,500	-1,876

Recipient	Component	Existing approval	Net change
HUNGARY	Equipment (CC)	15,200	1,500
	Equipment (NCC)	72,000	21,000
	Fellowships (CC)	3,000	-3,000
INDONESIA	Experts (months)	103/17	-2/13
	Equipment (CC)	1,146,829	69,083
	Fellowships (CC)	68,400	5,171
INTERREGIONAL	Experts (months)	379/26	-6/11
	Equipment (CC)	27,100	77,430
	Equipment (NCC)	248,646	-112,000
	Training courses (CC)	66,850	-8,128
	Sub-contracts (CC)	0	30,610
IRAN, ISLAMIC REPUBLIC OF	Experts (months)	83/13	-9/23
	Equipment (CC)	731,541	88,205
	Equipment (NCC)	0	72,500
	Fellowships (CC)	79,305	20,697
	Fellowships (NCC)	4,300	4,826
IRAQ	Experts (months)	69/08	0/00
	Fellowships (CC)	3,760	15,900
IRELAND	Equipment (CC)	35,000	2,742
JAMAICA	Experts (months)	12/14	0/27
	Equipment (CC)	356,500	-2,900
JORDAN	Experts (months)	30/12	0/15
	Equipment (CC)	261,750	-6,950
	Fellowships (CC)	28,260	7,196
	Equipment (NCC)	0	1,200
KENYA	Experts (months)	67/04	-2/03
	Equipment (CC)	456,100	7,085
	Fellowships (CC)	49,500	26,400
KOREA, REPUBLIC OF	Experts (months)	91/12	-3/25
	Equipment (CC)	160,215	8,581
	Fellowships (CC)	31,350	25,300
LIBYAN ARAB JAMAHIRIYA	Experts (months)	4/18	-0/15
	Equipment (CC)	323,600	750
	Fellowships (CC)	101,850	-67,900
	Equipment (NCC)	0	18,800
MADAGASCAR	Experts (months)	7/00	-0/10
	Equipment (CC)	90,180	7,050
	Equipment (NCC)	0	7,000
MALAYSIA	Experts (months)	79/23	-9/11
	Equipment (CC)	830,759	6,607
	Fellowships (CC)	68,950	41,110
	Fellowships (NCC)	0	9,600
MALI	Experts (months)	3/20	0/00
	Equipment (CC)	796,550	42,500
	Fellowships (CC)	17,060	-14,400
MAURITIUS	Experts (months)	12/02	-3/25
	Equipment (CC)	156,080	1,016
	Fellowships (CC)	30,000	29,493
MEXICO	Experts (months)	131/23	-4/21
	Equipment (CC)	590,202	9,563
	Fellowships (CC)	143,850	-74,140
	Sub-contracts (CC)	612,980	3,739

Recipient	Component	Existing approval	Net change
MONGOLIA	Experts (months)	5/00	-1/19
	Equipment (CC)	307,059	23,230
	Equipment (NCC)	231,800	199,877
	Fellowships (CC)	87,300	-51,589
	Fellowships (NCC)	0	9,323
MOROCCO	Experts (months)	57/04	-11/07
	Equipment (CC)	529,100	87,955
	Fellowships (CC)	143,582	-66,775
MYANMAR	Experts (months)	16/16	-1/23
	Equipment (CC)	278,706	2,900
	Fellowships (CC)	59,400	-14,400
NICARAGUA	Experts (months)	9/20	-4/00
	Equipment (CC)	223,000	3,699
	Equipment (NCC)	195,000	2,641
	Fellowships (CC)	44,100	-19,200
NIGER	Experts (months)	11/15	-1/23
	Equipment (CC)	328,050	13,149
	Fellowships (CC)	29,793	-4,049
NIGERIA	Experts (months)	67/19	-9/25
	Equipment (CC)	816,808	63,287
	Equipment (NCC)	0	3,500
	Fellowships (CC)	117,330	-15,000
PAKISTAN	Experts (months)	60/06	-9/24
	Equipment (CC)	543,549	72,106
	Equipment (NCC)	265,000	55,000
	Fellowships (CC)	10,000	8,604
	Fellowships (NCC)	0	12,000
PANAMA	Experts (months)	30/27	-6/21
	Equipment (CC)	702,090	56,015
	Fellowships (CC)	51,900	-19,769
PARAGUAY	Experts (months)	19/20	-3/09
	Equipment (CC)	526,775	9,340
	Equipment (NCC)	67,000	-52,789
	Fellowships (CC)	122,400	-74,952
PERU	Experts (months)	241/16	14/04
	Equipment (CC)	1,990,797	15,891
	Equipment (NCC)	1,172,000	-59,000
	Fellowships (CC)	19,265	18,079
PHILIPPINES	Experts (months)	22/00	-4/06
	Equipment (CC)	1,261,596	18,652
	Fellowships (CC)	91,150	5,475
	Fellowships (NCC)	0	5,000
POLAND	Experts (months)	17/25	-6/21
	Equipment (CC)	441,875	54,270
	Equipment (NCC)	3,842,845	11,000
	Fellowships (CC)	12,510	2,600
	Fellowships (NCC)	0	500
PORTUGAL	Experts (months)	20/23	-7/20
	Equipment (CC)	322,100	55,920
	Equipment (NCC)	1,876,000	340,199
	Fellowships (CC)	0	7,242
	Fellowships (NCC)	0	800

Recipient	Component	Existing approval	Net change
REGIONAL AFRICA	Experts (months)	37/20	-3/12
	Equipment (CC)	260,000	22,203
	Fellowships (CC)	1,488,100	357,016
	Fellowships (NCC)	359,250	-46,781
	Training courses (CC)	71,000	12,325
	Sub-contracts (CC)	37,000	3,240
REGIONAL ASIA AND PACIFIC	Experts (months)	215/18	-30/27
	Equipment (CC)	111,572	-32,133
	Fellowships (CC)	1,379,300	124,935
	Fellowships (NCC)	359,250	252,800
	Training courses (CC)	1,009,071	118,668
	Training courses (NCC)	0	3,684
REGIONAL EUROPE	Experts (months)	104/10	13/20
	Equipment (CC)	121,700	349,697
	Fellowships (CC)	1,624,700	-85,531
	Fellowships (NCC)	359,250	-7,297
	Training courses (CC)	395,500	-225,316
	Training courses (NCC)	0	29,000
	Sub-contracts (CC)	429,168	11,532
REGIONAL LATIN AMERICA	Experts (months)	514/01	36/14
	Equipment (CC)	2,252,564	90,013
	Fellowships (CC)	1,688,527	-209,740
	Fellowships (NCC)	359,250	-62,400
	Training courses (CC)	2,164,100	-64,138
	Training courses (NCC)	0	30,000
	Sub-contracts (CC)	312,000	84,996
ROMANIA	Equipment (NCC)	144,258	-17,000
SENEGAL	Experts (months)	12/04	-3/01
	Equipment (CC)	181,200	16,200
SINGAPORE	Experts (months)	8/00	-2/23
	Equipment (CC)	90,000	6,210
	Fellowships (CC)	24,750	11,340
SRI LANKA	Experts (months)	40/07	-11/09
	Equipment (CC)	425,004	21,382
	Equipment (NCC)	25,000	-25,000
	Fellowships (CC)	0	38,774
SUDAN	Experts (months)	30/05	-2/05
	Equipment (CC)	1,066,494	17,400
	Fellowships (CC)	52,800	-52,800
SYRIAN ARAB REPUBLIC	Experts (months)	26/09	-1/22
	Equipment (CC)	983,320	-18,016
	Equipment (NCC)	1,000,000	0
	Fellowships (CC)	34,800	4,400
	Fellowships (NCC)	0	1,400
THAILAND	Experts (months)	78/20	-5/19
	Equipment (CC)	2,038,738	40,001
	Equipment (NCC)	345,600	-21,219
	Fellowships (CC)	126,794	33,243
TUNISIA	Experts (months)	10/21	-1/02
	Equipment (CC)	157,150	13,700
	Fellowships (CC)	52,955	-19,200

Recipient	Component	Existing approval	Net change
TURKEY	Experts (months)	97/21	-13/12
	Equipment (CC)	1,237,975	61,519
	Equipment (NCC)	120,000	0
	Fellowships (CC)	29,150	55,591
UGANDA	Experts (months)	13/17	-0/15
	Equipment (CC)	45,000	8,100
	Fellowships (CC)	28,800	-28,800
UK (HONG KONG)	Experts (months)	7/00	-1/29
	Equipment (CC)	30,000	-12,000
	Fellowships (CC)	18,000	-3,536
UNITED ARAB EMIRATES	Experts (months)	5/04	-1/00
	Equipment (CC)	56,150	8,100
UNITED REPUBLIC OF TANZANIA	Experts (months)	23/22	-0/15
	Equipment (CC)	297,100	14,644
	Fellowships (CC)	10,000	-3,644
URUGUAY	Experts (months)	12/07	-1/06
	Equipment (CC)	469,301	7,233
	Equipment (NCC)	57,400	-12,000
	Fellowships (CC)	48,600	-4,655
VENEZUELA	Experts (months)	52/20	-5/28
	Equipment (CC)	887,525	48,079
	Equipment (NCC)	120,000	195,000
	Fellowships (CC)	136,500	-51,700
VIET NAM	Experts (months)	14/04	-1/09
	Equipment (CC)	682,129	6,530
	Equipment (NCC)	20,000	15,500
	Fellowships (CC)	29,700	23,169
	Fellowships (NCC)	0	119,950
YUGOSLAVIA	Experts (months)	4/00	-2/03
	Equipment (CC)	231,770	20,838
	Fellowships (CC)	32,600	3,407
ZAIRE	Experts (months)	16/23	-6/06
	Equipment (CC)	281,262	41,840
	Equipment (NCC)	70,000	-20,000
	Fellowships (CC)	35,980	-8,000
	Fellowships (NCC)	0	175
ZAMBIA	Experts (months)	16/02	-1/18
	Equipment (CC)	423,040	10,277
	Equipment (NCC)	120,200	2,500
	Fellowships (CC)	264,800	-95,365
ZIMBABWE	Experts (months)	9/00	-0/27
	Equipment (CC)	65,000	4,490
	Equipment (NCC)	3,000	2,800
TOTALS	Experts (months)	3,693/26	-227/08
	Experts ($)	25,196,856	-2,141,433
	Equipment (CC)	41,762,553	2,211,619
	Equipment (NCC)	16,984,212	670,269
	Fellowships (CC)	9,847,374	-255,745
	Fellowships (NCC)	1,448,100	401,328
	Training courses (CC)	3,764,321	-181,939
	Training courses (NCC)	0	62,684
	Sub-contracts (CC)	1,907,213	183,221
	TOTAL ALLOTTED	100,910,630	950,004

ANNEX X

NET REPHASINGS UNDERTAKEN DURING 1989

Recipient	Project component	Net allotted/ Net rephased	Current year	1990	1991
BRAZIL	EXPERTS	ALLOTTED	0/02	3/00	0/00
	MONTHS	REPHASED	0/10	-0/10	0/00
COLOMBIA	EXPERTS	ALLOTTED	6/06	5/06	0/00
	MONTHS	REPHASED	-1/21	1/16	0/00
	EQUIPMENT	ALLOTTED	20,000	10,000	0
	(NCC)	REPHASED	-13,200	13,200	0
COSTA RICA	FELLOWSHIPS	ALLOTTED	7,200	22,950	0
	(CC)	REPHASED	-7,200	7,200	0
CUBA	EQUIPMENT	ALLOTTED	20,000	57,000	0
	(CC)	REPHASED	30,000	-30,000	0
GREECE	EQUIPMENT	ALLOTTED	195,000	160,000	75,000
	(CC)	REPHASED	65,000	-65,000	0
GUATEMALA	EXPERTS	ALLOTTED	0/00	1/00	1/00
	MONTHS	REPHASED	0/04	-0/04	0/00
HAITI	EQUIPMENT	ALLOTTED	10,000	0	0
	(NCC)	REPHASED	-6,769	6,769	0
INTERREGIONAL	EXPERTS	ALLOTTED	23/00	6/00	0/00
	MONTHS	REPHASED	3/18	-3/18	0/00
IRAN, ISLAMIC REPUBLIC OF	EQUIPMENT	ALLOTTED	137,250	50,000	0
	(CC)	REPHASED	15,000	-15,000	0
JORDAN	EQUIPMENT	ALLOTTED	190,700	50,000	0
	(CC)	REPHASED	20,000	-20,000	0

Recipient	Project component	Net allotted/ Net rephased	Current year	1990	1991
PARAGUAY	EXPERTS	ALLOTTED	7/15	2/00	0/00
	MONTHS	REPHASED	-6/15	6/15	0/00
	EQUIPMENT	ALLOTTED	52,300	30,000	0
	(CC)	REPHASED	6,000	-6,000	0
TURKEY	EQUIPMENT	ALLOTTED	52,000	90,000	0
	(CC)	REPHASED	10,000	-10,000	0
VENEZUELA	EXPERTS	ALLOTTED	40/00	2/00	0/00
	MONTHS	REPHASED	-7/15	7/15	0/00
	EQUIPMENT	ALLOTTED	202,500	52,000	0
	(CC)	REPHASED	12,000	-12,000	0
	FELLOWSHIPS	ALLOTTED	14,400	0	0
	(CC)	REPHASED	-14,400	14,400	0
TOTALS	EXPERTS	ALLOTTED	76/23	19/06	1/00
	MONTHS	REPHASED	-11/19	11/14	0/00
	EXPERTS ($)	ALLOTTED	574,560	161,280	8,850
	($)	REPHASED	-86,580	96,320	0
	EQUIPMENT	ALLOTTED	849,750	489,000	75,000
	(CC)	REPHASED	158,000	-158,000	0
	EQUIPMENT	ALLOTTED	30,000	10,000	0
	(NCC)	REPHASED	-19,969	19,969	0
	FELLOWSHIPS	ALLOTTED	21,600	22,950	0
	(CC)	REPHASED	-21,600	21,600	0
	TOTAL ALLOTTED		1,475,910	683,230	83,850
	TOTAL REPHASED		29,850	-20,110	0