THE ANNUAL REPORT FOR 1984

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INTERNATIONAL ATOMIC ENERGY AGENCY

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CONTENTS

LIST OF ABBREVIATIONS

Agency	International Atomic Energy Agency
CANDU	Canada deuterium-uranium (reactor)
CCAQ	Consultative Committee on Administrative Questions
CEC	Commission of the European Communities
EEC	European Economic Community
FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
ICSC	International Civil Service Commission
INTOR	International Tokamak Reactor
kGy	Kilogray
LMFBR	Liquid-metal fast breeder reactor
MOX	Mixed oxide (fuel)
NDA	Non-destructive assay
NEA	Nuclear Energy Agency of OECD
NNW	Non-nuclear-weapon
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NW	Nuclear-weapon
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (INFCIRC/167)
SAGSI	Standing Advisory Group on Safeguards Implementation
SIDA	Swedish International Development Authority
SQ	Significant quantity
TCDC	Technical co-operation between developing countries
UF_6	Uranium hexafluoride
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIPEDE	International Union of Producers and Distributors of Electrical Energy
UNJSPB	United Nations Joint Staff Pension Board
VIC	Vienna International Centre
WEC	World Energy Conference
WHO	World Health Organization
WWER	Water-cooled and -moderated reactor (Soviet Union)

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1. All sums of money are expressed in United States dollars.

2. The designations employed and the presentation of material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

INTRODUCTION

Article VI.A.1 of the Statute

1. Following a unanimous recommendation of the Board of Governors, the General Conference decided - also unanimously - to amend Article VI.A.1 of the Agency's Statute by providing for the designation by the Board each year of the ten - instead of nine - Member States "most advanced in the technology of atomic energy including the production of source materials". The amendment will come into force when it has been accepted by two thirds of the Agency's Member States in accordance with their respective constitutional practices.

2. In June, the Board of Governors designated China - which joined the Agency with effect from 1 January 1984 - to serve on the Board for the period 1984-85 and agreed that in future the outgoing Board would, pursuant to Article VI.A.1 of the Statute, designate 13 Members instead of 12 until the entry into force of the proposed amendment of Article VI.A.1 whose approval it had unanimously decided to recommend to the General Conference, it being understood that the designation of 13 instead of 12 States did not alter the status of the nine States which had hitherto been considered the most advanced in the technology of atomic energy, including the production of source materials, and which had been designated in the past under Article VI.A.1 of the Statute.

Twentieth anniversary of the Joint FAO/IAEA Division

3. On 1 October 1984 the Joint FAO/IAEA Division of Isotopes and Radiation Applications of Atomic Energy for Food and Agricultural Development had its twentieth anniversary. To mark this event the Director-General of FAO, Dr. Edouard Saouma, addressed the Agency's General Conference in September at the opening meeting of its twenty-eighth regular session.

Nuclear power

4. Thirty-four nuclear power plants with a total capacity of 31.8 GW(e) started generating electricity in 1984, increasing the world's installed nuclear capacity by 17% to 220 GW(e). In both absolute and relative terms, that was the largest annual increase since the beginning of the large-scale introduction of nuclear power - in the early 1970s. During 1984, nuclear power plants accounted for about 13% of the world's total electricity generation.

5. However, last year construction work started on only 14 plants, with a total capacity of 11.3 GW(e) - by far the lowest number since 1968. Ten nuclear power plant orders were cancelled in the United States and construction work was suspended indefinitely on nine plants (five in Spain and four in the United States). It is now expected that nuclear capacity world-wide in 1990 will be around 368 GW(e), compared with the capacity figure of 430 GW(e) projected two years ago. The reasons vary from country to country, the main ones being excess generating capacity, lower growth rates for electricity demand and financial difficulties. The present trend, which will probably not change much during this decade, could have serious consequences for the nuclear industry in some countries.

6. At the same time, 1984 again confirmed that nuclear power plants are based on a mature technology. Total operating experience reached 3470 reactor-years, and both France and Belgium produced more than 50% of their electricity from nuclear power plants; the number of countries for which the corresponding figure is 20% or more increased from seven to ten. Operation in the load-following mode is consequently becoming increasingly important for nuclear power plants, for which load-following appears not to present major technical problems judging by initial experimental data obtained and demonstrations carried out in France.

7. In general, the current proven types of nuclear power plant still compare favourably with fossil-fired plants in terms of reliability and generation costs. Information on nuclear power plant operating experience collected by the Agency indicates a steady trend towards higher plant availability in several countries, with exceptionally good performance in some. The importance of performance improvements is now generally recognized as vital for maintaining and increasing the competitiveness of nuclear power and compensating for rising investment costs.

8. Outside the industrialized States no new nuclear power plant was connected to the grid; construction work started on only one new plant. Financing difficulties remained the major problem for the further expansion of nuclear power in such countries. The renewed interest

in small and medium power reactors, however, could lead to an expansion of the nuclear market, especially in developing countries, although their economic competitiveness presupposes new approaches to construction - for example, modular designs and increased shop fabrication - and tightly controlled construction schedules.

9. The development of advanced reactor systems - especially fast breeders - continued, with increased international co-operation aimed at the pooling of expertise and the sharing of costs.

Nuclear safety

10. The Agency's efforts to help strengthen nuclear safety and radiation protection worldwide included three new initiatives: (i) a scheme was introduced for making available to Member States radiation protection advisory teams (RAPATs) which will assist in defining long-term technical co-operation projects in the radiation protection field; (ii) the Agency's radiation protection service was extended to include the provision of technical advice to Member States on the establishment of national radiation protection services; and (iii) the Director General announced his intention of setting up an "International Nuclear Safety Advisory Group" (INSAG) - composed of individuals of high standing from the industrial, research and regulatory sectors - to consider current nuclear safety issues without involving itself in regulatory matters or the development of safety standards.

11. Work on implementing the Basic Safety Standards for Radiation Protection (Safety Series No. 9) continued with the preparation of new and revised documents. The latest revision of the Agency's Regulations for the Safe Transport of Radioactive Materials (Safety Series No. 6) was completed and approved by the Board of Governors. To meet the growing demand for Agency assistance in planning and preparedness for radiation emergencies, training courses were organized, expert advice provided and guidelines developed.

12. The operational safety review team (OSART) programme continued with teams visiting nuclar power plants in Yugoslavia and the Philippines. The Agency's incident reporting system (IRS) became operational, 17 countries having joined the system by the end of the year. The Agency's Nuclear Safety Standards (NUSS) programme progressed as planned, and it is expected that the remaining five documents will be completed during 1985; emphasis shifted towards promoting the implementation of NUSS documents.

13. In the area of risk assessment, the Agency continued to assist Member States in the use of probabilistic risk analysis techniques. A symposium was held in Jülich, Federal Republic of Germany, on risks and benefits of energy systems. Case studies presented at the symposium demonstrated that risk assessment techniques can be used in identifying strategies for managing the environmental and health risks of energy systems. Steps were taken to establish joint activities in this area with ILO, WHO and UNEP.

Nuclear fuel cycle

14. The uranium situation continued to be characterized by near-term over-supply and low prices. However, uranium production in WOCA[1] countries was close to the 1983 level of approximately 37 000 tonnes, increasing in Canada but decreasing in other major producing countries. Exploration was considerably reduced in major producing countries as a consequence of the low prices, but many developing countries intensified their exploration efforts.

15. The Joint NEA/IAEA Working Groups on uranium were disbanded during the year, but the Agency and NEA agreed that they would continue to co-operate in preparing the publication "Uranium - Resources, Production and Demand" (the "Red Book").

Waste management

16. In the area of radioactive waste management, which continued to command worldwide interest in the context of nuclear power development, an integrated systems approach was adopted in evaluating the safety of waste disposal operations. The development of standards, criteria and codes of practice and the performance assessment of total systems continued. The problems of the decontamination and decommissioning of nuclear facilities continued to grow in importance. With regard to the environmental aspects of waste disposal, progress was made in applying "de minimis" or the exempt quantities concept, a matter on which many Member States require guidance.

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[1] "World Outside the Centrally planned economies Area".

Committee on Assurances of Supply

17. The Committee on Assurances of Supply (CAS) held its eleventh to thirteenth sessions in March, July and November respectively.

18. It continued its consideration of principles of international co-operation in the field of nuclear energy in accordance with the mandate of the Committee on Assurances of Supply, with the focus of discussion on the linkage between non-proliferation assurances and assurances of supply. Extensive use was made, during the year, of informal consultations conducted by the CAS Chairman and the other members of the CAS Bureau.

19. Recommendations made in 1983 by CAS to the Board for the establishment within the Agency of an "IAEA system for an emergency and back-up mechanism"[2] were examined by the Board in the light of a Secretariat paper on the operational and financial implications of such a system.[3] The Board took note of CAS's conclusions regarding mechanisms for revising international nuclear co-operation agreements[4] and welcomed the progress which CAS had made with respect to such mechanisms.

20. In March, CAS requested the Secretariat to prepare a report on the existing practical, technical and administrative problems in international shipments of nuclear materials and equipment. In November, after considering the report, which had been prepared in the light of discussions in a group of experts convened by the Secretariat, CAS transmitted it to the Board together with a number of observations on it. In particular, CAS felt that there was a need for Governments to consider the report with a view to reducing administrative burdens and practical problems in international shipments of nuclear materials and equipment.[5]

Applications of nuclear techniques

21. The results of a regional project on food irradiation conducted with financial support from Japan during the period 1980-84 and designed to enable scientists from developing countries in Asia and the Pacific region to further the use of irradiation for food preservation and in improving the hygienic quality of fishery products, mangoes, onions and spices clearly demonstrated the technological and economic viability of the radiation processing of these food items.

22. An International Consultative Group on Food Irradiation was established with the objectives of furthering the development and possible commercialization of food irradiation and assisting Member States in the promotion of wholesome food supplies and proper nutrition; the Group has been established for an initial period of five years.

23. In the medical applications area, efforts to upgrade the maintenance of nuclear instruments in developing countries continued. In the field of radioimmunoassay and related techniques, particular emphasis was placed on quality control and training. The results of co-ordinated research programmes concerning mineral body burdens and of epidemiological studies of health impacts of low-level radiation were evaluated, and a co-ordinated research programme was initiated on the use of nuclear techniques to monitor toxic elements in food and drinking water.

24. In the field of isotope hydrology, the Agency supported technical co-operation projects aimed at solving hydrological problems associated with the development of water resources, including the problems of sedimentation and sediment transport.

25. The Agency continued to monitor developments in the area of industrial applications, including techniques for on-line process control in coal processing and utilization and for the determination of moisture, specific energy and sulphur and other elements in coal. Promising prototypes of technetium-99m generators underwent further tests. A co-ordinated research programme was initiated on the radiation modification of polymers for industrial and medical use.

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[2] See para. 18 of the Agency's Annual Report for 1983 (GC(XXVIII)/713).

[3] In February 1985, the Board decided that it would revert to the question of an IAEA system for an emergency and back-up mechanism at a future meeting, after appropriate informal consultations.

[4] See para. 17 of the Agency's Annual Report for 1983 (GC(XXVIII)/713).

[5] The Board took note of the report in February 1985.

Funds obligated in 1984

Programme	Source of funds				Total
	Regular Budget	Extra-budgetary	TACF	UNDP	
Animal production	70 059	-	-	-	70 059
Food irradiation	-	27 423[a/]	-	-	27 423
Plant breeding					
- grain legumes	34 127	-	-	-	34 127
- rice	40 000	-	-	-	40 000
Impact of mineral substances on man and the environment	2 800	-	-	-	2 800
Maintenance of medical instrumentation	50 490	-	-	-	50 490
Isotope hydrology	-	22 351[b/]	-	-	22 351
Improvement of cancer therapy	5 300	10 000[a/]	-	-	15 300
Nuclear techniques for tropical parasitic diseases	27 300	-	-	-	27 300
Development of $^{99}Tc^{m}$ generator systems	6 000	-	-	-	6 000
Radiation sterilization of biological tissue grafts	4 000	-	-	-	4 000
Imaging procedures for the diagnosis of liver disease	642	30 348[a/]	-	-	30 990
Industrial applications of isotopes and radiation technology	-	341 327[a/]	115 213	363 839	820 379
Total	240 718	431 449	115 213	363 839	1 151 219

a/ Met from cash contributions made by the Government of Japan.

b/ Met from cash contributions made by the Government of Australia.

Technical co-operation

26. The high resource level reached in 1983 for Agency technical co-operation activities ($34.5 million) was surpassed in 1984, during which resources valued at $35.9 million became available. The Technical Assistance and Co-operation Fund, whose income is derived mainly from the voluntary contributions of Member States, continued to represent the largest source of funds, its share of total resources in 1984 amounting to 61.9% (1983: 55.7%). At 25.3%, the next largest share was represented by extrabudgetary funds, which totalled $9.1 million in 1984 (1983: $9.4 million). In-kind and UNDP resources in 1984 amounted to $2.1 million and $2.5 million respectively; their shares of the total available resources declined for the third consecutive year, by 4.9% and 31.4% respectively as compared with 1983.

27. Owing to the introduction of streamlined administrative procedures, the use of new financial management tools endorsed by the Board in 1983, and a sizable amount of unliquidated obligations brought forward on 1 January 1984 ($16.7 million), total technical co-operation disbursements reached $32.6 million, which is $6 million, or 22%, higher than the 1983 total of $26.6 million. Disbursements from the Technical Assistance and Co-operation Fund were $20.1 million, or 20.2%, higher and those from extrabudgetary funds were $6.5 million, or 89.7%, higher than in the previous year. The volume of assistance provided in kind and from UNDP funds declined.

28. Progress made in the implementation of Agency technical co-operation activities in 1984 is evident from the following table.

Item	1983	1984
Number of expert assignments	1 099	1 530
Number of expert man-months served	1 020	1 550
Number of expert assignments undertaken by Agency staff	333	378
Value of project equipment supplied (in $1000)	14 746	16 610
Number of fellows in the field	612	702
Number of scientific visitors	65	123
Number of participants in study tours and training courses	659	850

29. The RCA agreement on the Asian Regional Co-operative Project on Food Irradiation[6], which was due to expire on 27 August 1984, was extended for another three years. In 1984, the following eight Member States accepted the terms of the extension agreement: Bangladesh, India, Indonesia, Malaysia, Pakistan, the Republic of Korea, Thailand and Viet Nam. Australia, which subsequently became a party to this agreement, has pledged cash contributions in support of the project commencing in 1985. The 13th meeting of representatives of RCA Member States was held in Vienna in September 1984 in conjunction with the twenty-eighth session of the Agency's General Conference; at this time, the report of the sixth meeting of the RCA Working Group - held in March in India - was reviewed and progress reports on active projects were given. Representatives of China attended the September 1984 meeting as observers.

30. The funds obligated in 1984 by the Agency for 13 programmes being carried out within the framework of the RCA are shown in the following table. In addition, one RCA programme on basic science using research reactors is being financed from in-kind contributions made by India. The largest RCA programme, relating to industrial applications of isotopes and radiation technology, is being assisted by Australia, Japan, UNDP and the Agency; in 1984, approximately $1.75 million were available for this programme, a large part contributed by participating Member States and local industries.

[6] Reproduced in document INFCIRC/285.

International Laboratory of Marine Radioactivity

31. The current tripartite agreement for the Laboratory was extended for a period of one year, until 30 June 1985, under the same terms and conditions.

32. The Agency conducted negotiations with the Monegasque authorities on a draft seat agreement for the International Laboratory of Marine Radioactivity.

International Centre for Theoretical Physics

33. In 1984 the International Centre for Theoretical Physics celebrated its twentieth anniversary. In view of the fact that the first course held at the Centre, in 1964, was dedicated to plasma physics, a commemorative meeting on the subject was held at the end of September. The actual celebration of the twentieth anniversary took place on 12 October, when the Italian Minister for Foreign Affairs, Mr. Giulio Andreotti, visited the Centre. At the time of his visit, three meetings were being held simultaneously: a conference on physics for development, a symposium on the state of physics and mathematics in Africa, and the General Assembly of the International Union of Pure and Applied Physics (IUPAP); in addition, Professor C. Rubbia, who shared the 1984 Nobel Prize for Physics with Dr. S. Van der Meer, gave his first lecture as a Nobel Laureate at the Centre.

Safeguards

34. Negotiations were concluded during 1984 between the Agency and the Soviet Union for a safeguards agreement relating to its voluntary offer to place some of its peaceful nuclear installations under Agency safeguards.[7]

35. On 2 July the Agency formally established an office in Tokyo, mainly to facilitate the implementation of the agreement between Japan and the Agency for the application in Japan of safeguards in connection with NPT.

36. In 1984, as in previous years, the Secretariat, in carrying out the safeguards obligations of the Agency, did not detect any anomaly which would indicate the diversion of a significant amount of safeguarded nuclear material - or the misuse of facilities or equipment subject to safeguards under certain agreements - for the manufacture of any nuclear weapon, or for any other military purpose, or for the manufacture of any other nuclear explosive device, or for purposes unknown[8]. It is considered reasonable to conclude that nuclear material under Agency safeguards in 1984 remained in peaceful nuclear activities or, with the exception of one case[9], was otherwise adequately accounted for.

United Nations Conference for the Promotion of International Co-operation in the Peaceful Uses of Nuclear Energy

37. The Preparatory Committee of the United Nations Conference for the Promotion of International Co-operation in the Peaceful Uses of Nuclear Energy held its fifth session in Vienna in June/July 1984. It recommended in its report to the General Assembly that one of the main topics of discussion at the Conference should be "Principles universally acceptable for international co-operation in the peaceful uses of nuclear energy and appropriate ways and means for the promotion of such co-operation, as envisaged in General Assembly resolution 32/50, and in accordance with mutually acceptable considerations of non-proliferation".

38. The General Assembly, in resolution 39/74, approved this recommendation and decided that the Conference should be held in November 1986, in Geneva, and that a sixth Preparatory Committee session should be held from 21 October to 1 November 1985, in Vienna. The Agency, which continued to assist in the preparations for the Conference, was invited to provide papers for the sixth Preparatory Committee session and for the Conference itself.

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[7] The safeguards agreement, which was approved by the Board of Governors and signed in February 1985, entered into force on 10 June 1985.

[8] In the case of voluntary-offer agreements with nuclear-weapon (NW) States, nuclear material to which safeguards were applied was not withdrawn from safeguards except in conformity with these agreements.

[9] In this case an export of depleted uranium was made without due notification to the Agency. Subsequently the country to which the export was made declared to the Agency that the material had been imported exclusively for non-nuclear, non-explosive uses and that part of the material had been so used. A major part of the material was made available to Agency staff for examination.

Third Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons

39. The Preparatory Committee of the Third Review Conference held two sessions in 1984. The first was mainly procedural. At the second one, the provisional background papers prepared by the United Nations, the Agency and OPANAL were discussed. Work started on updating these papers for the third session of the Preparatory Committee, in April 1985, and for the Review Conference itself, in September 1985.

Matters of special interest to the Agency discussed by the General Assembly of the United Nations

40. Several matters of interest to the Agency were discussed at the thirty-ninth session of the General Assembly. In the debate that followed the presentation of the Agency's Annual Report for 1983, delegates indicated their broad support for the Agency, its safeguards system, its technical co-operation programme, its work in the field of nuclear safety and its role in relation to the Third Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons and to the United Nations Conference for the Promotion of International Co-operation in the Peaceful Uses of Nuclear Energy. In its resolution on the report, the General Assembly affirmed its confidence in the role of the Agency in the application of nuclear energy for peaceful purposes and urged all States to co-operate in carrying out the work of the Agency.

41. The General Assembly adopted resolutions on the establishment of nuclear-weapon-free zones in the Middle East and South Asia. Also, it noted that the ad hoc group of experts assisting the Secretary-General with a study of the question of nuclear-weapon-free zones in all its aspects had not concluded its work and requested that the study be continued.

42. In resolution 39/147 on Israeli nuclear armament, the General Assembly again requested the Security Council to investigate Israel's nuclear activities, reiterated its request to the Agency "to suspend any scientific co-operation with Israel which could contribute to Israel's nuclear capabilities", reiterated "its condemnation of the Israeli threat ... to repeat its armed attack on peaceful facilities in Iraq and in other countries", reaffirmed "its condemnation of the continuing nuclear collaboration between Israel and South Africa" and requested the Security Council to ensure that Israel complies with resolution 487 (1981) and places all its nuclear facilities under Agency safeguards. A similar request to the Security Council was made in resolution 39/14 on the Israeli military attack on Iraqi nuclear installations; in this resolution the General Assembly also stated that statements made by Israel did not fulfil, or in the view of some, did not completely fulfil the provisions of General Assembly resolution 38/9 of 10 November 1983, which specifically demanded that Israel withdraw forthwith its threat to attack and destroy nuclear facilities in Iraq and other countries, demanded that "Israel undertake forthwith not to carry out, in disregard of the safeguards system of the International Atomic Energy Agency, any attack on nuclear facilities in Iraq, or on similar facilities in other countries, devoted to peaceful purposes" and called for the international consideration "of legal measures to prohibit armed attacks against nuclear facilities, as a contribution to promoting and ensuring the safe development of nuclear energy for peaceful purposes".

43. In resolutions 39/61A and 39/61B, the General Assembly demanded once again "that South Africa submit forthwith all its nuclear installations and facilities to inspection by the International Atomic Energy Agency", and in resolution 39/71A it again requested the Agency to refrain from extending to South Africa any facilities which might assist it in its nuclear plans.

44. In September 1984 the Agency's General Conference adopted two resolutions relating to matters which had previously been discussed by the United Nations General Assembly and which were also the subject of resolutions adopted by the General Assembly during its thirty-ninth session and referred to in paragraphs 42 and 43 above. In resolution GC(XXVIII)/RES/423 the General Conference once again demanded that South Africa immediately submit all its nuclear facilities to inspection by the Agency. Also, it called upon those Member States which had not done so yet to end all nuclear co-operation with the South African régime and to stop all purchases of Namibian uranium. The Board of Governors was requested to make recommendations to the General Conference at its twenty-ninth regular session on appropriate action to be taken in accordance with the Statute if by that session South Africa had not complied with resolution GC(XXVIII)/RES/423, and the Board and the Director General were requested to contribute to the implementation of the relevant resolutions of the General Assembly and to report at the twenty-ninth session of the General Conference on the implementation of resolution GC(XXVIII)/RES/423.

45. In resolution GC(XXVIII)/RES/425, on the consequences of the Israeli military attack on the Iraqi nuclear research reactor, the General Conference, taking note of Security Council resolution 487 and of the relevant resolutions of the General Assembly, demanded that Israel "undertake forthwith not to carry out any further attacks on nuclear facilities in Iraq or on similar facilities in other countries, devoted to peaceful purposes, in disregard of the Agency's safeguards system" and requested the Director General personally to seek from the Government of Israel the undertakings in question; also, it called upon Israel "urgently to place all its nuclear facilities under Agency safeguards".

Finance and personnel

46. The Regular Budget total for 1984 was $96 830 000, of which $88 786 000 was to be financed from contributions made by Member States on the basis of the 1984 scale of assessment, $3 532 000 from income from work for others and $4 512 000 from other miscellaneous income.

47. At the end of 1984, the number of members of the Secretariat was 1861 - 684 in the Professional and higher cateogries, 1039 in the General Service category and 138 in the Maintenance and Operatives Service category; 563 staff members were in posts subject to geographical distribution. The first traineeship programme for graduates and junior professionals from developing areas (with 15 trainees participating) was completed in August 1984.

THE AGENCY'S ACTIVITIES

TECHNICAL CO-OPERATION

Resources and their utilization

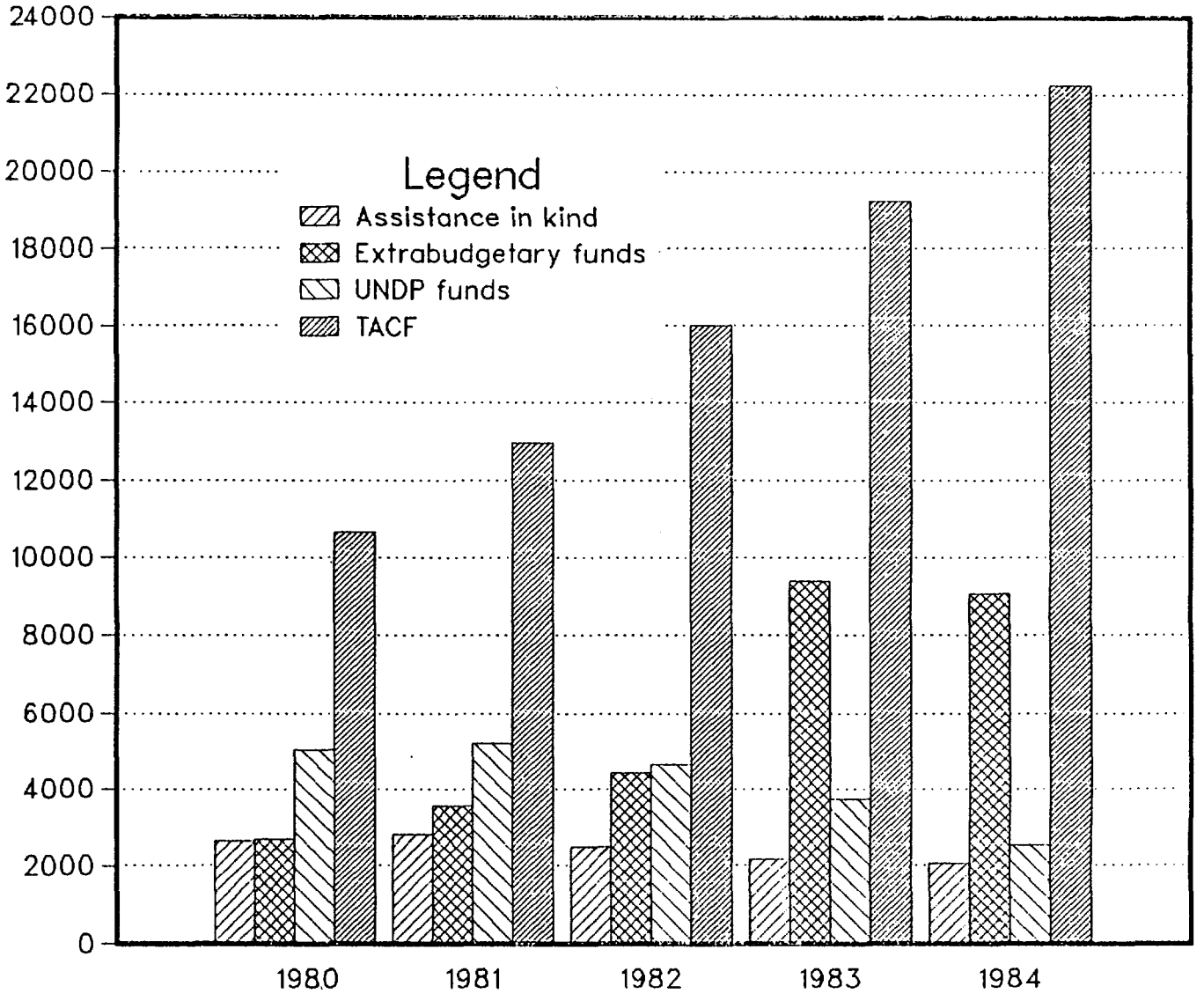
48. The resources for the Agency's technical co-operation programmes are the Technical Assistance and Co-operation Fund (TACF), extrabudgetary funds, UNDP funds and assistance in kind. Figure 1 shows the amounts available for financing technical co-operation activities during the period 1980-84.

49. Total resources available for technical co-operation rose to $35.9 million in 1984 (1983: $34.5 million). The growth, by 4%, was due solely to an increase of $3 million in income to the TACF. It may appear to be modest, but it should be noted that a high resource level had been attained in 1983, owing primarily to a $5 million increase in extrabudgetary funds for that year. This can be seen in the table at the bottom of Fig. 1.

50. The total value of the technical assistance provided in 1984 was $32.6 million, which is 22.4% higher than in 1983. A 1983:1984 comparison of technical co-operation resources and disbursements is given in Fig. 2.

FIGURE 1

RESOURCES AVAILABLE FOR
AGENCY TECHNICAL CO-OPERATION PROGRAMMES: 1980 - 1984
(in thousands of dollars)

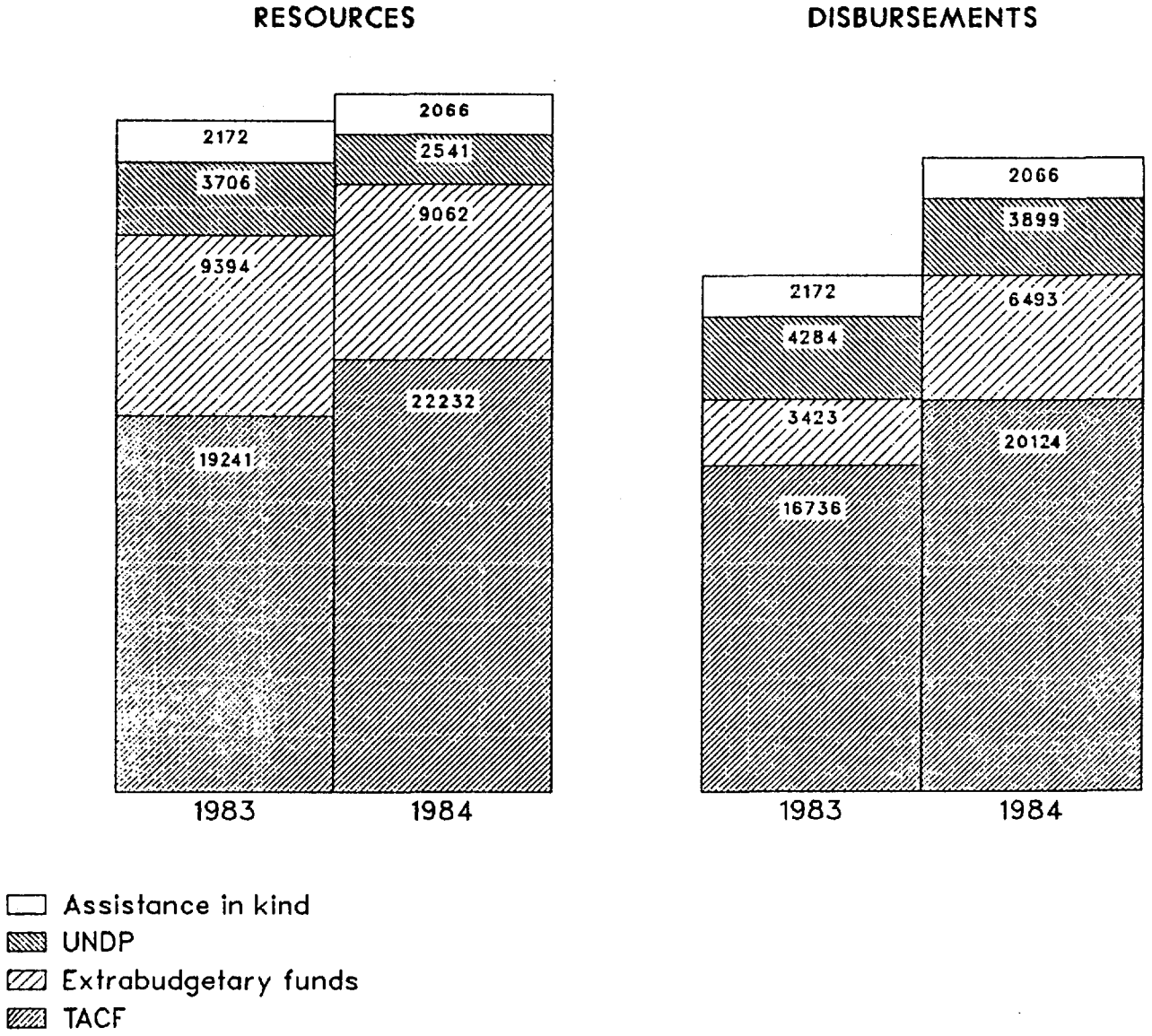


TACF	10 632	12 956	16 003	19 241	22 232
Extra-budgetary funds	2 669	3 531	4 413	9 394	9 062
Assistance in kind	2 628	2 788	2 493	2 172	2 066
UNDP	5 018	5 186	4 631	3 706	2 541
TOTAL	20 947	24 461	27 540	34 513	35 901

FIGURE 2

COMPOSITION OF AGENCY TECHNICAL CO-OPERATION RESOURCES AND DISBURSEMENTS

(in thousands of dollars)



1. Technical Assistance and Co-operation Fund

51(i) Resources: Income to the TACF is derived from the voluntary contributions of Member States towards the annual target and additional income (for example, receipts of assessed programme costs from recipient countries, interest earned on convertible currency holdings, and exchange gains or losses). In 1984, income to the TACF rose to $22 232 000, which is 15.5% higher than the 1983 total of $19 241 000. By 31 December 1984, as one year earlier, pledges amounting to 92.1% of the target had been made. However, whereas only 70.3% of 1983 pledges were paid within 12 months, the comparable figure for 1984 was exceptionally high - at 97.3%. As in 1983, about half of the Agency's Member States either made no pledge or pledged below their indicative shares.

51(ii) Disbursements: The volume of the assistance provided from the TACF in 1984 was, at $20 124 000, 20.2% higher than in 1983 ($16 736 100). As in 1983, TACF disbursements increased at a higher rate than new resources. Several factors were responsible for the high level of disbursements: a certain amount of overprogramming, the introduction of dynamic programming and the large volume of new financial obligations. At $25.9 million, total new obligations were 51% higher than the comparable 1983 figure ($17.1 million) and represented a new record for the TACF.

2. Extrabudgetary funds

52(i) Resources: Totalling $9 062 000, extrabudgetary resources decreased by 3.5% from the exceptionally high level attained in 1983 ($9 394 000). The major donors in 1984 were Italy (62.0%) and the United States of America (15.4%). The above totals include "funds in trust" received from developing countries to finance assistance for themselves ($3100 in 1983 and $131 700 in 1984); they do not include funds made available by Australia and Japan for RCA research contract programmes or contributions received in support of project activities scheduled for implementation during the next programme year; the total under the latter heading was $1.3 million, as against $2.5 million in 1983.

52(ii) Disbursements: Assistance valued at $6 492 700 was provided from extrabudgetary funds in 1984; this is 89.7% more than in 1983. Footnote-a/ projects [10] have attracted the largest share of extrabudgetary funds; however, the share of the Special Programme has been registering rapid growth, representing 39.9% of disbursements from extrabudgetary funds in 1983 and 45% in 1984. Eight Special Programme projects were under implementation in 1984, six in Africa and two in Asia and the Pacific; they all related to agricultural problems.

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[10] A footnote-a/ project is a project that has been approved by the Agency's Board of Governors for implementation but for which assistance is provided only in substitution for other assistance which it is planned to provide to the Member State in question or if additional contributions from Member States, funds or services become available.

3. Assistance in kind

53(i) Resources: The volume of in-kind resources declined for the third consecutive year, from $2 172 500 in 1983 to $2 066 100 in 1984. The major donors were the United States of America ($836 900), the Federal Republic of Germany ($149 800), India ($122 700) and the United Kingdom ($102 100). Thirty-three developing countries - including non-Member States Barbados and Guyana - also provided sizable in-kind inputs ($364 000 in 1983 and $549 600 in 1984); their contributions helped to offset the dwindling volume of assistance in kind donated by developed countries.

53(ii) Disbursements: Most in-kind assistance is made available in the form of fellowship training. In 1984, fellowships, with an estimated value of $1 491 100, accounted for 72.2% of in-kind assistance (1983: 70%). The next largest share, 13.8%, was in the form of expert services (1983: 10.4%). The balance, 14%, consisted of training courses (11.4%) and equipment (2.6%). As the Agency did not receive full information on in-kind inputs from some donors, the picture given in this report is incomplete.

4. UNDP

54(i) Resources: For the third consecutive year, UNDP resources at the Agency's disposal declined. At $2.5 million, UNDP's share of total 1984 resources amounted to only 7.1% (1980: 24%). In spite of UNDP's improved financial situation, programming is still limited to 55% of indicative planning figures. The Agency exercises no control over the distribution of UNDP resources, which makes it virtually impossible to predict accurately the volume of new resources that will be approved for projects. Twenty-three UNDP-assisted projects were under implementation in 1984 (1983: 29) in 19 countries and two regions; in three additional countries the Agency provided UNDP-financed assistance in an "associated agency" capacity. Ten projects were completed during the year and four new ones approved.

54(ii) Disbursements: Total 1984 disbursements from UNDP funds amounted to $3.9 million; this is 53% higher than the UNDP resource level in 1984 but 9% - about $0.4 million - below the level of 1983 disbursements ($4.3 million). The relatively high level of disbursements in 1984 was due mainly to large payments made in respect of obligations incurred in 1983. Disbursements totalled $1 217 800 for a project, within the framework of the RCA, on industrial applications of isotopes and radiation technology in the Asia and Pacific region; also, $559 100 were spent on a nuclear energy applications project in Peru; for all other projects disbursements were less than $400 000 each.

FIGURE 3
UTILIZATION OF RESOURCES: 1983 and 1984
(in thousands of dollars)

Field of activity		Year	Experts	Equipment	Fellowships	Share of total programme	
			$	$	$	$	%
General atomic energy development		1983	642.9	1 123.9	383.9	2 150.7	8.1
		1984	857.6	1 570.0	342.9	2 770.5	8.5
Nuclear physics		1983	381.4	1 878.0	346.2	2 605.6	9.8
		1984	486.1	2 215.8	720.2	3 422.1	10.5
Nuclear chemistry		1983	84.7	608.2	218.8	911.7	3.4
		1984	114.5	271.8	234.2	620.5	1.9
Prospecting, mining and processing of nuclear materials		1983	580.7	857.0	238.4	1 676.0	6.3
		1984	698.4	432.5	253.2	1 384.1	4.2
Nuclear engineering and technology		1983	763.0	2 470.3	1 143.9	4 377.3	16.5
		1984	1 106.3	2 405.9	1 375.6	4 887.8	15.0
Application of isotopes and radiation in	Agriculture	1983	1 609.5	2 159.9	1 213.0	4 982.4	18.7
		1984	2 038.9	4 409.5	1 456.4	7 904.8	24.3
	Medicine	1983	412.6	1 016.6	821.6	2 250.8	8.5
		1984	460.1	1 370.9	906.1	2 737.1	8.4
	Biology	1983	20.0	111.1	171.4	302.5	1.1
		1984	31.0	38.2	87.3	156.5	0.5
	Industry and Hydrology	1983	893.3	2 824.6	435.8	4 153.7	15.6
		1984	889.4	2 396.3	518.6	3 804.3	11.7
Safety in nuclear energy		1983	775.5	1 696.7	732.5	3 204.7	12.0
		1984	1 303.6	2 111.2	1 360.2	4 775.0	14.6
Miscellaneous[a/]		1984	32.4	54.3	32.1	118.8	0.4
Total		1983	6 163.6	14 746.3	5 705.5	26 615.4	100.0
		1984	8 018.3	17 276.4	7 286.8	32 581.5	100.0

a/ Miscellaneous amounts for 1983 were pro-rated by field of activity and programme component.

Distribution of the assistance provided

55. As can be seen from the following table, in which the share of individual components is expressed as a percentage of total disbursements, equipment again accounted for about half of all disbursements in 1984. The largest variation over the past five years has been in the training component.

Component	1983	1984	Five-year average, as at 31 December 1984
Experts	20.8%	21.1%	21.2%
Equipment	49.5%	49.1%	46.6%
Training	24.5%	25.4%	28.8%
Sub-contracts	4.6%	3.8%	2.8%
Miscellaneous	0.6%	0.6%	0.6%

56. In Figure 3, a comparison is given of the assistance provided in 1983 and 1984 by field of activity and major component (experts, equipment and fellowships). Disbursements for sub-contracts and some disbursements classified as "miscellaneous" are reflected under the relevant major component headings.

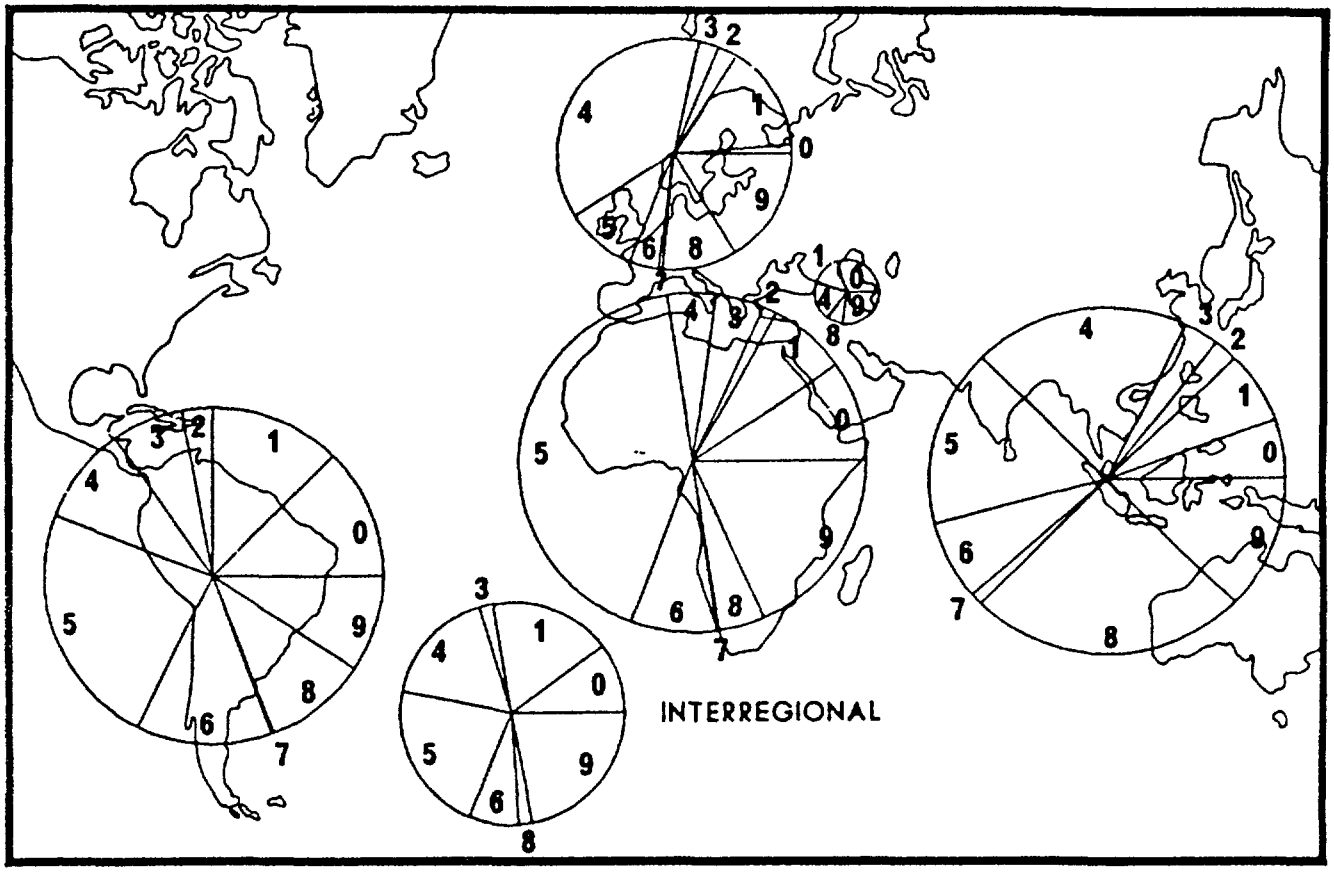
57. Trends in the distribution of assistance by field of activity were, by and large, maintained in 1984. Ten years ago, the share of total assistance accounted for by nuclear physics was 8.2% and that accounted for by prospecting, mining and processing of nuclear materials was 15.9%; by 1984, the share of the former had increased to 10.5%, the latter having dropped to 4.2%. Also, continued growth has been registered in the field of nuclear safety, whose share has increased threefold during the past ten years; in 1984, its share of the total programme was 14.6%. The respective shares of the other major fields of activity (nuclear engineering and technology, agriculture, medicine, and industry and hydrology) have fluctuated by as much as 10% during the past ten years.

58. How programme emphasis varies from region to region can be seen in Fig. 4. In 1984, agriculture was the leading field for Africa and Latin America, and also for the programme as a whole. Industry and hydrology ranked first in Asia and the Pacific, nuclear engineering and technology in Europe, and general atomic energy development in the Middle East.

59. Figure 5 shows the distribution of assistance by region and resource category. A comparison of Fig. 5 in this report with Fig. 5 in the report covering 1983 (GC(XXVIII)/713) reveals a wide range of fluctuation, as might be expected from one year to the next. The degree of fluctuation observed in the summary pie charts for these two years and during 1980-84 can be seen in the following table.

FIGURE 4

DISTRIBUTION OF TECHNICAL CO-OPERATION INPUTS BY FIELD AND REGION, 1984



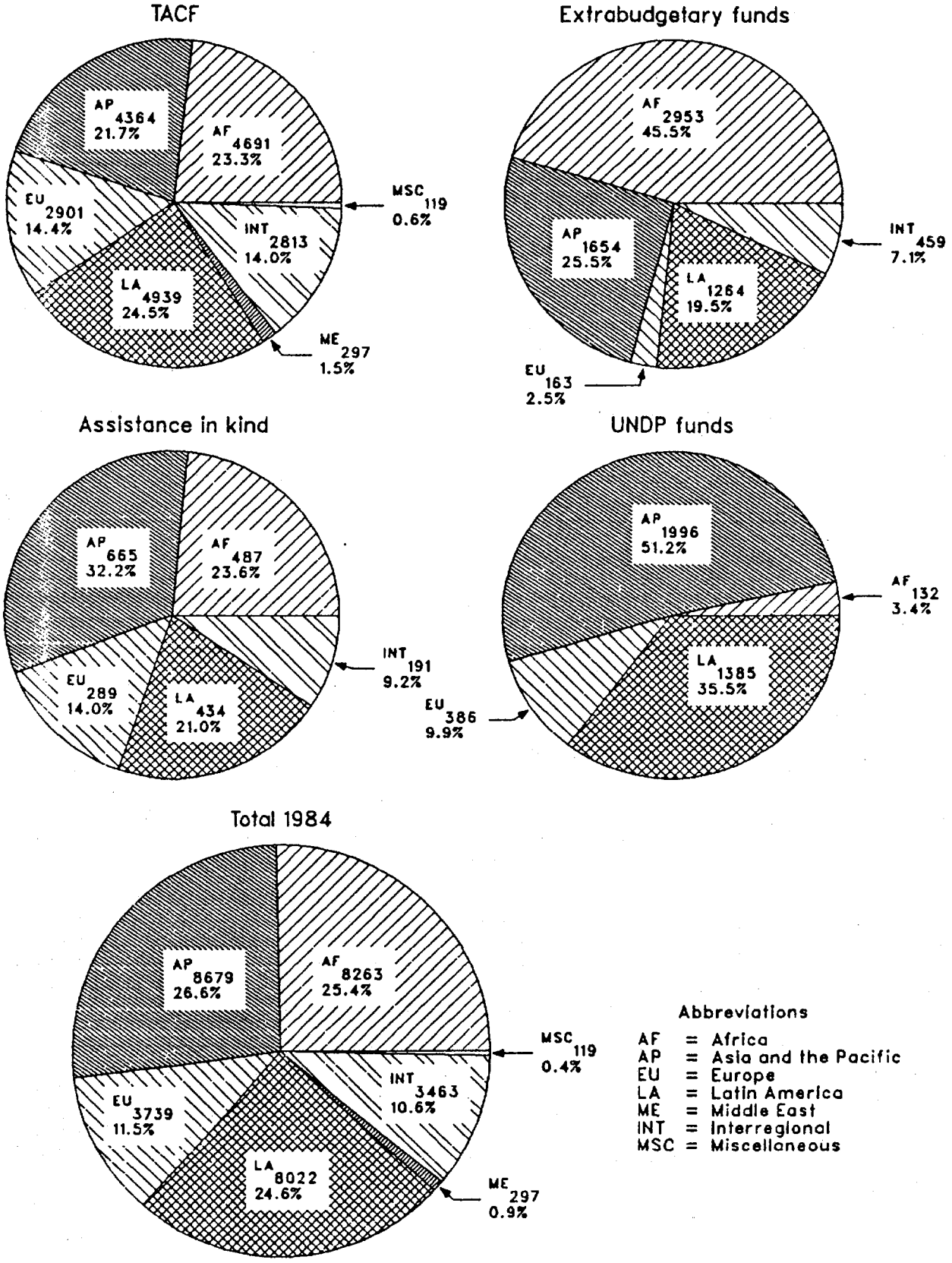
SUMMARY

(in thousands of dollars)

Field of activity		Africa $	Asia and the Pacific $	Europe $	Latin America $	Middle East $	Inter-regional $	All regions $
0 - General atomic energy development		803.6	485.9	45.5	1 001.7	87.1	346.7	2 770.5
1 - Nuclear physics		616.2	590.6	554.6	1 004.2	44.4	612.1	3 422.1
2 - Nuclear chemistry		102.2	184.5	99.8	234.0	-	-	620.5
3 - Prospecting, mining and processing of nuclear materials		368.3	279.5	106.6	559.1	3.3	67.3	1 384.1
4 - Nuclear engineering and technology		377.4	1 710.9	1 400.0	747.7	56.8	595.0	4 887.8
Application of isotopes and radiation in	5 - Agriculture	3 451.2	1 437.1	372.1	1 878.8	2.4	763.2	7 904.8
	6 - Medicine	665.4	628.3	149.8	1 044.6	-	249.0	2 737.1
	7 - Biology	19.9	96.2	22.2	18.2	-	-	156.5
	8 - Industry and Hydrology	348.8	2 199.0	382.7	784.8	22.6	66.4	3 804.3
9 - Safety in nuclear energy		1 509.8	1 066.8	605.9	749.2	80.2	763.1	4 775.0
Sub-total		8 262.8	8 678.8	3 739.2	8 022.3	296.8	3 462.8	32 462.7
Miscellaneous		-	-	-	-	-	-	118.8
GRAND TOTAL		8 262.8	8 678.8	3 739.2	8 022.3	296.8	3 462.8	32 581.5

FIGURE 5

DISTRIBUTION OF TECHNICAL CO-OPERATION DISBURSEMENTS BY SOURCE AND REGION, 1984
(in thousands of dollars)



Region	Overall share in (%)		
	1983	1984	1980-84
Africa	23.2	25.5	23.2
Asia and the Pacific	32.2	26.7	27.1
Europe	14.3	11.5	13.7
Latin America	21.1	24.7	25.0
Middle East	1.4	0.9	1.2
Interregional	7.8	10.7	9.8

General observations

60. Implementation of the expert component, which had for many years been a source of concern, increased notably over the 1983 level. The number of assignments undertaken during 1984 (1530) was 39% higher than during the previous year. The number of man-months delivered (1550) rose even more sharply (52%).

61. An important development in 1984 was the increase in the share of developing-country nationals serving on Agency-assisted projects; about 46% of all persons who undertook project assignments in 1984 were from developing countries. Also, whereas 17 out of the 35 training courses conducted in 1983 were held in developing countries, the corresponding figures for 1984 were 31 and 51, which represents a very considerable increase. The number of cost-free lecturers and the value of the facilities provided by developing countries for Agency-sponsored training courses - already of a significant magnitude in 1983 - reached a record level in 1984.

62. The number of assignments carried out by Agency staff increased from 333 in 1983 to 378 in 1984; however, owing to the much higher total number of assignments undertaken in 1984, the share of assignments carried out by Agency staff actually went from 30% in 1983 to 25% in 1984. During the year, 108 staff members of the Agency's "technical-substantive" Departments provided support to 770 on-going projects as technical officers; in the previous year 92 technical officers provided support to 646 on-going projects.

63. During 1984, 702 persons were undergoing fellowship training (612 persons in 1983). An increase of 89% was recorded in the number of persons who undertook scientific visits during 1984. In all, 850 persons participated in Agency-sponsored training courses in 1984, which is 30% higher than the figure for 1983. Little change was noted in the distribution of training by field, reactor technology and nuclear safety together accounting for the largest share (41%), followed by agriculture (19%) and medicine (13%).

64. The Technical Co-operation Evaluation Unit introduced an interim project implementation reporting system in 1984 which relies on national counterparts to report regularly on the progress of their projects; in this way, the Secretariat is alerted to implementation problems as they arise. Approximately 65% of all on-going projects had been covered by this system by the end of 1984. Also, 55 mid- or end-of-project evaluations were completed and three "major process" evaluations were initiated.

65. Work on the technical co-operation computer system continued during the year, information on UNDP-financed projects being added to the system and considerable improvements being made to computer programs dealing with expert recruitment. For the purpose of monitoring and analysing data related to new assistance requests, a "project pipeline system" was designed and made operational for use on microcomputers. The system facilitates the preparation of documentation for the Technical Assistance and Co-operation Committee.

66. A Joint Inspection Unit (JIU) study of Agency technical co-operation, begun in 1983, was completed in 1984. In its report, the JIU concluded that Agency assistance was indeed

valuable to Member States and that project implementation proceeded in most instances without delay. The Technical Assistance and Co-operation Committee and the Board assessed the JIU's report, endorsing most of the recommendations put forward.

67. A management review of technical co-operation was completed in 1984 by an independent consultant. As a result, a number of actions are planned that should help the Secretariat to cope more effectively with increasing responsibilities in the coming years.

68. In 1984, the Secretariat examined the extent of Agency co-operation with Least Developed Countries (LDCs). The first list of LDCs was established in 1971 by the General Assembly of the United Nations; it contained 25 States. The present list contains 36 States, and four States are treated as if they were LDCs. Twelve of these 40 countries are Agency Member States. During 1981-84, Agency assistance to LDCs increased at the rate of 31% a year. The amount of assistance received by individual LDCs varied from $6300 to $596 000 per country and year (these figures do not include the value of assistance provided from UNDP funds and in kind).

69. A number of measures are being taken to increase the involvement of LDCs in the Agency's technical co-operation programme and, thereby, the amount of assistance they receive. The measures include pre-project assistance, to help improve the capability of local authorities for project formulation and design, country programming assistance, to facilitate the longer-term planning of Agency inputs in support of integrated programmes of nuclear applications, and intercountry co-operation, to assist LDCs in a given sub-region, region or regions in applying nuclear techniques to problems they have in common.

General

70. Statistical data collected by the Agency indicate that the total installed nuclear power-generating capacity in the world increased by 17% during 1984, reaching 220 GW(e) by the end of the year. Nuclear power plants accounted for around 13% of the world's total electricity generation during 1984.

71. Despite the fact that in most countries the growth in electricity demand was higher than in previous years, there was no sign of an increase in the ordering of nuclear power plants in the near future. Construction work started on only 16 plants in 1984, compared with 23 plants in 1983. Low load growth and uncertainties about future demand and financing in most market-economy countries remained the major reasons for this continued slow-down, which may cause severe problems for the nuclear industry in the second half of this decade. Given the present environmental impact of fossil-fired plants, the electricity demand-supply situation may become a matter of concern during the 1990s in several countries.

72. Fourteen nuclear power plant orders representing a total capacity of 15 GW(e) were cancelled or suspended in the United States of America and construction work on five plants was suspended in Spain. At the same time, six new plants were brought on line in both France and the United States. In Europe and Japan, it appears that priority is being given to further improvements in economics through simplified licensing procedures, the standardization of plants and high operating availability as a result of better operating management and better maintenance.

73. In most developing Member States outside Eastern Europe, nuclear power programme growth continued to be slow, with no nuclear power plant being connected to the grid and construction work starting on only one plant. In response to a growing number of requests, the Agency further strengthened its efforts to assist developing countries with nuclear power programme planning and infrastructure development.

74. A small and medium power reactor (SMPR) project initiation study provided a better understanding of the situation regarding the availability of nuclear power plants in sizes of special interest for developing countries and the potential market for such plants.

75. The development of fast breeder reactors is now clearly oriented towards improving their economics. The establishment of co-operation in fast breeder development between several West European countries in 1984 may well prove to be important for the future market introduction of fast breeder reactors.

76. The status of nuclear power programmes at the end of 1984 is summarized in Table 1.

Table 1

Nuclear power reactors in operation
and under construction
at the end of 1984

Country	In operation		Under construction		Electricity generated by nuclear power reactors in 1984		Total operating experience (to end 1984)	
	Number of units	Total MW(e)	Number of units	Total MW(e)	TW(e)·h	% of total	Years	Months
Argentina	2	935	1	692	4.2	(10)*/	12	7
Belgium	6	3 474	2	2 012	26.4	50.8	56	9
Brazil	1	626	1	1 245	1.5	(1)	2	9
Bulgaria	4	1 632	2	1 906	12.7	28.6	26	6
Canada	16	9 521	7	5 630	49.3	11.6	135	7
China			1	300				
Cuba			1	408				
Czechoslovakia	3	1 194	10	4 394	6.7	8.5	18	0
Finland	4	2 310			17.8	41.1	23	4
France	41	32 993	23	28 355	181.8	58.7	297	0
German Democratic Republic	5	1 694	6	3 432	(11)	(11)	52	5
Germany, Federal Republic of	19	16 133	7	6 881	86.7	23.2	196	3
Hungary	2	820	2	820	3.5	13.5	2	5
India	5	1 020	5	1 100	3.6	2.6	49	3
Italy	3	1 273	3	1 999	6.6	3.8	66	10
Japan	31	21 751	10	9 182	126.1	22.9	254	1
Korea, Republic of	3	1 790	6	5 622	11.0	(20)	11	5
Mexico			2	1 308				
Netherlands	2	508			3.5	5.8	27	9
Pakistan	1	125			0.3	1.6	13	3
Philippines			1	620				
Poland			2	880				
Romania			3	1 980				
South Africa	1	921	1	921	3.9	(3)	0	9
Spain	7	4 690	3	2 807	22.1	19.3	49	7
Sweden	10	7 355	2	2 100	48.6	40.6	87	7
Switzerland	5	2 882			17.4	36.5	48	10
Union of Soviet Socialist Republics	46	22 997	39	36 575	(131)	(9)	483	8
United Kingdom	37	9 564	5	3 130	45.7	17.3	657	1
United States of America	85	68 867	34	38 242	325.2	13.5	870	9
Yugoslavia	1	632			4.2	7.0	3	3
Worldwide[a]/	345	219 718	180	163 448	1175	13	3467	10

a/ "Worldwide" figures include Taiwan, China, where there were five units with a total capacity of 4011 MW(e) in operation and one unit with a total capacity of 907 MW(e) under construction and where a total of 20 years and 2 months of operating experience had been gained.

*/ Figures in brackets indicate estimates - no data provided by Member State.

Nuclear power planning

77. Activities aimed at helping developing Member States to assess the appropriate role of nuclear power within their national energy plans were further strengthened; they included (a) the adaptation of assessment methodologies available in industrialized countries for use in developing countries, (b) energy and nuclear power planning missions, and (c) training courses on electricity system and nuclear power planning:

(a) Assessment methodologies

The Agency continued its co-operation with industrialized Member States and with United Nations agencies and other international organizations in the use of methodologies for forecasting electricity demand in developing countries as a basis for studying the role of nuclear power;

(b) Planning missions

Agency advisory teams visited Thailand in April, Turkey in October and December, and Indonesia and China in November. The Agency received visits by members of national counterpart teams from Jordan in July and December, and from Thailand in August;

(c) Training courses

The sixth interregional training course on "Electric System Expansion Planning" was held at the Argonne National Laboratory, United States of America; it included visits to nuclear, coal-fired and oil-fired power plants and to a load-dispatching centre. A Guidebook on Expansion Planning for Electrical Generating Systems (Technical Reports Series No. 241), a comprehensive reference book for this course, was published in November;

A comprehensive Training Manual on Energy and Nuclear Power Planning in Developing Countries was completed in April 1984, for issue in 1985. It is intended for use as a textbook in interregional training courses.

78. The Agency co-operated with NEA in producing revised projections of the long-term demand for energy, electricity and nuclear power. The primary tool used for estimating energy and electricity demand was a computer model developed by the Agency in collaboration with the Institute for Energy of the Technical University of Vienna and the International Institute of Applied Systems Analysis.

79. In July 1984, the Agency published a comprehensive overview report entitled "Nuclear Power: Status and Trends 1984" and based in particular on data in the Agency's Energy and Economic Data Bank (EEDB) and the Power Reactor Information System (PRIS).

80. The booklet entitled "Energy, Electricity and Nuclear Power Estimates for the Period up to 2000" (Reference Data Series No. 1) was updated, in November, using data from EEDB and PRIS and results of Agency and other international demand projections.

81. Three research agreements and three research contracts were initiated under a co-ordinated research programme on the implications of nuclear power for the overall economic development of developing countries.

Economics of nuclear power

82. A symposium on the risks and benefits of energy systems, organized by the Agency (Division of Nuclear Power and Division of Nuclear Safety) in collaboration with WHO and UNEP, was held in Jülich, Federal Republic of Germany; the proceedings were published in November.

83. Substantial progress was made in revising the Agency's Guidebook on the Economic Evaluation of Bids for Nuclear Power Plants. In September a group of consultants reviewed the first draft revision and made recommendations for improving it.

84. In October, an advisory group advised the Agency on various aspects of financing nuclear power in developing countries and did initial planning for a 1985 seminar on this subject.

85. In November, two experts from France assisted the Agency in writing a small financial simulation model for use in making preliminary assessments of the financial feasibility of nuclear power programmes.

Power reactors of proven types

(a) Support to nuclear power programmes development

86. As part of its continued efforts to assist in ensuring a systematic approach to preparing and strengthening the infrastructures needed for nuclear power programmes in developing Member States, the Agency published guidebooks entitled "Qualification of Nuclear Plant Operations Personnel" and "Nuclear Power Plant Instrumentation and Control".

87. The manuscript for a guidebook entitled "Nuclear Power Plant Project Management" was completed and work started on one entitled "Industrial Support for Nuclear Power Programmes". The manuscripts of guidebooks entitled "Education in Nuclear Engineering and Science for Nuclear Power" and "Problems in Operating Nuclear Power Plants in Systems of Limited Capacity" neared completion.

88. The Agency organized an interregional training course on the technology of water-cooled power reactors jointly with Canada and the United States of America and one on quality assurance for nuclear power jointly with the Federal Republic of Germany. Training courses were held in Yugoslavia (on quality assurance) and Egypt (on nuclear power project management) as part of technical co-operation projects. A policy-level seminar on nuclear power was held in Lisbon at the request of the Portuguese authorities.

89. Staff members supported nuclear power pre-feasibility studies carried out as part of technical co-operation projects in Peru and Uruguay. Staff members also supported a study on the nuclear power option in Malaysia, where the national authorities had decided to carry out a systematic assessment of manpower and industrial support infrastructure needs before deciding whether the country should embark on a nuclear power programme.

90. Two UNDP projects concerned with nuclear manpower development - in Argentina and the Philippines - were supported. The number of projects concerned with this subject in the Agency's regular technical co-operation programme was 32 in 1984.

(b) Small and medium power reactors

91. In the SMPR project initiation study (see para. 74 above), 16 nuclear power plant manufacturers, responding to an Agency questionnaire, provided information on 24 designs of nuclear power plants with power levels lower than 600 MW(e) which could be offered commercially now or within the next ten years. From the potential buyer side fifteen developing countries provided information in response to the questionnaire.

(c) Technology of nuclear power plants of proven types

92. PRIS became fully operational, the annual reports "Nuclear power reactors in the world" and "Operating experience with power reactors in Member States" being produced direct from the computerized data base.

93. Member States and power plant owners contributing data to PRIS made more than 20 requests for data; the number of requests was far more than expected, but it proved possible to meet them promptly and without great effort owing to the flexibility of the system.

94. A new questionnaire for the collection of operating experience information was devised by the Agency in co-operation with CEC, WEC and UNIPEDE; it permits the collection of additional information, but should not increase the reporting burden for plant operators.

95. At a symposium on nuclear power plant outage experience, information was exchanged on ways to minimize outage times at nuclear power plants, the emphasis being on further reductions in the duration of planned outages for refuelling, inspection, maintenance and repair; the proceedings of the symposium were issued in December.

96. At a seminar on nuclear power plant operation management, directed primarily to executive-level staff of operating organizations, about 80 participants from more than 20 Member States discussed major issues involved in the safe, reliable and economic production of energy.

97. The International Working Group (IWG) on the Reliability of Reactor Pressure Components and the IWG on Nuclear Power Plant Control and Instrumentation met to plan future activities.

98. A co-ordinated research programme on the irradiation embrittlement of advanced pressure vessel steels showed that it is now possible to produce reactor pressure vessel steels with improved and predictable embrittlement characteristics.

99. It was decided to launch a co-ordinated research programme on optimizing reactor pressure vessel surveillance programmes, as the results could be useful from the point of view of promoting standardization in this area; by the end of the year 12 countries had offered to participate. A co-ordinated research programme on the development of common modelling approaches for training simulators for nuclear power plants was launched.

100. Specialists' meetings were held on the irradiation embrittlement of pressure vessel steels, the use of digital computing devices in systems important to safety, and backfitting in nuclear power plant control and instrumentation.

101. With completion of the part of the Nuclear Safety Standards (NUSS) programme relating to quality assurance, the emphasis shifted to revising one of the NUSS safety guides ("Quality Assurance in Nuclear Power Plant Operation"), preparing manuals which will explain how the NUSS quality norms can be achieved in practice and providing quality assurance assistance to Member States; the need for these activities stems largely from the fact that the NUSS quality assurance code and guides have been accepted partly or entirely by more than 20 Member States for incorporation into their national regulations.

102. A manual on auditing quality assurance programmes was published and manuals on the training, qualification and certification of quality assurance personnel and quality assurance for the surveying, evaluation and confirmation of nuclear power plant sites entered the final stages of preparation.

Advanced nuclear power reactor technology

103. The IWG on Fast Reactors reviewed the progress of LMFBR programmes - especially in Western and Eastern Europe, Japan and India - and organized specialists' meetings on the maintenance and repair of LMFBR steam generators, core distortion behaviour, predictions and experience, and methods of detecting thermal noise in fast reactors - three topics relating to the operational safety and availability of fast reactors.

104. The preparation of a technical report on the status of fast reactors worldwide and the compilation of the technical parameters of LMFBRs in operation, under construction or planned in Member States were completed.

105. A co-ordinated research programme was initiated on sodium boiling noise detection, the aim being to ensure the early detection of local boiling in order that corrective action may be taken promptly.

106. The IWG on Gas-Cooled Reactors reviewed current trends in national development programmes and organized specialists' meetings on heat-exchanger components for gas-cooled reactors and on design criteria for and experience with pre-stressed concrete reactor vessels.

107. A technical report on the status of and prospects for gas-cooled reactors and the proceedings of a meeting on high- and low-temperature nuclear heat applications were published. A co-ordinated research programme was initiated on codes for the structural design of gas-cooled reactor components.

108. Current research and development work in the field of advanced light- and heavy-water reactors were reviewed by a technical committee, which concluded that significant improvements in fuel utilization are possible with current reactor designs through incremental improvements in fuel design in the case of light-water reactors; even greater improvements would be possible with new core designs, but these would necessitate extensive development programmes.

109. A co-ordinated research programme was initiated on future applications of advanced reactors (especially light- and heavy-water reactors) in Member States, the aim being to co-ordinate existing research on advanced systems in the participating countries and to assess possible future applications.

110. A co-ordinated research programme on in-core fuel management computer codes was completed and a final report published. Through a co-operative arrangement with the NEA Data Bank, 48 computer code packages were provided in response to requests from 28 Member States during the first half of 1984. Mexico was assisted in the selection of in-core fuel management computer codes for use in the nuclear power plants which are under construction there.

General

111. The programme continued to cover developments in all steps of the nuclear fuel cycle and nuclear materials technology. Up-to-date assessments of world uranium and thorium resources and supply and related technology were maintained and used in providing information and advice to Member States. Data continued to be collected on the status, capacity, processes, economics and operation of existing and planned fuel cycle facilities throughout the world in order to provide Member States with information on the availability of fuel cycle services. In the area of fuel technology, efforts were directed towards the improvement of the reliability of fuel elements and to promoting quality control in fuel fabrication. Spent fuel management activities were expanded to include the evaluation of spent fuel arising in and the storage capacity requirements of Member States and the periodic compilation of data on the technical and economic aspects of spent fuel storage, transportation and reprocessing.

Nuclear materials and fuel cycle technology

Uranium resources and production

112. The uranium situation continued to be characterized by near-term over-supply and low prices. However, uranium production in WOCA countries was close to the 1983 level of approximately 37 000 tonnes[11], increasing in Canada but decreasing in the other producing countries.

113. The average delivery price in the United States in 1983 (the latest year for which reliable figures are available at present) was about $90/kg for domestic and imported uranium. In the EEC area, average delivery prices in 1983 were about $80/kg.

114. The spot market price fell from about $60/kg in the autumn of 1983 to about $45/kg in early 1984 and about $42/kg in October.

115. Exploration was considerably reduced in major producing countries as a consequence of the low prices, but many developing countries intensified their exploration efforts.

116. It was estimated that the demand for uranium in WOCA countries would increase from about 31 000 tonnes in 1984 to 47 000 tonnes in 1990 and 57 000 tonnes in 1995. As the lead times for uranium mining projects are very long, over ten years, higher levels of uranium exploration will be needed if this demand is to be met.

117. Preparation of a new edition of the publication "Uranium - Resources, Production and Demand" (the "Red Book"), scheduled to appear late in 1985, continued although the Joint NEA/IAEA Working Group on Uranium Resources, which was previously involved in its preparation, was disbanded. A manual on the projection of uranium production capability (Technical Reports

118. A technical committee meeting on uranium resources and supply in Africa was held in Niamey, Niger.

119. The Working Group on Uranium Geology completed its work on the preparation of comprehensive reports concerning the geological aspects of five major types of uranium deposit. Presentations of the Group's findings were made at a symposium on uranium held in Moscow in August 1984 during the 27th International Geological Congress.

120. A report on the geology and metallogenesis of uranium deposits in South America was issued and the preparation of a report and maps concerning uranium geology in South America and Africa reached the final stage.

121. A technical committee meeting on uranium deposits in volcanic rocks was held in El Paso, United States of America, and the proceedings prepared for publication.
Series No. 238) was published; it is hoped that this manual will lead to improvements in the reporting of data for the Red Book. Preparation of a manual on ore reserve estimation methods was completed.

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[11] Production reached a peak of 44 000 tonnes in 1980 and 1981 and then decreased.

122. The NEA/IAEA Working Group on R&D in Uranium Exploration Techniques and four of its five project-groups held meetings covering the following topics: uranium province recognition, natural gamma ray measurement, sub-surface geophysics, and gases in uranium exploration. During the year the Agency withdrew from joint sponsorship of the Group, which was disbanded, but the Agency will continue working on selected topics in the field in question as part of its regular programme of activities.

123. A report (with an extensive bibliography) on the state of the art of biogeochemistry was completed, and preparatory work was done on manuals on geochemical exploration and the use of radon in uranium exploration.

124. An intercalibration study of gamma spectrometry calibration facilities was completed and the final report prepared for publication. Gamma spectrometry reference samples of uranium, thorium and potassium were prepared for use in geological work.

125. New data from several countries were incorporated into the International Uranium Geology Information System (INTURGEO). The computer-based geochemical analysis system (GAS) was modified for use with current-generation microcomputers and a software package for mapping obtained; the modified system has been given the name "MICROGAS".

126. Computer programs for projecting and analysing the availability of uranium from known and speculative resources were obtained.

127. At a meeting of the NEA/IAEA Working Group on Uranium Extraction, status reports were presented on uranium ore processing R&D in each of the 14 countries represented. The proceedings of an NEA/IAEA workshop on the economics of uranium ore processing operations were published. Preparatory work started on a manual on laboratory evaluation techniques for uranium ore processing.

128. A technical committee met to consider the use of inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; the topics covered included the preparation and properties of inorganic ion exchangers and their use in the treatment of radioactive wastes and in the recovery of fission products, thorium, uranium and other actinides.

129. The Nuclear Fuel Cycle Information System, which compiles and distributes information on the status of nuclear fuel cycle facilities throughout the world, was revised and updated.

130. Assistance was provided to 31 countries (7 in Africa, 7 in Asia, 11 in Latin America, and 6 in Europe and the Middle East) with uranium exploration, production and ore processing; 17 expert missions to 16 countries were carried out in this connection. Also, a training course was held on the front end of the nuclear fuel cycle.

Fuel performance and technology

131. Activities in this area focused on water reactor fuel and were carried out under the guidance of the IWG on Water Reactor Fuel Performance and Technology.

132. A seminar was held on practical experience in the application of quality control in water reactor fuel fabrication, and there were three specialists' meetings - on "Computer Modelling for Water Reactor Fuel Behaviour", "Light-Water Reactor Fuel Utilization with Special Emphasis on Increased Burn-up and Plutonium Recycle" and "Post-irradiation Examination and Experience". The proceedings of the seminar and of the specialists' meeting on "Computer Modelling for Water Reactor Fuel Behaviour" were published.

133. The proceedings of an earlier specialists' meeting on "Pellet Cladding Interaction in Water Reactor Fuel" were published.

134. Results obtained under a co-ordinated research programme on the development of computer models for simulating fuel element behaviour in water reactors were reviewed at a meeting where proposals were made for a programme on code validation.

135. At a meeting convened to review progress under a co-ordinated research programme on "Investigation of Fuel Element Cladding Interaction with Water Coolant in Power Reactors", it was concluded that the first - survey - stage of the programme had been successfully completed and that the second stage (analytical techniques for monitoring water chemistry in power reactors and the modelling of corrosion product behaviour and crud build-up in water-cooled reactor circuits) was well under way.

136. A co-ordinated research programme was initiated on methodologies for examining and documenting water reactor fuel; at the end of 1984, research agreements had been signed by ten countries and it was expected that two or three more countries would conclude such agreements with the Agency.

137. An advisory group reviewed the status of advanced fuel technology and performance and made recommendations for future Agency activities in this area.

138. Assistance was provided in connection with technical co-operation projects on reactor materials and fuel production in Egypt, Indonesia, the Republic of Korea, Romania and Yugoslavia.

Spent fuel management

139. The Agency's activities in this area focused on technical, environmental and economic aspects of spent fuel management - including spent fuel storage, transportation and reprocessing and fissile material recycling.

140. A guidebook on spent fuel storage (Technical Reports Series No. 240) was published in October and a glossary of terms relating to spent fuel management was finalized. With the help of consultants, the draft of technical documents entitled "Current Status of Rod Consolidation for Storage Purposes" and "Current Status of Dry Storage Concepts" were prepared for publication. Work on a survey of world dry and wet spent fuel storage experience started with the preparation of a questionnaire to be distributed among Member States in 1985.

141. A co-ordinated research programme on the behaviour of spent fuel assemblies during extended storage (known as the "BEFAST" programme) continued, yielding useful information on the integrity of fuel cladding and the operational reliability of storage facility components.

142. A technical document entitled "Status of the Treatment of LWR Fuel", which describes world experience with spent fuel reprocessing technology, and a technical report on ion-exchange technology were prepared for publication.

Waste management

143. A senior advisory group met in October to review and advise the Agency on its waste management programme and make recommendations regarding work during the period up to 1990 in the following areas:

(a) Handling, treatment, storage and conditioning of radioactive wastes;

(b) Decontamination and decommissioning of nuclear facilities;

(c) Underground disposal of radioactive wastes; and

(d) Environmental and radiological safety aspects of waste management.

144. The proceedings of the International Conference on Radioactive Waste Management, held in the United States of America in 1983, were issued in five volumes: (1) Waste management policy and its implementation; (2) Radioactive waste handling, treatment and conditioning; (3) Storage and disposal of radioactive waste; (4) Environmental and safety assessment of waste management systems; and (5) Radioactive releases into the environment from nuclear operations.

145. The Agency/WHO booklet "Nuclear Power, the Environment and Man" was published in Spanish, and the French and Russian versions were prepared for publication. The 15th annual edition of "Waste Management Research Abstracts" (containing 503 abstracts from 36 countries) was issued.

Handling and treatment of radioactive wastes

146. A code of practice on the management of radioactive waste from nuclear power plants was finalized for submission to the Board of Governors. An advisory group reviewed techniques and practices for the handling, transportation and storage of low- and intermediate-level waste prior to treatment. A safety guide on the design of radioactive waste management systems to be installed at nuclear power plants was completed following a review of the subject by another advisory group.

147. Technical committee meetings were held on management of cladding hulls and fuel hardware and the management of gaseous wastes at waste treatment facilities; at the end of the year, Technical Reports Series documents covering these subjects were being prepared.

148. Three Technical Reports Series documents were issued: "Management of Tritium at Nuclear Facilities" (No. 234), "Treatment of Low- and Intermediate-Level Liquid Radioactive Wastes" (No. 236), and "Testing and Monitoring of Off-Gas Clean-up Systems at Nuclear Facilities" (No. 243).

149. A research co-ordination meeting was held on the retention of iodine and other airborne radionuclides during abnormal and accident conditions, and a co-ordinated research programme on the performance of solidified high-level waste forms and engineered barriers under repository conditions was initiated.

150. A research co-ordination meeting on the decontamination and decommissioning of nuclear facilities was held, and a technical report on decontamination technologies was prepared for publication.

Underground disposal of radioactive wastes

151. Nineteen reports and the proceedings of two symposia and a seminar were published. A seminar was held in Sofia on site investigations techniques and assessment methods for the underground disposal of radioactive wastes. Also, two advisory group meetings were held.

152. In the area of shallow ground and rock cavity disposal, three documents were published in the Agency's Safety Series: "Site Investigations, Design, Construction, Operation, Shutdown and Surveillance of Repositories for Radioactive Wastes in Rock Cavities" (No. 62); "Design, Construction, Operation, Shutdown and Surveillance of Repositories for Solid Radioactive Waste in Shallow Ground" (No. 63); and "Safety Analysis Methodology for Radioactive Waste Repositories in Shallow Ground" (No. 64). A technical document entitled "Effects of Heat from High-Level Waste on Performance of Deep Geological Repository Components" (IAEA-TECDOC-319) was published.

153. Safety Series documents entitled "Performance Assessment for Underground Disposal Systems for Solid Radioactive Wastes" and "Near Field Effects in Deep Underground Disposal of Radioactive Wastes" were prepared for publication.

154. Work on Safety Series documents entitled "Acceptance Criteria for Disposal of Radioactive Solid Waste in Shallow Ground and Rock Cavities" and "Management of Wastes Produced by Radionuclide Users in Medicine and Industry" and on a technical report entitled "Site Investigation Techniques for Underground Disposal of Solid Radioactive Wastes" neared completion.

155. An advisory group reviewed the Safety Series document "Management of Wastes from the Mining and Milling of Uranium and Thorium Ores" (No. 44, issued in 1976) and, on the basis of that document, prepared the second draft of a waste management code of practice and guide to the code.

156. A state-of-the-art paper was prepared on standards and criteria for the underground disposal of high-level wastes.

Environmental aspects of nuclear energy

157. Work on revising the definition of radioactive material unsuitable for dumping at sea (see Agency document INFCIRC/205/Add.1/Rev.1) neared completion. The results obtained with oceanographic transfer models using a revised data base and including additional exposure pathways were discussed by an advisory group which also examined the underlying assumptions used in deriving the definition. Safety Series documents on environmental assessment methodologies (No. 65) and the radiological and oceanographic basis for the definition (No. 66) were published.

158. Progress has been made in applying the "de minimis" concept to waste disposal in the terrestrial environment. A document describing a procedure for establishing exempt concentrations of radionuclides in wastes released to municipal landfill sites and incinerators was reviewed by an advisory group; the procedure involves the use of simple exposure models to establish the link between a defined trivial risk or radiation dose and the associated limiting concentrations of radionuclides in waste.

159. A programme on the behaviour of radionuclides which disperse on a regional and global scale ended; preparatory work was done on a document concerned with methods for predicting the atmospheric dispersion of such nuclides and approval was given for the publication of a technical report concerned with the assessment of their radiological impact.

160. Two research co-ordination meetings were held: one on the environmental migration of radium and other contaminants present in solid and liquid wastes from the mining and milling of uranium and one on the role of sediments in the transport and accumulation of radioactive pollutants in rivers and estuaries. Two related technical documents were issued (IAEA-TECDOCs 301 and 302): one provides an account of a co-ordinated research programme on the behaviour of radium in waterways and aquifers and the other is an introduction to the subject of sediments and pollution in waterways.

General

161. In 1984 the Agency continued its efforts directed at the enhancement of nuclear safety by developing internationally agreed guidelines and helping to implement them through - inter alia - direct assistance to Member States, advisory missions and training programmes.

162. In the field of radiation protection, work on implementing the Basic Safety Standards for Radiation Protection (Safety Series No. 9) continued, with the preparation of new and revised documents on subjects such as occupational radiological safety, radiation protection of the public and the environment, radiation safety during transport, emergency planning and preparedness for radiological emergencies, and the handling of exposed individuals.

163. The Agency initiated a scheme for making available to Member States, on request, the services of radiation protection advisory teams (RAPATs) which will assist in defining long-term technical co-operation projects in the radiation protection field; China and Iraq were the first countries visited by a RAPAT. Also, the Agency assisted a number of Member States engaged in establishing national radiation protection services.

164. By the end of the year, all but five of the 60 documents envisaged in the Nuclear Safety Standards (NUSS) programme for developing codes and guides for nuclear power plants had been completed. Efforts shifted towards the implementation of NUSS documents, with a symposium and several training courses being held in this connection.

165. The Agency sent operational safety review teams (OSARTs) to Yugoslavia and the Philippines; the OSART visiting the Philippines was the first one to review a nuclear power plant prior to its going into operation, the emphasis being on the adequacy of the preparations for safe operation.

166. The Agency's incident reporting system (IRS), which collects and disseminates information about significant incidents occurring at nuclear power plants, became operational; it is hoped that the dissemination of such information to plant designers and operators will enable them to draw appropriate conclusions. Close co-operation with NEA ensures compatibility between its incident reporting system and the Agency's and avoids duplication of effort.

167. The Agency continued to assist Member States in the use of probabilistic risk analysis techniques. A symposium on the risks and benefits of energy systems was held in Jülich, Federal Republic of Germany and a co-ordinated research programme was initiated on the cost-effectiveness of risk reduction. In co-operation with several Member States, the Agency completed work on studies of public attitudes towards nuclear energy.

168. The Nuclear Safety Review for 1983, describing events in the area of operational safety experience and discussing current safety issues, concluded that, although there had been various incidents caused by human failure or technical problems in 1983, no accidents with significant consequences had occurred at nuclear power reactors.

169. The Director General announced his intention of setting up an "International Nuclear Safety Advisory Group" (INSAG) which would be composed of about 14 individuals of high standing from the industrial, research and regulatory sectors nominated on the basis of suggestions made by various international expert groups, and which would consider current nuclear safety issues without involving itself in regulatory matters or the development of safety standards.

Radiological safety

170. Work focused on the elaboration of guidelines for implementing the system of dose limitation set forth in the revised Basic Safety Standards for Radiation Protection; guidelines were elaborated for the design of radiation protection systems and for occupational monitoring, and work started on the formulation of principles for operational radiation protection activities.

171. As part of its continuing support for the interchange of information on contamination monitoring, the Agency organized - in co-operation with WHO - a symposium on the assessment of radioactive contamination in man. Work on two technical reports relating to the protection of workers in nuclear installations was completed.

172. A revision of the Agency's policy on the limitation of radioactive effluent releases and on radiation protection monitoring of the public was initiated.

173. Progress made in studying carbon-14 from nuclear facilities was reviewed at a research co-ordination meeting.

174. A glossary of radiation protection terms was compiled in four languages (English, French, Russian and Spanish).

175. A total of 65 technical co-operation projects concerning radiation protection were handled and 13 missions visited developing Member States. Fellowships in the field of radiation protection were arranged for 43 persons from developing countries. Courses forming part of a long-term training programme in radiation protection were held in Argentina and India.

176. The latest revision of the Agency's Regulations for the Safe Transport of Radioactive Materials (Safety Series No. 6) was completed and the revised version approved by the Board of Governors. Work started on the preparation of documents designed to facilitate harmonized implementation of the Regulations in Member States, on the formulation of guidelines for optimizing radiation protection in the transport of radioactive materials and on procedures for the review and approval of package designs. Advice was provided to eight developing Member States on the drafting of national transport regulations.

177. Growing recognition of the need to initiate and improve planning and preparedness for radiation emergencies resulted in an increased demand for Agency assistance in this field. Regional and interregional training courses were held, with emphasis on the use of computerized aids in accident assessment. Several missions were made to Member States for the purpose of assisting them in the preparation, assessment and testing of their emergency preparedness arrangements. Guidelines on mutual emergency assistance arrangements were published and guidelines relating to reportable events, integrated planning and information exchange in the event of transboundary releases were prepared for publication.

178. Documents giving guidance on principles for the establishment of intervention levels, on the preparation, conduct and evaluation of emergency exercises, and on techniques for and decision-making in the assessment of the off-site consequences of a nuclear accident were completed for publication in the Agency's Safety Series. Work started on documents relating to the maintenance of on-site habitability during an accident and on requirements to be met by emergency response facilities.

179. The Agency embarked on the establishment of guidelines for handling exposed individuals. The use of biological and biochemical indicators as a complement to physical dosimetry received new emphasis, a co-ordinated research programme on the use of chromosomal aberration analysis (see para. 220) being of particular interest in this connection. A realistic chest phantom for use in calibrating equipment for measuring plutonium deposition in the lungs was developed under another co-ordinated research programme; models of the phantom can be made available to Member States.

Physical protection of nuclear facilities and materials

180. The sixth interregional training course on the physical protection of nuclear facilities and materials, held in Madrid, was attended by 18 participants from seven Member States.

Radiation protection service

181. Radiation protection services continued to be provided for the Agency's laboratories, for safeguards inspectors, for technical co-operation experts, and for trainees from Member States.

182. The services of the Agency's personnel monitoring system were made available to a number of Member States where Agency-assisted activities are being carried out and where personnel monitoring services are not yet available locally; about 1000 dosimeters worn by local staff in Ethiopia, Mali, Nigeria, Senegal, Sierra Leone and the United Republic of Tanzania were evaluated.

183. Missions visited Kenya, Sudan, United Republic of Tanzania and Zambia to advise on the establishment of national radiation protection services. Quality assurance services were provided for personnel monitoring systems in developing countries. Training in radiation protection was given to fellows from Ethiopia, Nigeria and Sudan. Fellows from Ethiopia and Sudan participated in an introductory course on radiation protection services.

Safety of nuclear installations

184. The OSART programme continued, with one team visiting the Krsko nuclear power plant in Yugoslavia and another performing a pre-operational review of the Philippines' nuclear power plant. Work continued on the development of OSART guidelines based on applicable Agency standards and the experience gained during OSART reviews.

185. By the end of the year, 17 countries had joined the Agency's IRS; however, incident reports had been received from 20 countries. Two technical meetings were held, one to improve the system itself and another - organized by the Agency in co-operation with NEA - to evaluate significant incidents.

186. With only five NUSS documents left to be completed at the end of the year, it is expected that all 60 documents envisaged in the NUSS programme will have been completed by the end of 1985. Accordingly, the emphasis shifted towards making necessary revisions of the NUSS documents and the preparation of manuals containing detailed guidance in selected areas. Several training courses were held for the purpose of helping personnel in Member States to make use of NUSS documents and familiarize them with complementary detailed standards.

187. As part of the Agency's efforts to promote the implementation of NUSS documents, a symposium was held on the NUSS programme in the light of current safety issues. It resulted in a general consensus that the programme adequately responded to basic requirements for ensuring the safety of nuclear power plants. No need was seen for any significant revision of the NUSS documents in the near future, and there was general agreement that only a few manuals would be needed in order to provide more detailed guidance in specific areas. Also, the Agency was urged to provide further guidance to Member States with regard to the interface between NUSS documents and national standards and to issue regular reports on current safety issues with an analysis of trends.

188. Teams visited four Member States to advise on nuclear power plant siting, licensing and safety analysis and other nuclear power plant safety matters. In addition, advice was provided to several Member States on the safety of research reactors.

189. As part of the Agency's efforts to encourage the exchange of information on and co-operation in reactor safety research, the first issue of a Nuclear Safety Research Index was prepared. A consultants' group made recommendations for increasing the involvement of developing countries in reactor safety research. Additional codes for safety analysis were installed on the Agency's computer and a workshop was held on accident analysis.

190. A total of 50 technical co-operation projects concerning nuclear safety were handled and fellowships in the field of nuclear safety were arranged for 55 persons from developing countries.

Risk assessment

191. A symposium on the risks and benefits of energy systems was held in Jülich, Federal Republic of Germany; 40 papers and the summaries of three panel discussions were published in the proceedings.

192. Twelve Member States co-operated with the Agency in a three-month comparative study of the contents of energy-related newspaper articles; a report analysing the results was prepared. Assistance was provided to four Member States in performing studies of public attitudes towards nuclear energy. A report on the results of a study of public attitudes in the Philippines was published.

193. The first research co-ordination meeting was held under a co-ordinated research programme on the cost-effectiveness of risk reduction for different energy systems. A technical document entitled "Cost-effectiveness analysis of risk reduction measures in energy systems" was finalized.

General

194. In 1984, which marked the twentieth anniversary of the Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, the Agency continued to help developing Member States to improve their agriculture and food production through the application of isotopes, ionizing radiation and related techniques.

195. Support was given to over 130 technical co-operation projects in 54 developing Member States. Some 400 agricultural institutes and laboratories in 67 Member States took part in 35 co-ordinated research programmes, for several of which extrabudgetary support was received from the Federal Republic of Germany, Italy and Sweden. In addition, five training courses were held and a number of programming missions organized.

Soil fertility, irrigation and crop production

196. A series of co-ordinated research programmes involving the utilization of biological nitrogen fixation (BNF) in crop production systems continued, with nitrogen-15 labelling techniques being used to measure the extent to which fixed nitrogen contributes to meeting the overall nitrogen requirements of a crop or crop component. Agronomic practices which optimize BNF and thus reduce dependence on fertilizer nitrogen were identified.

197. Isotope techniques were used in field experiments to measure nutrient transfer from biofertilizers (for example, the transfer of nitrogen from Azolla to paddy rice and nutrient transfer between components of mixed cropping or mixed pasture systems) and in estimating the plant availability of phosphorus from rock phosphate.

198. Portable radiation equipment for studies of the dynamics of water movement in field soils under cropping conditions provided a simple method of identifying water conservation practices which enhance yield and ensure efficient fertilizer use.

199. An international FAO/IAEA/SIDA training course on the use of isotopes and radiation techniques in studies of soil-plant relationships, was held at the FAO/IAEA Agricultural Biotechnology Laboratory at Seibersdorf, Austria; the course was organized in collaboration with the Austrian Government. Emphasis was placed on the value of nitrogen-15 methodology for field studies of BNF. An FAO/IAEA interregional training course held in Ghent, Belgium, covered the use of isotopes and radiation techniques in soil physics studies. The combined attendance by participants from developing countries at these two courses was 40.

200. An FAO/IAEA seminar on the use of isotopic techniques in studies of BNF, for research workers in the Middle East and Africa, was held in Ankara; it was attended by 73 participants.

Plant breeding and genetics

201. In the field of mutation plant breeding and genetics, work continued within the framework of seven co-ordinated research programmes concerned with grain legumes, cereals, root crops, tubers and other major crops and aimed at improving yields through the induction, selection and direct and/or indirect use of mutants in breeding new varieties. Through technical co-operation projects, the Agency was supporting plant breeders in 18 countries (Brazil, Burma, Ghana, Hungary, India, Indonesia, the Republic of Korea, the Libyan Arab Jamahiriya, Mali, Mexico, Mongolia, Panama, Peru, Sudan, Venezuela, Viet Nam, Yugoslavia and Zaire).

202. New mutant varieties were released in several countries (for example, Bulgaria, China, the German Democratic Republic, India, Indonesia, Pakistan and the United States of America).

203. For the purpose of reporting on results obtained and co-ordinating future work the scientists involved in the programme on legumes met in Faisalabad, Pakistan; those involved in the prograqmme on semi-dwarf cereal mutants met in Obregon, Mexico; and those involved in the programme on root crops and tubers met in Bangkok.

204. An FAO/IAEA advisory group meeting was held in Vienna on the potential for and limitations of using in vitro cultures in mutation breeding for disease resistance.

205. An FAO/IAEA interregional training course on the induction and use of mutations in plant breeding was held at Seibersdorf, Austria; it was attended by 20 participants from developing countries.

206. Following the establishment of in vitro culture facilities, work continued at the FAO/IAEA Agricultural Biotechnology Laboratory on developing and adapting in vitro culture technology for use in the mutation breeding of crops such as bananas and cassava.

Animal production and health

207. Co-ordinated research programmes continued on the nutrient value and use of low-quality roughages and agro-industrial by-products as potential feedstuffs for ruminant animals, on the control of parasitic diseases, on the reproductive efficiency of large ruminants, on the optimization of grazing animal productivity in the Mediterranean and North African regions and on the productivity of sheep and goats in Africa.

208. Co-ordinated research programmes were initiated on the productivity of domestic buffalo in Asia (within the framework of RCA) and on the reproductive efficiency of cattle, sheep and cameloids in Latin America; by the end of the year, 35 research contracts and agreements have been concluded with institutes in 21 Member States. Current research was reviewed and work plans for the future established at three research co-ordination meetings on large ruminant reproduction, ruminant nutrition and the reproductive efficiency of animals in Latin America.

209. A consultants' meeting was held on the use of nuclear techniques to assess and improve indigenous pig productivity in developing countries. An FAO/IAEA regional training course on the use of radioimmunoassay techniques in animal reproduction was held in Peru and a training manual on the use of nuclear techniques in animal nutrition was prepared.

Insect and pest control

210. The eradication phase of the BICOT project[12] neared successful completion.

211. The use of insecticide-impregnated screens as barriers on the western boundary of the project area together with intensified trapping within the project area followed by weekly releases of sterile males resulted in a drastic reduction of Glossina palpalis populations generally and in complete eradication in most of the forest patches. Financial support was provided by Belgium, the Federal Republic of Germany, Italy and Sweden.

212. In the case of the MISR-MED project[13], land was acquired for the construction of mass-rearing and other facilities, a contractor was selected for the construction work, eight Egyptians underwent training at Tapachula, Mexico, in Medfly field activities under an Egypt/Mexico TCDC programme, five field stations were established in Egypt and field work was initiated.

213. Studies being done within the framework of the Medfly eradication project in Peru (MOSCAMED), which is being supported by Italy, revealed that Medflies occur and can survive at unusally high altitudes (over 2000 m).

214. Research in support of the BICOT, MISR-MED and MOSCAMED projects continued at Seibersdorf, Austria. With the help of a pilot plant commissioned in November 1983, mass-rearing methodologies and diets to be used in the MISR-MED project were investigated and refined. Research continued on the development of genetic sexing systems, the objectives being to eliminate female Medflies at a very early stage of development in order to make the production of male Medflies more efficient and mass-rearing operations less expensive.

215. A co-ordinated research programme was initiated with the aim of developing methodologies for application of the sterile-insect technique in tsetse fly eradication or control; by the end of the year, 20 scientists from 12 countries were participating. Work continued under a co-ordinated research programme on the genetic sexing of fruit flies, with ten scientists from seven countries participating.

216. An FAO/IAEA seminar held in Lusaka, Zambia, on the use of the sterile-insect technique for tsetse fly control was attended by 57 participants from 18 African countries.

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[12] IAEA/Government of Nigeria Project on the Biological Control of Tsetse Flies by the Sterile-Insect Technique, the aim of which is to eradicate the tsetse fly from a 1500 km^2 area in Nigeria.

[13] A project, jointly sponsored by the Agency and the Government of Egypt, for eradicating the Mediterranean fruit fly (Medfly) from the Nile Valley; the project is being supported by Austria and Italy.

217. The biennial FAO/IAEA eight-week training course on the use of isotopes and radiation in entomolgy and pest management was held at the University of Florida, United States of America.

Agrochemicals and residues

218. Co-ordinated, isotope-aided research programmes continued on pesticide residues in meat, milk and other food items, rice-fish ecosystems in paddy fields and stored grains and on bound residues in soils, plants and food. Through the use of isotopically labelled pesticides, it was possible to determine the amount and the extent of binding of residues of pesticide protectants and fumigants applied to cereal grains in storage.

219. Research continued at the FAO/IAEA Agricultural Biotechnology Laboratory with the aim of developing and testing controlled-release pesticide formulations; this research is supported by the Federal Republic of Germany. A promising endosulfan-alginate formulation was prepared for control of the tsetse fly and plans were made for a large-scale test in Africa.

220. Other activities at the Laboratory included the development of specific analytical methods for measuring trypanocidal drugs in cattle and the isolation from African termite guts of micro-organisms capable of hydrolysing lignocellulose; through these activities technical backing is being provided to research programmes in Kenya which are supported by Italy.

Food preservation

221. The International Consultative Group on Food Irradiation, which became operational in May 1984, met for the first time in December; experts from 20 Member States of FAO, WHO and the Agency discussed global developments in the field of food irradiation and made recommendations to the three international organizations on activities to be undertaken by them.

222. The second phase of an Asian regional project on food irradiation being carried out within the framework of RCA and designed to assist participating countries with the transfer of food irradiation technology got under way with support from Australia.

223. The International Facility for Food Irradiation Technology (IFFIT) at Wageningen, the Netherlands, organized a general training course in which 35 scientists from 25 developing countries participated.

224. An FAO/IAEA advisory group on regulatory and tcechnological requirements for the authorization of the food irradiation process recommended that the provisions of the Codex Alimentarius Commission's General Standard for Irradiated Foods relating to the radiation sources to be used in the treatment of foods be made a mandatory part of any governmental regulations and that governments accept and implement the General Standard with its reference to a broad clearance of food irradiated up to an overall average dose of 10 kGy.

General

225. Assistance continued to be rendered to Member States - and especially the developing countries among them - with the application of nuclear techniques in medicine, biology and health-related environmental research. Also, the Agency continued to promote greater reliability and accuracy in radiation dosimetry for medical and industrial purposes, with emphasis on the needs of developing Member States. Many of these activities were carried out in co-operation with WHO and other international organizations.

Medical applications

226. Efforts to upgrade the preventive and corrective maintenance of nuclear instruments in developing countries continued, through two co-ordinated research programmes (covering ten Asian and eight Latin American countries), an interregional technical co-operation programme (covering 28 countries) and the provision of training - including a "train-the-trainers" workshop held in Malaysia for participants from Asia and the Pacific region. Emphasis was placed on local initiatives in maintenance management and technical training and on regional co-operation in the training of electronics engineers in microprocessor techniques. Progress was reviewed at two research co-ordination meetings, held in Costa Rica and Sri Lanka.

227. In the field of radioimmunoassay and related techniques, particular emphasis was placed on quality control and training. Support continued for a co-ordinated research programme (covering eight countries) on quality control of the assay of thyroid-related hormones, progress being reviewed at a research co-ordination meeting held in Thailand. Work on upgrading quality control through the introduction and improvement of data processing continued under another co-ordinated research programme (with nine participants). The development of textual and audiovisual aids for training courses conducted at the local level was evaluated at a "train-the-trainers" course held in Mexico. A seminar on quality control in radioimmunoassay was held in Thailand for participants from Asia and the Pacific region.

228. The use of in vivo nuclear medicine procedures was supported in about 25 countries through technical co-operation projects and two co-ordinated research programmes - one in Asia and one in Latin America; progress in the latter programme was reviewed at a research co-ordination meeting held in Uruguay. A technical document on the quality control of nuclear medicine instruments was published and an interregional training course on the maintenance and quality control of gamma cameras was held in the United Kingdom. An interregional training course and study tour on nuclear medicine was organized in the Soviet Union, with participants from 18 countries.

229. A co-ordinated research programme was started on the optimization of nuclear medicine procedures for the diagnosis and treatment of thyroid disorders and the strategy for this programme was reviewed at a research co-ordination meeting held in Vienna.

230. Results of a co-ordinated research programme on nuclear-related techniques in occupational health studies were reviewed at a research co-ordination meeting held in Italy. Three other co-ordinated research programmes involving applications of nuclear analytical techniques were also active during the period, with a total participation of 29 institutes in 22 Member States. A technical report on quality assurance in biomedical neutron activation analysis was published. Applications of short-lived activation products in the neutron activation analysis of bio-environmental specimens were reviewed at a consultants' meeting (the report is being published in 1985). Quality control services (mainly the supply of reference and intercomparison materials) were provided to 318 recipients in 52 Member States.

Dosimetry

231. In 1984, China and Indonesia each nominated a dosimetry laboratory for membership in the IAEA/WHO network of Secondary Standard Dosimetry Laboratories (SSDLs), raising the number of SSDLs in the network to 48.

232. An advisory group meeting on the present status and the future of the SSDL network was held with the participation of WHO, the International Bureau of Weights and Measures, the International Commission of Radiation Units and Measurements and the International Office of Legal Metrology. The group acknowledged the efforts being made by the Agency and WHO and recommended that the two organizations continue to act as the central network secretariat. The essential funcion of the Agency's Dosimetry Laboratory was emphasized.

233. A questionnaire inquiry in which 41 SSDLs participated revealed that 26 SSDLs are engaged in calibrating radiotherapy dosimeters (17 of them because of legal requirements) and 28 are engaged in calibrating radiation protection dosimeters (20 of them because of legal requirements).

234. In 1984, new technical co-operation approvals relating to the establishment of SSDLs involved 48 man-months of expert assignments and the provision of equipment valued at $1 600 000.

235. A four-week training course on dosimetry was held at the Brazilian SSDL, with 22 participants from as many countries.

236. Technical and administrative preparations for the initiation of an international dose assurance service for radiation processing facilities in Member States continued. A pilot dose assurance exercise involoving 15 commerical plants did not reveal any organizational problems, and the alanine/ESR (electron spin resonance) dosimeter selected as a reference dosimeter for the dose assurance system performed well under practical conditions.

237. A dose intercomparison study started for the selection of a dosimeter suitable for an international electron dose assurance service. A co-ordinated research programme on high-electron-dose intercomparisons for radiation processing dosimetry continued.

238. An international symposium on high-dose dosimetry was held in Vienna, with 30 countries and two organizations participating.

239. The final report on a co-ordinated research programme entitled "Research and radiation processing dosimetry" was published.

Radiation biology

240. The IAEA/WHO technical co-operation project on the use of brachytherapy in treating cancer of the cervix continued successfully in Egypt. The second training/demonstration course was attended by 31 participants, from Egypt and another African country.

241. A first training course for radiotherapy technologists was held in Japan, 14 participants from south-east Asian countries familiarizing themselves with recent achievements in radiotherapy. Preparatory work was done for the establishment of a cancer radiotherapy service in Nicaragua and for similar projects in other developing countries.

242. A research co-ordination meeting was held in Egypt under the co-ordinated research programme on the combined use of conventional radiation and chemical or physical means.

243. Activities continued under co-ordinated research programmes on the development of a defined antigen vaccine against schistosomiasis and on nuclear techniques for monitoring malaria vectors. At research co-ordination meetings, the results obtained during the first year of these two programmes were reviewed and protocols for the exchange of materials and the application of standardized techniques were developed.

244. A co-ordinated research programme on radiation sterilization for tissue grafts was initiated, and a seminar in the Philippines reviewed the feasibility of the current relevant nuclear techniques.

245. The Agency's activities in the radiation sterilization of medical supplies were extended to include Africa and the Middle East, with a research co-ordination meeting held in Kenya to review current results.

246. The results of a co-ordinated research programme on radiation-induced chromosomal aberrations and the evaluation of genetic risks in man were reviewed at a research co-ordination meeting in Egypt. The final draft of a technical report entitled "Biological Dosimetry: Chromosomal Aberration Analysis for Dose Assessment" was approved for publication.

Health-related environmental research

247. The results of a co-ordinated research programme on the relationship between hair mineral concentrations and internal body burdens were reviewed at a research co-ordination meeting in Vienna. A co-ordinated research programme relating to an RCA project on health-related environmental research using nuclear techniques was completed and the results prepared for publication.

248. With the help of consultants, a proposal was developed for a co-ordinated research programme on the use of nuclear techniques in monitoring compliance with regulations concerning toxic elements in food and drinking water.

249. Results obtained over a period of three years through a co-ordinated research programme on improving the methodology for epidemiological studies of health impacts of low-level ionizing radiation were evaluated at a final research co-ordination meeting in Switzerland. The results are important for developing generally acceptable methods for use in monitoring systems for radiation workers.

Nuclear physics

250. Assistance was provided in introducing nuclear science programmes into the curricula of universities in a number of developing Member States and a technical committee meeting was held on research and teaching at universities in developing countries.

251. A co-ordinated research programme on modular nuclear instruments based on the Eurocard System (a system for the supply of circuits on cards which can be easily inserted into and removed from instruments) resulted in the construction of a series of scintillation spectroscopy instruments of particular use to laboratories in developing countries.

Research reactor support programme

252. A 14-week training course on research reactor operation was conducted for senior operators and managers.

253. A technical report on the use of research reactors for basic research in developing countries was published.

254. A guidebook on the conversion of research reactors from highly enriched to low-enriched uranium was prepared and one on core instrumentation and pre-operational procedures for core conversion from highly enriched to low-enriched uranium was issued (IAEA-TECDOC 304). Missions were sent to five countries to advise on research reactor core conversion and a training course on core conversion was developed.

Fusion

255. The Tenth International Conference on Plasma Physics and Controlled Nuclear Fusion Research was held in the United Kingdom.

256. An assessment of the existing data base for the construction of an INTOR-like device was performed by the INTOR Workshop, which also examined the technical benefits accruing to partners building such a device with various levels of redundancy.

257. The current areas of interest in fusion continued to be addressed in a series of technical committee meetings designed to promote information exchange between interested Member States.

258. Assistance was provided to several developing Member States with plasma physics programmes.

Industrial applications and chemistry

259. As part of the Agency's efforts to promote the transfer of nuclear technologies employed in industry and chemistry, 86 technical co-operation projects in 47 countries were supported.

260. Research co-ordination meetings were held within the framework of co-ordinated research programmes on the development of a new technology for technetium-99m generator systems and the development of new, more specific radiopharmaceuticals. Promising prototypes of technetium-99m generators underwent further tests.

261. The role of cyclotron technology in the production of medically important radionuclides in developing countries was discussed at a consultants' meeting.

262. At a conference on radiopharmaceuticals and labelled compounds, 70 scientific papers were presented; the conference was attended by 156 participants from 34 Member States.

263. Publication of the series "The Chemical Thermodynamics of Actinide Elements and Compounds" continued; by the end of 1984, eight volumes had been published and the manuscript of a ninth prepared. A consultants' meeting to facilitate drafting of volumes 12 and 14 was held. By the end of the year, various stages had been reached in the preparation of the other three volumes foreseen in this series and all meetings in that connection had been held.

264. A final research co-ordination meeting was held within the framework of the co-ordinated research programme on chemical aspects of nuclear methods of analysis and a group of consultants reviewed modern separation techniques used in chemical analysis.

265. Developments in nuclear techniques for on-line process control in coal processing and utilization, the analysis of coal ash, the determination of moisture and specific energy in coal, the determination of sulphur and other elements in coal, and borehole logging for coal exploration and mining were reviewed.

266. The co-ordinated research programmes on the use of radiation technology in the immobilization of bioactive materials and the radiation treatment of sewage sludge for safe reutilization continued and one on the radiation modification of polymers for industrial and medical use was initiated.

267. A consultants' meeting on the design of multi-purpose gamma irradiation facilities was held in Vienna and an advisory group meeting on food irradiation technology was held in Wageningen, the Netherlands.

268. A co-ordinated research programme entitled "Nuclear Techniques in Exploration and Exploitation of Natural Resources: Nuclear Borehole Logging Techniques for Determination of Rock Characteristics" was initiated with the aim of harmonizing activities in this important area.

269. At a meeting in Leipzig, German Democratic Republic, a group of consultants reviewed problems concerning - and strategies for - the transfer of industrial tracer technology to developing countries.

Isotope hydrology

270. During 1984 the Agency supported 37 technical co-operation projects in 29 countries; two projects were completed in the course of the year. These projects involved the execution of and the provision of guidance on isotope-aided studies aimed at solving hydrological problems associated with the development of water resources, including the problem of sedimentation and sediment transport. Also, assistance was provided to various Member States in establishing and/or upgrading facilities for environmental analyses.

271. Through 46 research contracts, one technical contract and eight research agreements, the Agency continued to promote the development of new methodologies and the improvement of existing ones.

272. Two co-ordinated research programmes on isotope hydrology continued - one in the Far East, financed by Australia, and the other in Latin America, financed by the Federal Republic of Germany. These programmes include the award of research contracts to the participating countries, visits by experts and the provision of analytical services by laboratories in the financing countries and by the Agency's laboratories.

273. A co-ordinated research programme on the use of isotopic and geochemical techniques in geothermal exploration in Latin America was launched. At the end of the year, eight Latin American countries are so far participating in the programme, which is being financed by Italy.

274. A group of consultants formulated recommendations for a co-ordinated research programme on the isotopic dating of old groundwater which is to start during 1985 and developed scientific guidelines for the programme.

275. A regional seminar on the use of isotopic and geochemical techniques in geothermics held in Mexico was attended by participants from 14 Latin American countries and one on isotope hydrology held in Argentina was attended by participants from 11 Latin American countries.

276. A regional training course in isotope hydrology held in the United Republic of Tanzania was attended by participants from 12 African countries.

277. An advisory group evaluated the development and use of mathematical models for interpreting tracer data in groundwater hydrology, with special emphasis on artificial and environmental isotope tracers.

278. The Agency hosted a co-ordination meeting of a UNDP-financed regional hydrological project being conducted in Northern Africa. During the meeting, the isotope techniques used and results achieved in a parallel Agency programme in the same region were presented and discussed.

Nuclear data

279. The Agency continued to provide nuclear and atomic data services to Member States and to co-ordinate the activities of a world-wide network of data centres. In the course of 1984 the Agency distributed on request some 1600 nuclear data reports, 60 000 sets of numerical data and more than 500 data processing computer codes; also, it continued to publish the quarterly Bulletin on Atomic and Molecular Data for Fusion and the Computer Index of Neutron Data (CINDA)

280. As part of its continuing effort to keep abreast of the nuclear data requirements of nuclear science and technology, the Agency convened expert groups to review the status of transactinium isotope nuclear data and of the nuclear data used as international reference standards in nuclear data measurements. Experts met for the first time to survey the status of material properties data of interest in fusion technology.

281. In order to stimulate the production of necessary nuclear and atomic data and to improve the accuracy of existing data, the Agency convened research co-ordination meetings on the nuclear properties of heavy radionuclides and on atomic data for fusion plasma diagnostics.

282. Within the framework of the transfer of nuclear data technology to developing Member States, the Agency held a four-week workshop on nuclear model computer codes at the International Centre for Theoretical Physics, Trieste. It continued to provide equipment, fellowships and experts for an interregional project on nuclear data techniques and instrumentation designed specifically for the training of nuclear scientists in developing countries. At Headquarters, five fellows received training in the techniques of nuclear data compilation and computer processing.

283. Two bodies which regularly review the Agency's nuclear and atomic data programmes, the International Nuclear Data Committee and the International Fusion Research Council's sub-committee on atomic and molecular data, met in Vienna to discuss the Agency's activities in the nuclear and atomic data fields during the next two years.

Seibersdorf Laboratory

General

284. While the basic objective of the Seibersdorf Laboratory continued to be the provision of practical support to Agency programmes, there was an increase in emphasis on support for the transfer of advanced techniques to developing Member States through the servicing of co-ordinated research, advice on and assistance with technical co-operation projects and the training of young scientists and technicians.

285. A new group, the Animal Production Unit, was added to the Laboratory's Agriculture Section, the name of which was changed to "Agricultural Biotechnology Section".

286. The following description of the activities of the Seibersdorf Laboratory is divided into sections corresponding to the Agency programmes which the Laboratory supports.

I. Agricultural biotechnology (support for Joint FAO/IAEA programmes)

Soil fertility, irrigation and crop production

287. Fertilizer use by crops and water management practices were studied in mixed cropping systems, pastures and orchards. Greenhouse and field experiments using isotopic techniques were carried out in order to study the availability of nutrients from natural sources: rock phosphates (Asia, Africa and Latin America), guano (Africa) and Azolla in combination with paddy rice. Symbiotic nitrogen fixation by forage legumes was also investigated, with the aim of reducing fertilizer nitrogen needs under optimum productivity conditions. Studies on the improvement of nitrogen fixation by grain legumes were initiated. Ongoing co-ordinated research programmes and technical co-operation projects were supported through this research and also through analytical assays of samples from Member States for nitrogen-15 content determination.

Plant breeding and genetics

288. The adaption of a laboratory for plant tissue culture work was completed. Studies on in vitro mutagenesis - including the screening of regenerated plants - in pea, maize, cassava and banana were carried out. The transfer of single traits into a recipient cultivar was achieved by fertilization with irradiated pollen. Radiation sensitivity tests on and mutagenesis in Azolla were initiated. About 400 seed irradiation treatments were carried out as a service to plant breeding institutes in Member States.

Animal production and health

289. Facilities were established for assessing the nutritive value of forages and agroindustrial by-products from developing countries as ruminant livestock feeds and for providing standardized reagents for scientists in developing countries using immunoassay techniques to monitor livestock reproductive efficiency and diseases. This operation involved the establishment of a "fibrous feeds bank", the characterization of the fermentation patterns of fibrous feeds in an artificial rumen, and the development of a simple solid-phase radioimmunoassay for progesterone in blood and milk.

Insect and pest control

290. More efficient and effective methods of rearing tsetse flies were developed for use in the BICOT project in Nigeria, and studies were made with a view to improving artificial diets for use in rearing tsetse flies. Work continued on developing genetic techniques for eliminating females during the mass-rearing of the Mediterranean fruit fly (Medfly) so that only male flies are released after sterilization; also, experiments were carried out with a view to developing better starter diets and improving other aspects of mass-rearing.

291. Installation of a pilot-scale facility for the Medfly was completed with financial support from the Austrian Government. It is being used for training and diet development in support of a large-scale Medfly field project in Egypt.

Agrochemicals and residues

292. Pesticide formulation experiments continued, the results being applied in co-operation with FAO in field tests for tsetse fly eradication in the United Republic of Tanzania. New,

more sensitive analytical methods were developed for determining three important trypanocidal drugs in bovine serum. Further experiments related to biomass degradation led to the isolation of more effective micro-organisms for the degradation of cellulose.

II. Life Sciences

Environment and nutrition

293. Work continued on applications of nuclear analytical techniques in studies of trace elements, support being given to five co-ordinated research programmes with altogether about 50 participants. The analytical capabilities of the Laboratory were extended by the introduction of a neutron activation analysis method for the rapid determination of mercury and of methods based on inorganic ion-exchange for the determination of various other toxic elements (for example, arsenic, cadmium, antimony and selenium). An intercomparison of cadmium and other trace elements in a horse kidney reference material was completed. The preparation of a mixed human diet reference material, developed mainly for use in a co-ordinated research programme on human dietary intakes of nutritionally important trace elements, was completed and an intercomparison study started. Training was given in various aspects of trace element analysis and gamma-ray spectrometry.

Radiation dosimetry

294. The Agency's Secondary Standard Dosimetry Laboratory (SSDL) continued its postal dose intercomparison services for radiotherapy hospitals and for laboratories belonging to the IAEA/WHO SSDL Network. Three batches of thermoluminescence dosimeters were evaluated for a total of 114 institutes. The capacity of the Agency's SSDL was increased through the procurement of a semi-automatic thermoluminescence dosimetry system. A graphite absorbed-dose calorimeter with accessories was completed and put into operation. Two secondary standard dosimeters were calibrated, and calibration support was provided continuously to the Agency's radiation protection service. Two trainees spent a total of 10 man-months in the Dosimetry Laboratory.

III. Physical sciences

Chemistry and analytical quality control

295. Twelve intercomparisons of radionuclide and trace element analyses were completed; laboratories in about 40 countries took part in one or more of these intercomparisons. Eleven reference materials were added to the list of such materials available from the Agency; the list now contains 39 items. The laboratory supplied 1136 aliquots of such materials to 350 institutes in Member States at a price of $60 000; the book value of samples held in stock is now $1 235 000.

296. Co-operation continued with the World Meteorological Organization (WMO) on the analysis of air pollution samples from WMO's Background Air Pollution Monitoring Network. Some 140 samples of rain water and over 200 air filters were received, and more than 1000 individual analytical data were reported. Three trainees received training related to analytical quality control and atomic absorption spectrometry.

Hydrology

297. Some 1500 water samples were analysed for oxygen-18, 1000 for deuterium, 550 for tritium, 125 for carbon-14 and 160 for carbon-13. Chemical analyses were performed on 120 water samples (850 individual element determinations) for WMO and on 70 water samples (700 individual element determinations) in support of technical co-operation projects.

Instrumentation

298. Two control units were designed and constructed for a nitrogen isotope analyser to be used in agricultural tracer experiments. Work continued on a modular gamma spectrometer which will be made available in kit form. A training laboratory was installed for electronics technicians from developing countries; six received training for periods varying from 3 to 12 months.

IV. Safeguards Analytical Laboratory (SAL)

299. During the first 11 months of 1984 SAL analysed 703 samples of uranium, 203 samples containing plutonium or mixtures of uranium and plutonium, and 103 samples of spent fuel solutions. In addition, 49 samples were analysed in the course of a quality control project

and for the characterization of non-destructive analysis (NDA) standards and the calibration of NDA instruments.

300. Laboratories providing back-up facilities when SAL is overloaded ("network" laboratories) reported the analysis of seven plutonium and uranium solution samples and 42 samples of spent fuel solutions. In addition, 64 samples were analysed by network laboratories for the characterization of NDA standards and in the course of intercomparison and tank calibration exercises.

301. An extension to SAL was completed in July 1984, providing an additional 350 m^2 of floor space.

International Laboratory of Marine Radioactivity

General

302. In March 1984 a group of consultants reviewed the scientific activities of the Laboratory and recommended - inter alia - strengthening the technical services being provided to Member States, focusing research activities on problems directly related to radiation protection and waste management in the marine environment, and maintaining a balance between activities in the nuclear and the non-nuclear field.

303. In line with the group's recommendations, the Laboratory continued to organize intercalibrations of measurements of radionuclides in marine samples, to supply reference materials for analytical quality control, to develop methodologies for low-level environmental measurements and to accept fellows and trainees from developing countries.

304. Non-nuclear pollutant measurements were carried out with financial support from UNEP.

305. Research activities focused on evaluating the impact of radionuclide releases into the marine environment, in connection with the radiological safety of nuclear operations. Studies were carried out of:

(a) Processes controlling the vertical flux of radionuclides associated with particulate matter in the sea;

(b) The bioaccumulation, transfer and transport of radionuclides through the marine food chain;

(c) The fate of radionuclides released into different marine environments; and

(d) The behaviour of radionuclides in sediments and at the water/seabed interface.

306. A co-ordinated research programme on the behaviour of long-lived radionuclides associated with the deep-sea disposal of radioactive wastes was completed; a final report will be published during 1985.

307. The Laboratory participated in other co-ordinated research programmes, including one on radioactive materials in the Baltic Sea and one on the transport of radioactive materials in waterways, especially sediments.

308. The Laboratory continued to support UNEP's Regional Marine Pollution Monitoring and Research Programmes, providing scientific and technical expertise for the Mediterranean Action Plan, the Kuwait Action Plan, and action plans for West and Central Africa. A project for developing testing and intercalibrating reference methods for marine pollution studies was initiated with financial support from UNEP.

General

309. The main fields of research and training-for-research at the Centre in 1984 were:

(a) Physics and energy (nuclear physics, non-conventional energy, plasma physics);

(b) Fundamental physics (elementary particles and fundamental theory, cosmology);

(c) Physics and technology (condensed-matter physics);

(d) Physics of the living state (biophysics);

(e) Physics of the environment and of natural resources (atmospheric physics, geophysics);

(f) Physics and development;

(g) Mathematics (applicable mathematics); and

(h) Training at Italian laboratories.

310. Over 2000 scientists visited the Centre during 1984, staying for a total of almost 2000 man-months. Just over half of them were from developing countries, but they accounted for 76% of the total man-months.

311. Under its "Associate Membership" scheme, the Centre welcomed 56 associates from 28 developing countries. Two hundred scientists from federated institutes in 35 developing countries visited the Centre.

312. Almost a hundred scientists, about three quarters of them from developing countries, visited the Centre in order to carry out independent research in fields for which no activity was scheduled or in periods when no activities relating to their particular fields were taking place.

Physics and energy

313. The year began with a workshop on nuclear model computer codes which was organized by the Centre in collaboration with the Agency's Nuclear Data Section and in which 53 scientists participated, 37 of them from developing countries. It was followed by a winter college in nuclear physics; of the 157 scientists who took part, 93 were from developing countries.

314. A seminar on solar energy held in French brought together 71 scientists, 39 of them from French-speaking developing countries.

315. The commemorative meeting on plasma physics held to mark the Centre's twentieth anniversary (see para. 29) was attended by over 30 experts who discussed expected developments in plasma physics during the next decades.

Fundamental physics

316. A spring school on supergravity and supersymmetry in which 163 scientists took part was followed by a workshop dedicated to supergravity, supersymmetry and Kaluza-Klein theories (with 145 participants).

317. In June and July the Centre organized a workshop in high-energy physics and cosmology which attracted 88 scientists, 53 of them from developing countries. During this period 130 scientists took part in the 8th Trieste conference on particle physics.

318. The permanent research group on elementary particles and fundamental theory was very active, with some 160 scientists - over half from developing countries - contributing to its work.

Physics and technology

319. A spring college devoted to the physics of crystalline semiconducting materials and devices attracted 112 scientists, over 70% of them from developing countries. It was

followed by a research workshop in condensed-matter physics in which some 200 physicists took part and which was accompanied by three topical meetings: a symposium on the surface spectroscopy of adsorbates, attended by 74 scientists; a meeting on high-excitation and short-pulse phenomena organized by the Centre in collaboration with the IUPAP Semiconductor Physics Commission and attended by over 80 physicists; and a meeting on first-order phase transitions (statics and dynamics) attended by 53 scientists. A number of the physicists participating in the workshop formed a working party on the physics of condensed matter at planetary pressures.

320. The permanent research group in condensed-matter physics received support from some 50 scientists during the year.

321. The Centre organized an Asian regional college on microprocessor technology and applications in Sri Lanka; 92 scientists took part.

Physics of the living state

322. A summer college on biophysics was held as a follow-up to a course on the same subject which aroused great interest in 1982; it attracted 113 scientists, 79 of them from developing countries.

323. A small meeting on brain theory organized by the Centre in collaboration with the International School for Advanced Scientific Studies (SISSA), Trieste, was attended by 15 scientists.

Physics of the environment and of natural resources

324. An autumn college on the troposphere, stratosphere and mesosphere was attended by some 110 scientists - 97 of them from developing countries - working in atmospheric physics and geophysics.

Physics and development

325. A conference on physics for development attracted 155 scientists, of whom 107 were from developing countries. Its main purpose was to consider the role of physics in development and to familiarize physics communities in developing countries with potential sources of assistance in carrying out physics research and using the results to help meet national needs.

326. A symposium on the state of physics and mathematics in Africa brought together 83 scientists, mainly from African countries. Concurrently, the Centre hosted the IUPAP General Assembly.

327. As in the past, throughout the year participants in other scheduled activities delivered talks relevant to the "Physics and development" programme.

Mathematics

328. Mathematics research continued throughout the year, some 15 scientists taking part.

329. In the field of applicable mathematics, the Centre held a workshop on dynamical systems in which 67 scientists - 48 of them from developing countries - took part.

330. An autumn college dedicated to semigroup theory and applications was attended by 135 scientists, 73 of them from developing countries.

Training at Italian laboratories

331. Under a programme started in 1982 with the aim of giving experimental scientists from developing countries the opportunity to work in advanced Italian laboratories, as a complement to theoretical work at the Centre, some 70 scientists - with grants from the Centre - worked for periods of various lengths at 56 Italian laboratories.

Safeguards statement for 1984

332. In 1984, as in previous years, the Secretariat, in carrying out the safeguards obligations of the Agency, did not detect any anomaly which would indicate the diversion of a significant amount of safeguarded nuclear material - or the misuse of facilities or equipment subject to safeguards under certain agreements - for the manufacture of any nuclear weapon, or for any other military purpose, or for the manufacture of any other nuclear explosive device, or for purposes unknown[14]. It is considered reasonable to conclude that nuclear material under Agency safeguards in 1984 remained in peaceful nuclear activities or, with the exception of one case[15], was otherwise adequately accounted for. This statement should be seen in the light of the following observations:

(a) Extensive safeguards activities in 1984 resulted in more than 1820 (1826 in 1983) inspections carried out at about 474 (520) nuclear installations in 49 (50) non-nuclear-weapon States and three (three) nuclear-weapon States. In 30% (26%) of inspections nuclear material was verified by non-destructive assay (NDA). More than 240 (230) automatic photo and television surveillance systems operated in the field, and 8300 (6170) seals applied to nuclear material were detached and subsequently verified at Headquarters. More than 1080 (1150) plutonium and uranium samples were analysed, with about 2770 (2980) analytical results being reported. Accounting and other safeguards data comprising 760 000 (800 000) data entries were processed and stored in the Agency's computer;

(b) The sensitivity of inspection and evaluation activities may be illustrated by the fact that about 400 (420[16]), mostly minor, discrepancies or anomalies were found. All cases but the one[15] referred to above were satisfactorily explained upon subsequent appraisal or investigation;

(c) The level of assurance associated with the Secretariat's findings depends - inter alia - on the funds, manpower and equipment available to the Agency and, for a particular installation or State, on the content of the safeguards agreement concluded with the State in question, and on the co-operation of the State and of the facility operators in it;

(d) The findings of the Safeguards Implementation Report (SIR) refer for each facility to the latest available State report, Agency inspection, analysis, etc. relating to that facility.

Safeguards coverage

333. By the end of 1984 there was a total of 163 safeguards agreements in force with 95 States, compared with 159 agreements in force with 92 States at the end of 1983.

334. Three non-nuclear-weapon States became party to NPT during 1984, Dominica in August and Equatorial Guinea and St. Vincent and the Grenadines in November, bringing the total number of States party to the Treaty to 124, including three nuclear-weapon States.

335. During 1984, safeguards agreements concluded pursuant to NPT with Nauru and Sri Lanka entered into force. A safeguards agreement concluded with Panama pursuant to the Tlatelolco Treaty entered into force. Thus, the total number of non-nuclear-weapon States having safeguards agreements in force pursuant to NPT and/or the Tlatelolco Treaty was 80 at the end of 1984.

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[14] In the case of voluntary-offer agreements with nuclear-weapon (NW) States, nuclear material to which safeguards were applied was not withdrawn from safeguards except in conformity with these agreements.

[15] In this case an export of depleted uranium was made without due notification to the Agency. Subsequently the country to which the export was made declared to the Agency that the material had been imported exclusively for non-nuclear, non-explosive uses and that part of the material had been so used. A major part of the material was made available to Agency staff for examination.

[16] The anomaly which was reported in the 1983 annual report as being under investigation was satisfactorily resolved in 1984.

336. Of the 121 non-nuclear-weapon States party to NPT, 39 have not yet complied with their obligations under Article III.4 of the Treaty regarding the conclusion of the relevant safeguards agreement with the Agency. With the exception of Viet Nam, none of these 39 States has, as far as the Agency is aware, significant nuclear activities (see Table 6).

337. Safeguards were actually applied in 40 non-nuclear-weapon States under agreements concluded pursuant to NPT or to NPT and the Tlatelolco Treaty, and in one non-nuclear-weapon State pursuant to the Tlatelolco Treaty.

338. Safeguards agreements based on INFCIRC/66/Rev.2 were in force with the following ten non-nuclear-weapon States not party to either NPT or the Tlatelolco Treaty: Argentina, Brazil, Chile, Cuba, the Democratic People's Republic of Korea, India, Israel, Pakistan, South Africa and Spain (see Table 7). Safeguards were actually applied in nine of the ten States pursuant to these agreements. Also, safeguards were applied in Viet Nam, which is a party to NPT (see para. 310 above), pursuant to an INFCIRC/66/Rev.2-type agreement.[17]

339. In six of these ten States, as in nuclear-weapon States, unsafeguarded facilities of significance for safeguards were known to be in operation or under construction.[18]

340. During 1984, safeguards were applied in three nuclear-weapon States pursuant either to voluntary-offer agreements or to safeguards transfer agreements - namely, France, the United Kingdom and the United States of America. Negotiations were concluded during 1984 between the Agency and the Soviet Union for a safeguards agreement on a voluntary offer to place some of the Soviet Union's peaceful nuclear installations under Agency safeguards.[19] It is expected that the agreement will enter into force during the first half of 1985, and inspections will start subsequently.

341. On 31 December 1984, there were 460 facilities under safeguards or containing safeguarded nuclear material (455 in 1983); there were also 415 locations outside facilities containing small amounts of safeguarded material (425 in 1983) and one non-nuclear installation in non-nuclear-weapon States. There were also ten facilities in nuclear-weapon States under Agency safeguards pursuant either to voluntary-offer agreements or to safeguards transfer agreements (see Tables 4, 5 and 8).

342. At the end of 1984, the nuclear material under Agency safeguards, including that covered by voluntary-offer agreements with nuclear-weapon States, amounted to 7.7 t (7.7 t in 1983) of separated plutonium, 11.8 t (11.0 t) of high-enriched uranium (HEU), 129.5 t (95.8 t) of plutonium contained in irradiated fuel, 22 784 t (19 690 t) of low-enriched uranium (LEU) and 31 724 t (28 075 t) of source material. Non-nuclear material under Agency safeguards included 1362 t (1307 t) of heavy water (see Tables 2 and 3).

Major activities during 1984

Safeguards implementation

343. The noteworthy developments in this area included the following:

- Inspection effort deployed in 1984 achieved a coverage of 71.3% (73.6% in 1983) with regard to the total planned actual routine inspection effort (PLARIE);
- The number of inspections where NDA measurements were performed was 15% higher in 1984 than in 1983;
- The number of major facilities at which inspection goals were fully attained for the whole facility was 21% higher in 1984 than in 1983;

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[17] The Agency also applies safeguards to nuclear facilities in Taiwan, China.

[18] In one of the six States a fuel fabrication plant is not subject to Agency safeguards, although the Agency safeguards the nuclear material in the plant. However, an amendment to an existing agreement was approved by the Board of Governors in February 1985 and signed on 4 July 1985. When the amendment enters into force, Agency safeguards will again cover all nuclear facilities in that State.

[19] The safeguards agreement, which was approved by the Board of Governors and signed in February 1985, entered into force on 10 June 1985.

- Through the allocation of extra effort at Headquarters the timeliness of inspection reports improved considerably, with the result that the number of statements on inspections dispatched to States in 1984 was about 70% higher in 1984 than in 1983;

- In one State, the Agency performed a simultaneous physical inventory verification at all major facilities involved in the natural-uranium fuel cycle in that State;

- Working procedures were improved through the introduction of - inter alia - the computerized evaluation of data in inspection reports on item facilities, two new items of safeguards equipment approved for routine use, and a new Safeguards Manual;

- The IAEA Office at Tokyo was officially opened on 2 July 1984. There are now two such offices - one in Japan and one in Canada - ensuring greater effectiveness and efficiency of safeguards implementation;

- The use of inspection assistants for complementary inspection purposes in a number of countries increased, although limitations were still imposed on their use.

Safeguards information treatment

344. The noteworthy developments in this area included the following:

- Some 20 000 State reports and 1560 computerized inspection reports (CIRs) were processed. The data base increased by about 25%, to approximately 3.8 million records;

- The IAEA Safeguards Information System (ISIS) was routinely used in support of field inspection activities and for safeguards evaluation and management information purposes;

- At a meeting on international transfers of nuclear material, consultants considered further action to improve reporting procedures. The recommendations of the consultants have been for the most part accepted and a plan of action has been established for their implementation;

- With two States which submit reports pursuant to INFCIRC/66/Rev.2-type agreements, discussions were started on the feasibility of submitting reports on magnetic tape, with a view to more efficient and effective processing of the data;

- The Tenth Safeguards Workshop Seminar was attended by participants from 20 countries and one regional organization. The seminar aided Member States in meeting their obligations in respect of reporting and provided a forum for the exchange of information on nuclear accounting.

- A major review of ISIS after three years of operational experience was completed and a summary of the results published. Recommendations for further improving the system are being implemented;

- The software and quality control procedures for the CIR were revised to make the CIR the reporting medium for all facilities, including bulk-handling facilities, and a new on-line entry/correction system was introduced so as to permit more efficient and effective report preparation;

- A pilot project involving the use, in the field and at Headquarters, of personal computers with a direct link into the Safeguards mainframe computer was successfully completed.

Safeguards development and technical support

345. In the development of instruments, methods and techniques:

- the performance monitoring and control programme for safeguards equipment was expanded, the emphasis continuing to be on ensuring the long-term reliability of safeguards equipment and on automated data-gathering from microprocessor-controlled instruments,

- field tests of recently developed NDA and containment and surveillance (C/S) equipment were performed,

- a major effort was made in evaluating two commercially produced battery-powered multichannel analysers (MCAs) with built-in microprocessor control, and one of them was selected for safeguards use,

- in the development of C/S equipment, an improved in situ fibre optic sealing system was received and preparations were made for testing it in the field,

- an ultrasonic sealing system for CANDU irradiated fuel stores began to undergo testing for tamper-resistance and a prototype of a laser-based surveillance system for spent fuel storage ponds was demonstrated.

346. Special attention was paid to developing and improving new safeguards approaches for sensitive facilities such as reprocessing plants, HEU and MOX fuel fabrication plants and ultracentrifuge uranium enrichment plants:

- Preparations for the demonstration of near-real-time material accountancy at reprocessing plants continued;

- Further work on an agreed concept for safeguarding commercial enrichment plants was done;

- The development of safeguards approaches for heavy-water production plants continued;

- Work on improving safeguards implementation at several on-load refuelled reactors continued, including the formulation of performance evaluation procedures;

- The safeguards approach for LEU fuel fabrication plants was analysed in support of SAGSI studies on safeguards approaches.

347. The development of detailed guidelines for establishing and maintaining a State System of Accounting for and Control of nuclear material (SSAC) at facility level was completed for research reactors and critical assemblies and continued for other types of facilities.

348. There was a significant increase in the scale of technical services operations. For example:

- about 360 photo cameras were repaired, tested and delivered to the Operations Divisions for field use,

- some 35% more seals removed after service at nuclear facilities were verified than in 1983, monthly receipts of seals at Headquarters sometimes exceeding 1000.

349. Twin-camera photo units continued to be the mainstay of safeguards surveillance activities, the number of operating units increasing to about 225. Among the innovations in photo surveillance were the introduction of an elevator mount for photo units and a video-based film reviewer.

350. The first version of a computerized system for safeguards equipment inventory control was utilized throughout the year. A formal acceptance procedure was implemented for the repair and maintenance of NDA equipment. The procedures for maintenance scheduling, equipment routing and documentation control were improved.

Safeguards evaluation

351. In the area of data evaluation:

- Services were provided to the Divisions of Operations, particularly in connection with the analysis of samples at the Safeguards Analytical Laboratory (SAL) and through the Network of Analytical Laboratories (NWAL), with the material balance evaluation of bulk-handling facilities, with the evaluation of mass measurements of nuclear material in liquid form and with the preparation and characterization of NDA reference materials;

- The quality of analytical data obtained during the last three years was evaluated;

- In co-operation with the European Safeguards Research and Development Association (ESARDA), "target values" for safeguards sample measurement errors were published and used in evaluating material balance data;

- ICT (isotope correlation techniques) software from several States was installed on the safeguards computer;

- Data evaluation services were provided to the Division of Development and Technical Support in connection with the testing and calibration of NDA equipment, with the automatic transfer of data from instruments to computers in the field and at Headquarters, and with the co-ordination of several Member States' support activities relating to data evaluation methods and software for use on field computers.

352. Further improvements were made in the review and evaluation of inspection reports and of inspection statements to States pursuant to safeguards agreements based on INFCIRC/153 (Corrected) and on INFCIRC/66/Rev.2.

- 2224 inspection reports and 2461 inspection statements were reviewed using computer-assisted review procedures.

- Detailed procedures for the internal review of safeguards implementation were applied in specific cases.

Evaluations of item facilities for the SIR were done with the help of computer-assisted procedures which used almost exclusively data taken directly from CIRs.

Standardization, training and administrative support

353. Policy advice was provided in a variety of areas, especially financial management, manpower recruitment and allocation, and overall management.

354. Financial management involved preparation of the safeguards budget and financial plan and the monitoring of expenditure. Manpower responsibilities included the preparation of job descriptions and vacancy notices, the processing of applications, and participation with the Division of Personnel in an exercise aimed at the classification of all positions in the Department. Overall management included such generic issues as organization and procedures and such specific issues as the interrelationship of managerial responsibilities.

355. The design of a standardized format for computerized data entry to be used - from 1985 onwards - by all Divisions of Operations for reporting on inspections at all types of facilities under safeguards was completed; training in the use of this format and of the CIR was organized for all inspectors.

356. A new Safeguards Manual, containing a comprehensive set of instructions and guidelines, was prepared and issued for use by the inspectorate with effect from January 1985.

357. Two introductory courses on Agency safeguards for new inspectors were organized; they included inspection exercises at facilities in Member States. In addition, advanced courses in NDA, inspection procedures and computer data base utilization were provided at Headquarters and in five Member States. Five refresher courses for experienced inspectors were held.

358. For the 11 safeguards trainees participating in the first training programme for junior professionals, the programme consisted of classroom lectures and visits to operating nuclear facilities in the Federal Republic of Germany and additional training at Headquarters. Half of the group attended an inspection exercise in the Soviet Union and the other half accompanied inspectors in the field. Eight of the eleven applied for inspector positions in the Department of Safeguards and offers were made to them. A second programme, which includes ten safeguards trainees, started in October.

Support by outside expert groups

359. A number of advisory group and similar meetings took place in 1984.

- SAGSI held two series of meetings. One series was held in the United States of America, where the members witnessed a safeguards demonstration exercise at an LEU fuel fabrication plant. At the second series of meetings, recommendations were made in respect of the safeguards approach at this type of facility,

particularly in light of the development of new equipment; this was done within the framework of a long-term plan for obtaining SAGSI's advice on safeguards approaches to various types of nuclear facilities. Also SAGSI continued - inter alia - to provide advice on safeguards research and development activities, a task previously performed by the Scientific Advisory Committee and first performed by SAGSI in 1983 at the Director General's request.

- An advisory group made recommendations on Agency action relating to C/S monitors and sensors and their applications in international safeguards.

- An advisory group formulated a revised set of recommendations on the Agency's programme for evaluating the quality of safeguards NDA measurements.

- At a final research co-ordination meeting on the use for safeguards purposes of installed instrumentation at fuel reprocessing facilities, it was noted that substantial progress had been made in the application of a number of techniques under industrial conditions during the co-ordinated research programme in question.

- The application of safeguards at WWER-440 reactors was discussed at a meeting, held in the Soviet Union, on technical means of nuclear material control at such reactors.

- Experts in safeguards measurements in the cascade areas of centrifuge uranium enrichment plants concluded that the degree of enrichment of UF_6 in pipelines can be determined by NDA measurements.

- Consultant groups considered: (1) the safeguarding of nuclear material at separate spent fuel storages; (2) fuel-cycle-oriented safeguards approaches; (3) safeguards effectiveness assessment methodologies; (4) methods for improving the determination of plutonium in small samples; (5) the incorporation of information on improved methods of safeguards data evaluation into the IAEA Safeguards Technical Manual, Part F, Statistical Concepts and Techniques, (Vol. 3); and (6) international transfers of nuclear material.

Co-operation between States and the Agency

360. In May 1984, the IAEA Office in Tokyo was formally established by an exchange of letters between Japan and the Agency, a procedure similar to that followed in the establishment of the Toronto Field Office in September 1980. In addition to providing logistic support to the Agency staff on duty in Canada and Japan, these offices have led to a considerable improvement in day-to-day contacts between the Agency and State officials in solving safeguards problems.

361. Substantial contributions to the safeguards development programme were made by national programmes in support of Agency safeguards. Australia, Belgium, Canada, France, the Federal Republic of Germany, Japan, the Soviet Union, the United Kingdom, the United States of America and the European Community provided support within the framework of formalized support programmes, while other Member States (including Austria, Bulgaria, Czechoslovakia, Finland, the German Democratic Republic, Hungary, the Netherlands, Romania, Sweden and Switzerland) contributed through arrangements such as research and development agreements, contracts and test programmes. Extensive tests of safeguards equipment for CANDU reactors were performed in Argentina, Canada, India, the Republic of Korea and Pakistan. Argentina co-operated with the Agency in the development of a safeguards approach for heavy-water production plants. A second "support programme co-ordinators' meeting" was held with a view to further improving co-ordination.

362. Committees and other regular forms of contact, including working arrangements with facility operators, continued to make a significant contribution to the solution of problems relating to safeguards implementation.

363. A training course on SSACs held in the Soviet Union was attended by participants from 13 countries.

The Agency's resources

Manpower

364. During 1984, the procedures for the recruitment of inspectors improved considerably. The number of available inspector (including inspection assistant) man-years rose from 137.2 to 154.1. This resulted in an increase of 19% in the available man-years of designated inspectors (and inspection assistants) for carrying out inspections at facilities.

Equipment

365. During 1984 some of the safeguards instruments developed under national safeguards support programmes became commercially available. The procurement of these instruments resulted in the expenditure of about $3.3 million. The procurement of equipment for safeguarding a heavy-water plant was deferred until 1985.

366. Among the new equipment purchased were portable multichannel analysers (PMCAs) to replace the stabilized assay meters (SAM-2) which the Agency had been using for more than a decade for uranium enrichment measurements and which, while accurate, took a long time to calibrate and were prone to inspector error. In addition, a photo surveillance enclosure which is far more tamper-resistant than its predecessor and has provision for conversion to video was procured and implemented.

367. To help expedite the field application of safeguards equipment, a comprehensive assessment of short-term and long-term equipment requirements undertaken in 1983 was updated in 1984.

Table 2

States having significant nuclear activities
(at the end of the year indicated)

	Number of States		
	1982	1983	1984
NNW States with safeguards applied under NPT and/or Tlatelolco agreements	39	40	41
NNW States with safeguards applied under INFCIRC/66/Rev.2 agreements[a/]	11	11	11
NNW States without safeguards agreements in force	0	0	0
Total number of NNW States with significant nuclear activities	50	51	52
NW States with voluntary-offer agreements in force	3	3	3
Other NW States	2	2	2
Total number of States with significant nuclear activities	55	56	57

a/ Some States with INFICRC/66/Rev.2 agreements which have not yet been suspended, although NPT agreements have entered into force, are listed under NPT agreements only.

Table 3

Approximate quantities of material subject to Agency safeguards except that covered by voluntary-offer agreements with NW States (at the end of 1984)

Type of material	Quantity of material (t)		Quantity in SQ
	in NNW States	in NW States	
Nuclear material			
Plutonium[a] containted in irradiated fuel	99.2	9.5	13 590
Separated plutonium	5.7	0.8	820
HEU (equal to or greater than 20% uranium-235)	11.8	0	270
LEU (less than 20% uranium-235)	19 000	1 287	6 190
Source material[b] (natural or depleted uranium and thorium)	28 000	0	2 230
Total significant quantities			23 100
Non-nuclear material[c]			
Heavy water	1 362	0	-[d]

a/ The quantity includes an estimated 43.7 t (5465 SQ) of plutonium in irradiated fuel, which is not reported to the Agency under the reporting procedures agreed to (the non-reported plutonium is contained in irradiated fuel assemblies to which item accountancy and C/S measures are applied).

b/ This table does not include material within the terms of sub-paragraphs 34(a) and (b) of INFCIRC/153 (Corrected) - in essence, yellow cake.

c/ Non-nuclear material subject to Agency safeguards under INFCIRC/66/Rev.2-type agreements.

d/ "Quantity in SQ" does not apply to non-nuclear material.

Table 4

Approximate quantities of material subject to Agency safeguards[a/] in NW States in installations designated for inspection under voluntary-offer agreements (at the end of 1984)

Type of nuclear material	Quantity of material (t)	Quantity in SQ
Plutonium contained in irradiated fuel	20.8	2 602
Separated plutonium	1.2	145
LEU (less than 20% uranium-235)	2 497	406
Source material (natural or depleted uranium and thorium)	3 724	216
TOTAL		3 369

a/ This table does not include small quantities of HEU rounded to zero SQ.

Table 5

Installations in NNW States under safeguards or containing safeguarded material at 31 December 1984

Installation category	Number of installations			
	INFCIRC/153[a]	INFCIRC/66/Rev.2	Total[b]	
A. Power reactors	139	26	165	(147)
B. Research reactors and critical assemblies	148	26	174	(177)
C. Conversion plants	4	2	6	(7)
D. Fuel fabrication plants	29	9	38	(40)
E. Reprocessing plants	4	2	6	(6)
F. Enrichment plants	4	0	4	(4)
G. Separate storage facilities	25	2	27	(28)
H. Other facilities	39	1	40	(46)
I. Other locations	388	27	415	(425)
J. Non-nuclear installations	0	1	1	(1)
TOTALS	780	96	876	(881)

a/ Covering safeguards agreements pursuant to NPT and/or Tlatelolco Treaty.

b/ Numbers for 1983 are indicated in parentheses for comparison.

Table 6

Installations in NW States under INFCIRC/66/Rev.2 safeguards agreements or designated for inspection under voluntary-offer agreements during 1984

Installation category	Number of installations		
	INFCIRC/66/Rev.2	Voluntary offer	Total[a]
A. Power reactors	0	2	2 (4)
D. Fuel fabrication plants	0	1	1 (2)
F. Enrichment plants	0	2	2 (1)
G. Separate storage facilities	5[b]	1[c]	6 (5)
TOTAL	5	6	11 (12)

a/ Numbers for 1983 are indicated in parentheses for comparison.

b/ One storage facility was safeguarded under an INFCIRC/66/Rev.2 agreement for only part of 1984.

c/ This storage facility includes spent fuel storage ponds of a reprocessing plant.

Table 7

Situation on 31 December 1984 with respect to the conclusion of safeguards agreements between the Agency and non-nuclear-weapon States in connection with NPT

Non-nuclear-weapon States which have signed, ratified, acceded to or succeeded to NPT[a/] (1)	Date of ratification, accession or succession[a/] (2)	Safeguards agreement with the Agency (3)	INFCIRC (4)
Afghanistan	4 February 1970	In force: 20 February 1978	257
Antigua and Barbuda	1 November 1981		
Australia	23 January 1973	In force: 10 July 1974	217
Austria	27 June 1969	In force: 23 July 1972	156
Bahamas	10 July 1973		
Bangladesh	27 September 1979	In force: 11 June 1982	301
Barbados	21 February 1980		
Belgium	2 May 1975	In force: 21 February 1977	193
Benin	31 October 1972		
Bolivia[b/]	26 May 1970	Signed: 23 August 1974	
Botswana	28 April 1969		
Bulgaria	5 September 1969	In force: 29 February 1972	178
Burkina Faso	3 March 1970		
Burundi	19 March 1971		
Cameroon	9 January 1969		
Canada	8 January 1969	In force: 21 February 1972	164
Cape Verde	24 October 1979		
Central African Republic	25 October 1970		
Chad	10 March 1971		
Colombia[e/]			
Congo	23 October 1978		
Costa Rica[b/]	3 March 1970	In force: 22 November 1979	278
Cyprus	10 February 1970	In force: 26 January 1973	189
Czechoslovakia	22 July 1969	In force: 3 March 1972	173
Democratic Kampuchea	2 June 1972		
Democratic Yemen	1 June 1979		
Denmark[c/]	3 January 1969	In force: 21 February 1977	193
Dominica	10 August 1984		
Dominican Republic[b/]	24 July 1971	In force: 11 October 1973	201
Ecuador[b/]	7 March 1969	In force: 10 March 1975	231
Egypt	26 February 1981	In force: 30 June 1982	302
El Salvador[b/]	11 July 1972	In force: 22 April 1975	232
Equatorial Guinea	1 November 1984		
Ethiopia	5 February 1970	In force: 2 December 1977	261
Fiji	14 July 1972	In force: 22 March 1973	192
Finland	5 February 1969	In force: 9 February 1972	155
Gabon	19 February 1974	Signed: 3 December 1979	
Gambia	12 May 1975	In force: 8 August 1978	277
German Democratic Republic	31 October 1969	In force: 7 March 1972	181
Germany, Federal Republic of	2 May 1975	In force: 21 February 1977	193
Ghana	5 May 1970	In force: 17 February 1975	226
Greece[f/]	11 March 1970	Accession: 17 December 1981	193
Grenada	19 August 1974		
Guatemala[b/]	22 September 1970	In force: 1 February 1982	299
Guinea-Bissau	20 August 1976		
Haiti[b/]	2 June 1970	Signed: 6 January 1975	
Holy See	25 February 1971	In force: 1 August 1972	187
Honduras[b/]	16 May 1973	In force: 18 April 1975	235
Hungary	27 May 1969	In force: 30 March 1972	174
Iceland	18 July 1969	In force: 16 October 1974	215

(1)	(2)	(3)	(4)
Indonesia	12 July 1979	In force: 14 July 1980	283
Iran, Islamic Republic of	2 February 1970	In force: 15 May 1974	214
Iraq	29 October 1969	In force: 29 February 1972	172
Ireland	1 July 1968	In force: 21 February 1977	193
Italy	2 May 1975	In force: 21 February 1977	193
Ivory Coast	6 March 1973	In force: 8 September 1983	309
Jamaica[b/]	5 March 1970	In force: 6 November 1978	265
Japan	8 June 1976	In force: 2 December 1977	255
Jordan	11 February 1970	In force: 21 February 1978	258
Kenya	11 June 1970		
Korea, Republic of	23 April 1975	In force: 14 November 1975	236
Kuwait[e/]			
Lao People's Democratic Republic	20 February 1970		
Lebanon	15 July 1970	In force: 5 March 1973	191
Lesotho	20 May 1970	In force: 12 June 1973	199
Liberia	5 March 1970		
Libyan Arab Jamahiriya	26 May 1975	In force: 8 July 1980	282
Liechtenstein	20 April 1978	In force: 4 October 1979	275
Luxembourg	2 May 1975	In force: 21 February 1977	193
Madagascar	8 October 1970	In force: 14 June 1973	200
Malaysia	5 March 1970	In force: 29 February 1972	182
Maldives	7 April 1970	In force: 2 October 1977	253
Mali	10 February 1970		
Malta	6 February 1970		
Mauritius	25 April 1969	In force: 31 January 1973	190
Mexico[b/]	21 January 1969	In force: 14 September 1973	197
Mongolia	14 May 1969	In force: 5 September 1972	188
Morocco	27 November 1970	In force: 18 February 1975	228
Nauru	7 June 1982	In force: 13 April 1984	317
Nepal	5 January 1970	In force: 22 June 1972	186
Netherlands[d/]	2 May 1975	In force: 21 February 1977	193
New Zealand	10 September 1969	In force: 29 February 1972	185
Nicaragua[b/]	6 March 1973	In force: 29 December 1976	246
Nigeria	27 September 1968		
Norway	5 February 1969	In force: 1 March 1972	177
Panama	13 January 1977		
Papua New Guinea	25 January 1982	In force: 13 October 1983	312
Paraguay[b/]	4 February 1970	In force: 20 March 1979	279
Peru[b/]	3 March 1970	In force: 1 August 1979	273
Philippines	5 October 1972	In force: 16 October 1974	216
Poland	12 June 1969	In force: 11 October 1972	179
Portugal	15 December 1977	In force: 14 June 1979	272
Romania	4 February 1970	In force: 27 October 1972	180
Rwanda	20 May 1975		
St.Lucia	28 December 1979		
St. Vincent and the Grenadines	6 November 1984		
Samoa	17 March 1975	In force: 22 January 1979	268
San Marino	10 August 1970	Approved by the Board, Feb.1977	
Senegal	17 December 1970	In force: 14 January 1980	276
Sierra Leone	26 February 1975	Signed: 10 November 1977	

(1)	(2)	(3)	(4)
Singapore	10 March 1976	In force: 18 October 1977	259
Solomon Islands	17 June 1981		
Somalia	5 March 1970		
Sri Lanka	5 March 1979	In force: 6 August 1984	320
Sudan	31 October 1973	In force: 7 January 1977	245
Suriname[b/]	30 June 1976	In force: 2 February 1979	269
Swaziland	11 December 1969	In force: 28 July 1975	227
Sweden	9 January 1970	In force: 14 April 1975	234
Switzerland	9 March 1977	In force: 6 September 1978	264
Syrian Arab Republic	24 September 1969		
Thailand	7 December 1972	In force: 16 May 1974	241
Togo	26 February 1970		
Tonga	7 July 1971	Approved by the Board, Feb.1975	
Trinidad and Tobago[e/]			
Tunisia	26 February 1970		
Turkey	17 April 1980	In force: 1 September 1981	295
Tuvalu	19 January 1979		
Uganda	20 October 1982		
Uruguay[b/]	31 August 1970	In force: 17 September 1976	157
Venezuela[b/]	26 September 1975	In force: 11 March 1982	300
Viet Nam	14 June 1982		
Yemen Arab Republic[e/]			
Yugoslavia	3 March 1970	In force: 28 December 1973	204
Zaire	4 August 1970	In force: 9 November 1972	183

a/ The information reproduced in columns (1) and (2) was provided to the Agency by depositary Governments of NPT, and an entry in column (1) does not imply the expression of any opinion on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers. The Table does not contain information relating to the participation of Taiwan, China in NPT.

b/ The relevant safeguards agreement refers to both NPT and the Tlatelolco Treaty.

c/ The NPT safeguards agreement with Denmark (INFCIRC/176), in force since 1 March 1972, has been replaced by the agreement of 5 April 1973 between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency (INFCIRC/193) but still applies to the Faroe Islands.

d/ An agreement had also been concluded in respect of the Netherlands Antilles (INFCIRC/229). This agreement entered into force on 5 June 1975.

e/ The following States had signed NPT but not yet ratified it: Colombia, on 1 July 1968; Kuwait, on 15 August 1968; Trinidad and Tobago, on 22 August 1968; and the Yemen Arab Republic, on 23 September 1968.

f/ The application of Agency safeguards in Greece under the agreement INFCIRC/166, provisionally in force since 1 March 1972, was suspended on 17 December 1981, at which date Greece acceded to the agreement of 5 April 1973 (INFCIRC/193) between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency.

Table 8

Agreements providing for safeguards, other than those in connection with NPT, approved by the Board as of 31 December 1984

Party(ies)[a]	Subject	Entry into force	INFCIRC
(While the Agency is a party to each of the following agreements, only the State(s) party to them is (are) listed.)			
(a) Project Agreements			
Argentina	Siemens SUR-100	13 March 1970	143
	RAEP Reactor	2 December 1964	62
Chile	Herald Reactor	19 December 1969	137
Finland[b]	FiR-1 Reactor	30 December 1960	24
	FINN sub-critical assembly	30 July 1963	53
Greece[b]	GRR-1 Reactor	1 March 1972	163
Indonesia[b]	Additional core-load for TRIGA Reactor	19 December 1969	136
Iran, Islamic Republic of[b]	UTRR Reactor	10 May 1967	97
Jamaica[b]	Fuel for research reactor	25 January 1984	315
Japan[b]	JRR-3	24 March 1959	3
Malaysia[b]/United States	TRIGA-II Reactor	22 September 1980	287
Mexico[b]	TRIGA-III Reactor	18 December 1963	52
	Siemens SUR-100	21 December 1971	162
	Laguna Verde Nuclear Power Plant	12 February 1974	203
Morocco[b]	Fuel for research reactor	2 December 1983	313
Pakistan	PRR Reactor	5 March 1962	34
	Booster rods for KANUPP	17 June 1968	116
Peru[b]	Research Reactor and fuel therefor	9 May 1978	266
Philippines[b]	PRR-1 Reactor	28 September 1966	88
Romania[b]	TRIGA Reactor	30 March 1973	206
	Experimental fuel elements	1 July 1983	307
Spain	Coral-I Reactor	23 June 1967	99
Turkey[b]	Sub-critical assembly	17 May 1974	212
Uruguay[b]	URR Reactor	24 September 1965	67
Venezuela[b]	RV-1 Reactor	7 November 1975	238
Viet Nam[c]	Fuel for research reactor	1 July 1983	308
Yugoslavia[b]	TRIGA-II Reactor	4 October 1961	32
	Krško Nuclear Power Plant	14 June 1974	213
Zaire[b]	TRICO Reactor	27 June 1962	37
(b) Unilateral submissions			
Argentina	Atucha Power Reactor Facility	3 October 1972	168
	Nuclear material	23 October 1973	202
	Embalse Power Reactor Facility	6 December 1974	224
	Equipment and nuclear material	22 July 1977	250
	Nuclear material, material, equipment and facilities	22 July 1977	251
	Atucha II Nuclear Power Plant	15 July 1981	294
	Heavy water plant	14 October 1981	296
	Heavy water	14 October 1981	297
	Nuclear material	8 July 1982	303
Chile	Nuclear material	31 December 1974	256
	Nuclear material	22 September 1982	304
Cuba	Nuclear research reactor and fuel therefor	25 September 1980	298
	Nuclear power plant and nuclear material	5 May 1980	281
	Zero-power nuclear reactor and fuel therefor	7 October 1983	311
Democratic People's Republic of Korea	Research Reactor and nuclear material for this reactor	20 July 1977	252
India	Nuclear material, material and facilities	17 November 1977	260
Pakistan	Nuclear material	2 March 1977	248
Spain	Nuclear material	19 November 1974	218
	Nuclear material	18 June 1975	221
	Vandellos Nuclear Power Plant	11 May 1981	292
	Four nuclear facilities	11 May 1981	291
United Kingdom	Nuclear material	14 December 1972	175
Viet Nam	Research reactor and fuel therefor	12 June 1981	293

Party(ies)[a]	Subject	Entry into force	INFCIRC
(c) Tlatelolco Treaty			
Colombia	All nuclear material	22 December 1982	306
Mexico[d]	All nuclear material, equipment and facilities	6 September 1968	118
Panama	All nuclear material	23 March 1984	316
(d) Agreements concluded with nuclear-weapon States on the basis of voluntary offers			
France	Nuclear material in facilities submitted to safeguards	12 September 1981	290
United Kingdom	Nuclear material in facilities designated by the Agency	14 August 1978	263
United States of America	Nuclear material in facilities designated by the Agency	9 December 1980	288
(e) Other agreements			
Argentina/United States of America		25 July 1969	130
Australia[d]/United States of America		26 September 1966	91
Austria[d]/United States of America		24 January 1970	152
Brazil/Germany, Federal Republic of[d]		26 February 1976	237
Brazil/United States of America		31 October 1968	110
Colombia/United States of America		9 December 1970	144
India/Canada[d]		30 September 1971	211
India/United States of America		27 January 1971	154
Iran, Islamic Republic of[d]/United States of America		20 August 1969	127
Israel/United States of America		4 April 1975	249
Japan[d]/Canada[d]		20 June 1966	85
Japan[d]/France		22 September 1972	171
Japan/United States of America		10 July 1968	119
Japan[d]/United Kingdom		15 October 1968	125
Korea, Republic of/United States of America		5 January 1968	111
Korea, Republic of[d]/France		22 September 1975	233
Pakistan/Canada		17 October 1969	135
Pakistan/France		18 March 1976	239
Philippines[d]/United States of America		19 July 1968	120
Portugal[d]/United States of America[e]		19 July 1969	131
South Africa/United States of America		26 July 1967	98
South Africa/France		5 January 1977	244
Spain/Germany, Federal Republic of[d]		29 September 1982	305
Spain/United States of America		9 December 1966	92
Spain/Canada[d]		10 February 1977	247
Sweden[d]/United States of America		1 March 1972	165
Switzerland[d]/United States of America[e]		28 February 1972	161
Turkey/United States of America		5 June 1969	123
Venezuela[d]/United States of America[e]		27 March 1968	122

(f) The Agency also applies safeguards under two agreements (INFCIRC/133 and INFCIRC/158) to the nuclear facilities in Taiwan, China. Pursuant to the decision adopted by the Board of Governors on 9 December 1971 that the Government of the People's Republic of China is the only government which has the right to represent China in the Agency, the relations between the Agency and the authorities in Taiwan are non-governmental. The agreements are implemented by the Agency on that basis.

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a/ An entry in this column does not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country or territory or of its authorities or concerning the delimitation of its frontiers.

b/ Agency safeguards are being applied to the items required to be safeguarded under this (these) project agreement(s) pursuant to an agreement in connection with NPT covering the State indicated.

c/ The requirement for the application of safeguards under this agreement is satisfied by the application of safeguards pursuant to the agreement of 12 June 1981 (INFCIRC/293).

d/ Application of Agency safeguards under this agreement has been suspended in the State indicated as the State has concluded an agreement in connection with NPT.

e/ Application of Agency safeguards under this agreement has been suspended in the United States of America in order to comply with a provision of INFCIRC/288.

Table 9

Facilities under Agency safeguards or containing safeguarded material on 31 December 1984

A. Power reactors

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	Atucha NPS	Lima	x
	Embalse PR	Embalse	-
Austria	Tullnerfeld	Zwentendorf	x
Belgium	BR3-CEN	Mol	x
	DOEL-1	Doel	x
	DOEL-2	Doel	x
	DOEL-3	Doel	-
	DOEL-4	Doel	-
	Tihange-1	Tihange	x
	Tihange-2	Tihange	-
	Tihange-3	Tihange	-
Brazil	Angra-1	Angra dos Reis	x
Bulgaria	Kozloduy-I, Unit 1	Kozloduy	x
	Kozloduy-I, Unit 2	Kozloduy	x
	Kozloduy-II, Unit 1	Kozloduy	x
	Kozloduy-II, Unit 2	Kozloduy	x
Canada	Bruce A, Unit 1	Tiverton	x
	Bruce A, Unit 2	Tiverton	x
	Bruce A, Unit 3	Tiverton	x
	Bruce A, Unit 4	Tiverton	x
	Bruce B, Unit 1	Tiverton	-
	Bruce B, Unit 2	Tiverton	-
	Bruce B, Unit 3	Tiverton	-
	Bruce B, Unit 4	Tiverton	-
	Douglas Point	Tiverton	x
	Gentilly-1	Gentilly	x
	Gentilly-2	Gentilly	x
	NPD G.S.	Rolphton	x
	Pickering-1	Pickering	x
	Pickering-2	Pickering	x
	Pickering-3	Pickering	x
	Pickering-4	Pickering	x
	Pickering-5	Pickering	x
	Pickering-6	Pickering	x
	Pickering-7	Pickering	x
	Pickering-8	Pickering	x
	Point Lepreau G.S.	Point Lepreau	x
Czechoslovakia	A1	Bohunice	x
	EDU-1, Unit 1	Dukovany	-
	V-1, Unit 1	Bohunice	x
	V-1, Unit 2	Bohunice	x
	V-2, Unit 1	Bohunice	x
Finland	Loviisa-1	Loviisa	x
	Loviisa-2	Loviisa	x
	TVO-1	Olkiluoto	x
	TVO-2	Olkiluoto	x

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
German Democratic Republic	Bruno Leuschner-I, Unit 1	Greifswald	x
	Bruno Leuschner-I, Unit 2	Greifswald	x
	Bruno Leuschner-II, Unit 1	Greifswald	x
	Bruno Leuschner-II, Unit 2	Greifswald	x
	Rheinsberg PWR	Rheinsberg	x
Germany, Federal Republic of	KVR	Jülich	-
	KFK-MZFR	Eggenstein-Leopoldshafen	x
	GKN	Neckarwestheim	x
	KKB	Brunsbüttel	x
	KKG	Grafenrheinfeld	-
	KKI	Ohu	x
	KKK	Geesthacht-Krümmel	-
	KKS	Stade	x
	KKP-1	Philippsburg	x
	KKU	Stadland	x
	KKW Philippsburg, Block 2	Philippsburg	-
	KNK	Eggenstein-Leopoldshafen	x
	KRB	Gundremmingen	x
	KRB II, Block B	Gundremmingen	-
	KRB II-C	Gundremmingen	-
	KWG Grohnde	Grohnde	-
	KWL	Lingen	x
	KWW	Würgassen	x
	KWO	Obrigheim	x
	RWE-BIBLIS-A	Biblis	x
	RWE-BIBLIS-B	Biblis	x
	Thorium Hochtemperatur Reaktor	Hamm	-
	VAK-KAHL	Karlstein-Grosswelzheim	x
Hungary	PAKS-I, Unit 1	Paks	x
	PAKS-I, Unit 2	Paks	x
India	RAPS Unit 1	Rajasthan	x
	RAPS Unit 2	Rajasthan	x
	TAPS Unit 1	Tarapur	x
	TAPS Unit 2	Tarapur	x
Italy	ENEL	Borgo-Sabatino	x
	ENEL	San Venditto	x
	ENEL	Caorso	x
	FERMI	Trino-Vercellese	x
Japan	Fugen	Tsuruga-Fukui	x
	Fukushima Dai-Ichi-1	Okuma-Fukushima	x
	Fukushima Dai-Ichi-2	Okuma-Fukushima	x
	Fukushima Dai-Ichi-3	Okuma-Fukushima	x
	Fukushima Dai-Ichi-4	Okuma-Fukushima	x
	Fukushima Dai-Ichi-5	Okuma-Fukushima	x
	Fukushima Dai-Ichi-6	Okuma-Fukushima	x
	Fukushima Dai-Ni-1	Naraha-Fukushima	x
	Fukushima Dai-Ni-2	Naraha-Fukushima	-
	Fukushima Dai-Ni-3	Naraha-Fukushima	-
	Genkai-1	Kyushu	x
	Genkai-2	Kyushu	x
	Hamaoka-1	Hamaoka-cho	x
	Hamaoka-2	Hamaoka-cho	x
	Ikata-1	Nishiuwa-gun	x
	Ikata-2	Nishiuwa-gun	x
	JPDR	Tokai-Mura	x
	Kashiwazaki-1	Niigata	-

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Japan (cont'd)	Mihama-1	Mihama-Fukui	x
	Mihama-2	Mihama-Fukui	x
	Mihama-3	Mihama-Fukui	x
	N.S. Mutsu	Minato-Machi Mutsu	x
	Ohi-1	Ohi-cho, Fukai-ken	x
	Ohi-2	Ohi-cho, Fukai-ken	x
	Onagawa-1	Tsukahama	-
	Sendai-1	Sendai	-
	Sendai-2	Sendai	-
	Shimane	Kashima-cho	x
	Takahama-1	Takahama	x
	Takahama-2	Takahama	x
	Takahama-3	Takahama	-
	Takahama-4	Takahama	-
	Tokai-1	Tokai-Mura	x
	Tokai-2	Tokai-Mura	x
	Tsuruga	Tsuruga	x
Korea, Republic of	Kori-1	Pusan	x
	Kori-2	Pusan	x
	Kori-5	Pusan	-
	Wolsung-1	Ulsan	x
Mexico	Laguna Verde 1	Alto Lucero	-
	Laguna Verde 2	Alto Lucero	-
Netherlands	GKN	Dodewaard	x
	PZEM	Borssele	x
Pakistan	KANUPP	Karachi	x
Philippines	PNPP-1	Morong, Bataan	-
South Africa	Koeberg-1	Cape Town	x
	Koeberg-2	Cape Town	x
Spain	Almaraz-1	Almaraz	x
	Almaraz-2	Almaraz	x
	Asco-1	Asco	x
	Asco-2	Asco	x
	Cofrentes	Cofrentes	x
	José Cabrera	Almonazid de Zorita	x
	Lemoniz-1	Lemoniz	x
	Lemoniz-2	Lemoniz	x
	Santa María de Garona	Santa Maria de Garona	x
	Vandellos	Vandellos	-
Sweden	Barsebäck I	Malmö	x
	Barsebäck II	Malmö	x
	Forsmark I	Uppsala	x
	Forsmark II	Uppsala	x
	Forsmark III	Uppsala	x
	Oskarshamn I	Oskarshamn	x
	Oskarshamn II	Oskarshamn	x
	Oskarshamn III	Oskarshamn	-
	Ringhals I	Göteborg	x
	Ringhals II	Göteborg	x
	Ringhals III	Göteborg	x
	Ringhals IV	Göteborg	x

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Switzerland	KKB-I	Beznau	x
	KKB-II	Beznau	x
	KKG	Gösgen-Däniken	x
	KKL	Leibstadt	-
	KKM	Mühleberg	x
United States	Arkansas II	Pope County	-
	San Onofre, Unit 2	San Diego County	-
Yugoslavia	Krsko	Krsko	x

B. Research reactors and critical assemblies

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	RA-1	Constituyentes	x
	RA-2	Constituyentes	x
	RA-3	Ezeiza	x
	RA-4	Rosario	x
	RA-6	Bariloche	-
Australia	HIFAR	Lucas Heights	x
	MOATA	Lucas Heights	x
	CF	Lucas Heights	x
Austria	ASTRA	Seibersdorf	x
	SAR	Graz	x
	Triga II	Vienna	x
Belgium	BR1-CEN	Mol	x
	BR2-CEN	Mol	x
	BR02	Mol	x
	CEN-Venus	Mol	x
	Thetis	Gent	x
Brazil	IEAR-1	Sao Paulo	x
	RIEN-1	Rio de Janeiro	x
	Triga-CDTN	Belo Horizonte	x
Bulgaria	IRT-2000	Sofia	x
Canada	McMaster	Hamilton	x
	NRX	Chalk River	x
	NRU	Chalk River	x
	PTR	Chalk River	x
	Slowpoke-AECL	Ottawa	x
	Slowpoke-Dalhousie Univ.	Halifax	x
	Slowpoke-Ecole Polytechnique	Montreal	x
	Slowpoke-Saskatchewan	Saskatoon	x
	Slowpoke-Toronto University	Toronto	x
	Slowpoke-Univ. of Alberta	Edmonton	x
	WR-1	Pinawa	x
	ZED-2	Chalk River	x
Chile	La Reina	Santiago	x
	Lo Aguirre	Santiago	x
Colombia	IAN-R1	Bogotá	x
Czechoslovakia	LR-0	Rez	x
	SR-0D	Vochov	x
	VVR-S	Rez	x
Democratic People's Republic of Korea	Critical assembly	Nyonphyon	x
	IRT-DPRK	Nyonphyon	x
Denmark	DR-1	Roskilde	x
	DR-3	Roskilde	x

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Egypt	Nuclear Research Centre	Inshas	x
Finland	Triga II	Otaniemi	x
German Democratic Republic	RAKE	Rossendorf	x
	RRR	Rossendorf	x
	Training Reactor AKR	Dresden	x
	Training research reactor	Zittau	x
	WWR-S M	Rossendorf	x
Germany, Federal Republic of	FMRB	Braunschweig	x
	FRF-2	Frankfurt	x
	FRM	Garching	x
	GKSS-FRG1	Geesthacht	x
	GKSS-FRG2	Geesthacht	x
	KFA-FRJ1	Jülich	x
	KFA-FRJ2	Jülich	x
	KFA-NEA	Jülich	x
	KFK-SNEAK	Eggenstein-Leopoldshafen	x
	KWU heisse Zellen	Karlstein	x
	SUR 100	Garching	x
	SUR 100	Darmstadt	x
	SUR 100	Stuttgart	x
	SUR 100	Hamburg	x
	SUR 100	Kiel	x
	SUR 100	Ulm	x
	SUR 100	Eggenstein-Leopoldshafen	x
	SUR 100	Bremen	x
	SUR 100	Furtwangen	x
	SUR 100	Aachen	x
	SUR 100	Hannover	x
	Triga	Mainz	x
	Triga	Hannover	x
	Triga II	Heidelberg	x
	BER-2	Berlin (West)[b/]	x
	SUR 100	Berlin (West)[b/]	x
Greece	GRR-1	Attiki	x
Hungary	Training reactor	Budapest	x
	WWR-S M	Budapest	x
	ZR-4	Budapest	x
	ZR-6	Budapest	x
Indonesia	Gama	Yogyakarta	x
	PPTN	Bandung	x
Iran, Islamic Republic of	TSPRR	Teheran	x
Iraq	IRT-5000	Baghdad Tuwaitha	x
	Tamuz-2	Baghdad Tuwaitha	-

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Israel	IRR-1	Soreq	x
Italy	AGN-201	Palermo	x
	CESNEF-L54	Milan	x
	ESSOR	Ispra	x
	RANA	Santa Maria di Galeria	x
	RB-1	Montecuccolino	x
	RB-2	Montecuccolino	x
	RB-3	Montecuccolino	x
	RITMO	Santa Maria di Galeria	x
	RTS-1	San Piero a Grado	x
	TAPIRO	Santa Maria di Galeria	x
	Triga-RC1	Santa Maria di Galeria	x
	Triga-2	Pavia	x
Jamaica	Centre for Nuclear Sciences	Kingston	-
Japan	DCA	Oarai-Machi	x
	FCA	Tokai-Mura	x
	HTR	Kawasaki-shi	x
	JMTR	Oarai-Machi	x
	JMTR-CA	Oarai-Machi	x
	JOYO	Oarai-Machi	x
	JRR-2	Tokai-Mura	x
	JRR-3	Tokai-Mura	x
	JRR-4	Tokai-Mura	x
	Kinki University R.R.	Kowake	x
	KUCA	Kumatori-cho	x
	KUCA	Kumatori-cho	x
	KUCA	Kumatori-cho	x
	KUR	Kumatori-cho	x
	Musashi College R.R.	Kawasaki	x
	NSRR	Tokai-Mura	x
	NAIG-CA	Kawasaki-ku	x
	Rikkyo University R.R.	Nagasaka	x
	SHE	Tokai-Mura	x
	TCA	Tokai-Mura	x
	TODAI	Tokai-Mura	x
	TTR	Kawasaki-shi	x
Korea, Republic of	Triga II	Seoul	x
	Triga III	Seoul	x
	Kyung-Hee Univ.	Seoul	x
Libyan Arab Jamahiriya	IRT-TAJURA	Tajura	x
Malaysia	Puspati	Bangi, Selangor	-
Mexico	Triga	Ocoyoacac	x
	SUR 100	Mexico City	x
Netherlands	HOR	Delft	x
	HFR	Petten	x
	LFR	Petten	x

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Norway	HBWR-Halden	Halden	x
	JEEP-II	Kjeller	x
Pakistan	PARR	Rawalpindi	x
Peru	RP-0	Lima	x
Philippines	PRR-1	Diliman, Quezon City	x
Poland	Agata	Swierk	x
	Anna	Swierk	x
	Ewa	Swierk	x
	Maria	Swierk	x
	Maryla	Swierk	x
Portugal	RPI	Sacavem	x
Romania	RP-01	Margurele	x
	Triga II	Pitesti-Colibasi	x
	VVR-S	Margurele	x
South Africa	SAFARI-1	Pelindaba	x
Spain	ARBI	Bilbao	x
	ARGOS	Barcelona	x
	CORAL-1	Madrid	x
	JEN-1 and JEN-2	Madrid	x
Sweden	R2	Studsvik	x
	R2-0	Studsvik	x
	RO	Studsvik	x
Switzerland	AGN 201P	Geneva	x
	AGN 211P	Basel	x
	Crocus	Lausanne	x
	Proteus	Würenlingen	x
	Saphir	Würenlingen	x
Thailand	TRR-1	Bangkok	x
Turkey	TR-1	Istanbul	x
	ITU-TRR	Istanbul	x
Uruguay	Lockheed	Montevideo	x
Venezuela	RV-I	Altos de Pipe	-
Viet Nam	Da-Lat Research Reactor	Da Lat	-
Yugoslavia	RA	Vinca	x
	RB	Vinca	x
	Triga II	Ljubljana	x
Zaire	Triga-Zaire	Kinshasa	x

C. Conversion plants, including pilot plants

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	UO_2 Conversion Plant	Cordoba	-
Canada	Eldorado Resources Ltd.	Port Hope	x
Japan	Japan Nuclear Fuel Conversion Co. Ltd.	Tokai-Mura	x
	Ningyo R + D	Ningyo	-
	PCDF	Tokai-Mura	-

D. Fuel fabrication plants, including pilot plants

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	Atucha Fuel Fabrication Plant	Ezeiza	-
	Fuel Fabrication Plant (CANDU)	Ezeiza	-
	Pilot Fuel Fabrication Plant (HEU)	Constituyentes	x
Belgium	Belgonucléaire-BN-MOX	Dessel	x
	FBFC	Dessel	x
Brazil	Fuel Fabrication Plant Resende	Resende	-
Canada	CGE	Peterborough	x
	CGE	Toronto	x
	Combustion Engineering	Moncton	x
	CRNL Fuel Fabrication	Chalk River	x
	WCL	Varennes	x
	WCL	Port Hope	x
Denmark	Metallurgy	Roskilde	x
Germany, Federal Republic of	ALKEM	Wolfgang	-
	Exxon	Lingen	x
	NUKEM	Wolfgang	x
	RBU-1	Wolfgang	x
	RBU-2	Karlstein	x
India	NFC	Hyderabad	x
Iraq	ERLFF	Baghdad Tuwaitha	-
Italy	Comb. Nuc.	Policoro	x
	COREN	Saluggia	x
	Fabnuc	Bosco Marengo	x
	IFEC	Saluggia	x
Japan	JNF	Yokosuka	x
	MNF	Tokai-Mura	x
	NFI (Kumatori-1)	Kumatori, Osaka	x
	NFI (Kumatori-2)	Kumatori, Osaka	x
	NFI (Tokai) Fuel Fabrication	Tokai-Mura	x
	NFI (Takayama-R&D)	Takayama	x
	PPFF	Tokai-Mura	x
Korea, Republic of	Fuel Fabrication Pilot Plant	Daejeon	x
Romania	Romfuel	Pitesti Colibasi	x
Spain	Planta Metall. Juan Vigon Res. C.	Madrid	x
	Fuel Fabrication Plant Juzbado	Salamanca	x
Sweden	ASEA - ATOM	Västeras	x
United States	Combustion Engineering Fuel Fab. Plant	Windsor, Conn.	-

E. Chemical reprocessing plants, including pilot plants

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Germany, Federal Republic of	WAK	Eggenstein-Leopoldshafen	x
India	PREFRE	Tarapur	x
Italy	EUREX	Saluggia	x
	ITREC-Trisaia	Rotondella	x
Japan	Tokai Reprocessing Plant	Tokai-Mura	x
Spain	Juan Vigon Research Centre	Madrid	x

F. Enrichment plants, including pilot plants

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Germany, Federal Republic of	Uranit*	Jülich	-
Japan	PNC Pilot Enrichment Plant	Ningyo	-
Netherlands	URENCO	Almelo	-
	Ultra-Centrifuge*	Almelo	-
United Kingdom	BNFL Centrifuge plant and associated storage	Capenhurst	-
United States	Portsmouth Gas Centrifuge Enrich. Pl.	Portsmouth	-

* Location associated with enrichment technology.

G. Separate storage facilities

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	Storage of 20% enriched uranium	Cac	-
Belgium	BN UF_6 store	Dessel	-
	Eurochemic	Mol	x
Canada	Bruce A	Tiverton	x
	Bruce B	Tiverton	-
	CRNL	Chalk River	x
	Pickering	Pickering	x
	WNRE	Pinawa	x
Denmark	Risø Store	Roskilde	x
France	COGEMA Storage Pond	La Hague	x
	COGEMA Pu and U Storage	La Hague	x
	COGEMA UP2	La Hague	-
Germany, Federal Republic of	Braunkohle	Wesseling	x
	Bundeslager	Wolfgang	-
	Exxon Nuclear UF6 Lageranlage	Lingen	-
	Lageranlage für abgereichertes Uran	Kalkar	-
	KFA Jülich	Jülich	-
	KFK-FR-2	Eggenstein-Leopoldshafen	-
	Lager II Leese	Landesbergen-Leese	-
	Transnuklear Halle	Hanau	-
	Urananlage	Birkenfeld	x
Iraq	Separate storage facility	Baghdad Tuwaitha	-
Italy	AGIP	Bosco Marengo	x
	Avogrado	Saluggia	-
	Ispra Central Storage	Ispra	x
Japan	KUFFS	Kyoto	-
Luxembourg	International Metals S.A.	Luxembourg-Dommeldange	-
Pakistan	Storage at Government depot	Karachi Malir	x
Portugal	Instalacao de Armazenagens	Sacavem	x
Switzerland	Diorit Storage	Würenlingen	x
United Kingdom	Sellafield Pu-storage	Sellafield	x
	Sellafield Storage Pond	Sellafield	x

H. Other facilities

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Australia	Research Laboratory	Lucas Heights	x
Belgium	BCMN	Geel	x
	CEN-WASTE	Mol	-
	CEN-Labo	Mol	x
	PULAB	Mol	x
Canada	Physics, Chemistry, Fuel Eng., Health Phys., R+D	Chalk River	x
Czechoslovakia	Nuclear Fuel Inst. (UJP)	Zbraslav	x
	Research Laboratories	Rez	x
Denmark	Hotcell Plant	Roskilde	x
German Democratic Republic	Uran Technikum	Rossendorf	-
Germany, Federal Republic of	KFA-Lab	Jülich	-
	KFA-heisse Zellen	Jülich	-
	KFK-heisse Zellen	Eggenstein-Leopoldshafen	x
	KFK/IHCH	Eggenstein-Leopoldshafen	x
	KFK/IMF3	Eggenstein-Leopoldshafen	x
	KFK/Hauptabt. Ing.-Technik	Eggenstein-Leopoldshafen	-
	Transuran	Eggenstein-Leopoldshafen	x
Hungary	Institute of Isotopes	Budapest	x
Italy	CNEN-LAB. TEC.	Santa Maria di Galeria	x
	CNEN-LAB.PU.	Santa Maria di Galeria	x
	Joint Research Centre	Ispra	-
Japan	JAERI-Oarai R&D	Oarai-Machi	x
	JAERI-Tokai R&D	Tokai-Mura	x
	MAPI Ohmiya	Ohmiya	x
	NERL, University of Tokyo	Tokai-Mura	x
	NFD	Oarai-Machi	x
	NFI Tokai II	Tokai-Mura	-
	NRF Neutron Radiation Facility	Sakura-Mura	x
	PNC Tokai R&D	Tokai-Mura	x
	PNC-Oarai R&D	Oarai-Machi	x
Korea, Republic of	PIEF	Daejeon	-
Netherlands	ECN+JRC	Petten	x
	Kema Lab.	Arnhem	x
	ZWO-Lab-Iso	Amsterdam	-
Norway	Research laboratories	Kjeller	x
Poland	Institute of Nuclear Research	Swierk	x
	Miscellaneous locations combined in one material balance area	Various	x
Sweden	Central storage fresh fuel	Studsvik	x
Switzerland	Fed. Inst. of Reactor Research	Würenlingen	x

J. Non-Nuclear Installations

State[a/]	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	Heavy water plant	Arroyito	-

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b/ The interests of Berlin (West) are represented within the United Nations system by the Federal Republic of Germany.

Note: The Agency also was applying safeguards in Taiwan, China at six power reactors, six research reactors/critical assemblies, one uranium pilot conversion plant, two fuel fabrication plants and one research and development facility.

General

368. After fourteen years of growth and development, the International Nuclear Information System (INIS) has reached the status of a mature, smoothly operating system. It is expected that future changes will be made largely to take advantage of new developments in communications and information-handling technology. As a result of joining INIS, some developing countries have been able to improve their own infrastructure in the technical information service area.

International Nuclear Information System (INIS)

369. INIS is operated by the Agency in collaboration with 73 Member States[20] and 14 international organizations. Its purpose is to provide, using modern computer and micrographic techniques, a comprehensive nuclear information announcement, abstracting and document delivery service. The collection of input and the dissemination of output are basically decentralized.

370. In 1984, the input to the data base totalled about 73 400 documents, a decline of 19 000 documents from the 1983 level; the decline was the result of technical problems in two major participating countries. The size of the data base had risen to 880 000 records by the end of the year. A new system for numbering INIS records and a revised subject category scheme were put into effect during the year.

371. The annual consultative meeting of INIS Liaison Officers was held in Vienna. Twenty-eight persons from nine countries in Asia and the Pacific region attended a one-week INIS training seminar held in Tokyo.

372. Revisions of five volumes in the INIS Reference Series were issued: "Terminology and Codes for Countries and International Organizations", "Authority List for Corporate Entries and Report Number Prefixes", "Authority List for Journal Titles", "Manual for On-Line Retrieval" and "INIS: Thesaurus". An information leaflet on INIS, "INIS Services", was published for distribution in response to requests for general information about the system; the leaflet is intended for use by the Secretariat and by Liaison Officers in Member States.

373. The INIS Clearinghouse distributed an unusually large number (530 000) of microfiches, partly as a result of orders for backfiles of fiches; the income from the Clearinghouse's operations was correspondingly high. By the end of 1984, the total collection of microfiche masters numbered 165 000 documents (220 000 microfiches). New computer software to assist in managing the large inventory of microfiches and to keep track of shipments and billings became fully operational, greatly increasing both speed and accuracy.

374. Thirty-two Member States used the experimental facility for remote on-line access to the INIS and AGRIS data bases, the income from users being approximately equal to the marginal cost of providing this service.

[20] China joined INIS in 1984.

Table 10

INIS statistics

	1983	1984
Number of records added to the data base	92 216	73 362
Number of microfiches distributed	599 000	530 000
Number of full microfiche subscriptions	37	38
Number of participating Member States	70	73
Number of participating International organizations	14	14
Direct access usage (connect hours)	1 747	1 896

Agricultural Information System (AGRIS)

375. The year 1984 marked the tenth anniversary of AGRIS, the membership of which rose to 117 with the accession of China. The number of records in the AGRIS data base passed the one million mark.

376. AGRIS became multilingual with the adoption of a multilingual indexing vocabulary called AGROVOC; participating countries are now encouraged to submit their input with AGROVOC indexing in order to help make the data base more easily accessible.

377. Steps were taken to integrate AGRIS output into the information systems and services of Member States, national bibliographies being produced for - inter alia - Egypt, Italy, Nepal, Sri Lanka and Upper Volta.

378. By the end of 1984, AGRIS was distributing data in various formats on magnetic tape to 38 recipients.

Computer services

379. A software package (ACF2) which permits improvements in the security of all the Agency's computer-based data was installed at the central computer site. Also at the central computer site, a mechanical printer was replaced by a laser printer; the higher speed and output quality of this device enable computer-generated reports to be used more effectively, and the possibility is being investigated of producing some types of Agency publication with it.

380. There was an expansion of computer-aided reactor safety analysis work, with experts from developing Member States visiting the Agency for a total of 40 man-weeks and using its computer facilities for such work.

381. A start was made in implementing a data base to be used as a clearing house for information on research reactors in Member States.

382. The computer-based monitoring system for technical co-operation was developed further, particularly through improvements in its reporting facilities and the inclusion of UNDP projects.

383. Computer programs were written to assist in increasing the efficiency of the recruitment process and for a computerized index of Agency legal agreements with Member States in the safeguards and technical co-operation fields.

384. A start was made in adapting the Agency's computer-based financial accounting system to the budgetary approach being adopted by the Agency in 1985.

385. Utilization of the two central computers was 47% higher in 1984 than in 1983, owing mainly to additional processing work in support of technical co-operation activities. Approximately 22% of the total workload was for other United Nations organizations located at the VIC, which contributed approximately $1 million of income.

386. As it is expected that considerable use is going to be made of personal computers in the Agency, a policy for their acquisition and use was formulated and subsequently approved by the Director General.

387. The Computer Steering Committee was dissolved and a Computer Management Committee established - at a higher level - to co-ordinate and direct the Agency's data processing activities.

Library services

388. At the VIC Library, which is managed by the Agency and provides library and information services to all the organizations located at the VIC on a reimbursable basis, considerable work was done on computerization of library systems - in particular on bar-coding - an essential element of the loan procedures.

389. The information resources of the Library were enhanced through the installation of the "DOCFILE" data base, which permits the on-line searching of United Nations documents; updates to this data base are supplied regularly by the Dag Hammarskjöld Library of the United Nations.

390. The number of volumes in the book collection rose by 3350 to a little over 64 000 and the journal collection increased slightly to 3590 current titles. Some 230 500 pieces were received for the documents collection, and the technical reports collection increased by 32 600 pieces.

391. The Library dealt with about 8000 reference questions and made 13 800 loans of books and 330 loans of films. Current awareness bulletins were distributed in 18 125 copies, representing 7000 tables of contents per month. Photocopying by Library staff amounted to 71 000 pages.

Scientific journals

392. Twelve regular issues of "Nuclear Fusion" and one special issue ("Data Compendium for Plasma-Surface Interactions") were published, the articles and papers in them involving (as authors and/or referees) scientists from more than 100 laboratories in 28 Member States.

393. The "Fusion Vocabulary Control Project" was reviewed by a group of consultants which made recommendations on the use of its different components by the Agency and other interested organizations.

394. The activities of the Agency's Scientific Journals Unit were endorsed at the 20th meeting of the International Fusion Research Council.

Legal Affairs

Physical protection

395. The Convention on the Physical Protection of Nuclear Material[21] was signed by two more States - Australia and Portugal. By the end of the year, 38 States and one regional organization had signed it and ten States had ratified it.

Nuclear liability

396. Morocco signed the Vienna Convention on Civil Liability for Nuclear Damage on 30 November 1984. By the end of the year, 14 Member States had signed the Convention and 10 Member States were parties to it.

Regional course on nuclear law

397. A regional course on nuclear law and nuclear safety regulations for Latin American countries was held in Uruguay, with the co-operation of the National Atomic Energy Commission and the Faculty of Law and Social Sciences of Montevideo University. The purpose of the course was to provide an overview of the major components of nuclear legislation and to exchange information on the elaboration and enactment of such legislation in Latin American countries. More than 60 participants from 12 Member States in Latin America participated in the course, at which lectures were presented by Agency staff members and invited experts from Argentina, Brazil, Mexico and Spain.

Advisory services

398. Following the provision by the Agency of advisory services to the Governments of Chile, Malaysia and Uruguay, the "Law on Nuclear Safety" of 16 April 1984 and the "Atomic Energy Licensing Act 1984" were promulgated in Chile and Malaysia respectively, and regulations for the control of the use of radioactive materials and ionizing radiation were adopted by decree in Uruguay.

Privileges and immunities

399. China and Spain accepted the Agreement on the Privileges and Immunities of the Agency[22] on 16 July and 22 May respectively. By the end of 1984, 56 Member States were parties to the Agreement.

Finance

400. The Regular Budget total for 1984 was $96 830 000, of which $88 786 000 was to be financed from contributions made by Member States on the basis of the 1984 scale of assessment, $3 532 000 from income from work for others and $4 512 000 from other miscellaneous income.

401. The appropriation Sections were based on a rate of exchange of 17.50 Austrian schillings to the United States dollar. Throughout 1984, however, the mean United Nations operational rate of exchange was AS 19.75, resulting in a reduction of the estimated requirements by $8 384 000.

402. The actual obligations in 1984 amounted to $84 058 578, resulting in an unused balance of $12 771 422, of which $8 384 000 was due to currency exchange rate fluctuations. The total provisional budgetary surplus, including additional income and savings on the liquidation of prior years' obligations, amounted to $16 624 918, compared with $8 964 070 in 1983.

403. The target for voluntary contributions to the Technical Assistance and Co-operation Fund in 1984 was established at $22.5 million. At the end of the year, $20 732 803 had been pledged by Member States in support of the technical assistance programme. Net new obligations incurred during 1984 amounted to $25 916 844.

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[21] Reproduced in document INFCIRC/274/Rev.1. There were two ratifications in 1984 (Bulgaria and Hungary).

[22] Reproduced in document INFCIRC/9/Rev.2.

404. A total of $17 458 305 was offered in extra-budgetary contributions from Member States, United Nations and other international organizations during 1984. Of this amount, $13 236 242 was for technical assistance projects, $3 208 901 was in support of safeguards, $187 528 was for projects in the field of food and agriculture, and $381 320 was in support of RCA. The remaining $444 314 was in support of various other projects implemented by the Agency.

Public Information

405. During 1984, the Agency distributed information material (brochures, pamphlets and press releases) in response to nearly 2000 individual requests for information from members of the public. The "IAEA Bulletin" was mailed to about 20 000 addressees in 162 countries.

406. The Agency mounted about 20 exhibitions at the VIC and the Hofburg Congress Centre and supplied exhibition panels to ten Member States. Staff members lectured to nearly 50 groups of visitors to the VIC on the work of the Agency.

General Services

407. Close co-ordination was maintained with the other United Nations organizations located at the VIC with a view to achieving economic optimization in the operation of the VIC complex.

408. The implementation of modern records-handling procedures progressed according to schedule, with enhancement of the computer program for the management of records, which now provides for the management of non-current records and archives. An automated telex transmission system was installed in order to speed up the flow of information.

409. Purchases of scientific and non-scientific equipment and supplies and expenditures in connection with scientific and maintenance contracts amounted to around $8 million; nearly 3200 procurement actions were involved.

410. Assistance in finding accommodation and advice relating to housing problems are provided to more than 3500 staff members of the international organizations located in Vienna and persons accredited to these organizations. The addresses of over 1200 dwellings were made available to persons looking for accommodation, and more than 400 lease contracts were concluded with the help of the VIC Housing Service.

411. The Commissary, with a range of around 5000 articles, served about 7000 households. Total sales amounted to approximately AS 250 million.

Personnel

412. In 1984, 192 members of the Secretariat left and 299 were appointed. Of the new Secretariat members, 153 were in the Professional and higher categories.

413. At the end of 1984, the number of members of the Secretariat was 1861 - 684 in the Professional and higher categories, 1039 in the General Service category and 138 in the Maintenance and Operatives Service category.[23]

414. Among the 563 staff members in posts subject to geographical distri- bution, 76 nationalities were represented.

415. The first traineeship programme for graduates and junior professionals from developing areas, which began in September 1983, was completed in August 1984; 15 trainees participated. The second traineeship programme (also 15 trainees) started in October 1984. The aim of the traineeship programmes is to qualify the trainees for employment with the Agency or for relevant work in their home countries.

416. The Secretariat continued to participate in the work of United Nations bodies established for the purpose of co-ordinating or regulating conditions of employment - for example, ICSC, CCAQ and UNJSPB. In 1984 the emphasis was on reviewing the post adjustment system, pensionable remuneration and pensions.

417. The following organizational chart shows the structure of the Secretariat.

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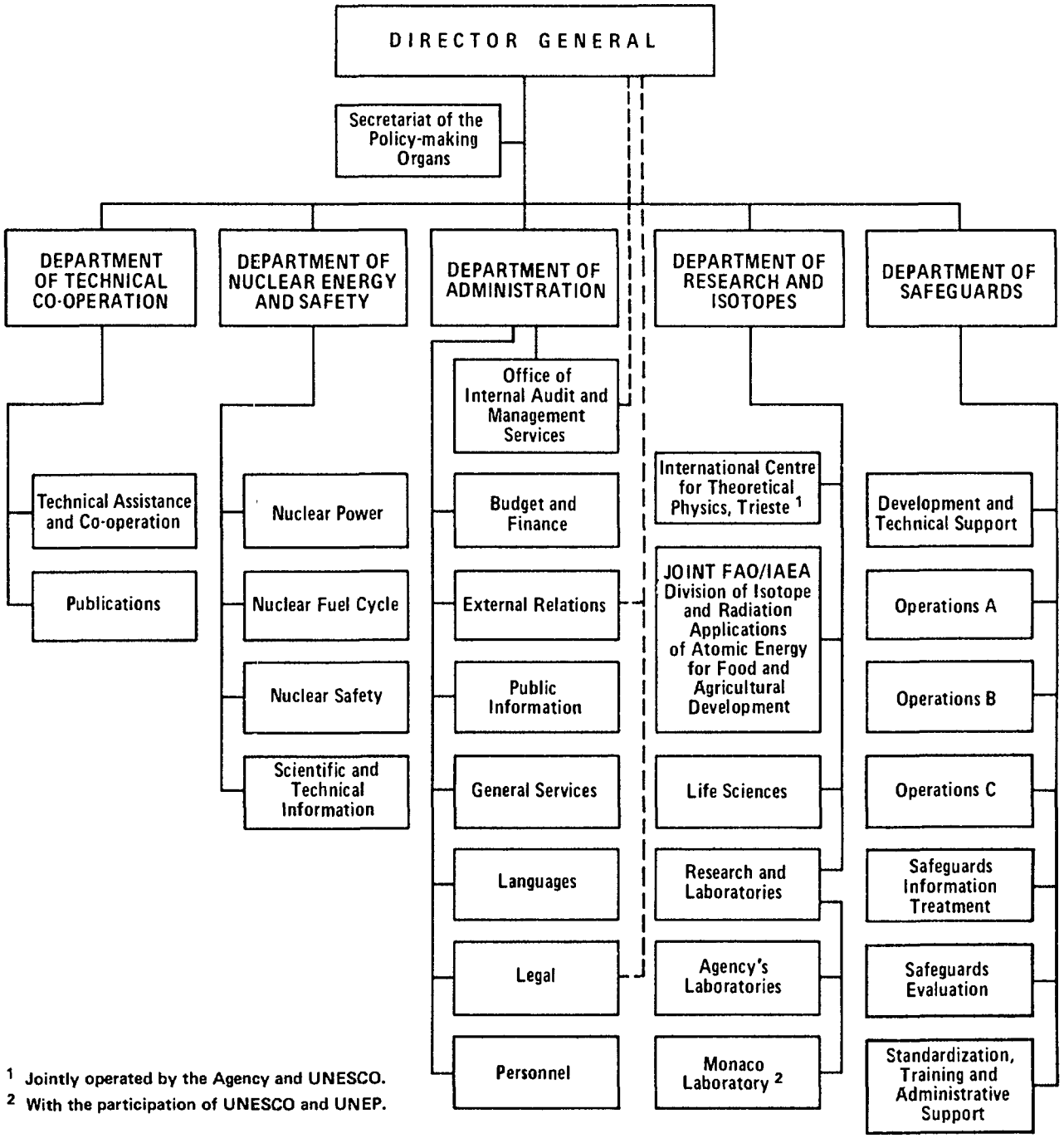
[23] These figures represent: members of the Secretariat occupying manning table posts (1455) or charged to manning tables posts (96), to the temporary assistance fund (121) and to consultancy funds (8); officials serving on a reimbursement basis (170) or on secondment (11).

ORGANIZATIONAL CHART



1 Jointly operated by the Agency and UNESCO.

2 With the participation of UNESCO and UNEP.